Request for a Change to the

Selwyn District Plan

Hughes Development Limited

Dunns Crossing, Goulds, Rangitira and East Maddisons Roads • Rolleston

November 2020

HUGHES
DEVELOPMENTS

Request To Change the Selwyn District Plan under Clause 21 of the First Schedule of the Resource Management Act 1991

TO: The Selwyn District Council achieving

Hughes Developments Limited request changes the Selwyn District Plan as detailed below.

1. **The locations** to which this request relates are:

Location:	Triangle of land in southern corner land bounded by Dunns Crossing Road Goulds Road and East Maddisons Road, Rolleston
Legal Descriptions:	See table below
Total Area:	63.326 hectares
Address:	See table below

	Legal Description	Address	Title	Total Area (ha)
1.	Lot 3 DP 70352	3/144 Dunns Crossing Road	CB40D/788	4.0000
2.	Lot 2 DP 61278	108 Dunns Crossing Road	CB36C/248	10.1150
3.	Lot 1 DP 61278	92 Dunns Crossing Road	CB36C/247	10.1150
4.	Lot 3 DP 57004	Corner of Dunns Crossing and Goulds Roads	CB33K/67	20.7210
5.	Lot 1 DP 57004	597 East Maddisons Road	CB33K/65	20.3750
TOTAL				**65.326 ha**

2. **The Proposed Plan Change** undertakes the following:

a. Amend Selwyn District Plan Planning Maps rezoning the following block of land from Rural Inner Plains to Living Z:

Faringdon Far West

	Legal Description	Address	Total Area (ha)
1.	Lot 3 DP 70352	3/144 Dunns Crossing Road	4.0000
2.	Lot 2 DP 61278	108 Dunns Crossing Road	10.1150
3.	Lot 1 DP 61278	92 Dunns Crossing Road	10.1150
4.	Lot 3 DP 57004	Corner of Dunns Crossing and Goulds Roads	20.7210
5.	Lot 1 DP 57004	597 East Maddisons Road	20.3750
TOTAL			**65.326 ha**

b. Insert new Outline Development Plan Area 16, Faringdon Far West, Rolleston in Appendix 38 of Volume 1 Townships as illustrated in Attachment 1

c. Any other consequential amendments including but not limited to renumbering of clauses and District Plan maps as appropriate

DATED: 30 October 2020



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(Signature of applicant or person authorised to sign on behalf)

Title and address for service:	Address for the applicant and all Council fees:
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Attachment 1 – Proposed Outline Development Plan
Area 16 – Faringdon Far West

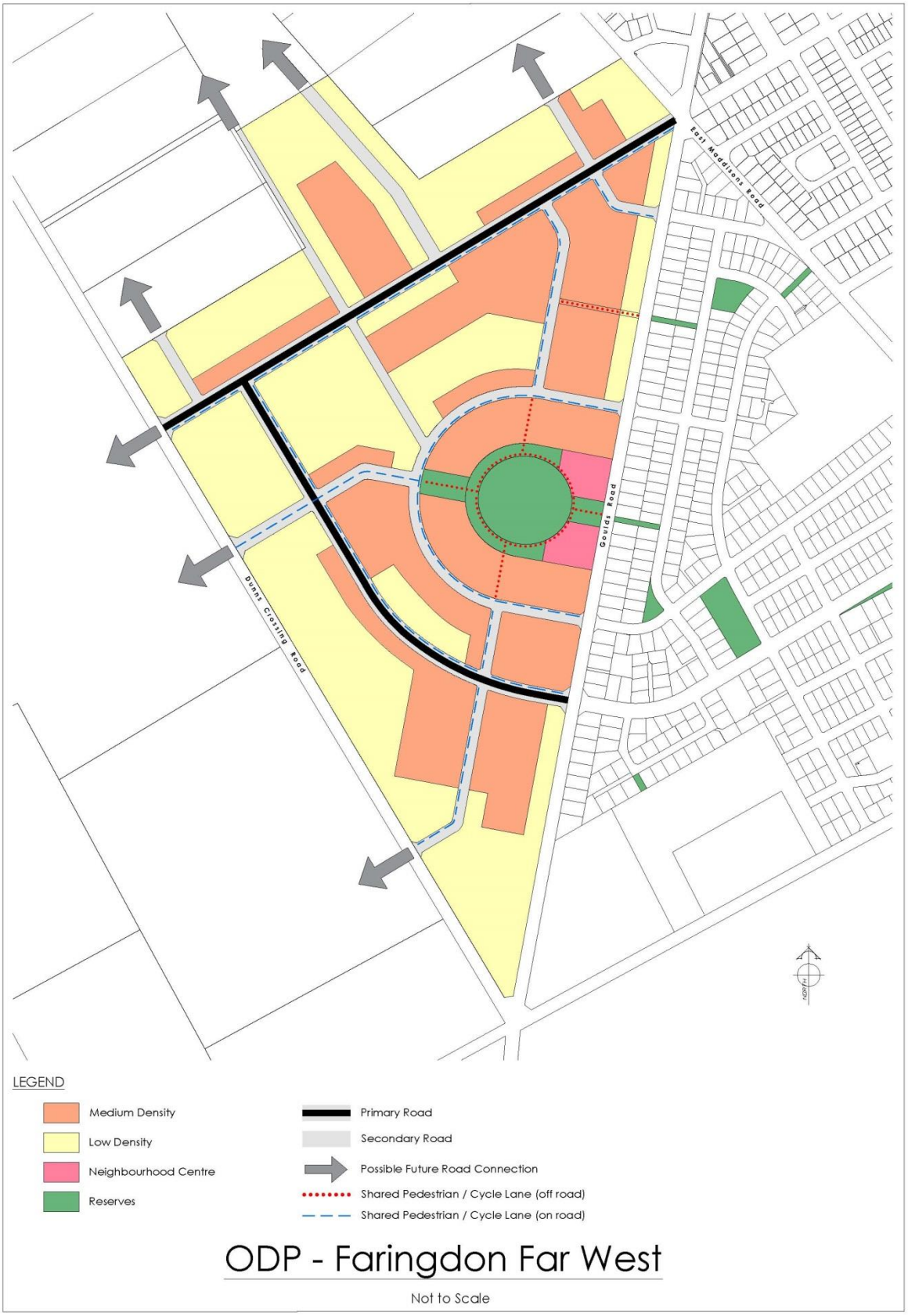


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	Resource Management Act 1991 **Selwyn District Council** Selwyn District Plan	Plan Change **P6?**
Private Plan Change Request – Hughes Developments Limited		
	References: Selwyn District Plan Volume 1: Townships Part E – Appendices, Outline Development Plan District Plan Planning Maps	

1 Introduction

Hughes Developments Ltd request a change to the Selwyn District Plan by rezoning the southern area of a block of land on Dunns Crossing, Goulds and East Maddisons Roads, south of Rolleston with a total area of 63.326 hectares from Rural Inner Plains to Living Z.

This document forms the Section 32 evaluation of the plan change, consisting of an evaluation of the contents of the Proposed Plan Change, and incorporates material from the following documents:

- Davie Lovell-Smith Infrastructure Report - (Appendix A)
- Carriageway Transportation Assessment - (Appendix B)
- Market Economics Economic Assessment and Significant Development Assessment (Appendix C)
- Engeo Geotechnical Assessments - (Appendix D)
- Engeo Preliminary Site Investigations, Soil Contamination - (Appendix E)
- Land Capacity Assessment - (Appendix F)
- Records of Title – (Appendix G)
- Future Growth Strategy (Appendix H)

2 The Environment

2.1 The Plan Change Sites

The land proposed to be rezoned is the southern section of a large block at the southern tip of Rolleston and contains 5 parcels of land. The majority of the properties within this block are still privately owned but with agreements to purchase by Hughes Developments Ltd, the applicant for this plan change. Hughes Developments Ltd owns the smallest and most northern parcel in the block. This block adjoins Faringdon South West on the east side of Goulds Road which is currently subject of a Private Plan Change 64 requesting rezoning from Rural Inner Plains to Living Z. Figure 1 below identifies the Faringdon Far West block.



Figure 1: Canterbury Maps Aerial of Plan Change Site

Faringdon Far West is bounded by Dunns Crossing Road, Goulds Road and East Maddisons Road (now Rangitira Street). It occupies the southern triangular section of the block bounded by Dunns Crossing, Goulds, East Maddisons and Lowes Road in the north. It has a total area of 65.326 hectares. Its frontage length on Dunns Crossing Road is 1170m, its length on Goulds Road is 1395m and its length on East Maddisons Road is 130m. The properties within the Faringdon Far West block and their address and ownership details are set out in the table below. With regard to the properties not in Hughes Development Ltd ownership there are unconditional sales and purchase agreements in place to secure each of these properties.

Faringdon Far West

	Legal Description	**Address**	**Owner**
1.	Lot 3 DP 70352	3/144 Dunns Crossing Road	Hughes Developments Limited
2.	Lot 2 DP 61278	108 Dunns Crossing Road	J C and L K Blackmore
3.	Lot 1 DP 61278	92 Dunns Crossing Road	D C and I G Robertson
4.	Lot 3 DP 57004	Corner of Dunns Crossing and Goulds Roads	D C and I G Robertson
5.	Lot 1 DP 57004	597 East Maddisons Road	M R and P R Main

Land within this block is generally flat ground with some gentle undulations and depressions. The depressions are generally in a northwest/southeast direction and have resulted from remnant river channels. Existing shelterbelts can be found along many road boundaries and internal boundaries of the site, as well some small plantations. The topography of the site is flat. The properties are currently divided into numerous rectangular and square paddocks of different sizes. There are three existing dwellings and farm buildings on the land.

2.2 The Surrounding Environment

Rolleston township extends through to Selwyn Road further east of the site. Land immediate to the east of Goulds Road is the subject of private Plan Change 64 also involving rezoning from Rural Inner Plains to Living Z. Further east and north are a series of recent residential subdivisions including Faringdon North and South. To the west of Dunns Crossing Road and to the south of Selwyn Road is rural land used for grazing and dairy farming.

The urban limit of Rolleston was initially defined in Change 1 of the Canterbury Regional Policy Statement (now Chapter 6 of the Canterbury Regional Policy Statement 2013). As a result of the review of the urban development capacity of Greater Christchurch a change to this urban limit is being implemented through a change to the Canterbury Regional Policy Statement which is expected to be publicly notified in late 2020. This change will extend the urban limits in Rolleston through to Selwyn Road and Dunns Crossing Road thereby aligning with the current Projected Infrastructure Boundary identified in Plan Change 1. This Plan Change will complete the residential rezoning and development of this "corner" of Rolleston as envisaged by the CRPS and the Rolleston Structure Plan.

3 The Plan Change

3.1 Description of the Proposal

It is proposed to rezone 63.326 hectares of Rural Inner Plains land to Living Z. This provides the opportunity to develop approximately 800 residential allotments. The allotments are to be developed generally in accordance with Living Z standards with a low density average allotment area of 650m^2 and medium density (small lot) average allotment area of 500m^2.

An Outline Development Plan (ODP) has been prepared for the block for inclusion in the District Plan. The ODP provides for:

- A mixture of low density, medium density (including small lot and comprehensive development). The lower density generally is on the boundaries which face existing rural areas and the medium density is more centralised within the block.
- A neighbourhood centre to provide convenience services and goods and community facilities for residents of the general area. This centre is located midway on Goulds Road and will be associated with a central reserve, shared pedestrian/cycle lane and recreational area.
- Primary roads with strong linkages to adjoining residential areas as well as numerous smaller roads within the development which enable easy movement in, to, through and from these development blocks
- Local recreation reserves which act as focal points for neighbourhoods and local communities, whilst also providing spatial relief for surrounding medium density development.

3.2 Servicing

Servicing of the development will be by reticulated Council services. Details of the infrastructure requirements for the development are contained in the Infrastructure Report in Appendix A and are summarised as follows:

- Wastewater will be catered for through gravity connections to existing and proposed. Infrastructure. The current pump capacity of RADAR pump station on the corner of Selwyn Road and Springston Rolleston Road will need to be increased to accommodate the fully developed catchment area which includes the newer Faringdon areas. Part of the Far West site will gravitate to the existing sewer on East Maddisons Road but the majority will need to be serviced by a new pump station which is to be located approximately 420m southwest of the intersection of Selwyn Road with East Maddisons Road. This pump station will also cater

for the South West ODP Area. The sewer main routes from the pump station to service the Far West area would be located along primary and collector road links which will be constructed as part of the Faringdon South and West development areas.

- Water reticulation will consist of an extension to the existing water network in line with the Waters Activity Management Plan. This plan identifies the existing pipework, 200mm (ID) or over and it also shows the future proposed 200mm (ID) pipes into the proposed plan change areas. These main pipes will follow main connecting primary and secondary roading alignments with the expectation that all other streets will contain a watermain of 100mm or 150mm (ID) for residential and fire-fighting purposes.
- Primary stormwater from the site will be discharged to ground. The soakholes on the individual sites will be constructed as part of the Building consent process but the drainage and soakholes associated with the roads will be constructed as part of any future subdivision and will be vested in SDC. The development will be designed to ensure that secondary flow will safely drain through the site via the road networks.
- Gas, power and telecommunications will be provided to all sites to utility company and industry standards. All cables will be placed underground and all kiosks will be constructed on separate individual lots.
- Roading will incorporate a number of collector roads in line with the CRETS network with extensions of main routes through from the Faringdon South West development. These include an extension of Shillingford Boulevard between East Maddisons and Dunns Crossing Roads and the extension of Northmoor Boulevard to connect to the future Shillingford Boulevard.

3.3 Proposed Amendments to the District Plan

This Plan Change is simply rezoning an area of land and therefore the objectives, policy and rule provisions of the Selwyn District Plan will remain the same. The only changes required are:

- Amending Selwyn District Plan Planning Maps by rezoning the Faringdon Far West block from Rural Inner Plains to Living Z
- Inserting an additional Outline Development Plan Area 16, Faringdon Far West, Rolleston in Appendix 38 of Volume 1 Townships as illustrated in Attachment 1 to this Plan Change Request

4 Consultation

Hughes Developments Ltd and their consultants have undertaken detailed consultation with Selwyn District Council staff in relation to this proposal to ensure that the area to be rezoned is appropriately located and can be adequately serviced. More specifically, the consultation can be summarised as follows:

Planning

Hughes Developments Ltd has commenced this plan change process following a period of engagement with SDC Policy Planning staff in respect of the potential for residential growth within Rolleston.

Hughes Developments Ltd participated as a submitter in the Our Space 2018-2048: Greater Christchurch Settlement Pattern Update process. As part of this process Hughes Developments Ltd consulted with SDC Planning Policy staff over their capacity and feasibility assessments undertaken to satisfy the requirements of the National Policy Statement on Urban Development Capacity. As an extension of the Our Space process, Hughes Developments Ltd also responded to a request for feedback in respect of the draft Proposed Change to Chapter 6 of the Canterbury Regional Policy Statement.

On a more specific level discussions have centred on the approach taken to satisfy the National Planning Standards when drafting this plan change and the implications presented by the then pending District Plan Review process.

Infrastructure

Hughes Developments Ltd have consulted with Council's Asset Department in respect of wastewater, water supply and stormwater infrastructure capacity. These discussions have confirmed that there are no infrastructure constraints from a water service perspective.

Tangata Whenua

Mahaanui Kurataiao has been asked to comment on the proposed plan change. Due to large workloads this process is ongoing and will be provided to Council once received. It is noted that Te Whakatau Kaupapa indicates that there are no silent files in the Rolleston area. In addition there are no waterbodies or remnant vegetation expected to be of significance to Tangata whenua. With regard to vegetation the soft landscaping associated with reserves, street berms and stormwater swales will in almost all situations be dominated by indigenous species from the local area. This approach has the dual advantage of achieving plantings in sympathy with the area as well as increasing the likelihood that the plants will survive and flourish in Rolleston's the dry and windy environment.

5 Assessment of Environmental Effects of the Proposed Change

The following assessment considers both the environmental effects and character of the proposed residential development areas as well as environmental effects beyond these sites. The matters assessed are:

- Township growth
- Rural –urban interface
- Natural hazards and geotechnical matters
- Soil contamination
- Water quality
- Neighbouring Activities and Potential Reverse Sensitivity
- Natural features
- Versatile soils
- Beneficial effects

5.1 Township Growth

Selwyn District Plan – Township Volume policies on township growth provide guidance on the outcomes sought by the Council and the community regarding expansion of townships. These policies are normally examined when considering rezoning through the plan change process. An assessment of this proposal in terms of those policies is contained in Section 8.3. As discussed below, there is considerable support within the Township policies for this development. This support indicates that the development of this plan change site for residential purposes is able to contribute positively to Rolleston's anticipated growth.

5.2 Urban- Rural Interface

The proposed outline development plan for the Faringdon Far West area addresses the urban-rural interface primarily through the location of lower density allotments around the north, north western and western boundaries of the site which immediately adjoin or are across a road from rural land. This is consistent with the direction supplied within the Rolleston Structure Plan which states it is necessary to "restrict the impact of higher density areas on the rural character by

generally containing visual effects within the urban limit". The initiative also replicates the approach taken within ODP6 for the Faringdon development, Faringdon South Special Housing Area and several other outline development plans for Rolleston.

For the most part the Faringdon Far West will be separated from adjacent rural properties by the surrounding road network (Dunns Crossing and Goulds Roads and a small section of East Maddisons Road now renamed Rangatira Street). However there are boundaries adjoining rural land to the north including the central extension area. Design controls derived from the District Plan will control the boundary treatment along the road network, particularly in respect of fencing. The applicant is prepared to accept the standard condition indemnifying the adjoining land owners to the far west from contributing to the costs of (non-rural) fencing along shared boundaries. Such interface treatments have been made on the proviso that at the time of development, the adjacent land retains its Inner Plains zoning status. In anticipation of future residential re-zoning, provisions have been made within the ODP to ensure that connectivity, reserves and density distribution are provided for at the boundary with adjoining properties.

With regard to the interface along Dunns Crossing Road the majority of this boundary is opposite land zoned Living 3 which provides for rural residential development with a minimum average lot size of 5000m^2. This zoning has been in place for some time and has been retained in the Proposed District Plan, however it is not is not known what the likelihood is of rural residential development being established. If it does occur it is not expected that it will create any adverse effects for residents of Faringdon or the rural residential development. The roading pattern in the ODP has been specifically developed to align with the ODP for this Living 3 zone should it proceed.

The Applicant notes that they have undertaken numerous large and small scale residential developments within Rolleston which have been within a rural setting. They have found that no major problems have arisen with regard to incompatibility with the surrounding rural land uses and residents. The combination of the factors referred to above ensures that the urban-rural interface within this application is appropriately managed to mitigate any potential effects that might arise.

5.3 Natural Hazards and Geotechnical

Geotechnical investigations have been prepared by Engeo for each of the properties within the block (Appendix D). These reports advise that there are no mapped faults in the immediate area but that this area could be subject to ground shaking from movement of faults elsewhere. The area is located between the Greendale Fault and the Port Hills Fault, the latter of which has not been mapped because it did not result in any surface rupture. With regard to the liquefaction potential for the site, the Engeo reports conclude that damaging liquefaction is unlikely consistent with a TC1 zoning.

The site is outside any defined flood zones in the District Plan. The Council has undertaken computer based modelling of the depth of flooding associated with 1 in 200 year and 1 in 500 year critical storm event in the vicinity of the Plan Change area refer Figure 4 in the Engeo Report in Appendix D). This modelling indicates that the water depth through the site may be up to 1m deep in the existing channel feature during a 1 in 500 year flood. The site is relatively flat. As part of the works to develop the subdivision the lots will become elevated and roads will be lowered. The roads then become secondary flow paths for stormwater off the sections, effectively replacing natural channels. These flow paths direct the water so that it can rejoin the natural flow paths in the area. The flows through the site generally have an increased velocity compared to the natural flows which results in reduced water depths and therefore reduced localised flooding potential.

There are no other known potential natural hazards that could affect the Plan Change site. In particular the site is not likely to be subject to material damage from erosion, falling debris, subsidence, slippage of inundation from any source.

5.4 Soil Contamination

Combined Preliminary and Detailed Site Investigations on potential for soil contamination have been undertaken for all properties proposed to be rezoned in terms of the Ministry for the Environment's Contaminated Land Management Guidelines No 1: Reporting on Contaminated Sites in New Zealand, 2011. These Investigations are contained in Appendix E to this Plan Change request and considered the following information:

- Reviews of Selwyn District Council property information provided in LIMs
- Obtaining ECan data from the Listed Land Use Register (LLUR)
- Review of ECan GIS data
- Review of historic aerial photos
- Review of historical ownership history
- Review of local knowledge of site history
- Site visits

The investigations involving site histories and walkovers generally found that activities on site have given rise to no soil contamination. The most common potential for soil contamination arises is from localised small burn sites and waste sites, chemicals stored in farm buildings and the potential for asbestos associated with cladding of existing buildings. The reports recommend that these matters be dealt with by:

- The areas of potential concern are managed appropriately during development earthworks. This would include excavation and off-site disposal of the burn pit and waste material to a licensed disposal location and observation of the soils in the area of ground disturbance. Should waste be present then further assessment would be required.

- For buildings constructed prior to 1 January 2000 which are to be demolished or refurbished as full asbestos survey must be undertaken by a competent person. It is noted however that the residential buildings are intended to be retained on site.

The localised nature of PSI/DSI findings are able to be dealt with at future subdivision stage and are not of any significance such as to warrant further investigation in support of the Plan Change.

5.5 Water Quality

Groundwater quality can be adversely affected by residential development from two main sources, namely on-site effluent treatment and disposal or stormwater generated by increases in impervious surface coverage. In terms of effluent treatment and disposal, no adverse effect will be generated by this proposal as the development will be connected into the Council's reticulated system within Rolleston. The appropriate infrastructure to connect to the Council's reticulated system will be installed within the subdivision.

As there will be an increase in impervious surfaces as a result of this development, it is proposed to collect all stormwater generated on site and discharge this to ground in accordance with Council's requirements of residential stormwater. This will ensure that groundwater quality is not adversely impacted by this proposal. It is noted that groundwater has been recorded as being 5 to 10m deep in the vicinity of the site thus limiting the potential for contamination from surface activities.

Consent will be obtained from Environment Canterbury for this discharge, and will ultimately be transferred to the Council.

With the reticulation of sewage and the stormwater treatment and disposal system proposed, it is anticipated that there will be minimal adverse effects on groundwater quality from the development of this land for residential purposes.

5.6 Neighbouring Activities and Potential Reverse Sensitivity Issues

Activities on neighbouring properties are largely rural and rural lifestyle. To the west across Selwyn and Dunns Crossing Road are various well established farming units mostly based on grazing. There is no intensive animal or crop production in the vicinity of the Plan Change area. There is a Living 3 zone providing for rural residential development on the west side of Dunns Crossing Road. This zoning is 72.2ha in area and extends along Dunns Crossing Road from 765m north of the Goulds/Selwyn/ Dunns Crossing intersection to 680m past the area proposed for rezoning. To the north are rural lifestyle blocks that are expected to be rezoned for residential purposes in the future. Further north is residential zoned and developed land based around RiverstoneWE Drive and Jean Archie Drive. To the east of this block is the Faringdon South West block which is currently the subject of notified Private Plan Change 64 of the Selwyn District Plan. This land currently has no active rural uses on site.

There will always be the potential for people living on the edge of townships to be impacted by noise, odour, and traffic impacts of rural activities. In most cases residents living opposite rural areas have chosen to live on these sites presumably with an expectation that the rural uses will be carrying on. Recent experience with the development of Faringdon South Special Housing Area which extends through to same location on Selwyn Road has confirmed that with the allocation of the larger lot sizes on the outer extent of residential subdivisions that there is very limited potential for people living in the residential area to be adversely affected by rural activities to the extent that they complain and seek a reduction in these activities.

5.7 Natural Features

There are no natural features within the proposed Plan Change areas which are generally flat with planted of fenced boundaries and some dwellings and farm buildings.

5.8 Versatile Soils

The Faringdon Far West block contains Lismore stony and shallow silt loam soils. These soils have limited ability to retain moisture and are considered to have severe limitation for food production even with irrigation. A commonly used land use/soil classification system used in planning, particularly plans under the Town and Country Planning Acts, is the Land Use Classification. Under this system the block of land proposed for rezoning is Land Use Class 4s7 which is described as “terraces and plains with shallow and stony soils of medium to low fertility in seasonally moisture deficient districts”.

5.9 Transportation

Wider Traffic Environment

The wider traffic environment comprises roads such as SH1, Selwyn, Shands and Springs Road which are important corridors for private and freight traffic travelling between Christchurch, Prebbleton, and Rolleston and Lincoln and further afield. These routes are fed from many east-west linkage roads such as Brookside, Dunns Crossing, East Maddisons, Goulds, Springston Rolleston, Lincoln - Rolleston, Weedons, Waterholes and Robinsons. This traffic environment has been changing over recent years and continues to change both as a result of an increase in population

and economic activity in Rolleston and the south western greater Christchurch urban area and with the Christchurch Southern Motorway Stage 2 (CSM2) works by New Zealand Transport Authority. CSM2, which is operational now and is expected to be completed by late-2020. This project establishes a motorway from Halswell reducing the travel time between Rolleston and Christchurch. In addition, SH1 has been widened and upgraded to a four lane expressway from Rolleston to Robinsons Road (MSRFL) which also forms part of the CSM2.

Upgrades of the Selwyn, Springston Rolleston and Lincoln - Rolleston Roads, in conjunction with Shands Road - Marshs Road upgrades will create a new district arterial network that will cater for growth, especially from the expanding southern areas of Rolleston. Additional progressive upgrades are taking place on adjoining local roads, including Shands Road, to cater for traffic using the CSM2 interchange and the new Weedons overbridge linking Rolleston with areas west of SH1.

Road Hierarchy

Dunns Crossing Road and Selwyn Road are arterial roads. Selwyn Road which also adjoins the proposed Faringdon South West and South East ODP areas provides a ready connection to areas of district importance including the other townships and key places and activities. Goulds Road and East Maddisons Road, which bound both the Faringdon Far West and Faringdon South West blocks, are listed as collector roads which distribute and collect local traffic with and between neighbourhoods. The remainder of the existing and proposed roads will be local roads.

The report by Carriageway Consulting contained in Appendix B has been prepared with a specific focus on rezoning of Faringdon South East and South West. Due to the Faringdon Far West adjoining the western edge of Faringdon South West the detailed descriptions of the road network and the numerous intersections in t eh Carriageway report are directly relevant to the proposed rezoning. The assessments of general transportation characteristics in the area are also relevant to this proposal. With regard to non-car modes of transport the report notes that the proposed ODP areas are at the edge of current urban development of Rolleston and footpath provision being intermittent and largely aligned with current extent of development.

Rolleston Structure Plan

With regard to alignment with the Rolleston Structure Plan Northmoor Boulevard in Faringdon South has already been constructed in the location indicated in the Structure Plan providing a convenient east-west link. Both of the new ODPs for Faringdon South East and South West and now Faringdon Far West provide for a continuation of this route providing a continuous route from Springston Rolleston Road though Goulds Road to the outer edge of the Far West development. These routes will provide a connection point with Acland Park to the north and to south west Rolleston via Faringdon Far West. There is also the potential to continue the link created by Shillingford Boulevard. These routes will be suitable for future consideration as public transport routes serving the whole of the southern area of Rolleston.

Proposal and Expected Traffic Generation

With regard to the ODP layout, these support the connectivity outcomes being promoted. These include shared pedestrian and cycle paths.

The Council and Carriageway and Abley Consulting have modelled the current volumes and intersection performances in the area of the neighbouring ODPs. This modelling concludes that the traffic remains relatively modest and the intersections have good levels of service in relation to delays with the majority being Level A and Selwyn Road having some turning movements down at Level C. This level of service is expected to remain the same with the additional traffic movements associated with Faringdon Far West. The volume of pedestrian and cyclists are low and there is no public transport service at this stage. The crash analysis shows that commonly these involve failure

to give way to another vehicle. It is anticipated that the changed and improved road environment in this area with consequential lower speed limits will reduce this type of crash.

The ODP area will have a number of linkages onto the adjacent road network creating choice and limiting queuing issues. These connections include main road link extensions of Northmoor Boulevard and Shillingford Boulevard from and through Faringdon South East, South and South West connecting through to Springston Rolleston Road across Goulds Road and East Maddisons Road. There are also four connections to Dunns Crossing Road and four connections to Goulds Road. Further minor connections onto these roads are anticipated.

Carriageway Group in their assessment of the neighbouring Faringdon South West proposal conclude that due to the location of this ODP which represents an extension of the urban area that a rate of 8 vehicle movements per day is appropriate for the purpose of modelling impacts of the additional households provided for. This lower rate per household is a consequence of the distance involved in each trip which includes multiple destinations within a single trip rather than several trips.

In assigning vehicle trips generated by the new ODP areas, many of which involve commuting to Christchurch, it is assumed the greater use will be made of Selwyn Road than the road network within Rolleston as the travel speeds are greater. The Sidra software program has been used to analyze the functioning of intersections and the effects of increased traffic volumes created by the rezoning. The intersections assessed were East Maddisons Road, Goulds Road, Selwyn Road/East Maddisons and Selwyn/Springston Rolleston Roads. Although queues and delays increase slightly from the current situation they remain relatively low. The levels of service remain good with the lowest level of service being C. On this basis the report does not recommend any revision in the intersection geometries. The modelling shows that there will be limited use of the Selwyn/Goulds Road intersection by traffic generated by Faringdon South East and West. The use of this intersection however could be expected to increase with traffic from of Faringdon Far West. This increase is not anticipated to change the level of service of this intersection or if it did so that the level of service would be in the acceptable range with no further roading upgrades needed.

The report assumes that the road environment and frontages adjoining these new areas will be changed from rural to urban with wider carriageways and urban formation including kerbs and footpaths. Along with this it is expected that speed limits will be reduced to maintain consistency for road users. The footpaths will provide for walking and cycling infrastructure will also serve these areas, providing safe routes to schools and other facilities. The internal road network creates the ability to form carriageway widths that would be suitable for a bus service.

Safety

The analysis of crashes to date indicates a cluster of crashes at the Selwyn Road/Goulds Road and Selwyn Road/Springston Rolleston Road intersections which largely results from motorists not giving away. The report concludes that the new ODP areas will enable a reduction in the speed limit on these roads which is expected to support a safer environment.

Finally the report considers that the standard of the new roads, including for non-car travel, means that there are unlikely to be new safety issues arising and that the flat and straight frontages ensure excellent sight lines.

5.10 Beneficial Effects

The Plan Change will provide for the continued growth of Rolleston within a master planned ODP area. Hughes Developments Limited has aggregated large areas of land which enable a master

planned approach to be employed to cater for future residential development. The benefits derived from this approach include facilitating high levels of connectivity, creating communities with focal points such as neighbourhood centres and/or recreation reserves and the strategic allocation of medium density areas.

The ODP area does not adjoin established residential areas but it is anticipated that Faringdon South West will be zoned and constructed within the next five years. This will enable continuity of supply and construction cost efficiencies. These benefits are reflected in the stable pricing Hughes Developments Limited has maintained since the commencement of development within the original Faringdon subdivision (ODP 6).

From a wider local perspective, the provision of land for residential growth will continue to support the Council's investment in community infrastructure by virtue of maintaining and perpetuating growth rates, increasing the rating base and attracting development contributions.

The economic activity associated with the development of Faringdon Far West has a number of components including economic activity supported during consent land development, build development and spend by residents once development is completed. In addition to these direct expenditure impacts there are flow-on effects from this form of development with builders, developers and new residents purchasing goods and services from other local business. In addition staff of business receives wages and salaries which are spent on goods and services. The economic role of the development is therefore expected to generate very significant direct expenditure over all phases of the development as well as flow on effects.

6 Quality Urban Environment

The inclusion of a neighbourhood centre and a central reserve supports the intention to promote social interaction and establish a heart to the precinct. The neighbourhood centre is located mid-block on Goulds Road and is opposite Faringdon South West. The neighbourhood centre is therefore ideally located to take advantage of high visibility and greater passing traffic volumes as well as function as a gateway to the ODP area.

The central reserve will effectively be part of the Neighbourhood centre adding to its profile. Its location ensures all residents within the development area can easily access public open space on foot. This central reserve area along with the neighbourhood centre will provide a focal point for the local community.

Like the wider Rolleston area, Faringdon is flat and ideal for active transport modes. Providing dedicated walking and cycling infrastructure that is safe and has high amenity encourages the adoption of walking and cycling for both neighbourhood trips and those further afield. Higher rates of walking and cycling has multiple benefits for both the local community and the general environment by improving physical and mental health, improving amenity and safety of movement corridors and reducing vehicle emissions and energy use.

Walking and cycling is promoted through the provision of:

- direct routes along desire lines to key destinations;
- options that cater for different users, for example commuter and recreational cyclists;
- safe routes which do not conflict with vehicles and enjoy passive surveillance from adjacent activities;
- visually interesting streetscapes.

The connection of each residential precinct to each other and to the wider Rolleston community is essential to creating an integrated and convenient community. Ensuring movement corridors (both vehicular, cycle and pedestrian) connect different development areas is imperative to creating a cohesive community in Faringdon. As such, careful consideration has been given to the location and connection of the ODP area to both immediate neighbours, the wider Faringdon area and indeed, greater Rolleston.

The connected roading patterns and minimum residential densities encourage the provision of public transport.

A range of section sizes and housing typologies provides future residents with choice and promotes a mixed community demographic, along with a range of price points, including more affordable options. Medium density housing is co-located with open spaces to provide those residents with additional opportunity for outlook, active and passive recreation and car parking.

The Rolleston Structure Plan promotes diversity with respect to residential development, thereby improving choice, diversity and affordability. The Rolleston Structure Plan's Design Principle 4 promotes higher density at nodal points, matching population density with centres of activity and high amenity. Whilst this principle addresses outcomes at more of a metropolitan level, the same principle can be applied to the neighbourhood level. It is common and best practice urban design to locate "density around amenity". In this instance it directs the location of medium density housing around the main neighbourhood reserve. The benefits of this practice include:

- the public open space compensates for smaller rear yards and reduced recreation opportunity on adjacent more compact housing typologies/sections;
- there are higher numbers of dwellings surrounding open spaces which promotes their active use, making better use of the land resource and more easily justifying investment and maintenance costs;
- higher numbers of dwellings around reserves increases levels of active and passive surveillance of the reserve, increasing real and perceived public safety;
- dwellings located closer together (and potentially higher) improves the spatial definition of the reserves, better defining their edges and helping to provide shelter for users and vegetation;
- neighbourhood parks provide additional opportunity for on-street parking to support adjacent medium density housing which can have less parking provision on the streets due to both the typical width of these streets and the proximity of driveway crossings etc.

Whilst "density around amenity" is a strong determination of the location of medium/higher density residential typologies, it is not the only justification for the identification of medium density housing in attractive residential neighbourhoods. Other drivers for the inclusion of medium density clusters include the better use of the land resource, wayfinding/legibility and visual interest in the streetscape. In addition, the requirement to achieve a minimum net density of 12hh/ha requires the inclusion of medium density housing.

The ODP therefore identifies areas for small lot/medium density residential development that are not directly adjoining or in very close proximity to public open spaces. As an example, pockets of medium density are indicated along the north side of Northmoor Boulevard where they have a dual benefit of making good use of a deep block, as well as adding variety, prominence and interest to a long road which is also a key connector. The inclusion of pockets of medium density in an otherwise low density street creates variety and visual interest.

The proposed Outline Development Plan captures the essential components of an underlying conceptual subdivision plan while retaining a measure of flexibility to response to additional opportunities and constraints, as well as market changes.
In summary the ODP:

- facilitates connectivity within the southern portion of Rolleston's urban area through the extension of Northmore Boulevard and provides for future connection to adjacent residential development in the future;
- delivers residential development at a density of 12 households/hectare and provides for a variety of residential house types, lifestyles and price points;
- promotes social interaction and neighbourhood cohesion through the inclusion of neighbourhood reserves;
- encourages active transport modes through the provision of shared paths and on-road cycle lanes that provide both internal connectivity as well as links to the wider Faringdon and Rolleston area;
- establishes a neighbourhood centre which meets daily convenience needs of the walkable catchment, provides an opportunity for a community focus/heart and functions as a gateway to aid legibility;
- responds sensitively to its interfaces with both existing and future adjacent development;
- is consistent with the design principles of the Rolleston Structure Plan.

7 Urban Development Capacity

A land development capacity assessment has been undertaken for the Rolleston Urban Area in support of the Plan Change (Appendix F). The report's methodology focusses on the capacity of zoned land within the most 'active' (feasible) ODP Areas. The report critically assesses the dataset information prepared by Council in respect of forecasted yields from each of the ODP Areas and updates the number of sites that have been developed and had 224c certificates issued.

The assessment focusses on the land development aspect of the ODP's largely due to the fact that its primary purpose is to inform a Plan Change to rezone land for residential development. Whilst housing capacity has been used in the Council's capacity assessment to satisfy the NPS, the capacity of available land is preferred in this instance.

The extent of section 'pre-sales' that are inherent to land development projects due to cost efficiencies or lending conditions (or both) mean that following 224c certification and issue of titles, a high proportion of sections (although vacant) are not available to the market. Accordingly they should not be counted as 'capacity'. In addition, the 'lag' in time taken to rezone land, obtain resource consents and construct the development prior to being able to construct housing means that identifying the capacity of available zoned land is an indicator which enables a shortfall to be identified early and a response is able to be prepared. For instance, at such a point in time that an imminent shortfall in housing capacity was identified, it would take a minimum of 2 years to provide a solution.

Using Council's dataset information (which has been compiled to inform capacity monitoring) the yield of each ODP has been critically examined to determine whether yield forecasts are feasible. Land allocated to existing improvements, land set aside for designated utility infrastructure, land used for non-residential purposes (schools, childcares etc.) and cadastral and topographical constraints have all been identified within ODP Areas and adjustments made to yields accordingly.

Alongside yield adjustments, monitoring data has been updated to reflect land that has been developed to the point of 224c certification being imminent or the issue of titles pending.

The assessment amends the Council's current capacity monitoring data and identifies a current capacity within all ODP Areas of 2059 households. This compares to Council's figure of 3082 households. Given the time that has lapsed since this assessment and with selling continuing unabated it must be assumed that there are less lots available.

Further to this comparison, it is likely the majority of short term development will be confined to ODP Areas 11 and 13 as well as the Acland Park Special Housing Area. It is doubtful if the other ODP Areas can be considered feasible in the short to medium term. If capacity is confined to these 'feasible' areas, then the overall capacity figure of 2059 households is reduced to 1372 households.

The steady rate of growth within Rolleston and the limited capacity identified justifies the need for additional land to be rezoned and therefore fully supports the intent of this Plan Change.

8 Policy and Plan Framework

The policy and planning framework relevant to the residential development is extensive including policy statements, plans and legislation at national, regional and district level. The following provides an assessment of the proposed plan change for rezoning in relation to these various documents.

8.1 National Policy Framework

- Part II RMA
- NPS Urban Development Capacity
- NPS Urban Development
- Draft NPS Highly productive land

Part II of the Resource Management Act

Part II of the Resource Management Act defines the purposes and principles of the Act, which are the overarching matters that should be taken into account in preparing policy statements and plans and when considering a resource consent application. In terms of this request for a plan change it is considered that the most relevant sections of Part II are sections 5 and 7. There are no relevant matters of national importance that are relevant to this proposal, and as such no assessment against this section has been made. The relevant sections are as follows:

5 Purpose

(1) The purpose of this Act is to promote the sustainable management of natural and physical resources.

(2) In this Act, sustainable management means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while—

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

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

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

7 *Other matters*

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 have particular regard to—

…

(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 Faringdon Far West proposal provides for the efficient and sustainable use of the land resource, in that it is an expansion of the residential development area in Rolleston in a location that meets the criteria in the relevant existing and proposed national, regional and local plans and policy documents. This increase in housing supply within Rolleston, including the provision of affordably priced residential sections and housing, will enable the social and economic wellbeing of the community to be maintained and enhanced.

The amenity of the neighbours and future residents has been taken into account throughout the development of Outline Development Plans for this block. This includes providing for lower density allotments in areas of the Faringdon Far West opposite rural and rural-residential zoned land. With regard to ensuring integration with adjoining existing residential areas and future growth areas this will be achieved by development by the respective outline development plans for Faringdon Far West, South West, South and South East having been prepared as part of a Master Plan for all of the Faringdon development . These ODPs provide for multiple connections within these sites which then provide linkages through to adjoining areas. Most of these linkages will be able to immediately actioned assuming the Plan Change 64 rezoning of Faringdon South West and South East is accepted. Achieving integration between the existing residential areas and the new areas will also result in the efficient use of existing infrastructure and other resources.

Achieving the balance required under Part II, has been achieved through a comprehensive approach to the design of the Faringdon Far West in coordination with Faringdon South West, South and South East development and is considered to achieve the overall purpose of the Act as set out in Part II.

National Policy Statement on Urban Development Capacity

The **National Policy Statement on Urban Development Capacity** (NPS-UDC) came into effect in December 2016, providing direction to decision-makers under the Resource Management Act 1991 in respect of planning for urban environments. The purpose of the Policy Statement is to recognise the national significance of:

- Urban environments and the need to enable these to develop and change and
- Provide sufficient development capacity to meet the needs of people and communities and future generations in urban environments

To achieve these purposes all councils that have part, or all, of a medium or high growth urban area within their district or region are required to produce a future development strategy which demonstrates that sufficient, feasible development capacity is available to support future housing and business growth. This includes over the medium (next 10 years) and long term (10 to 30 years) periods.

The Christchurch urban area was defined by Statistics NZ in 2016 as a high growth urban area. Given the strategic planning arrangements that already exist between the councils in the Greater Christchurch Partnership, it was agreed that a review of Greater Christchurch's settlement pattern should be done collaboratively, and in doing so, meet the statutory requirements of the NPS-UDC. Accordingly, the Partnership has determined that the Greater Christchurch area should be the geographic area of focus for the Update of the existing Urban Development Strategy (UDS) for the purposes of the NPS-UDC requirements.

This Update which is contained in the report "Our Space 2018-2018 – Greater Christchurch Settlement Pattern Update" was specifically undertaken to satisfy the requirements of Policies PC12 and PC13 of the NPS-UDC (related to producing a 'future development strategy') by:

- demonstrating that there will be sufficient, feasible development capacity over the medium and long term;
- identifying the broad location, timing and sequencing of future development capacity in new urban environments and intensification opportunities within existing urban environments;
- balancing the certainty regarding the provision of future development with the need to be responsive to demand for such development;
- being informed by a Capacity Assessment, the relevant Long Term Plans and Infrastructure Strategies required under the Local Government Act 2002, and any other relevant strategies, plans and documents;
- having particular regard to NPS-UDC Policy PA1.

This Update provides for residential development out to the Projected Infrastructure Boundary identified in Map A contained in Chapter 6 of the CRPS. In Rolleston the eastern extent of the Projected Infrastructure Boundary is Selwyn Road. The land proposed to be rezoned Living Z in this Plan Change sits west of Selwyn Road and is within the Projected Infrastructure Boundary thereby satisfying and implementing the Updated settlement pattern for Greater Christchurch and the National Policy Statement – Urban Development Capacity.

National Policy Statement on Urban Development 2020

The National Policy Statement on Urban Development (NPS-UD) was gazetted on 20 July 2020 and comes into effect on 20 August 2020. Its purpose is to ensure regional policy statements and regional and district plans provide adequate opportunity for land development for housing and business to meet community needs. This is to occur through improving the responsiveness and competitiveness of land and development markets to support productive and well-functioning cities. This National Policy Statement replaces the National Policy Statement on Urban Development Capacity 2016 by incorporating many of its elements.

The NPS-UD recognises at a national level the significance of well-functioning urban environments. In particular the Objectives of the NPS-UD seek the following:

- Urban environments that provide for the social, economic and cultural well-being and for their safety and safety now and in the future
- Planning decisions that improve housing affordability by supporting competitive land and development markets
- Regional policy statements and district plans enabling more people to live in areas of urban environments near centres or areas with employment opportunities,, area well serviced by public transport or a high demand for housing in the area.

- Urban environments develop and change over time in response to diverse and changing need of people, communities and future generations
- Local authority decisions on urban development are integrates with infrastructure planning and strategic over the medium term and long

The main tool to achieve these objectives is a Future Development Strategy (FDS) which has the purpose of achieving well-functioning environments in existing and future urban areas through, inter alia, provision of at least sufficient development capacity over the next 30 years to meet expected demand. As the NPS-UD has only recently been published there is no FDS for the greater Christchurch. However much of the work on development capacity has already been undertaken under the NPS -UDC 2016. Given the strategic planning arrangements that already exist between the councils in the Greater Christchurch Partnership, it was agreed that a review of Greater Christchurch's settlement pattern should be done collaboratively, and in doing so, meet the statutory requirements of the NPS-UDC. Accordingly, the Partnership determined that the Greater Christchurch area should be the geographic area of focus for the Update of the existing Urban Development Strategy (UDS) for the purposes of the NPS-UDC requirements. The Update determined feasible development capacity is available to support future housing and business growth for the medium (next 10 years) and long term (10 to 30 years) periods.

The Update has now been incorporated into proposed Change 6 to the Canterbury Regional Policy Statement. The main change to Chapter 6 is the inclusion of references to "Future Development Areas" as areas, alongside greenfield priority areas, that are to provide for future residential growth in Greater Christchurch. Assessment of this rezoning plan change in relation to the CRPS policy 6.3.12 is set out in detail in 9.2 below. This assessment concludes that the proposed rezoning of the Faringdon Far West along with South West and Faringdon South East blocks fully satisfies all the requirements of Chapter 6 of the CRPS.

The provision of additional land for housing through rezoning of Faringdon Far West achieves the following relevant policies of the NPS-UD:

Policy 1 – Planning decisions
The requested rezoning with accompanying outline development plan provides the Selwyn District Council with a mechanism to make a planning decision that provides for a variety homes with larger lots adjoining Dunns Crossing Road and mix of detached and attached homes elsewhere. A neighbourhood centre is set aside to enable establishment of local commercial facilities. In addition there is easy access to main roads for travel to work, schools, shops etc. as well as open space areas.

With regard to resilience to likely current and future effects of climate change the primary manner in which this can be achieved within new urban development is through encouraging reduced greenhouse gas emissions. The PC 64 request supports reduced greenhouse gas emissions through the following a consolidated urban form, proximity to community infrastructure and reduced reliance on vehicle travel as detailed below.

Consolidated Urban Form
The proposed development area lies within Rolleston's infrastructure boundary and forms part of the Rolleston Structure Plan which was prepared to ensure future growth was planned in an orderly and consolidated manner.

Proximity to Community Infrastructure
The proposed development areas are located in close proximity to key community infrastructure. This includes:

- Foster Park
- Rolleston Aquatic Centre
- Rolleston College
- Lemonwood Grove Primary School
- Faringdon commercial centre (South Point)

In addition to the community infrastructure identified above, a neighbourhood centre is proposed to provide for the convenience needs of local residents, similar to the way the South Point centre operates within the original Faringdon neighbourhood.

Reduce Reliance on Vehicle Travel

The layout of the proposed development is conducive to supporting future Public Transport. In tandem with the South West and South East areas that flank the Faringdon South Special Housing Area the boulevard linkages are extended, whilst also connecting with key local roads such as East Maddisons Road, Goulds Road and Springston Rolleston Road. Connections will also extend into the Acland Park Special Housing Area. The areas have been designed to provide a minimum net housing density of 12 households per hectare which at some point in the future will provide a critical mass in support of public transport. This public transport may be part of a district-wide service or a more locally-based service.

A key component of the layout for Faringdon Far West and associated South West and South East is the provision of an extensive pedestrian and cycle networks. These networks provides internal and external linkages which connect the areas with the established networks within Faringdon and along Springston Rolleston Road and Goulds Road.

Conclusion

The aforementioned factors which are inherent to the Far West area provide opportunities to reduce vehicle use and therefore greenhouse gas emissions. The factors mentioned are relevant on a predominantly local scale. Of further significance is the way in which the proposed plan change area supports reduced greenhouse gas emissions on a regional scale. Given the burgeoning employment base within Rolleston in the form of the growing industrial area, the town centre commercial development and ever-increasing community infrastructure projects, the provision of local housing options to support this growth also contributes significantly to reducing greenhouse gas emissions.

Policy 2 - Sufficient development capacity

This policy requires local authorities to provide sufficient development capacity to meet expected demand for housing over the short, medium and long term. The proposed rezoning is expected to provide for 800 houses over a period of 2022 through to 2029. The Economic analysis in Appendix C concludes that there is likely to be a shortage of residential capacity in the coming decade within Selwyn and Rolleston. There is therefore a clear case for more residential land to be zoned to meet the needs of the community and that the required rezoning should occur soon due to allow for the usual consenting and development phases invovled in bringing housing to the market. Market Economics consider that if Faringdon Far West is zoned in 2020/2021 the residential component will be easily developed in the coming decade thereby contributing to meeting current and anticipated demand.

Policy 8 – Responsiveness to plan changes

This policy requires local authority decisions to be responsive to plan changes that add significantly to development capacity and contribute to well-functioning urban environments even if the

development capacity is not anticipated by current RMA documents or is out-of-sequence for planned land release. Due to the very recent coming into force of the NPS-UD no council has yet defined the criteria for assessing what constitutes "significance" in terms of development capacity. Market Economics in their Significant Development" report attached in Appendix C considers that the relative size and scale of additional development capacity within the local economy may be an important criterion.

The proposed rezoning will provide for 800 new dwellings to be developed in Rolleston. This constitutes 12% more dwellings than currently exist in Rolleston which is significant increase by normal standards. If this is considered in combination with Faringdon South East and South West Market Economics (Refer Appendix C) then the proportion is around 17% of the current housing stock. With regard to the proposal in relation to growth in Rolleston the current growth rate is approximately 500 new dwellings per annum. Market Economics assess that based on recent rates of new dwelling consents granted that the new 1700 houses (900 in South East and South West and 800 in Far West) could be built over 10 years. At its peak during this period it is assessed that the new dwelling construction in the Faringdon South East, West and Far West areas could peak at around 30% to 45% of the annual house construction (2024 and 2025). They conclude that this is a sizeable share of the growth and would be "significant" within the context of Rolleston's future growth.

Draft National Policy Statement for Highly Productive Land

A discussion document on a proposed National Policy Statement on Highly Productive Land was released in August 2019. Its purpose is to:

- Recognise the full range and values and benefits associated with the use of highly productive land for primary production
- Maintain it availability for primary production for future generations and
- Protect highly productive land from inappropriate subdivision, use and development

The NPS is primarily directed at regional policy statements and district plans.

Proposed Policy 1 of the NPS requires regional councils within 3 years of the NPS coming into effect to identify areas of highly productive land based on specific criteria based primarily on:

- capability and versatility based on the Land Use Capability classification system ,
- suitability of the climate for primary production
- the size and cohesiveness of the area of land to support primary production.

At its most basic level it appears that Land Use Capability Classes 1, 2 and 3 will be included.

The document lists problems that need to be solved including urban expansion onto highly productive land. In relation to this issue the document contains proposed Objective 3 which states:

> ***Objective 3: Protecting from inappropriate subdivision, use and development***
> *To protect highly productive land from inappropriate subdivision, use and development, including by:*
> - *avoiding subdivision and land fragmentation that compromises the use of highly productive land for primary production;*
> - ***avoiding uncoordinated urban expansion on highly productive land that has not been subject to a strategic planning process; and***
> - *avoiding and mitigating reverse sensitivity effects from sensitive and incompatible activities within and adjacent to highly productive land.*

As assessed in relation to the effects of development on versatile soils the Faringdon Far West block contains Lismore stony and shallow silt loam soils. These soils have limited ability to retain moisture and are considered to have severe limitation for food production even with irrigation.

With regard to the proposed Objective 3 these soils would not be regarded as highly productive land, both because the majority of the soils have poor water retention and because the area of better soils is quite limited and so would not support viable intensive production. If the Land Use Classification (LUC) is applied the soils are only Class 4 and so not worthy of specific protection.

Importantly Objective 3 specifically refers to highly productive soils being protected by avoiding "*uncoordinated urban expansion on highly productive land that has not been subject to a strategic planning process".* In addition to the fact that the land to be rezoned is not highly productive, it has been identified through a very recent strategic planning process (Our Space) which provides for limited urban extensions including the subject land which sits inside the Projected Infrastructure Boundary. It is therefore considered that this rezoning Plan Change is aligned with the proposed National Policy Statement for highly productive land.

8.2 Regional Policy and Plans

- Canterbury Regional Policy Statement
- Our Space
- Canterbury Land and Water Regional Plan
- Iwi Management Plan

Canterbury Regional Policy Statement 2013

Chapter 5 – CRPS

The Selwyn District Plan is required under section 73(4) of the Resource Management Act to give effect to the Canterbury Regional Policy Statement 2013 (CRPS). Any proposed change to the District Plan must also give effect to the CRPS. Section 74(2) of the Act also requires territorial authorities to have regard to any proposed regional policy statement when preparing or changing a district plan.

The CRPS provides guidance on matters relevant to the growth of settlements within the region. Chapter 5 of the CRPS addresses concerns resulting from landuse and infrastructure on a region wide basis, and the objectives and policies of this chapter seek to ensure that development and growth does not have an adverse effect on the environment.

The objectives and policies in Chapter 5 of the CRPS 2013 seek to promote urban and rural-residential developments that have regard to the efficient use and development of resources while ensuring that any adverse effects on the environment are avoided, remedied or mitigated. Consolidation and integration with existing infrastructure is promoted, whilst ensuring that regionally significant infrastructure and the strategic transport network are not adversely impacted by any new development. The relevant objectives and assessment of the proposal in relation to these are set out below:

CHAPTER 5- LAND-USE AND INFRASTRUCTURE

5.2 OBJECTIVES

5.2.1 Location, design and function of development (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.*

Assessment:
The first goal of this objective is to achieve *consolidated, well designed and sustainable growth in and around existing urban areas*. This goal is achieved by the two proposed development areas adjoining the eastern extent of Rolleston. Development of these areas will achieve consolidation as they are logical extensions of very successful, well designed and sustainable suburban developments. The proposed rezoning of the Faringdon Far West block will also give effect to the second element of this Objective as it will enable the Greater Christchurch community to provide for their social, economic and cultural wellbeing through provision of additional housing as part of an established town. The development areas will not directly serve future generations as it is expected, based on known demand and supply, that they will be developed and built on in the short to medium term (3-10 years). Future generations will however benefit from current generations having "grown up" within an area that is part of well-planned growth of Rolleston, which in turn is part of Greater Christchurch.

With regard to the relevant location and design aspects referred to in clause 2:

- There are no areas within the land to be rezoned which have particular or significant natural values, nor is there any significant regional infrastructure.
- The area being rezoned has as its primary purpose the provision of housing choice for people of the region, and in particular, greater Christchurch.
- The rezoned land contains areas set aside to provide for community and commercial use, however these are expected to provide limited employment opportunities. However, there are substantial existing and future employment opportunities within Rolleston and the surrounding area.
- The land being rezoned is currently used for limited productive purposes
- Potential conflict is expected to be limited due to the land use history of the area and use of larger lot sizes on the eastern periphery of the two areas.

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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.*

Assessment:

The Transportation Assessment attached to the Plan Change request considers the impact of the additional traffic generated by the requested residential rezoning. The assessment concludes that the additional traffic can be accommodated into the existing, new and planned elements of the road network serving Rolleston and Greater Christchurch without any adverse safety impacts. With regard to safety, the level of service of some intersections used by resident and visitors close to and beyond the immediate area is expected to reduce slightly resulting from a small increase in waiting time. This degree of impact is considered to be of such as small scale that it is no regional significance. It is therefore considered that the rezoning will be consistent with Objective 5.3.7.

The proposal is effectively an extension of existing residential development (Faringdon). On this basis the proposed rezoning is considered to implement the requirements of consolidation and integration. The rezoning provides additional housing choice for the community, and will connect into existing infrastructure. The rezoning combined with the development requirements such as reticulation of services, ensures that the completed proposal will have minimal effects on the physical environment, as set out in the AEE. The location of the site also ensures that transportation infrastructure, including the proposed Stage 2 of the Christchurch Southern Motorway, is not compromised. Overall, the proposed rezoning is considered to give effect to the objectives and policies in Chapter 5.

Chapter 6 CRPS

Chapter 6 was included in the Regional Policy Statement in 2013 having been incorporated from the Land Use Recovery Plan developed in response to the Canterbury earthquakes. Specifically it "*provides a resource management framework for the recovery of Greater Christchurch to enable and support earthquake recovery and rebuilding including restoration and enhancement through to 2028"*. A key focus of Chapter 6 was to respond to the anticipated demand for business and residential activities which needed to be replaced or relocated as a result of the earthquakes. To a large extent this recovery has occurred in relation to provision and uptake of identified (and now zoned) land for business and residential activities impacted by the earthquakes. Accordingly, it is considered that the objectives and policies in Chapter 6 need to be applied and evaluated recognizing that Greater Christchurch has moved on from only responding to the direct impacts of the earthquakes. In particular there is ongoing demand for residential land for housing due to population growth in addition to the demand by first home buyers who are reluctant or unable to buy existing houses in areas impacted by the earthquakes. These factors have resulted in strong demand for lower cost housing outside Christchurch City, particularly in Rolleston. On the supply side a number of areas identified for residential development have not become available as anticipated.

In response to a recognised demand for housing beyond that anticipated in the LURP and Chapter 6 of the CRPS, the Greater Christchurch Partnership has chosen to revisit these documents. This review has also occurred in response to the requirements contained in the National Policy Statement of Urban Development Capacity which has the purpose of recognizing the national significance of:

- Urban environments and the need to enable these to develop and change and
- Providing sufficient development capacity to meet the needs of people and communities and future generations in urban environments

To achieve these purposes all councils that have part, or all, of a medium or high growth urban area within their district or region are required to produce a future development strategy which demonstrates that sufficient, feasible development capacity is available to support future housing and business growth. This includes over the medium (next 10 years) and long term (10 to 30 years) periods.

The Christchurch urban area was defined by Statistics NZ in 2016 as a high growth urban area. Given the strategic planning arrangements that already exist between the councils in the Greater Christchurch Partnership, it was agreed that a review of Greater Christchurch's settlement pattern should be done collaboratively, and in doing so, meet the statutory requirements of the NPS-UDC. Accordingly, the Partnership has determined that the Greater Christchurch area should be the geographic area of focus for the Update of the existing Urban Development Strategy (UDS) for the purposes of the NPS-UDC requirements.

This Update, which is contained in the report "Our Space 2018-2018 – Greater Christchurch Settlement Pattern Update", provides for residential development out to the Projected Infrastructure Boundary identified in Map A contained in Chapter 6 of the CRPS. In Rolleston the eastern extent of the Projected Infrastructure Boundary is Selwyn Road. The land proposed to be rezoned Living Z in this Plan Change sits north of Selwyn Road and is within the Projected Infrastructure Boundary thereby satisfying and implementing the Updated settlement pattern. Implementation of this updated settlement pattern is to be by way of a formal change to Chapter 6 of the Canterbury Regional Policy Statement which is to be achieved through a Streamlined Planning Process provided for in Part 5 of Schedule 1 of the RMA.

As mentioned above it is considered that the objectives and policies in Chapter 6 need to be applied and evaluated recognizing that Greater Christchurch has moved on from only responding to the direct impacts of the earthquakes. In particular there is a demand for residential land for housing simply created by natural growth in the population and that provision to meet this demand is going to be achieved by an amendment to Chapter 6 of the CRPS.

Objective 6.2.1 Recovery framework
Recovery, rebuilding and development are enabled within Greater Christchurch through a land use and infrastructure framework that:

1. *identifies priority areas for urban development within Greater Christchurch;*
2. *identifies Key Activity Centres which provide a focus for high quality, and, where appropriate, mixed-use development that incorporates the principles of good urban design;*
3. *avoids urban development outside of existing urban areas or greenfield priority areas for development, unless expressly provided for in the CRPS;*
4. *protects outstanding natural features and landscapes including those within the Port Hills from inappropriate subdivision, use and development;*
5. *protects and enhances indigenous biodiversity and public space;*
6. *maintains or improves the quantity and quality of water in groundwater aquifers and surface waterbodies, and quality of ambient air;*

7. *maintains the character and amenity of rural areas and settlements;*

8. *protects people from unacceptable risk from natural hazards and the effects of sea-level rise;*

9. *integrates strategic and other infrastructure and services with land use development;*

10. *achieves development that does not adversely affect the efficient operation, use, development, appropriate upgrade, and future planning of strategic infrastructure and freight hubs;*

11. *optimises use of existing infrastructure; and*

12. *provides for development opportunities on Māori Reserves in Greater Christchurch.*

6.2.1a Targets for sufficient, feasible development capacity for housing [Inserted in accordance with sections 55(2) and 55(A) of the Resource Management Act 1991, from the National Policy Statement on Urban Development Capacity 2016]
For the period 2018-2048, sufficient, feasible development capacity for housing is enabled in Greater Christchurch in accordance with Table 6.1.

Table 6.1 Targets for housing development capacity in Greater Christchurch, 2018-2048

	Development capacity to be enabled (number of dwellings)		
	Medium Term[1] (2018-2028)	Long Term[2] (2028-2048)	Total 30 Year Period (2018-2048)
Christchurch City	17,400	38,550	55,950
Selwyn	8,600	8,690	17,290
Waimakariri	6,300	7,060	13,360
Greater Christchurch	32,300	54,300	86,600

Policy 6.3.1 Development within the Greater Christchurch area

1. *In relation to recovery and rebuilding for Greater Christchurch:*

2. *give effect to the urban form identified in Map A, which identifies the location and extent of urban development that will support recovery, rebuilding and planning for future growth and infrastructure delivery;*

3. *give effect to the urban form identified in Map A (page 6-27) by identifying the location and extent of the indicated Key Activity Centres;*

4. *enable development of existing urban areas and greenfield priority areas, including intensification in appropriate locations, where it supports the recovery of Greater Christchurch;*

5. *ensure new urban activities only occur within existing urban areas or identified greenfield priority areas as shown on Map A, unless they are otherwise expressly provided for in the CRPS;*

6. *provide for educational facilities in rural areas in limited circumstances where no other practicable options exist within an urban area;*

7. *provide for a metropolitan recreation facility at 466-482 Yaldhurst Road; and*

8. *avoid development that adversely affects the function and viability of, or public investment in, the Central City and Key Activity Centres.*

Assessment Objective 6.2.1, 6.2.1.a and Policy 6.3.1:

Objective 6.2.1 sets out the form and content development and the means of achieving this through the land use and infrastructure framework set out in the CRPS. These means include identification of priority areas for urban development. The objective does not specify what those areas are, leaving that detail to the policies. The area proposed to be rezoned sitting inside the infrastructure boundary will be identified in the CRPS in the near future when the change to the CRPS is approved. All the other matters listed in this objective are either satisfied or not relevant.

Regarding **Objective 6.2.1a** Targets for housing development, the recent work undertaken by the Greater Christchurch Partnership updates this table reflecting both an increase in the number of households for provision which needs to be made and the fact that some of the land currently identified for development is not readily available.

Policy 6.3.1 largely mirrors Objective 6.2.1 but adds specific reference to identified greenfield priority areas on Map A. As mentioned those greenfield areas were developed on the basis of the anticipated demand primarily created by the recovery and rebuilding process following the Canterbury earthquakes. The process is largely occurred creating the opportunity to reconsider future needs associated with natural growth in the population and their housing needs. While the proposed rezoning is not consistent with this policy in regard to Map A, that will not be the case once the proposed change to Chapter 6 of the CRPS is in place. However it is noted that the actual development of this land will not occur prior to Map A being formally revised.

Objective 6.2.2 Urban form and settlement pattern

The urban form and settlement pattern in Greater Christchurch is managed to provide sufficient land for rebuilding and recovery needs and set a foundation for future growth, with an urban form that achieves consolidation and intensification of urban areas, and avoids unplanned expansion of urban areas, by:

1. *aiming to achieve the following targets for intensification as a proportion of overall growth through the period of recovery:*
    a. *35% averaged over the period between 2013 and 2016*
    b. *45% averaged over the period between 2016 to 2021*
    c. *55% averaged over the period between 2022 and 2028;*
2. *providing higher density living environments including mixed use developments and a greater range of housing types, particularly in and around the Central City, in and around Key Activity Centres, and larger neighbourhood centres, and in greenfield priority areas and brownfield sites;*
3. *reinforcing the role of the Christchurch central business district within the Greater Christchurch area as identified in the Christchurch Central Recovery Plan;*
4. *providing for the development of greenfield priority areas on the periphery of Christchurch's urban area, and surrounding towns at a rate and in locations that meet anticipated demand and enables the efficient provision and use of network infrastructure;*
5. *encouraging sustainable and self-sufficient growth of the towns of Rangiora, Kaiapoi, Woodend, Lincoln, Rolleston and Prebbleton and consolidation of the existing settlement of West Melton;*
6. *Managing rural residential development outside of existing urban and priority areas; and*
7. *Providing for development opportunities on Māori Reserves.*

Policy 6.3.1 Development within the Greater Christchurch area

In relation to recovery and rebuilding for Greater Christchurch:

1. *give effect to the urban form identified in Map A, which identifies the location and extent of urban development that will support recovery, rebuilding and planning for future growth and infrastructure delivery;*
2. *give effect to the urban form identified in Map A (page 6-27) by identifying the location and extent of the indicated Key Activity Centres;*
3. *enable development of existing urban areas and greenfield priority areas, including intensification in appropriate locations, where it supports the recovery of Greater Christchurch;*

4. *ensure new urban activities only occur within existing urban areas or identified greenfield priority areas as shown on Map A, unless they are otherwise expressly provided for in the CRPS;*

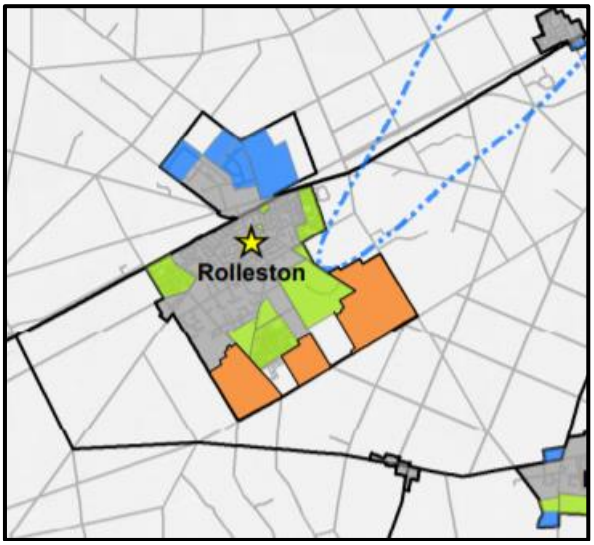
5. *provide for educational facilities in rural areas in limited circumstances where no other practicable options exist within an urban area;*

6. *provide for a metropolitan recreation facility at 466-482 Yaldhurst Road; and*

7. *avoid development that adversely affects the function and viability of, or public investment in, the Central City and Key Activity Centres.*

Assessment Objective 6.2.2 and Policy 6.3.1:
This objective and policy are highly relevant as they set the scene for moving on from the rebuilding and recovery as they seek to achieve an urban form and settlement pattern that not only provides sufficient land for the recovery but also wants this to set a foundation for future growth. To date this has been signalled by identification of Projected Infrastructure Boundary on Map A. This boundary provides a logical and clear eastern boundary for the growth of Rolleston through to Selwyn Road and has been adopted for the proposed rezoning as it follows through to this outer boundary.

The Selwyn Housing Accord identified a lack of capacity within Rolleston for existing and anticipated demand for housing. This lack of capacity has resulted in two major changes in the statutory planning framework relating to Rolleston. Firstly, Central Government have added two areas to Schedule 1 of the Housing Accord and Special Housing Areas Act, namely Faringdon South and Acland Park (refer grey areas between the orange Future Development Areas in the plan below). This has allowed these areas to be developed for urban purposes and in particular housing purposes. Secondly, this capacity issue has been recognised and identified at regional level in the report *Our Space, 2018-2048 - Greater Christchurch Settlement Pattern Update*" prepared by the Greater Christchurch Partnership. Of greater significance is the identification of three "Future development area" (shown in orange in the plan below adjoining Selwyn Road) for inclusion into Map A and Chapter 6 through a change to the CRPS. The western Future Development Areas is one of the three areas proposed for rezoning.



While the proposed plan change does not give effect to the current version of Map A, it will do so as soon as the proposed change to the Canterbury Regional Policy Statement is processed. The Plan

Change has been requested at this stage to avoid a delay in proceeding with development of these areas i.e. it will enable these areas to be developed as soon as Map A is formally amended.

With regard to various relevant criteria listed in Objective 6.2.2 there is sufficient infrastructure capacity to provide for development of Faringdon Far West site and outline development area plan have been prepared in accordance with the specified minimum density of 12 household per hectare.

The lack of consistency of the requested Plan Change with the current version of Map A is a function of timing. However, as the areas proposed to be rezoned will not be developed prior to Map A being formally amended to include these blocks, it is considered that the proposal will give effect to Objective 6.2.2 and Policy 6.3.1 of the CRPS.

Objective 6.2.3 Sustainability
Recovery and rebuilding is undertaken in Greater Christchurch that:

1. *provides for quality living environments incorporating good urban design;*
2. *retains identified areas of special amenity and historic heritage value;*
3. *retains values of importance to Tāngata Whenua;*
4. *provides a range of densities and uses; and*
5. *is healthy, environmentally sustainable, functionally efficient, and prosperous*

Assessment Objective 6.2.3:
The Assessment of Environmental Effects in the Plan Change Request document addresses the matters of good urban design, densities and uses and the adoption of sustainable infrastructure services. It is assessed that implementation of the requested Plan Change will give effect to this Objective.

6.2.4 Integration of transport infrastructure and land use
Prioritise the planning of transport infrastructure so that it maximises integration with the priority areas and new settlement patterns and facilitates the movement of people and goods and provision of services in Greater Christchurch, while:

1. *managing network congestion;*
2. *reducing dependency on private motor vehicles;*
3. *reducing emission of contaminants to air and energy use;*
4. *promoting the use of active and public transport modes;*
5. *optimising use of existing capacity within the network; and*
6. *enhancing transport safety*.

Assessment Policy 6.2.4:
This policy is not directly relevant to the Plan Change request.

6.3.2 Development form and urban design
Business development, residential development (including rural residential development) and the establishment of public space is to give effect to the principles of good urban design below, and those of the NZ Urban Design Protocol 2005, to the extent appropriate to the context:

1. *Tūrangawaewae – the sense of place and belonging – recognition and incorporation of the identity of the place, the context and the core elements that comprise the Through context and site analysis, the following elements should be used to reflect the appropriateness of the development to its location:*

landmarks and features, historic heritage, the character and quality of the existing built and natural environment, historic and cultural markers and local stories.

2. *Integration – recognition of the need for well-integrated places, infrastructure, movement routes and networks, spaces, land uses and the natural and built environment. These elements should be overlaid to provide an appropriate form and pattern of use and development.*

3. *Connectivity – the provision of efficient and safe high quality, barrier free, multimodal connections within a development, to surrounding areas, and to local facilities and services, with emphasis at a local level placed on walking, cycling and public transport as more sustainable forms of*

4. *Safety – recognition and incorporation of Crime Prevention Through Environmental Design (CPTED) principles in the layout and design of developments, networks and spaces to ensure safe, comfortable and attractive places.*

5. *Choice and diversity – ensuring developments provide choice and diversity in their layout, built form, land use housing type and density, to adapt to the changing needs and circumstances of the population.*

6. *Environmentally sustainable design – ensuring that the process of design and development minimises water and resource use, restores ecosystems, safeguards mauri and maximises passive solar gain.*

7. *Creativity and innovation – supporting opportunities for exemplar approaches to infrastructure and urban form to lift the benchmark in the development of new urban areas in the Christchurch region.*

6.3.3 Development in accordance with outline development plans

Development in greenfield priority areas and rural residential development is to occur in accordance with the provisions set out in an outline development plan or other rules for the area. Subdivision must not proceed ahead of the incorporation of an outline development plan in a district plan. Outline development plans and associated rules will:

1. *Be prepared as:*

   a. *a single plan for the whole of the priority area; or*

   b. *where an integrated plan adopted by the territorial authority exists for the whole of the priority area and the outline development plan is consistent with the integrated plan, part of that integrated plan; or*

   c. *a single plan for the whole of a rural residential area; and*

2. *Be prepared in accordance with the matters set out in Policy 6.3.2;*

3. *To the extent relevant show proposed land uses including:*

   a. *Principal through roads, connections with surrounding road networks, relevant infrastructure services and areas for possible future development;*

   b. *Land required for community facilities or schools;*

   c. *Parks and other land for recreation;*

   d. *Land to be used for business activities;*

   e. *The distribution of different residential densities, in accordance with Policy 6.3.7;*

   f. *Land required for stormwater treatment, retention and drainage paths;*

   g. *Land reserved or otherwise set aside from development for environmental, historic heritage, or landscape protection or enhancement;*

h. *Land reserved or otherwise set aside from development for any other reason, and the reasons for its protection from development;*

i. *Pedestrian walkways, cycleways and public transport routes both within and adjoining the area to be developed;*

4. *Demonstrate how Policy 6.3.7 will be achieved for residential areas within the area that is the subject of the outline development plan, including any staging;*

5. *Identify significant cultural, natural or historic heritage features and values, and show how they are to be protected and/or enhanced;*

6. *Document the infrastructure required, when it will be required and how it will be funded;*

7. *Set out the staging and co-ordination of subdivision and development between landowners;*

8. *Demonstrate how effective provision is made for a range of transport options including public transport options and integration between transport modes, including pedestrian, cycling, public transport, freight, and private motor vehicles;*

9. *Show how other potential adverse effects on and/or from nearby existing or designated strategic infrastructure (including requirements for designations, or planned infrastructure) will be avoided, remedied or appropriately mitigated;*

10. *Show how other potential adverse effects on the environment, including the protection and enhancement of surface and groundwater quality, are to be avoided, remedied or mitigated;*

11. *Show how the adverse effects associated with natural hazards are to be avoided, remedied or mitigated as appropriate and in accordance with Chapter 11 and any relevant guidelines; and*

12. *Include any other information that is relevant to an understanding of the development and its proposed zoning.*

Assessment Policy 6.3.2 and 6.3.3

The urban design approach and elements detailed in the outline development plan for Faringdon Far West are anticipated to achieve a high level of amenity and efficiency for residents and for the neighbourhood and accordingly it is considered that the Plan Change will give effect to policies 6.3.2 and 6.3.3.

6.3.4 Transport effectiveness

Ensure that an efficient and effective transport network that supports business and residential recovery is restored, protected and enhanced so that it maintains and improves movement of people and goods around Greater Christchurch by:

1. *avoiding development that will overload strategic freight routes;*

2. *providing patterns of development that optimise use of existing network capacity and ensuring that, where possible, new building projects support increased uptake of active and public transport, and provide opportunities for modal choice;*

3. *providing opportunities for travel demand management;*

4. *requiring integrated transport assessment for substantial developments; and*

5. *improving road user safety.*

Assessment of Policy 6.3.4

The location of these new residential areas is such that they can make use of the current arterial routes to the key activity centre at Rolleston which is currently undergoing expansion to serve the growing population. The location also connects well to routes to the east such as Lincoln (bus service uses the Springston Rolleston Road), existing routes to Prebbleton and Christchurch and to the Christchurch Southern Motorway stage 2 with associated overbridges to provide quicker and more efficient routes between Christchurch and Rolleston. The changes are also anticipated to improve safety by reducing the number of vehicles using roads crossing main routes. While not directly served with public transport, it is expected that improved services will follow population growth of the town. Overall it is considered that the Plan Change is consistent with this policy.

Policy 6.3.5 Integration of land use and infrastructure

Recovery of Greater Christchurch is to be assisted by the integration of land use development with infrastructure by:

1. *Identifying priority areas for development to enable reliable forward planning for infrastructure development and delivery;*

2. *Ensuring that the nature, timing and sequencing of new development are co-ordinated with the development, funding, implementation and operation of transport and other infrastructure in order to:*

    a. *optimise the efficient and affordable provision of both the development and the infrastructure;*

    b. *maintain or enhance the operational effectiveness, viability and safety of existing and planned infrastructure;*

    c. *protect investment in existing and planned infrastructure; and*

    d. *ensure new development does not occur until provision for appropriate infrastructure is in place;*

3. *Providing that the efficient and effective functioning of infrastructure, including transport corridors, is maintained, and the ability to maintain and upgrade that infrastructure is retained;*

4. *Only providing for new development that does not affect the efficient operation, use, development, appropriate upgrading and safety of existing strategic infrastructure, including by avoiding noise sensitive activities within the 50dBA Ldn airport noise contour for Christchurch International Airport, unless the activity is within an existing residentially zoned urban area, residential greenfield area identified for Kaiapoi, or residential greenfield priority area identified in Map A (page 6-28); and*

5. *Managing the effects of land use activities on infrastructure, including avoiding activities that have the potential to limit the efficient and effective, provision, operation, maintenance or upgrade of strategic infrastructure and freight hubs.*

Assessment of Policy 6.3.5

The factors and outcomes sought in Policy 6.3.5 have formed the basis for identification of growth areas with Greater Christchurch. To date these growth areas have been in the general area of the proposed rezonings at Rolleston but have not extended through to Selwyn Road. In addition, two significant areas have recently been developed under the Special Housing legislation. The efficient use and development of infrastructure was a key determinant in choosing these areas. The servicing of the proposed new areas is addressed in the Plan Change request. It concludes that the proposed areas will make efficient use of existing infrastructure including the new sewer pump station on the corner of Selwyn Road and Springston Rolleston Road and the recently modified layout of this intersection. Water supply can be efficiently connected and stormwater treated and

disposed of within the development sites. On this basis it is concluded that the proposal gives effect to this policy.

6.3.7 Residential location, yield and intensification

1. *In relation to residential development opportunities in Greater Christchurch:*

2. *Subject to Policy 5.3.4, residential greenfield priority area development shall occur in accordance with Map A. These areas are sufficient for both growth and residential relocation through to 2028.*

3. *Intensification in urban areas of Greater Christchurch is to be focused around the Central City, Key Activity Centres and neighbourhood centres commensurate with their scale and function, core public transport routes, mixed-use areas, and on suitable brownfield land.*

4. *Intensification developments and development in greenfield priority areas shall achieve at least the following residential net densities averaged over the whole of an ODP area (except where subject to an existing operative ODP with specific density provisions):*

5. *10 household units per hectare in greenfield areas in Selwyn and Waimakariri District;*

6. *15 household units per hectare in greenfield areas in Christchurch City;*

7. *Intensification development within Christchurch City to achieve an average of:*

8. *50 household units per hectare for intensification development within the Central City;*

9. *30 household units per hectare for intensification development elsewhere.*

10. *Provision will be made in district plans for comprehensive development across multiple or amalgamated sites.*

11. *Housing affordability is to be addressed by providing sufficient intensification and greenfield priority area land to meet housing demand during the recovery period, enabling brownfield development and providing for a range of lot sizes, densities and appropriate development controls that support more intensive developments such as mixed use developments, apartments, townhouses and terraced housing.*

Assessment of Policy 6.3.7

Policy 6.3.7 is similar to **Objective 6.2.1** Recovery Framework, **Objective 6.2.2** Urban Form and settlement pattern and **Policy 6.3.1** Development with the Greater Christchurch Area, all of which seek that urban growth occur within identified greenfield priority areas which are specified on Map A in Chapter 6 of the CRPS. As referred to in the assessment of these policies the greenfield areas identified on Map A were developed on the primary basis of anticipated demand created by the recovery and rebuilding process following the Canterbury earthquakes. While these were stated to apply through to 2028, recent analysis of population growth and take-up of land for new housing has shown that the growth requirements were underestimated and land availability overestimated.

Following from this recent analysis there has been an Update of the Urban Development Strategy which is contained in the report "Our Space 2018-2018 – Greater Christchurch Settlement Pattern Update". The Update provides for residential development out to the Projected Infrastructure Boundary identified in Map A contained in Chapter 6 of the CRPS. In Rolleston the eastern extent of the Projected Infrastructure Boundary is Selwyn Road. The land proposed to be rezoned Living Z in this Plan Change sits west of Selwyn Road and is within the Projected Infrastructure Boundary thereby satisfying and implementing the Updated settlement pattern. Implementation of this updated settlement pattern is to be by way of a formal change to Chapter 6 of the Canterbury Regional Policy Statement which is to be achieved through a Streamlined Planning Process provided for in Part 5 of Schedule 1 of the RMA.

As mentioned it is considered that the objectives and policies in the current Chapter 6 need to be applied and evaluated recognizing that housing needs of Greater Christchurch have moved on from responding to the impacts of the earthquakes. In particular there is a demand for residential land for housing simply created by natural growth in the population, particular the cohort associated with buying their first home. To meet this demand in an efficient manner and to avoid causing the price of new housing to increase beyond normal levels there needs to be provision to meet this demand. Providing for this demand is going to be achieved by an amendment to Chapter 6 of the CRPS providing for new future development.

With regard to various relevant criteria listed in Policy 6.3.7 there is sufficient infrastructure capacity to provide for development of the Faringdon Far West site and outline development area plan have been prepared in accordance with the specified minimum density of 12 household per hectare. The layout will address housing affordability by providing for a range lot sizes including small lots that enable first home buyers to enter the market.

While the proposed plan change does not give effect to the current version of Map A, it will do so as soon as the proposed change to the Canterbury Regional Policy Statement is processed. The Plan Change has been requested at this stage to avoid a delay in proceeding with development of these areas i.e. it will enable these areas to be developed as soon as Map A is formally amended. The lack of consistency of the requested Plan Change with the current version of Map A is a function of timing. As the areas proposed to be rezoned will not be developed prior to Map A being formally amended to include these blocks, it is considered that the proposal development provided for by the requested Plan Change will give effect to Policy 6.3.7 of the CRPS.

Our Space

The Greater Christchurch Partnership, which includes Environment Canterbury, Christchurch, City and the Selwyn and Waimakariri district councils, developed the Urban Development Strategy in 2007 to effectively plan for and manage urban development across Greater Christchurch. The collaboration played a crucial role in coordinating and facilitation rebuild and recovery activities after the earthquakes. This Partnership has now reviewed the settlement pattern for Greater Christchurch, which has to a large extent been undertaken to satisfy the requirements of the National Policy Statement on Urban Development Capacity (NPS-UDC) as referred to above. The reviewed settlement pattern is contained in the document *Our Space, 2018-2048 – Greater Christchurch Settlement Pattern Update.* The key considerations in supporting housing and business growth in Greater Christchurch raised by the Partnership are how:

- The desired urban form can be achieved while supporting increasing business and housing needs
- How to provide for diversity of housing that meets the needs of a changing residential population
- How to integrate land use and transport planning to create safe, accessible and liveable urban areas

Having chosen a scenario for Greater Christchurch for population and household growth over 30 years it has been estimated that about 74,000 new dwellings will be required. With a margin added to address the possibility of some development not occurring as predicted the total increases to 78,000 houses. For Selwyn District the projected household growth is 7,200 (8,600) for 10 years from 2018 to 2028 (the medium term) and an additional 13,500 (15,600) from 2028 to 2048[1] (30 years - the longer term).

[1] Numbers in brackets include the additional planning margins required by NPS-UDC Policies PC1 to PC4.

Minimum targets for housing development capacity for medium and long term periods have been developed informed by the projected demand for housing identified in the housing assessment. Rather than duplicating the demands for each territorial authority The Partnership consider that this may not align with the strategic goals of the UDS to support growth by redeveloping and intensifying existing urban areas. In recognising that the current character of development will not change overnight the housing development capacity have been chosen to represent a transitional approach that align with projected demands over the projected term. The targets for housing development capacity in Greater Christchurch 2018-2048 are set out in the table below. These targets have been incorporated into the draft proposed change to Chapter 6 of CRPS.

Targets for housing development capacity in Greater Christchurch, 2018-2048

	Development capacity to be enabled (number of dwellings)		
	Medium Term (2018-2018)	Long Term (2028-2048)	Total 30 Year Period (2018-2048)
Christchurch City	17,400	38,550	55,950
Selwyn	8,600	8,690	17,290
Waimakariri	6,300	7,060	13,360
Greater Christchurch	32,300	54,300	86,600

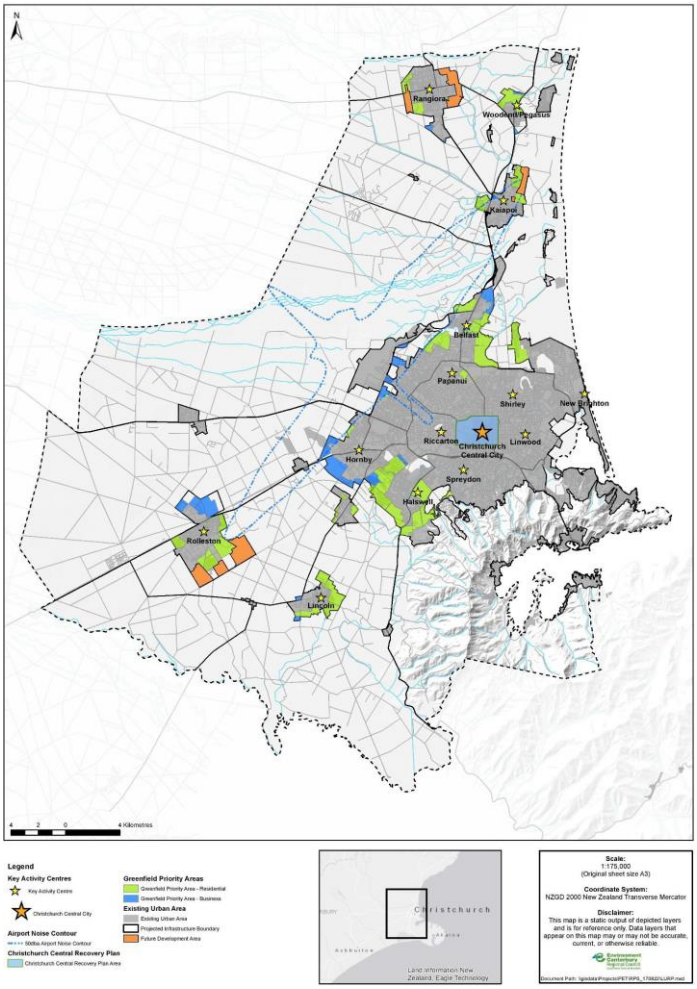
It is expected that the medium term targets will be addressed through zoning and other processes and mechanisms (district plans, structure plans, outline development plans and infrastructure strategies). The details of these targets for housing development capacity for Greater Christchurch (and its component districts) will be inserted into Chapter 6 by way of a change to the Canterbury Regional Policy Statement by the end of 2019. Those medium term targets will be identified as being achieved by rezoning in district plans. Additional capacity over the long term will be shown on Map A in Chapter 6 as Future development Area. These areas will be identified in relevant plans and strategies and the development infrastructure required to service these will be identified in each council's infrastructure strategy.

Draft Proposed Change to Chapter 6 of the CRPS

To implement the required changes to Chapter 6 setting in place the updated development capacity and related policies Environment Canterbury in consultation with Christchurch City, Waimakariri and Selwyn District Councils has prepared a draft change which is to be approved by the Minister for the Environment under the Streamlined Planning Process provisions. The main change to Chapter 6 is the inclusion of references to "Future Development Areas" as areas, alongside greenfield priority areas, that are to provide for future residential growth in Greater Christchurch. The new reference to Future Development Areas occurs within:

- Policy 6.2.2 Urban form and settlement pattern
- Policy 6.3.1 Development within Greater Christchurch - Principal reasons and explanation
- Policy 6.3.3 Development in accordance with outline development plans
- Policy 6.3.5 Integration of land use infrastructure
- Policy 6.3.7 Residential location, yield and intensification - Principal reasons and explanation
- Policy 6.3.12 Future Development Areas

The Future Development Areas referred to in these policies are the brown areas identified in a revised Map A shown below.



With regard to the plan change now requested the most relevant policy is Policy 6.3.12 which sets out the circumstances that are required if development in Future Development Areas is to be enabled. These circumstances are set out below with an assessment of this Plan Change request to rezone land within the western Future Development Area fronting Selwyn Road identified in revised Map A.

Policy 6.3.12 Assessment

1. *Monitoring of housing capacity and sufficiency carried out by the Partnership demonstrates there is a need to provide further feasible development capacity through rezoning of additional land to address the shortfall of feasible residential development to meet the medium term targets set out in Table 6.1 Objective 6.2.1a:*

   SDC have previously undertaken feasibility and capacity assessments to satisfy requirements under the NPS for Urban Growth Capacity. The last assessment was completed in 2017 and used datasets from Council records sourced in 2016. The development of land and housing construction has continued at a steady rate since 2016. Given that additional capacity hasn't been created in the intervening period, the shortfall of feasible residential development is likely to have intensified since 2017 forecasts.

2. *The development would support the pattern of settlement and principles for future urban growth set out in objective 6.2.1 and 6.2.2 and related policies:*

   The matters of the Recovery Framework and the patterns of settlement have been assessed elsewhere in this assessment and were taken into account in the recent Update of the Settlement Pattern – Our Space. These assessments concluded that the areas now

requested to be rezoned met the various criteria for growth areas and would provide for expected demand resulting from detailed development capacity assessments. With regard to the high quality development and good urban design this is primarily attained through implementation of the approved outline development plan for the area to be rezoned.

3. *The timing and sequencing of development is appropriately aligned with the provision of infrastructure, in accordance with Objective 6.2.4 and policies 6.3.4 and 6.3.5*

The integration of the proposed new Living Z areas with regard to infrastructure needs has been assessed in this request. Due to infrastructure improvements and new facilities servicing Rolleston and the eastern areas in particular, the areas proposed for rezoning are well placed to make efficient use of existing and planned services and facilities. In addition the developments will, through development contributions, contribute to new and expanded services in the Rolleston area.

4. *The development would occur in accordance with an outlined development plan and the requirements of Policy 6.3.3*

A detailed Outline Development Plan has been prepared for each of the areas proposed to be rezoned. These have been prepared in accordance with Policy 6.3.3 which has become accepted practice within the Selwyn District Plan which has numerous Outline Development Plans.

5. *Policy 6.3.11(5) relating to a range of matters are met*

Policy 6.3.11(5) has an extensive list of circumstances that must exist before development can occur as a result of a review of the extent and location of land for development. These circumstances are assessed below:

a. *Infrastructure to be in place* – This matter is satisfied with reticulated sewerage and water supply and on site stormwater treatment and disposal.
b. *Safe and convenient access to community, social and commercial services* – Linkages on main routes and internal collector routes through Faringdon and along Dunns Crossing, Selwyn Road, East Maddisons Road and Goulds Road all provide ready, safe and convenient access to existing and proposed commercial, community and social services.
c. *Urban consolidation continues to be achieved* –The location of the Faringdon Far West block largely completes rezoning and development of the southern and eastern extent of Rolleston providing a strong boundaries within which the urban area is consolidated.
d. *Development does not increase the risk of contamination of drinking water sources* – There is no risk of water contamination from residential development in these new areas.
e. *Doesn't lie between primary and secondary stopbanks of the Waimakariri River*- Satisfied
f. *Landscape of the Port Hills is protected* - Satisfied
g. *Open space character between urban areas is maintained*- Satisfied
h. *Operation capacity of infrastructure not compromised*- Satisfied

6. *The effects of natural hazards are avoided or appropriately mitigated*

There are no natural hazard risks associated with the general area in which the rezoned is located.

It is concluded therefore that the proposed rezoning of the Faringdon Far West block fully satisfies all the requirements of Chapter 6.

Mahaanui - Iwi Management Plan, 2013

The Mahaanui Iwi Management Plan (IMP) sets out Ngāi Tahu's objectives, issues and policies for natural resource and environmental management within the area bounded by the Hurunui River in the north and the Ashburton River in the south. Under Section 74(2A) of the Resource Management Act, a territorial authority must take into account any such plan to the extent that it has a bearing on the resource management issues of the district. The IMP is primarily a tool for the Rūnanga in the area it covers; the plan also provides guidance to territorial authorities and others. The IMP sets out the broad issues as well as the specifics for particular areas. These matters are considered below, as they are relevant to this proposed Plan Change. It is noted that the IMP does not identify any specific cultural values associated with this land that might be adversely impacted by its development.

Ranginui

The relevant matters identified in IMP are discharges to air and the protection of night time darkness. The proposed Plan Change does not contain controls on these matters. The main discharge to air that could occur through this proposal is the establishment of log burners or similar within individual houses. Such discharges are controlled by Environment Canterbury through the Regional Air Plan. With regard to street lighting we understand the District Council is reviewing its approach to reduce the impact on the night sky as occurs in areas such as West Melton.

Wai Māori

Freshwater is of considerable cultural significance to Rūnanga. The main matters of concern relate to water quality and quantity and mixing waters from different waterbodies. The land to be rezoned does not contain any waterways. With the reticulation of effluent disposal from the proposed new dwellings the potential from adverse impacts on groundwater quality are limited. The site will also be connect to a Council water supply, which is more efficient way to service the development than through a separate well or wells. Stormwater generated by the new road will be treated and disposed of through swales or alternative treatment methods, ensuring that no untreated stormwater will reach the water race or groundwater which is at least 7m-8m below ground level. Roof stormwater will be disposed of straight to ground as is commonplace in Rolleston. All of these aspects of the development combine to ensure that there will be minimum adverse impact on the freshwater quality or quantity within this locality.

Papatūānuku

The use of land and how it is developed is of importance to Rūnanga. This section identifies matters such as the urban planning, the subdivision and development of land, stormwater, waste management, and discharges to land. The potential effects of the proposal on the environment have been discussed in Section 5 of this proposed Plan Change. That assessment concludes that there will minimal adverse impacts on the quality of the natural environment as no waste or contamination will be discharged in a manner that will compromise the mauri of surface or groundwater.

Tāne Mahuta

This section addresses the significance of indigenous biodiversity and mahinga kai to Rūnanga. The application site is not located in a known mahinga kai area. The subject land has been used for farming purposes since 1900s, and contains substantial plantings in and around the site, the majority of which are exotic in nature. The majority of these plantings are expected to be removed, however the street and reserve plantings will be dominated by native species which are well suited to the area. From experience with other residential developments, property owners will take a lead from this approach and use native plants from local nurseries as a major component of their landscaping.

Ngā Tūtohu Whenua

There are no known wāhi tapu, wāhi taonga or mahinga kai sites within the application site or close by.

Te Waihora

The application site sits with the catchment of Te Waihora. The main matters of concern within this area relate to the management of water and waterways within the Te Waihora catchment, and the subsequent impact that can have on the water quality of Te Waihora and its environment. The proposal does not involve an activity that could adversely impact on the lake and its environmental and cultural values.

Summary

It is considered that overall the proposal will not have an adverse impact on the cultural values of iwi as set out within IMP.

8.3 District Policy and Plans

- Selwyn District Plan
- Rolleston Structure Plan
- District Development Strategy 2031

Assessment of Selwyn District Plan Township Section Objectives and Polices

Township Section Part B1 Natural Resources

Objective B1.1.1 and Policy 1.1.3 seek to limit the effects on people from contaminated soils, primarily through avoiding the exposure of people to contaminated soils. PSIs have been undertaken, and minor contamination identified.

Objective B1.1.2 seeks to ensure that new activities undertaken within the rural area do not create shortages of land or soil resources for other activities. This is implemented through Policy B1.1.8 which directs avoiding the zoning of land which contains versatile soils for other activities, such as new residential development. In considering this objective and policy, it is noted that versatile soils are defined in the District Plan, however they are defined in the Canterbury Regional Policy Statement 2013 as being soils with a Land Use Capability (LUC) class of 1 or 2. Information obtained from Landcare Research's New Zealand Land Resource Inventory identifies that this site as LUC4. This class is not considered to comprise versatile soils. Overall it is considered that the residential use of this land is appropriate and in keeping with the above objective and policy.

Objective B1.2.1 seeks to ensure that the expansion of townships either maintains or enhances the quality of ground or surface water resources within the District, while Objective 1.2.2 is directed towards ensuring activities do not adversely impact on water resources. The policies that implement these objectives provide direction on the provision of water supplies at both an individual lot and township level. They also require the provision of effluent and stormwater disposal systems that avoid adverse effects on the quality of ground water. The details of the infrastructure to be provided for Faringdon Far West are set out in Section 3.2 above and discussed in more detail in the attached Infrastructure Report (Appendix A). This infrastructure will ensure that the development of Faringdon Far West occurs in a manner sought by these objectives.

The objectives and policies within parts B1.3 Ecosystems and B1.4 Outstanding Natural and Landscapes are not considered to be relevant to the consideration of this proposal.

Township Section Part B2 Physical Resources

The objectives and policies within Part B2.1 Transport Networks address the issues of the integration of landuse and transport, ensuring a safe and efficient transport network, the provision for the future transport network and managing the effects of activities on the transport network and vice versa. The Faringdon Far West ODP provides comprehensive road network schemes for the development that will ensure it is integrated with the surrounding environment. This will be achieved by providing for future connections to existing residential land that is either adjoining or is opposite one of the boundary roads and potentially to the rural residential zone adjoining Dunns Crossing Road. The overall layout will ensure the safety, permeability and accessibility for vehicles, pedestrians and cyclists. The road geometry and layout is a continuation of that constructed for the Faringdon development to the east which ensures a consistency in design and street scape within this part of Rolleston. These aspects of the proposal are consistent with the outcomes sought by the objectives and policies within Part B2.1 Transport Networks.

Faringdon Far West will be supplied with a reticulated water and effluent disposal as well connections to the power and telecommunications networks in Rolleston. The provision of this infrastructure to the development is consistent with the outcomes sought by the objectives and policies in Part B2.2 Utilities.

Objectives B2.3.1 and B2.3.2 and their associated policies address the provision of community facilities and reserves within townships. The primary community facilities provided for within Faringdon Far West are the reserves and activities within the neighbourhood centre. These networks are being provided in accordance with the ODP prepared for this development. This aspect of proposal is in keeping with the Objective B2.3.1 and B2.3.2 and their associated policies.

Part B2.4 Waste Disposal addresses the matters of solid waste and reducing waste within the townships of the Selwyn District. For residential development such as Faringdon Far West this is achieved primarily through the provision of a solid waste collection and disposal service. It is anticipated that as this area is developed, that the Council's collection system will be expanded into Faringdon South. With the provision of this service and access to the Pines Resource Recovery Park, the matters address within Part B2.4 are provided for.

Township Section Part B3 People's Health, Safety and Values

Part B3.1 Natural Hazards address the issues associated with various natural hazards that can occur within the District, including earthquake and flooding. Faringdon Far West is not located within an area prone to flooding, and is also not located close to any known fault. This matter has been assessed in Section 5.3, which concluded the development is unlikely to result in an increase in natural hazard risk for future residents or for residents of surrounding land. Given this it is considered that the outcomes sought by the objectives and policies within Part B3.1 Natural Hazards are achieved for this development.

Parts B3.2 Hazardous Substances and B3.3 Culture and Historic Heritage objectives and policies are not considered to be relevant to this proposal. The objectives B3.4.1 to B3.4.3 of B3.4 Quality of the Environment address the issues associated with ensuring that the townships are pleasant places to work and live and provide for a range of activities to occur. The objectives seek to ensure that the character and amenity of zones is maintained and that reverse sensitivity effects between activities are avoided. Faringdon Far West has been designed comprehensively to ensure that a pleasant living environment is provided for future residents. The allotments that will be created will be of a size anticipated for the Living Z zone.

Objectives B3.4.4 addresses the growth of townships and seeks to achieve a compact form that provides for a range of living environments and housing choices. The ODP identifies areas suitable

for low density and medium density development. The Living Z framework within the District Plan ensures a variety of lot sizes, areas and shapes can be provided within low and medium density areas. The density requirements along with the rules framework allow a range of living environments and housing choice to be achieved. In this regard the Faringdon Far West development will be consistent with and implements this objective.

Objective B3.4.5 requires that the growth of townships provides a high level of connectivity both within the new developments and with adjoining areas, and enables access to a variety of forms of transport. The ODP provides for the primary connection points to the existing residential areas as well as provision for future connections to adjoining land, enabling a variety of transports forms to be used by future residents. Future subdivision designs will implement these ODPs thus satisfying this objective.

The policies of relevance that implement the objectives within B3.4 Quality of Environment are B3.4.1 and B3.4.3. The implementation method sought by these policies to achieve the objectives is through zoning. This is what this requested Plan Change is seeking with its proposed rezoning of the land to Living Z, including the provision of medium density housing. The rezoning of this area has been delayed due to need to also alter the Canterbury Regional Policy Statement to provide for this growth, however as this process is in motion it is considered that this requested Plan Change is the most appropriate tool to achieve the intent of these policies.

Township Section Part B4 Growth of Townships

Objectives B4.1.1 and B4.1.2 seek a range of living environments, including the provision of medium density areas, that provide a high quality of living and that the new areas are pleasant places to live. The Faringdon Far West development provides for a mix of medium and low density development which is consistent with the high quality development that is sought by the Outline Development Plans prepared for these areas.

The most relevant policy is policy B4.1.1(a) which provides for a range of allotments sizes within living zones, including the provision of medium density areas within identified areas of the Living Z zone. The provision of a mix of low and medium density allotments achieves this policy, and their location is consistent with the ODP prepared for Faringdon Far West. In addition, it is anticipated that the resultant built development within the medium density areas will implement policies B4.1.6 and B4.1.7 in relation to site coverage and will achieve a good level of urban design as sought by policy B4.1.13. In taking into these matters into consideration, Faringdon Far West will be consistent with Objectives B4.1.1 and B4.1.2 and their policies.

The objectives and policies within B4.2 Subdivision of Land address the issues relating to subdivision and ensuring the resulting development is fit for purpose. At this stage only rezoning is being sought by this Plan Change, however the ODP has been carefully designed with the ultimate subdivision in mind and have focussed on creating a high level of amenity to support the density of development being supplied. It is anticipated that on the basis of the ODP that there will be very limited rear allotments developed. This stage is part of an overall master planned development which achieves the outcomes prescribed within this policy. The location of reserves, roading layout and facilities such as cycle paths proposed will all be in accordance with the ODP by virtue of the inclusion of low and medium density lots into this area of the ODP, the proposed development is implements and is consistent with the objectives and policy with part B4.2 Subdivision of Land.

Part B4.3 Residential and Business Development contains the primary objectives and policies that enable the growth of townships within the District. Objective B4.3.1 outlines that the type of effects that should be avoided when the expansion of townships occurs. The impact of this proposal on natural and physical resources and the amenity values of the township has been

discussed in relation to the objectives and policies within Parts B1 Natural Resources, B2 Physical Resources and B3 Quality of the Environment. The conclusion of that assessment is that the development of Faringdon Far West is generally consistent with those objectives and policies, and as such is consistent with Objective B4.3.1.

Objective B4.3.3 requires new residential development within townships in the Greater Christchurch area to be provided within existing zoned land or priority areas identified in the Regional Policy Statement (RPS). Any such development is to be general accordance with an operative ODP. Faringdon Far West is not located within an existing zoned area or one that is identified as a priority area in the current CRPS. However *Our Space 2018-2048* which identifies and provides for implementation of the updated Greater Christchurch settlement pattern envisages rezoning of land out to the Projected Infrastructure Boundary contained in Map A in Chapter 6 of the CRPS. The Update of the settlement pattern identifies that some of the land that has been identified for growth within the RPS has very fragmented ownership and despite being zoned for some time thereby limiting land that can be considered available for development.

Objective B4.3.4 directs that new areas of residential development should support the timely, efficient and integrated provision of infrastructure. As part of the development of a neighbouring Faringdon subdivision, a large diameter sewer main was installed along the eastern boundary Faringdon South site. This pipe was sized to provide for the development of the Living Z zoned land in the area. As identified above, aside from Faringdon very little of the zoned land to the southeast of Rolleston has been developed. Faringdon Far West's development will support the efficient use of this sewer main. No new significant infrastructure is necessary to support this development. Given these factors it is considered that this development is consistent with Objective B4.3.4.

Objective B4.3.5 directs that sufficient land is available to accommodate that anticipated household growth within the District between 2013 and 2028 through both Greenfield growth areas and consolidation within existing townships. As identified previously the fragmented ownership of much of the zoned but underdeveloped land within Rolleston means that whilst there is zoned land available to provide for this growth, the ability for this to occur is restricted. In response to the shortfall created by this situation the Greater Christchurch Partnership has updated in the settlement pattern providing for growth of Greater Christchurch. This involves a change to Chapter 6 of the CRPS as the District Plan creating Future Development Areas in Rolleston which take permitted development out to the Projected Infrastructure Boundary shown on the original Map A. The Faringdon Far West area falls within the new Future Development Areas as can be seen in the proposed revised Map A in Chapter 6 of the CRPS above.

Objective B4.3.6 requires that the development of Living Z zoned land achieves an average net density of at least 10 households per hectare over an ODP area. The proposed ODP Area has been prepared on the basis of achieving a minimum yield of 12 households per hectare. This yield is reflective of the requirements of the Council's Special Housing Policy and a clear indication articulated through the Our Space process that 12hh/ha is the preferred net density to apply to future growth areas.

Policies B4.3.1, B4.3.3, and B4.3.4 manage residential growth through zoning and the use of ODPs to ensure a compact shape in a manner that avoids surrounding rural zoned land with urban development, and encourages the use of existing zoned land. Policy B4.3.7 relates specifically to the Living Z zones, and stipulates that the growth areas should not be developed until an Outline Development Plan is included within the District Plan; whilst policy B4.3.9 identifies the phasing of any Living Z zone land within Rolleston. The current issues with zoning this land for urban development and therefore the provision of an operative Outline Development Plan have been discussed above. As concluded previously it is considered that the purpose of the HASHA Act of

increasing land and housing supply in areas identified as having housing and supply and affordability issues outweighs the outcomes sought by these policies.

Policy B4.3.8 sets out the requirements that must be contained within any Outline Development Plan included in the District Plan. These matters include but are not limited to the identification of roads and connections to surrounding lands, land for schools, parks and similar facilities, the distribution of different residential densities across the ODP area. The ODP proposed as part of the Plan Change has been prepared to comply with the requirements of this policy.

Overall, in considering the objectives and policies of the Township Section of the District Plan, it is considered that the requested rezoning of the Faringdon Far West block meets the outcomes sought for new residential areas.

Assessment of Selwyn District Plan Rural Section Objectives and Polices

Given the current Rural zoning of the Faringdon Far West site, it is considered appropriate that an assessment is made of the relevant rural objectives and policies.

Rural Section Part B1 Natural Resource, B2 Physical Resources and B3 People's Health, Safety and Values

The objectives and policies of these two sections of the District Plan similar matters to those contained within the Township section. The conclusions reached in the assessment of the Township objectives and policies that the development of this land is appropriate and is generally consistent with the outcomes sought also applies here. As such it is not considered necessary to repeat that assessment.

The only matter of relevance not considered within Section 4.3.2 above relates to the matter of reverse sensitivity effects, addressed by Objective B3.4.2 and Policies B3.4.20 to B3.4.22. This objective and its policies seek to ensure that new activities do not give rise to any reverse sensitivity effects. For reverse sensitivity effects to arise, there must be an effect from a permitted activity that would give cause for complaints to occur that could impact on the ability for that permitted activity to operate. Typically, within rural areas this arises from horticultural and viticultural activities, intensive farming (such as poultry and pig farms) and quarrying. Aerial photography and site visits to the surrounding land indicate that the primary use of this area is for the rural living and pastoral use, primarily the grazing of animals and includes a dairy farm (which is currently zoned Living 3). Pastoral farming is typically not an activity associated with reverse sensitivity effects. However there is potential for aspects of dairy farming to create some nuisance, in particular the use of centre pivot irrigators can result in excess water being sprayed or drift onto roads and neighbouring properties. Given this environment it is considered that there is some potential for a limited number of residents to have reduced amenity however this does not necessarily result in reverse sensitivity effects being generated. Again it is noted that the area where the dairy farm is opposite the site is very largely zoned Living 3 so it is expected at some stage the use of this are may change.

Rural Section Part B4 Growth of Rural Area

The objectives and the policies that implement Rural Section Part B4 seek to ensure that the rural area maintains an overall low residential density that is consistent with the character of the area and avoids adverse effects on the environment including reverse sensitivity. Residential development at the density sought by the requested rezoning to Living Z clearly conflicts with the low residential densities typically found within the Rural Inner Plains Zone but is principally a distinction bought about by the fact that rezoning follows the change to the CRPS Greater Christchurch settlement pattern. Although the Faringdon Far West rezoning is inconsistent with this

aspect of these objectives and policies, it is consistent with the overriding national and regional policy statements relating to providing for future growth of urban areas..

The conclusions reached within the above assessment are that the development of Faringdon Far West is generally consistent with the outcomes sought by the relevant objectives and policies relating to natural and physical resources. The proposal has some potential to result in reverse sensitivity effects, but his is considered to be limited. As such the development while not consistent with the low density sought for the rural area does support the other outcomes sought by these objectives and policies.

Rolleston Structure Plan

The Rolleston Structure Plan was prepared in 2009 and seeks to manage the rapid growth that has and will likely occur in Rolleston, which could be a town as large as 50,000 by 2075. It was prepared as part of work relating to the Greater Christchurch Urban Development Strategy. The Strategy has the primary goals of a sustainable, well-designed and realistic and attainable Rolleston. The boundary chosen for the Structure Plan came from Variation 1 to Proposed Change 1 of the Regional Policy Statement (RPS PC1). The area follows Dunns Crossing Road as the western boundary, Weedons Road on the Eastern boundary and Selwyn Road on the southern boundary. This is effectively the same boundaries that are now from the basis of providing growth in the short to medium term.

The Structure Plan looks at many aspects of Rolleston including the strategic locations of the town centre, neighbourhood centres and local centres, land use patterns and community facilities and movement networks. In relation to the residential and community growth areas recommended in the Structure Plan these are the same or similar to what has been developed or is proposed to be developed.

The staging of Greenfield Residential Development set out in the Rolleston Structure Plan and illustrated on page 19 of that Plan is based on the progressive availability of infrastructure required for residential development. This approach favours the south western areas of Rolleston as the next areas for development. Stage 1 in the Rolleston Structure Plan covers what was the initial stage of Faringdon which is now fully built out. The second stage is Stage 2A for the period 2017-2026. Stage 2A includes the Faringdon South block which was approved and developed under the Housing Accords and Special Housing Areas Act (HASHA).This development has been subdivided and built on. Stage 2A also includes land to the west of Faringdon South lying within the triangle of East Maddisons, Goulds and Selwyn Roads. This is the Faringdon South West land and the now requested Faringdon Far West to be rezoned Living Z.

This sequencing approach has now been partially superseded by the Faringdon South and Acland Park developments proceeding under the HASHA process. These developments created the need for new wastewater servicing in the area. This has involved construction and operation of a new pump station on the corner of Springston Rolleston Road and Selwyn Road and the installation of sewer mains along the Springston Rolleston Road and along Selwyn Road from Faringdon South through to the pump station. This amended sequencing has been reflected in Council's recent master planning to inform the Long term Plan – refer Appendix H "Future Growth Staging" for Rolleston. The revised growth staging places the area in the southwest corner of Springston Rolleston Road and Selwyn Road in Stage 1. The triangle of land within East Maddisons, Goulds and Selwyn Roads is divided into two stages with the north eastern half in Stage 2A and the western side as Stage 2B. This revised staging is the basis for the proposed development sequence for the Faringdon South West and South East blocks and with the South East block (now in Stage 1) to be developed first followed by the South West and Far West Blocks (now in stages 2A and 2B).

District Development Strategy 2031

This Strategy was finalised in 2014 and was working with the population estimates and capacity assessments available at this time. This indicated that there was a trend leading to an 80/20 split of total population growth, where 80% of growth throughout the district will occur within identified urban boundaries. Further there was also an 80/20 split of urban population growth, where 80% will occur within the metropolitan Greater Christchurch area, comprising Rolleston, Lincoln, Prebbleton and West Melton township. From this data analysis Selwyn 2031 puts forward three key growth concepts being:

- establishment of a township network, which provides a support framework for managing the scale, character and intensity of urban growth across the whole district;
- establishment of an activity centre network, which provides a support framework for managing the scale and intensity of business areas throughout the district townships;
- encouraging self-sufficiency at a district-wide level.

With regard to urban expansion the Strategy seeks provision of sufficient zoned land to accommodate projected household and business growth to assist earthquake Recovery within the Greater Christchurch area. The actions to provide sufficient land are limited to rezoning of land in Rolleston and Lincoln including greenfield land ODP Areas 4, 9 - 13. Most land within the listed Rolleston ODP areas has now been developed and new capacity assessments have been undertaken all of which indicates that the District Development Strategy is not directly relevant to the consideration of current growth proposals.

9 Statutory Requirements of Section 32 of the Act

Before a proposed Plan Change is publicly notified an evaluation must be carried out by the person making the request. The evaluation, carried out under Section 32 of the Resource Management Act, must examine:

(a) the extent to which each objective is the most appropriate way to achieve the purpose of the Act; and

(b) whether, having regard to their efficiency and effectiveness, the policies, rules, or other methods are the most appropriate for achieving the objectives.

The evaluation is required to take into account:

- The benefits and costs of policies, rules, or other methods; and
- The risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the policies, rules, or other methods.

Specifically section 32(2) requires identification and assessment of benefits and costs of the environmental, economic, social and cultural effects that are anticipated from the implementation of the provisions including opportunities for:

- Economic growth that are anticipated to be provided or reduced; and
- Employment that are anticipated to be provided or reduced

The Guidance Note on section 32 analysis on the Quality Planning website makes the following statement:

> ***Appropriateness*** *- means the suitability of any particular option in achieving the purpose of the RMA. To assist in determining whether the option (whether a policy, rule or other method) is appropriate the* ***effectiveness*** *and* ***efficiency*** *of the option should be considered:*

- ***Effectiveness*** *- means how successful a particular option is in addressing the issues in terms of achieving the desired environmental outcome.*
- ***Efficiency*** *- means the measuring by comparison of the benefits to costs (environmental benefits minus environmental costs compared to social and economic costs minus their benefits).*

In this case it is the appropriateness of rezoning rural land for residential use that needs to be examined.

9.1 Objectives and Policies of the Selwyn District Plan

As the Proposed Plan Change does not seek to alter any objectives or policies of the Selwyn District Plan, the examination under Section 32(3)(a) of whether the objectives of the District Plan are the most appropriate way of achieving the purpose of the Resource Management Act is not required. This is because as the District Plan is operative it is assumed that the objectives are the most appropriate way to achieve the purpose of the Act. Similarly, it is assumed that as no policies are proposed to be altered, that they are the most appropriate means of achieving the objectives of the District Plan.

Although an assessment of the appropriateness of the objectives and policies of the Plan is not required, it is worthwhile to consider the proposed Plan Change against the proposed objectives and policies contained within the Selwyn District Plan relating to providing for urban growth. A detailed assessment of these objectives and policies has been undertaken in Section 8.3 of this assessment and it concludes that requested rezoning of the Faringdon Far West block meets the outcomes sought for urban growth and new residential areas.

Overall it is considered that the Proposed Plan Change is consistent with the strategic outcomes sought for residential development by Selwyn District Council. Additionally the resulting amenity is considered to be consistent with the outcomes required under the District Plan.

Given the conclusions within Sections 5, 6 and 7 on the effects of the proposal on the environment and the above assessment, the proposed rezoning of the Faringdon Far West block is considered to be an appropriate means of achieving the outcomes sought by the objectives and policies of the District Plan.

9.2 Assessment of the Benefits and Costs of the Proposed Change

In order to determine the effectiveness and efficiency of the proposed rezoning, an assessment of the benefits and costs of the proposed Plan Change, together with an examination of the risks of acting or not acting based on the information provided is required. In order to determine the relative benefits and costs of the proposed change, options other than the proposal should also be examined. In terms of this proposal the options considered are:

- Option 1 – Leave the area zoned Rural
- Option 2 – Rezone the land as Living Z by private plan change
- Option 3 – Wait for Council to rezone land as Living Z
- Option 4 – Apply for resource consent for proposed subdivision and development

The following is an assessment of these options.

Benefits and Costs of Option 1 – Leave the area zoned Rural

Benefits/Advantages	Costs/Disadvantages
• Maintains the existing character of the area. • Allows the Council to implement Our Space 2018-2048 Greater Christchurch Settlement Pattern Update and the associated changes to the Canterbury Regional Policy Statement (CRPS) within their own timeframe.	• Does not fulfil the District Plan's objective of an equitable process to rezoning land. • Does not implement Proposed Change to the CRPS 2019 which seeks a settlement pattern that provides sufficient land for future growth. • Reduces the level of choice for potential purchasers of residential allotments. • Does not contribute to the cost of existing reticulation of services.

Benefits and Costs of Option 2 - Rezoning land as Living Z by private plan change

Benefits/Advantages	Costs/Disadvantages
• Implements Our Space 2018-2048 Greater Christchurch Settlement Pattern Update and the associated changes to the Canterbury Regional Policy Statement • Implements the National Policy Statement on Urban Development Capacity • The area is not dependent on the development of other land to provide access or infrastructure, such as stormwater disposal. • Provides an alternative for prospective purchasers of residential allotments within Selwyn District and elsewhere. • Economic benefit to Council from larger rating base through additional properties being added upon subdivision, and the payment of development contributions for new infrastructure (e.g. Eastern Selwyn Sewerage Scheme). • Provides long-term certainty for both the developer and potential purchasers as to the use of the land. • Supports existing Council reticulated services, e.g. sewer system and water supply. • Costs of assessments and development of ODPs fall on the developer, not the Council.	• Loss of rural land for productive purposes. • Change in character of the area from rural to residential. • Increase in traffic generated within and around Rolleston. • Does not take into account other land that may be suitable to provide for growth

Benefits and Costs of Option 3 – Wait for Council to rezone land as Living Z

Benefits/Advantages	Costs/Disadvantages
• Allows the Council to implement Our Space 2018-2048 Greater Christchurch Settlement Pattern Update and the associated changes to the Canterbury Regional Policy Statement (CRPS) within their own timeframe. • Implements the National Policy Statement on Urban Development Capacity • The area is not dependent on the development of other land to provide access or infrastructure, such as stormwater disposal. • Provides an alternative for prospective purchasers of residential allotments within Selwyn District and elsewhere. • Economic benefit to Council from larger rating base through additional properties being added upon subdivision, and the payment of development contributions for new infrastructure (e.g. Eastern Selwyn Sewerage Scheme). • Provides long-term certainty for both the developer and potential purchasers as to the use of the land. • Supports existing Council reticulated services, e.g. sewer system and water supply.	• Could result in uncertainty and delay regarding rezoning for urban growth as Council has indicated it does not want to be directly involved in rezoning land. • Council would have to determine which land is to be rezoned and so undertake detailed comparative analysis. • Council would have to undertake detailed assessments (e.g. geotech, soil contamination,) which are a cost to the ratepayer. • Council would have to develop ODPs for the rezoned areas which are not something it normally undertakes and which would be at a cost for ratepayers. • Loss of rural land for productive purposes. • Change in character of the area from rural to residential. • Increase in traffic generated within and around Rolleston.

Benefits and Costs of Option 4 – Develop the land by Resource Consent

Benefits/Advantages	Costs/Disadvantages
• Council has the ability to place stricter controls on the development through consent conditions than may be possible through a plan change. • Potential for greater environmental benefit through Council having greater control over development, and being able to require some land for environmental compensation for the use proposed.	• Potential social cost arising from lack of long-term certainty for future purchasers and adjoining neighbours as to the use of the land, as additional consents to alter conditions can be sought. • Potential and future purchasers would need to obtain consent if they were to alter uses, for example home occupation rules from the rural zone would still apply. • Restricted timeframe in which land has to be developed and houses built, leading to potential economic costs for landowner/developer. • Less flexibility in being able to develop the land. • Possibly higher costs to develop land through the placing of tighter controls on the development by way of strict conditions on a consent. • Unwanted precedent in terms of allowing large scale residential activity in the rural zone through consent only.

The above assessment highlights that the advantages and benefits of rezoning this area of land for residential use (Option 2) by way of private plan change outweigh the potential costs and disadvantages. The costs or disadvantages of the other options clearly indicate that they are not the most appropriate method.

9.3 Effectiveness

In determining the effectiveness of the Plan Change and other options to achieve the objectives, it is considered appropriate to include within "the objectives" the objectives of the relevant broader policy documents. These matters are considered in more detail in Sections 7 to 9 of this report. These latter objectives are particular relevant because they set out, at a strategic level, how growth should be provided for within the Selwyn District as part of Greater Christchurch. On this basis the proposed Plan Change is assessed to be the most effective to achieve the objectives of the District Plan, and of implementing the proposed Change to Canterbury Regional Policy Statement and the decision and recommendations of Our Space 2018-2048.

The same rezoning could be achieved through incorporation of the rezoning into the review of the Selwyn District Plan that is expected to be publicly notified in April 2020. It is understood that the Council would prefer the initiative of rezoning to be taken by landowners who are familiar with the detailed characteristics of the land blocks as well as the challenges of developing them in a way that ensures a high level of integration with existing residential development in the south end of Rolleston. In addition if the rezoning is to be implemented through the proposed Selwyn Replacement District Plan it would likely result in a delay of 2 or more years before the zoning was finalised. Such a delay would adversely affect the delivery of lots to meet the assessed and known demand. This not only creates frustration for buyers and sellers but also has the potential to result in an escalation of costs making house ownership more difficult.

The proposed Plan Change is the only method that can ensure all of the following:

- Residential development of an appropriate density
- Development in accordance with an outline development plan
- Integration of development with existing infrastructure
- Specific amenity standards to be achieved in final development
- Enables the block of land to be planned, designed and physically constructed in a timely manner to meet the anticipated demand for new residential sections in Rolleston.

9.4 Efficiency

In determining efficiency, it is necessary to compare the costs and benefits of the four options listed in the tables above. These costs and benefits relate to a variety of matters including environmental, process and land use compatibility. In relation to all these matters Option 2 has a greater number of benefits/advantages as compared to Options 1, 3 and 4 while Option 2 has the same or lesser costs/disadvantages.

Assessment Regarding Information Provided

There is a large amount of information available about the site and the effects of the proposed rezoning; as such it is considered that there are no risks in acting.

9.5 Overall Assessment

Based on the assessment above, the overall conclusion is that the Proposed Plan Change is a more appropriate method for achieving the objectives and policies of the District Plan than the existing plan provisions or the alternatives canvassed above. It is also concluded that the environmental, social and economic benefits of the Proposed Plan Change outweigh any of the costs. On this basis, the proposed rezoning is considered to be an appropriate, efficient and effective means of achieving the purpose of the Resource Management Act.

Private Plan Change Request – Hughes Developments Limited
Appendix A – Infrastructure Report

Hughes Developments Ltd

Faringdon Far West– Rolleston

Infrastructure Report

20199 R0

October 2020

DAVIE LOVELL-SMITH

PLANNING SURVEYING ENGINEERING



Shaping the future since 1880

Revision History

Rev Number:	Prepared By:	Description:	Date:
Revision 0	Jamie Verstappen	For plan change submission	29/10/20

Document Control

Action:	Name:	Signed:	Date:
Prepared By	Jamie Verstappen		29/10/20
Reviewed By	Daniel Barr		29/10/20
Approved By	Andy Hall		29/10/20

This report has been prepared by Davie Lovell-Smith Ltd on the specific instructions of our client. It is solely for our clients use for the purpose for which it is intended and in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Davie Lovell-Smith Ltd has not given prior written consent, is at that persons own risk.

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1. General

1.1 Introduction

This infrastructure report addresses the future infrastructure required to service the proposed Faringdon Far West development area. This area covers approximately 65 Ha of land and is located on the south western urban limits of Rolleston, Canterbury. The site is bounded by Dunns crossing Road to the west, Goulds Road to the south-east and rural residential development to the north. A site location plan is attached as Appendix A.

The surrounding area falls towards the south east at an approximate grade of 1 in 200. The land is currently comprised of a number of lifestyle blocks of varying sizes. A number of boundaries within the site are lined with pine tree shelter belts and the blocks are fenced into smaller paddocks. There is also a Walnut Tree orchard located within one of the land parcels. Most blocks contain a substantial home and assorted out buildings. The homes may or may not be retained in the development of the site.

Davie Lovell-Smith Ltd (DLS) have held several meetings with Strategic Planners and Infrastructure Engineers at Selwyn District Council (SDC), primarily Murray England with specific regards to servicing the proposal for water supply and sewer. It is the Applicant's intention to construct infrastructure that will meet the demands of this project and also compliment the long-term requirements of the southern end of the Rolleston Urban Area. The proposed infrastructure will be integrated into the existing networks and all efforts will be made to ensure that the installations are complimentary to the current assets.

All sites will be serviced for sewage, water supply, telecommunications and power. It is anticipated that stormwater will be discharged to ground on-site under a separate consent to be obtained from Environment Canterbury (ECan).

1.2 Legal Description

There are 5 existing land parcels within the site. The legal descriptions of these sites are; Lot 3 DP 70352, Lots 1 and 3 DP 57004 and Lots 1 and 2 DP 61278.

1.3 Soil Conditions

From the various geotechnical investigations undertaken for the development area we can deduce that the soil profile beneath the site is generally covered with 100mm-300mm of topsoil overlying silty or sandy gravels to several tens of metres depth. A thin layer of sands and silts is intermittently located between the topsoil and gravel layers. Some seams of clay and silt may be present at various depths within the deeper gravel layers. The depth to groundwater was observed to be between 5m and 10m from surface level.

The site is situated in a 'Rural and Unmapped' area as per the MBIE mapping available on the New Zealand geotechnical database. Due to the granular nature of soils beneath the site, the low ground water table and low gradients this site has been categorised as equivalent TC1 in the geotechnical reporting.

1.4 Site Contamination

Detailed site investigations into potential contamination of soil within the land parcels which make up the Far West development area have been undertaken by ENGEO. These have identified various forms of contamination which are above the limits set by the NES, namely heavy metals and asbestos.

A remediation action plan will be provided to assist in the removal of this contaminated material from the development area. All contamination from site will be removed prior to earthworks and civil construction being undertaken and a site validation report provided. The contamination removal and site validation may be undertaken in stages as the development progresses.

1.5 Development Staging

The development area will likely be constructed in stages that best meet market demand. The location and size of stages will be determined by the servicing requirements, roading access and efficiencies of construction.

2. Water Supply

The Council have a strategic plan for the delivery of water trunk mains to the south east side of Rolleston. It is contained in the SDC 5 Waters Activity Management Plan and is described as the Rolleston Master Plan 2017-2048. The plan describes a network of water trunk mains with sizes and specific timings for installation specified. This plan also includes scheduled bore upgrades to supply the trunk main network. Please refer to the attached Figure 19-5 Rolleston Master Plan in Appendix B.

The Master Plan provides a very good framework for the roll out of water supply services but the timing is no longer valid as the development of land in Rolleston has overtaken these predictions. Added to this, the construction of the Faringdon Development has provided additional up-sized mains, and the area may be better supplied than what was originally intended. The reason for this added supply is that the original intentions for the development of the town were based on a minimum housing density on 10 per hectare. In reality the density is closer to 12 houses per hectare.

Please refer to the attached Proposed Trunk Mains plan in Appendix B.

This plan shows the existing pipework, 200mm (ID) or over. It also shows the future proposed 200mm (ID) pipes into the proposed plan change areas. This plan has been forwarded to SDC Officer Murray England for assessment in the Councils overall Network Analysis Model. It is understood that that modelling is underway.

The modelling will determine the verification of the pipe sizes and will also ascertain the timing for the upgrading of bores. For the purposes of this modelling, it is predicted that these plan change areas will be completed by 2023. This is a significant departure from the current Master Plan.

These main pipes will follow main connecting traffic routes but it is worth noting that all other streets will contain water mains of 100mm or 150mm (ID) for residential and firefighting supply purposes.

The methodology for determining peak flow for the development is presented as follows:

- Area within the Block = 65.3ha
- Potential number of lots for modelling purposes = 65.3 x 12 = 784 lots
- With reference to Chart 1 in Chapter 7 of the SDC Code of Practice, the Peak design flow will be 0.13l/s/lot.
- This equates to 101.92 l/s. We add to this 25l/s for firefighting purposes.
- Assuming that a third of this flow may be going down any one trunk main, the max flow becomes 42l/s.

  Colebrook-White Equation
  Pipe diameter 200mm
  Gradient - 1 in 126
  Pipe Roughness - ks 0.06mm
  Results for Full Bore Conditions:
  Velocities 1.338 m/s
  Discharge 42.02 litres/sec

- For a 200mm (ID) pipe this equates to a unit headloss of 1 in 126m.

The development area will also be designed to comply with the New Zealand Fire Service Firefighting Water Supplies Code of Practice SNZ PAS 4509:2008. The water supply classification will be FW2(25l/s).

3. Stormwater

3.1 Design

The landform and contours throughout the completed development will be designed to ensure that secondary flow will safely conveyed through the site via the road and reserve networks. The land falls to the south east towards Goulds Road.

Primary stormwater from the site is proposed to be discharged to ground. The soakpits on individual sites will be constructed as part of the Building consent process. All proposed drainage and soakpits associated with the roads will be constructed as part of the subdivision and will be vested in SDC.

Soakpits on private residential sites will accommodate storms up to a 10% AEP 1hr event in accordance with New Zealand Building Code requirements. The soakpits in the streets will deal with the flows off the streets up to a 2% AEP critical duration event plus the runoff from the house sites once the on-site soakpits are inundated. This will be calculated as the flows generated by a 2% AEP critical duration event, less a 10% AEP 1hr event. Particular care will be made to ensure that allsumps and pipe infrastructure can accommodate these flows.

Consent or a certificate of compliance for stormwater discharge to ground from the development site will be obtained from Environment Canterbury (ECAN). All consenting from ECAN will be verified by SDC as being suitable for transfer to their ownership if required.

It is expected that all stormwater will be permitted to discharge to ground ensuring that all sump outlets are trapped as a means of separating hydrocarbons and other floatable contaminants. No

other treatments requirements are anticipated. These conditions replicate those currently in use for the balance of the Faringdon development.

Stormwater discharge during construction will comply with the Environment Canterbury (ECAN) Erosion and Sediment Control Guidelines. Erosion and Sediment Control Management Plans will be compiled for both ECAN and SDC approval. The proposed methods of stormwater treatment and disposal replicate what is currently being used in Faringdon.

3.2 Flood Analysis

It has been identified that the site is affected by flooding in both the 1 in 200 year and 1 in 500 year storm events. Water is expected to pool up to 0.5m deep in these events. It is noted that this flooding data has been compiled using the existing land contours. Flood Level Plans are attached as Appendix C.

The land contouring which will be undertaken as part of any development works will ensure all surface water drains towards the road and reserve corridors. Building platforms will be set between 200mm and 500mm above the kerb level at the lot frontage. Stormwater up to the 1 in 50 year storm will be discharged to ground within soakpits on site. Secondary flow paths will be provided along these road and reserve corridors to ensure all flow over and above the 1 in 50 year event is directed down contour and away from residential lots. As flood water flows through the site the velocity will increase due to the reduced friction associated with paved surfaces. This increase in velocity will reduce water depths and allow safe and efficient transfer of flood water through the site. The proposed roading layout will take into account locations where flood flow may enter the site. Expected flood flow levels and the calculation of minimum floor levels will be determined during detailed engineering design.

Provided correct design methodologies are followed during detailed design and construction of the development the effects of flooding from both the 1 in 200 year and 1 in 500 year storm events can be fully mitigated.

3.3 Water Races

There are 2 water races which enter the development area. One water Race enters the North side of the site at the boundary between Lot 1 DP 57004 and Lot 3 DP 70352, this water race discharges to ground shortly after entering the site. Consultation with the adjacent property owner will be undertaken to determine if this water race could be terminated within the adjacent land, otherwise a point of discharge to ground will be provided within the development site nearer to the boundary. The other water race enters the site from Goulds Road and traverses the eastern boundary of the site before discharging to ground at the boundary between Lots 1 and 3 DP 57004. This water race would be closed at Goulds Road as part of the development works. A plan showing the water race network in the vicinity of the site is attached as Appendix D.

4. Sewer

4.1 Existing Network

As part of the Eastern Selwyn Sewage Scheme, a large pump station was constructed at the corner of Selwyn Road and Springston-Rolleston Road. This pump station is known as the RADAR Pump Station.

This pump station was designed to receive the flows from the southern side of Rolleston and also flows from other communities before pumping directly to the Pines Wastewater Treatment Plant west of Rolleston.

As part of the Faringdon development, a large sewer pipe was laid from the RADAR station, south along Selwyn Road and then north into the Faringdon Development Area. This pipe along Selwyn Road is a 525mm dia uPVC pipe and has been laid at a grade of 1 in 430. By applying the Colebrook White Equation, the following data is obtained:

Pipe diameter 525mm
Gradient - 1 in 430
Pipe Roughness ks = 0.6mm

Results for Full Bore Conditions:
Velocities 1.072 m/s
Discharge 232.11 litres/sec

Part-Full Conditions:
Proportion depth = 0.92
Actual depth = 483mm
Velocity = 1.189 m/s
Discharge = 247.64 litres/sec

By relating the flow back to Equation 3 of the Wastewater Section of the SDC Code of Practice, then we can determine the number of sites that this sewer can service.

MF =247.64 litres/sec
ASF = MF/ 2.5 / 2 = 49.53 litres/sec
= 4,279,392 litres/day
No of lots = ASF / 220 / 2.7 = 7204 homes

If we make an assumption that there are on average, a density of twelve homes per hectare over the catchment then the pipe should be able to service 600ha.

Please refer to the attached plan of the Wastewater Catchments in Appendix D. The overall shaded area (red, blue and green) is the catchment entering the 525mm sewer. This overall catchment area amounts to approximately 411ha. From this we can establish that the 525mm sewer can adequately service the entire catchment.

A wastewater capacity assessment of the RADAR pump station and Selwyn Road gravity main was undertaken by OPUS in January 2020. This assessment also concludes that the Selwyn Road gravity sewer has capacity to service the proposed catchments as shown on the catchment plan. However, the current pump capacity in the RADAR pump station will need to be increased to accommodate the fully developed catchment area. It is also noted that flows from the land to be rezoned has been loaded into the model as constant peak design values which has provided a conservative representation of volume and flow.

4.2 Sewer Design

Referring to the sewer catchment plan, the blue catchment includes most of the proposed Far West development area. Part of the Far West site will gravitate to the existing sewer on East Maddisons Rd but the majority will need to be serviced by a new pump station which will serve the 130 Ha blue catchment. The area of the Far West site inside the blue catchment is 64.8 ha which equates to approximately half of the pump station catchment.

The sewer demand for the proposal has been calculated using SDC Code of Practice. Please refer to the calculation below for the peak domestic demands.

Blue Catchment area = 130ha

At 12 sites per hectare that equates to 1560 lots

Faringdon is currently developing at about this density but it is conservative.

Average sewer flow
ASF = 1560 lots x 220 l/person/day x 2.7 people/lot

ASF = 927 m^3/day
ASF = 10.73 l/s

Peak wet weather flow
P/A ratio = 2.5 Part 6: Wastewater drainage SDC Code of Practice

SPF = 2 Part 6: Wastewater drainage SDC Code of Practice

MF = P/A ratio x SPF x ASF

MF = 2 x 2.5 x 10.72
MF = 53.65 l/s = Pump rate

The flows will most likely need to be pumped to the head of the 525mm diameter gravity main on Selwyn Road, approximately 880m to the east. An early estimate of the pipe size would be a 250mm PE PN12.5 with a head loss of around 1m per 80m length. An alternative solution of pumping directly into the large pressure main from RADAR pump station to the pines treatment plant is also being looked into by council.

The pump station would be located on Selwyn Road approximately 420m southwest of the intersection with East Maddisons Rd. This is the general location of where Selwyn Road will intersect with a major local road entering into the catchment area.

The sewer main route from the pump station to service the Far West area would be located along primary and collector road links which will be constructed as part of the Faringdon South-West development area. Indicative alignments for these routes are shown on the sewer catchment plan in Appendix D.

The required pump station depth will be calculated once the roading link locations are confirmed. It has been noted that the depth of the pump station can be reduced through the use of shallower than usual gradients of the downstream sewer mains where flow velocities will allow, this can be confirmed during detailed engineering design. The pump station will be constructed as part of the Faringdon South-West development which will likely commence in 2021.

The pump station will be designed with a suitable amount of storage for emergency situations. This volume can be derived from calculating 8hrs of mean flow. That is 8hrs at 10.48l/s. This amounts to 302m³. Part of this can be stored in the upstream pipe system and in the pump chamber, but this is still a very large volume to cater for. To that end we would like council to consider a lesser period of storage, perhaps 6 hours or 225m³.

Sewer mains will be laid throughout the development site within the road network. The size of mains will be determined based on their respective catchments. All lots will be serviced with a 100mm PVC lateral at least 1m inside the net area of the lot. Cover will be maintained on all sewer pipelines installed to ensure the entire proposed catchment area can be serviced.

All works will be to Council Standards unless otherwise agreed with council wastewater engineers. All public sewer pipes over private land or reserves will be covered by appropriate easements in favour of SDC. The pump station will be located on its own utility lot to be vested in SDC.

5. Power / Telecommunications / Street Lights

Power and telecommunications will be provided to all sites to utility company and industry standards. All cables will be placed underground and all kiosks will be constructed on separate individual lots. The kiosk sites will be forwarded to Council for approval following the power design.

Street lights will be provided to the roading and reserves to SDC standards. The applicant will provide a street light style consistent with the style used previously in Faringdon.

Full appraisals will proceed once the Plan Change has been obtained. This will include for potential substation sites and similar large scale infrastructure items.

6. Roading

The proposed Far West development area will incorporate a number of collector roads in line with the CRETS network. These include an extension of Shillingford Boulevard between East Maddisons and Dunns Crossing Roads and the extension of Northmoor Boulevard to connect to the future Shillingford Boulevard. The locations and alignments of these roads are largely dictated by the adjacent Faringdon and Faringdon South development areas. These roads are shown as primary routes in the figure shown below and will be continued through the Far West development area as

dual carriageway roads. Specific intersection design will be required for the intersections of these primary routes with Goulds Road, these will be covered during the consent and detailed design phases.

The Far West development area will also incorporate a number of secondary roads and cycle links as shown in the figure below. The roading and cycle links will extend to site boundaries where shown to provide the required level of traffic permeability within the development. Off road cycle links are also proposed to link the road network with the central reserve area.



Faringdon Far-West Roading ODP

The cross sections of new roads will be a continuation of what will be constructed in the adjacent stages of Faringdon with legal widths varying from 17m to 24m and formed widths between 6m and

8m. All cycleways will be 2.5m wide and footpaths 1.5m wide as per code of practice requirements. Indicative roading cross sections are attached as Appendix F.

Water, power and telecommunications services will be located in the road berms. The width of berms will be determined to allow the installation of these services along with street trees and street lighting.

The existing roads which front the development area will be upgraded to residential standards. These upgrades may include carriageway widening, installation of kerb and channel, footpaths, grassed berms, street trees and street lighting. The upgrades will be to the development frontage only however SDC will be given the opportunity to undertake additional road upgrades as part of the overall development work.

7. Earthworks and Clearing

A key intention of the development of Faringdon is to create simple building sites with as little earthworks as possible.

Earthworks will be carried out on the site to ensure that all future house sites will drain towards the street at a minimum grade of 1/500. Subject to design the house sites will be elevated above the street to facilitate drainage. The minimum elevation from the street boundary to the building site will be 100mm and may be as high as 500mm.

The area is not prone to flooding as the soils generally allow very good soakage, however, the design of the site levels will take into consideration flood levels in the streets and all building platforms will be above potential secondary flows associated with extreme storm events.

The total estimated cut to fill volume in the Far West development area may exceed 150,000m^3.The significant areas of cut are in the roadways where the depth to the subgrade may be as much as half a metre or more below existing ground level. Trenching for drainage will likely be up to 2.5m below ground level.

All topsoil on site will be stripped, stockpiled and replaced on the land immediately following bulk earthworks. All disturbed topsoil will be re-sown with Council specification grass seed mixes. A balance of cut and fill will be maintained where possible and removal of material from site will be kept to a minimum. Some topsoil may be removed from site due to contamination.

Sediment off the site will be controlled as per Council requirements. The basis of the sediment control will be the Environment Canterbury Guidelines and the discharge during construction will be undertaken either under Council's global discharge consent or in accordance with Environment Canterbury rules. All dust created on the site will be controlled by water cart or other such Council approved methods.

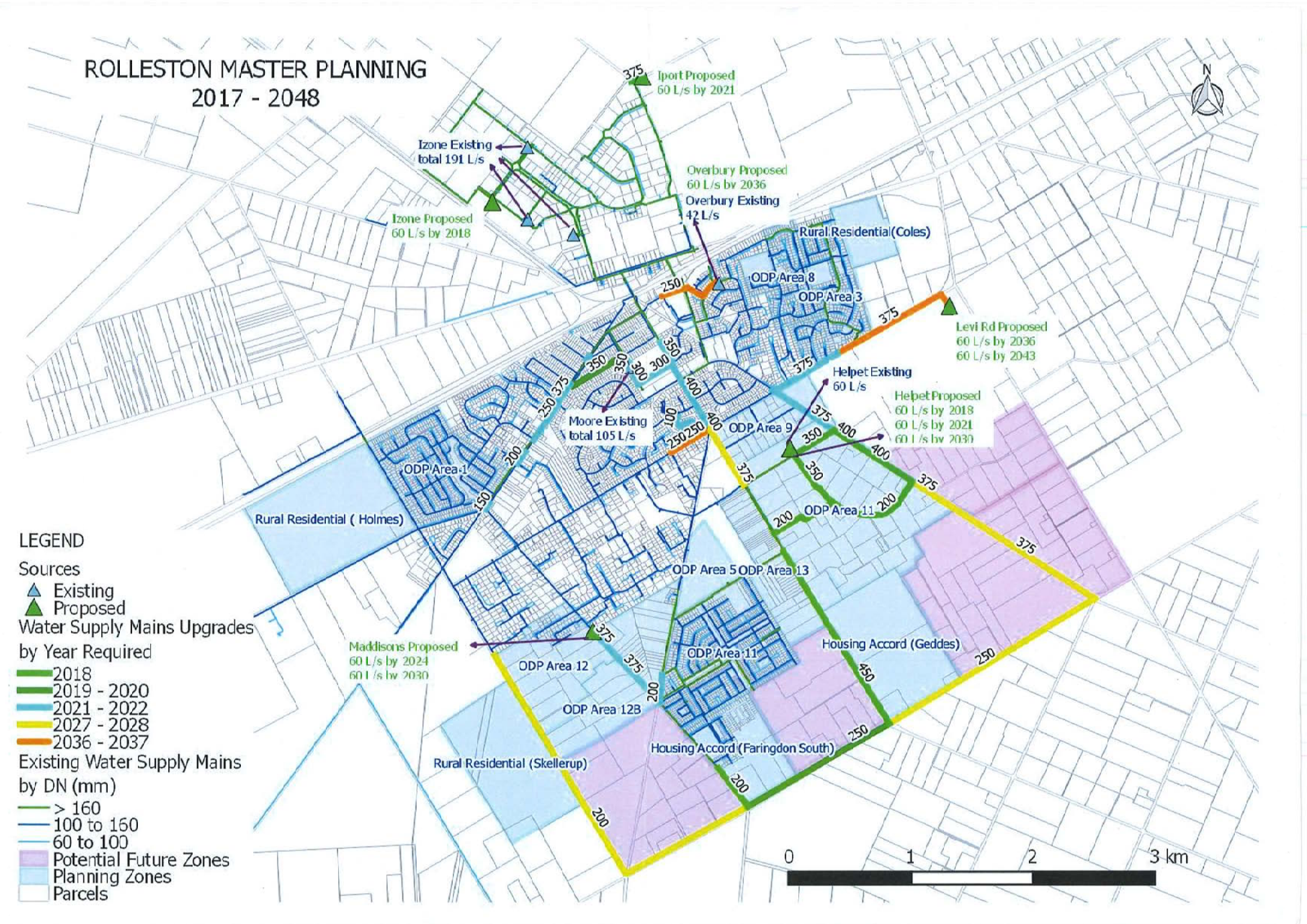
All bulk filling within residential sites will be undertaken in accordance with NZS 4431:1989. All fill testing will be carried out by an independent laboratory.

Jamie Verstappen
Chartered Professional Engineer
Davie Lovell-Smith Ltd

Appendix A- Location Plan



Appendix B – Water Supply Plans


ROLLESTON MASTER PLANNING
2017 - 2048
Iport Proposed
60 L/s by 2021
Izone Existing
total 191 L/s
Izone Proposed
60 L/s by 2018
Overbury Proposed
60 L/s by 2036
Overbury Existing
42 L/s
Rural Residential (Coles)
ODP Area 8
ODP Area 3
Levi Rd Proposed
60 L/s by 2036
60 L/s by 2043
Helpet Existing
60 L/s
Helpet Proposed
60 L/s by 2018
60 L/s by 2021
60 L/s by 2030
Moore Existing
total 105 L/s
ODP Area 9
ODP Area 1
Rural Residential (Holmes)
ODP Area 11
ODP Area 5
ODP Area 13
Maddisons Proposed
60 L/s by 2024
60 L/s by 2030
ODP Area 12
ODP Area 11
Housing Accord (Geddes)
ODP Area 12B
Housing Accord (Faringdon South)
Rural Residential (Skellerup)
LEGEND
Sources
Existing
Proposed
Water Supply Mains Upgrades
by Year Required
2018
2019 - 2020
2021 - 2022
2027 - 2028
2036 - 2037
Existing Water Supply Mains
by DN (mm)
> 160
100 to 160
60 to 100
Potential Future Zones
Planning Zones
Parcels
0
1
2
3 km

T`XaW`Xagf!

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abgXf!

NORTH

DUNNS CROSSING ROAD

EAST MADDISONS ROAD

SPRINGSTON ROLLESTON ROAD

SELWYN ROAD

GOULDS ROAD

Legend

- Existing 200mmØ
- Existing 300mmØ
- Existing 450mmØ
- Proposed 200mmØ

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DAVIE LOVELL-SMITH

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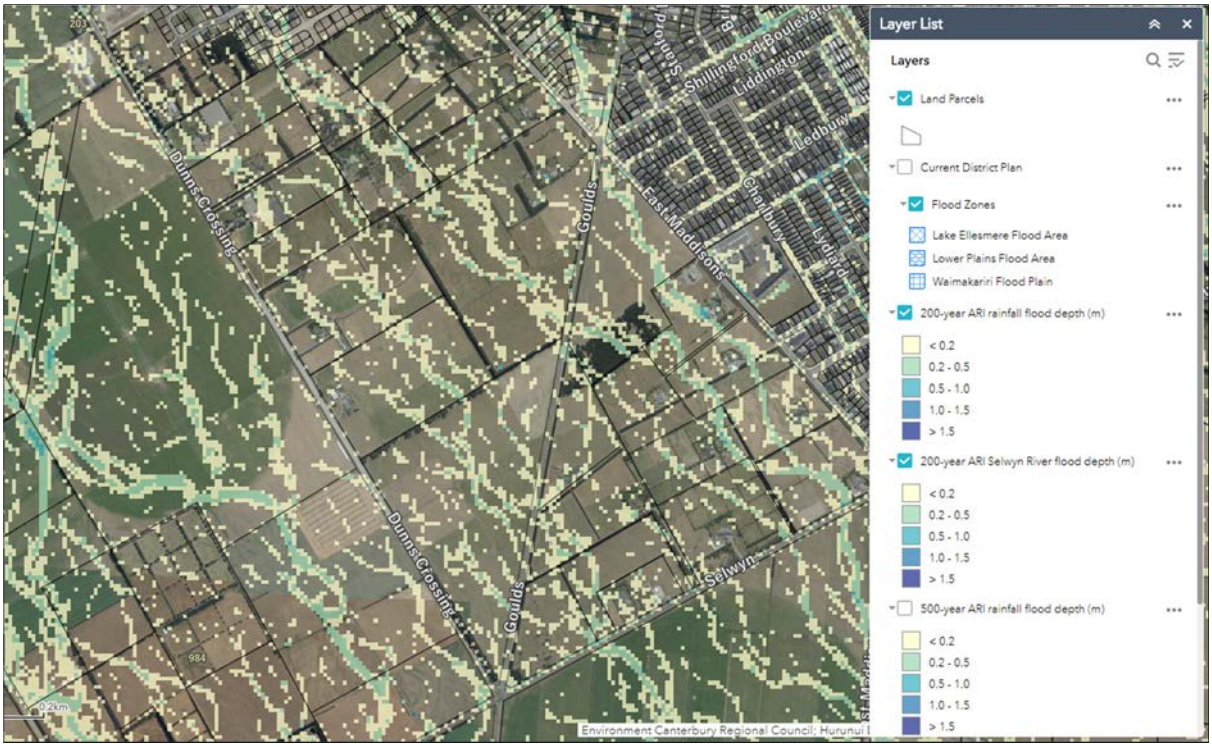
Proposed Trunk Mains

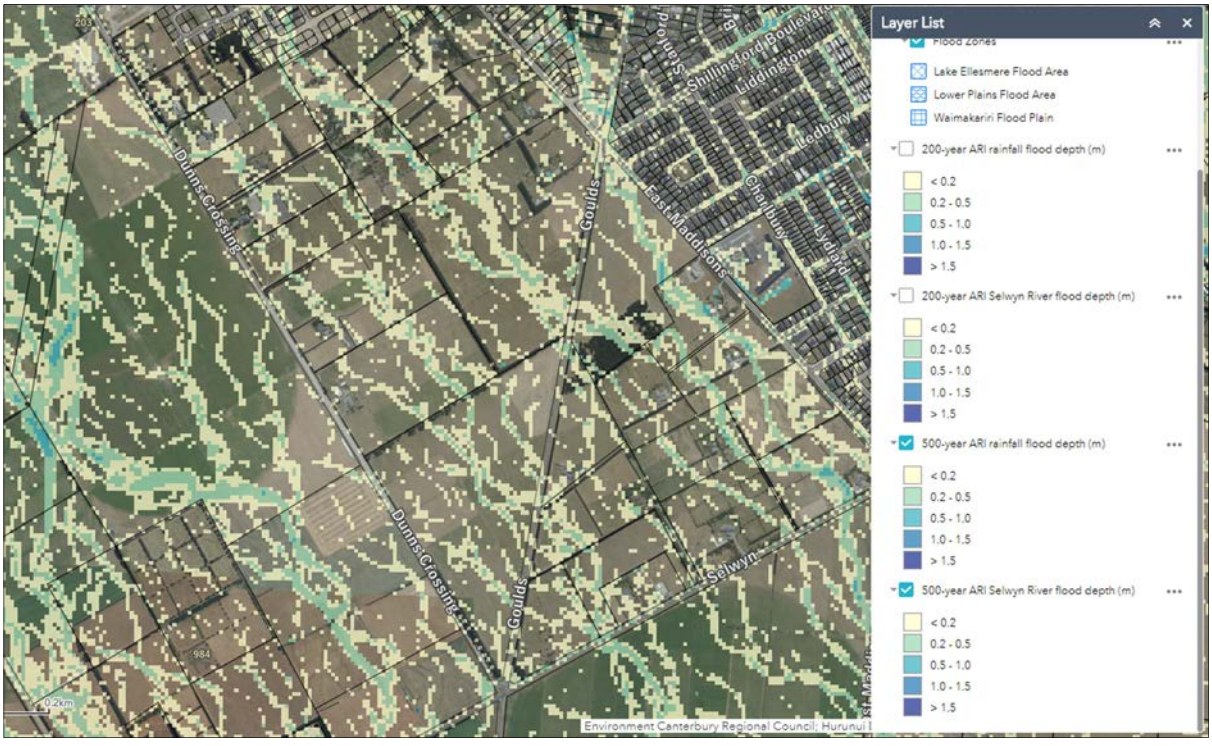
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For Discussion

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Appendix C – Flood Level Plans





Appendix D – Water Race Map and Existing Bore Data

Canterbury Maps

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0 0.1 0.2 0.3 0.4 Kilometres

Scale: 1:5,000 @A3

Map Created by Canterbury Maps on 22/10/2020 at 7:54 AM



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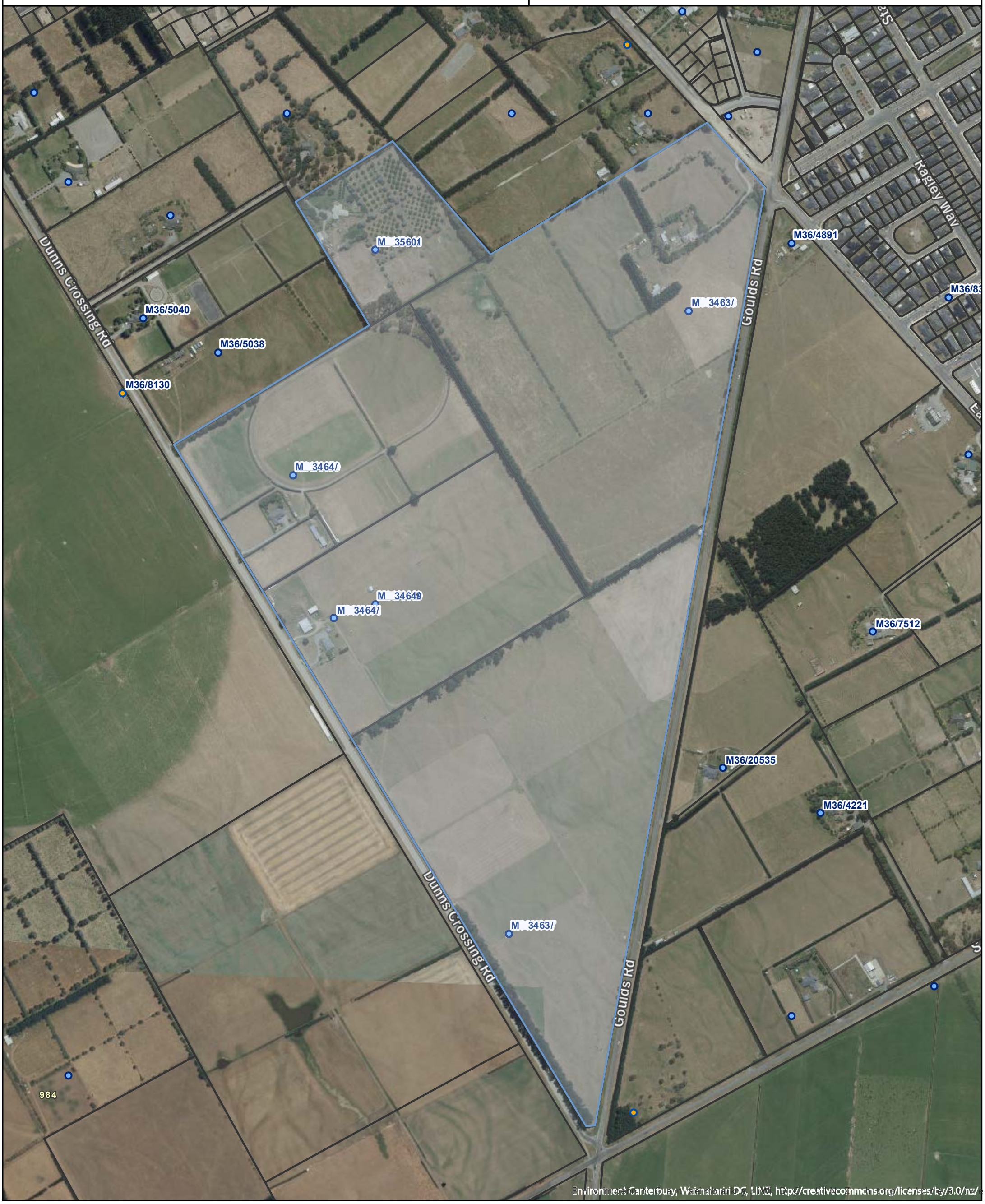
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Map Created by Canterbury Maps on 22/10/2020 at 7:5. AM



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Bore or Well No	M36/5041
Well Name	DUNNS CROSSING ROAD
Owner	KAJENS TRADING DEVELOPMENT LTD

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/5041	**File Number**	CO6C/10302
Owner	KAJENS TRADING DEVELOPMENT LTD	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING ROAD	**NZTM Grid Reference**	BX23:49507-69990
Locality	ROLLESTON	**NZTM X and Y**	1549507 - 5169990
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	32.00m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	6.80m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	40.47m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	10	**Calc Min 80%**	9.73m below MP (Estimated)
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	01 Feb 1997	**Max Tested Yield**	5 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	13 m
Drilling Method	Cable Tool	**Specific Capacity**	0.40 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	30	32				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Feb 1997	1	5.1	67.31074	12.8	2

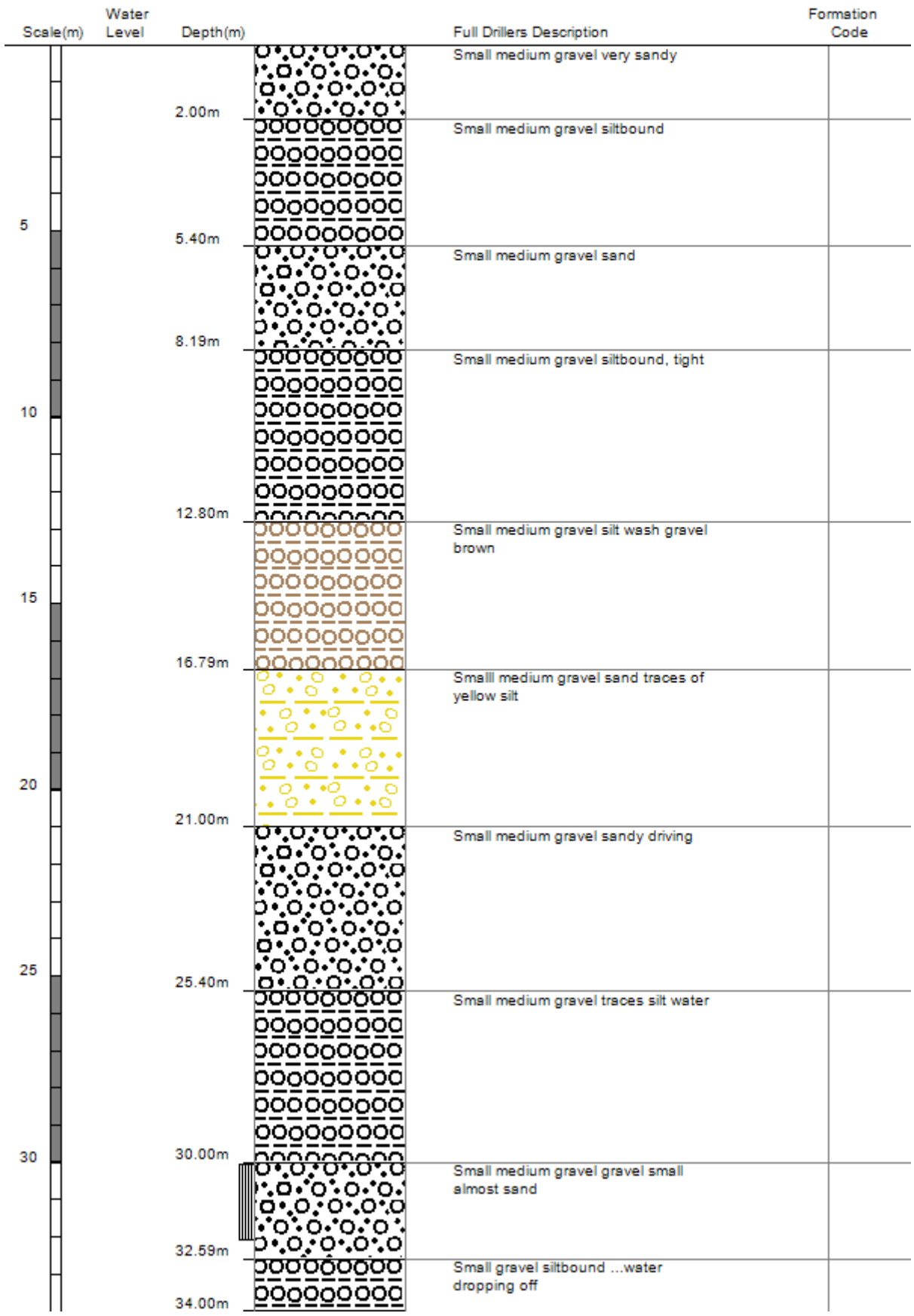
No comments for this well

Bore Log

Borelog for well M36/5041

Grid Reference (NZTM): 1549508 mE, 5169991 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.5 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 34.0 m Drill Date: 01-Feb-1997

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Bore or Well No	M36/4451
Well Name	DUNNS CROSSING RD
Owner	TYACK GJ & FR

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Well Number	M36/4451	**File Number**	
Owner	TYACK GJ & FR	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49448-69450
Locality	ROLLESTON	**NZTM X and Y**	1549448 - 5169450
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth		**Water Level Count**	0
Diameter		**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	38.92m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	0	**Calc Min 80%**	
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	0
Drill Date		**Max Tested Yield**	
Driller	not known	**Drawdown at Max Tested Yield**	
Drilling Method	Unknown	**Specific Capacity**	
Casing Material		**Last Updated**	18 Oct 2006
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

No screen data for this well

No step tests for this well

No comments for this well

Bore or Well No	M36/4450
Well Name	DUNNS CROSSING RD
Owner	Mr & Mrs L K & J C Blackmore

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Well Number	M36/4450	**File Number**	CO6C/02046
Owner	Mr & Mrs L K & J C Blackmore	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49388-69660
Locality	ROLLESTON	**NZTM X and Y**	1549388 - 5169660
Location Description	DP61278 LOT 2	**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Irrigation,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	25.20m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	39.62m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	8	**Calc Min 80%**	9.43m below MP (Estimated)
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	09 Apr 1992	**Max Tested Yield**	6 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	6 m
Drilling Method	Cable Tool	**Specific Capacity**	1.00 l/s/m
Casing Material		**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	23.2	25.2				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
09 Apr 1992	1	6.1	80.50892	6.1	0

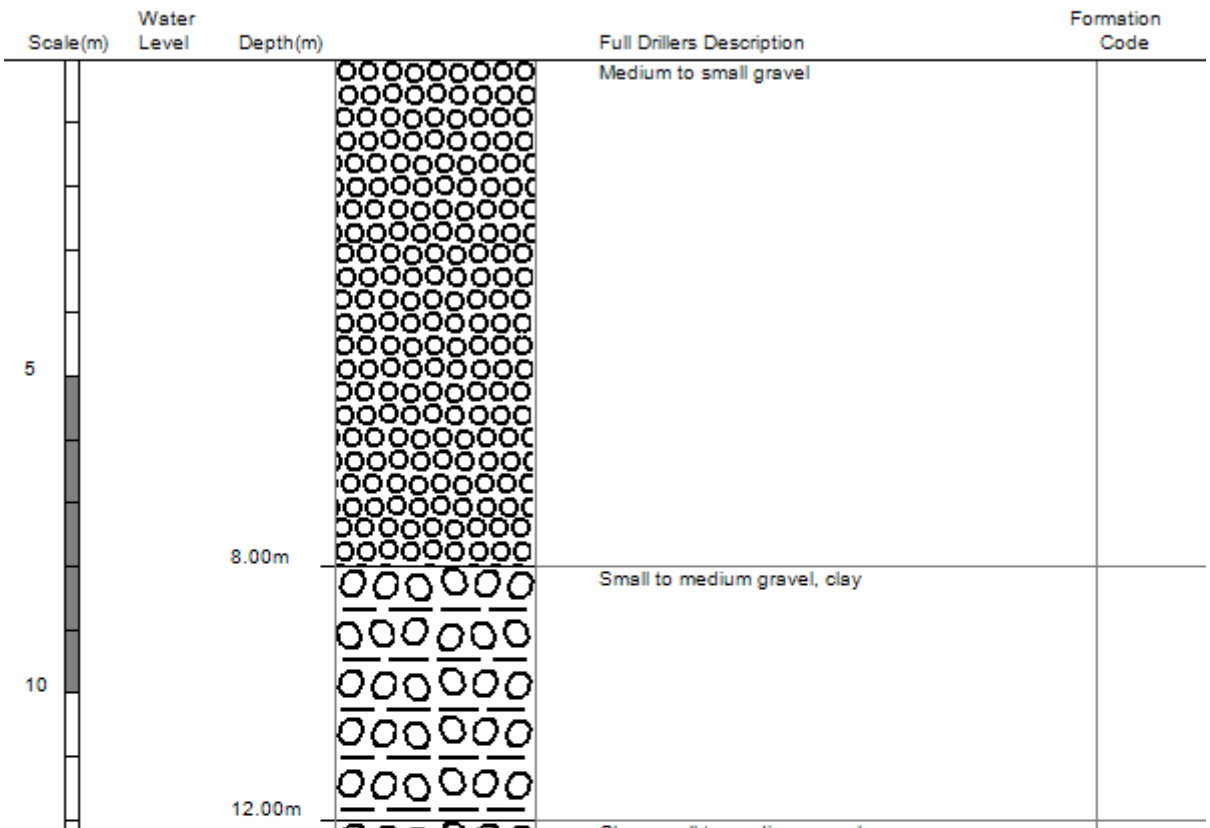
No comments for this well

Bore Log

Borelog for well M36/4450

Grid Reference (NZTM): 1549388 mE, 5169661 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 39.6 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 26.5 m Drill Date: 09-Apr-1992

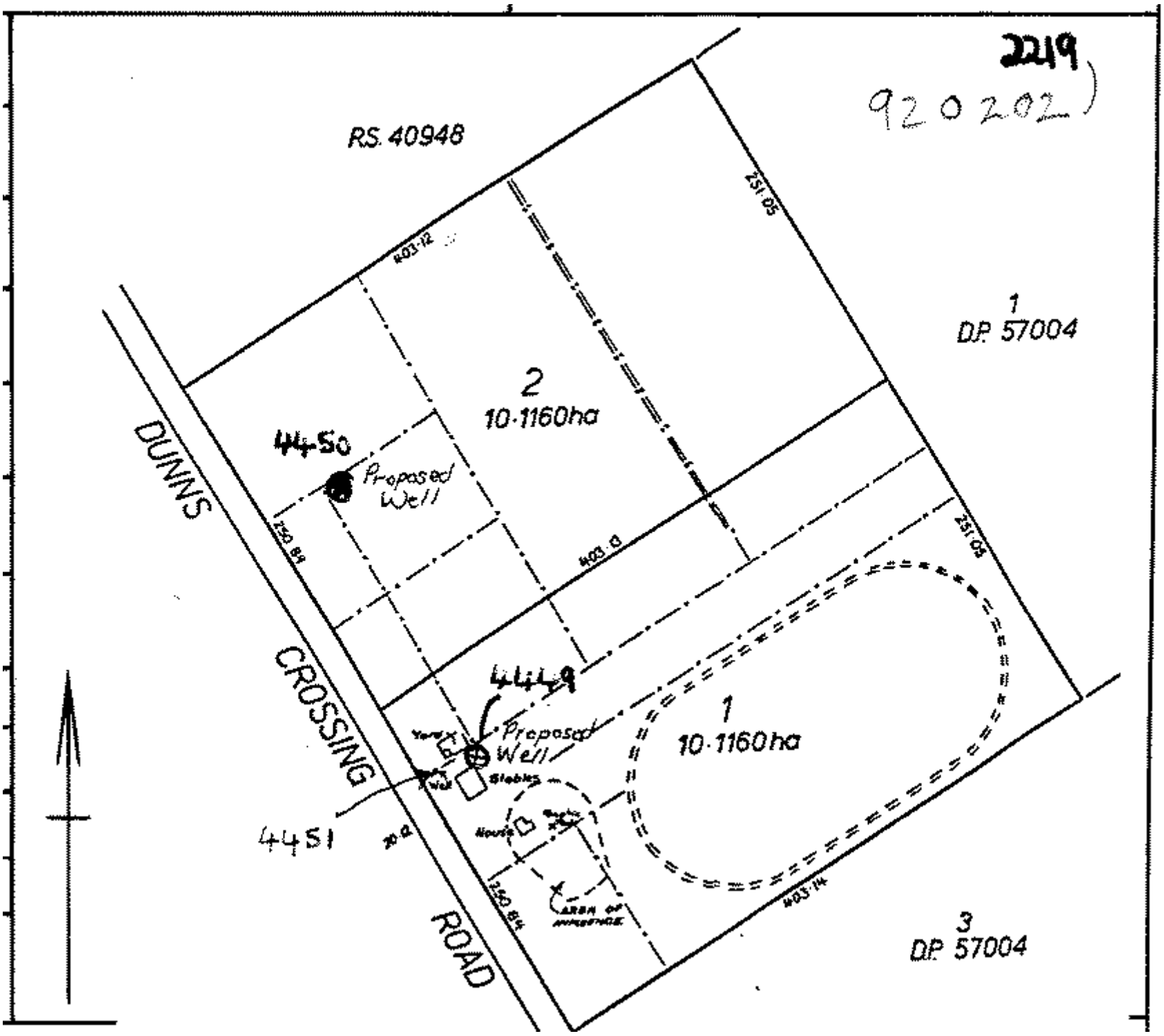
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Bore or Well No	M36/4449
Well Name	DUNNS CROSSING RD
Owner	TYACK GJ & FR

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Well Number	M36/4449	**File Number**	CO6C/02046
Owner	TYACK GJ & FR	**Well Status**	Not Used
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49508-69470
Locality	ROLLESTON	**NZTM X and Y**	1549508 - 5169470
Location Description	LOT 1	**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Irrigation,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	24.20m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	38.81m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	9	**Calc Min 80%**	9.27m below MP (Estimated)
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	09 Jun 1992	**Max Tested Yield**	6 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	5 m
Drilling Method	Cable Tool	**Specific Capacity**	1.36 l/s/m
Casing Material		**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		



Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	22.2	24.2				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
09 Jun 1992	1	6.1	80.50892	4.5	0

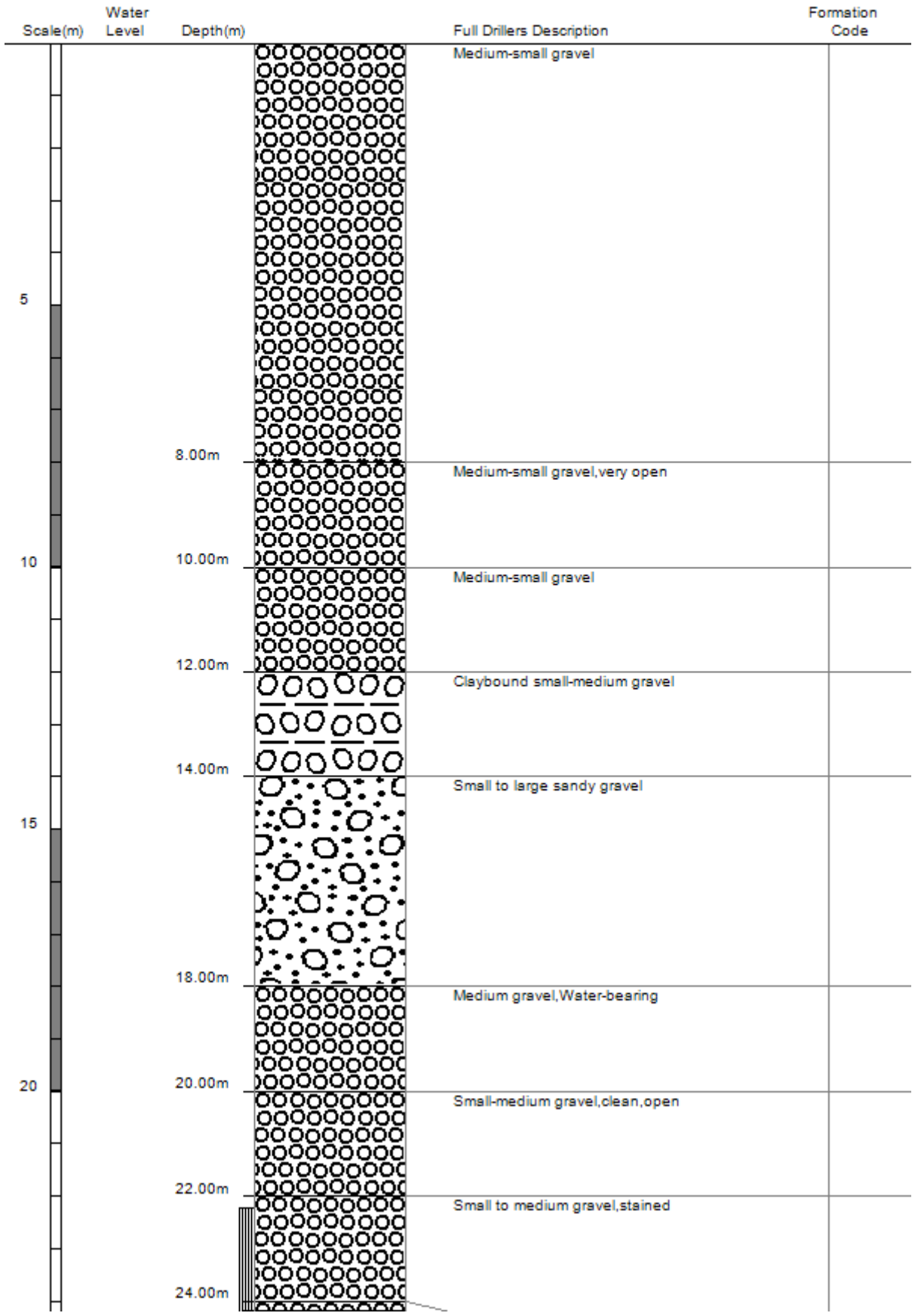
No comments for this well

Bore Log

Borelog for well M36/4449

Grid Reference (NZTM): 1549508 mE, 5169471 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 38.8 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 24.2 m Drill Date: 09-Jun-1992

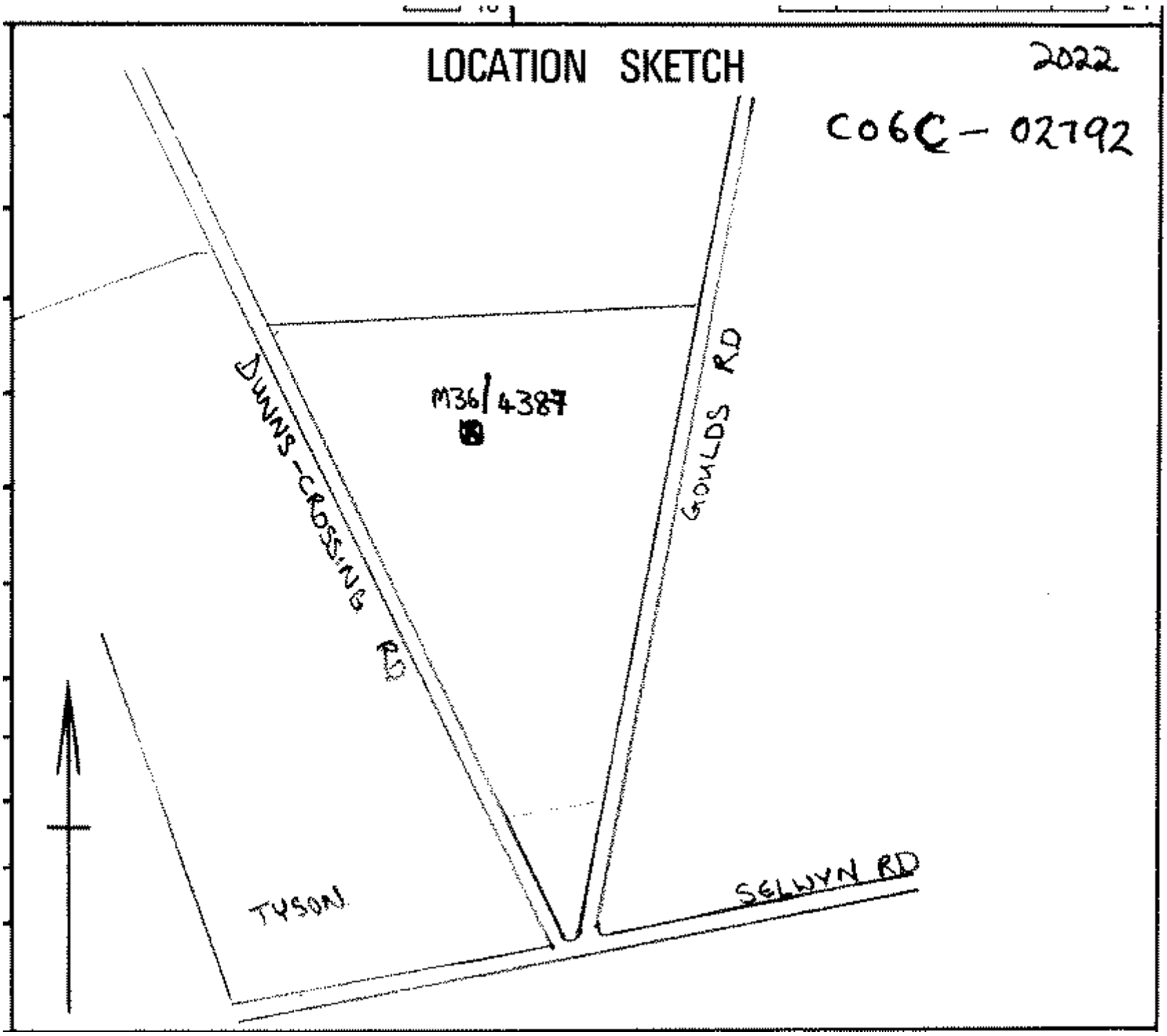
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Bore or Well No	M36/4387
Well Name	DUNNS CROSSING RD
Owner	Mr & Mrs I G & D C Robertson

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Well Number	M36/4387	**File Number**	CO6C/02792
Owner	Mr & Mrs I G & D C Robertson	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49703-68988
Locality	ROLLESTON	**NZTM X and Y**	1549703 - 5168988
Location Description		**Location Accuracy**	2 - 15m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	35.60m	**Water Level Count**	0
Diameter	200mm	**Initial Water Level**	5.65m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	36.46m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	5	**Calc Min 80%**	8.87m below MP (Estimated)
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	2
Drill Date	11 Oct 1991	**Max Tested Yield**	18 l/s
Driller	McMillan Drilling Ltd	**Drawdown at Max Tested Yield**	10 m
Drilling Method	Rotary/Percussion	**Specific Capacity**	1.64 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	Yes		



Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	32.6	35.6				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
11 Oct 1991	1	15.9	209.85112	9.7	2

Comments

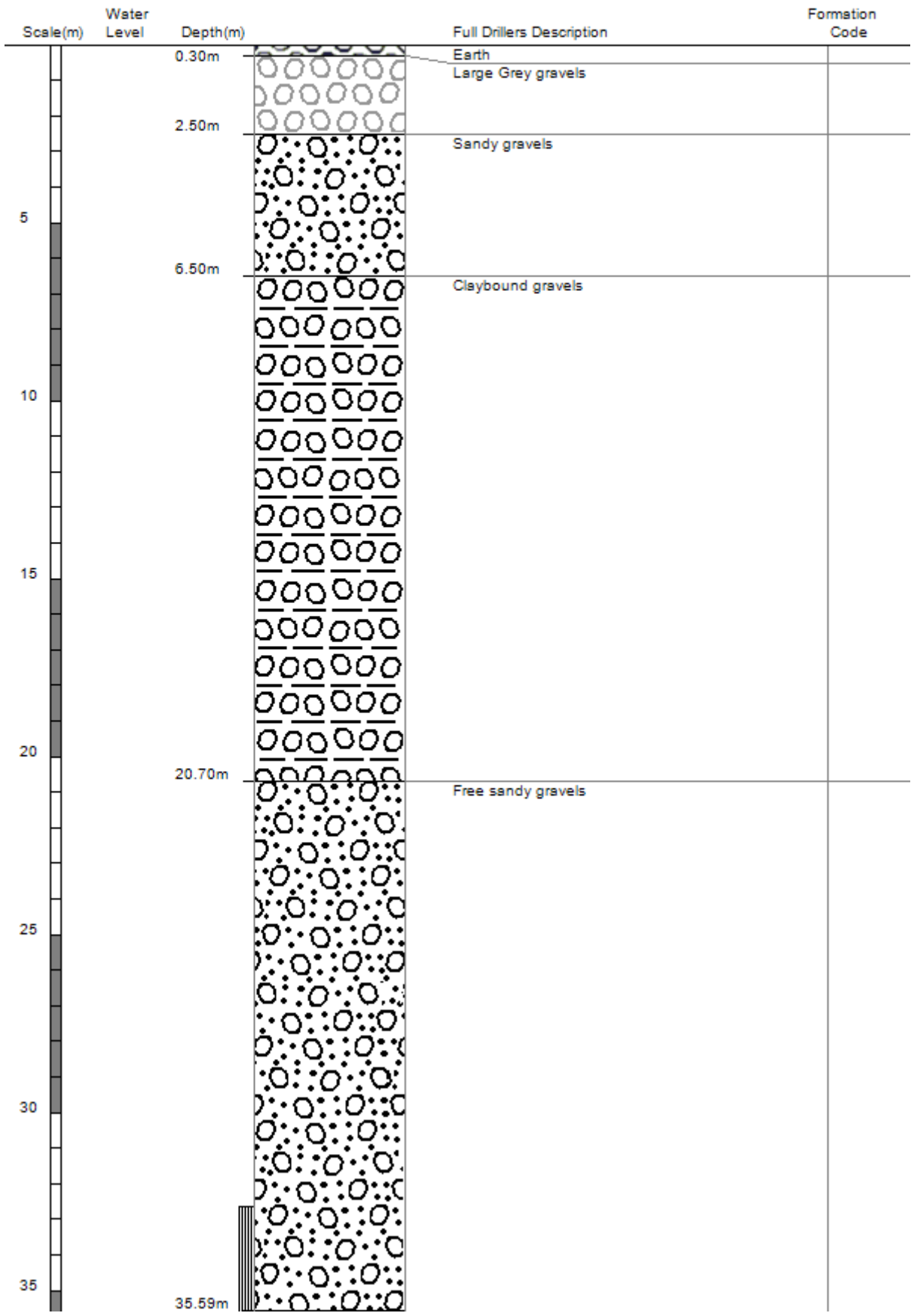
Comment Date	Comment
22 Feb 2006	Gridref changed from: M36:5975-3065. No access to depth etc. Located in the middle of the paddock.

Bore Log

Borelog for well M36/4387

Grid Reference (NZTM): 1549704 mE, 5168988 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 36.5 m +MSD Accuracy: < 2.5 m
Driller: McMillan Drilling Ltd
Drill Method: Rotary/Percussion
Borelog Depth: 35.6 m Drill Date: 11-Oct-1991

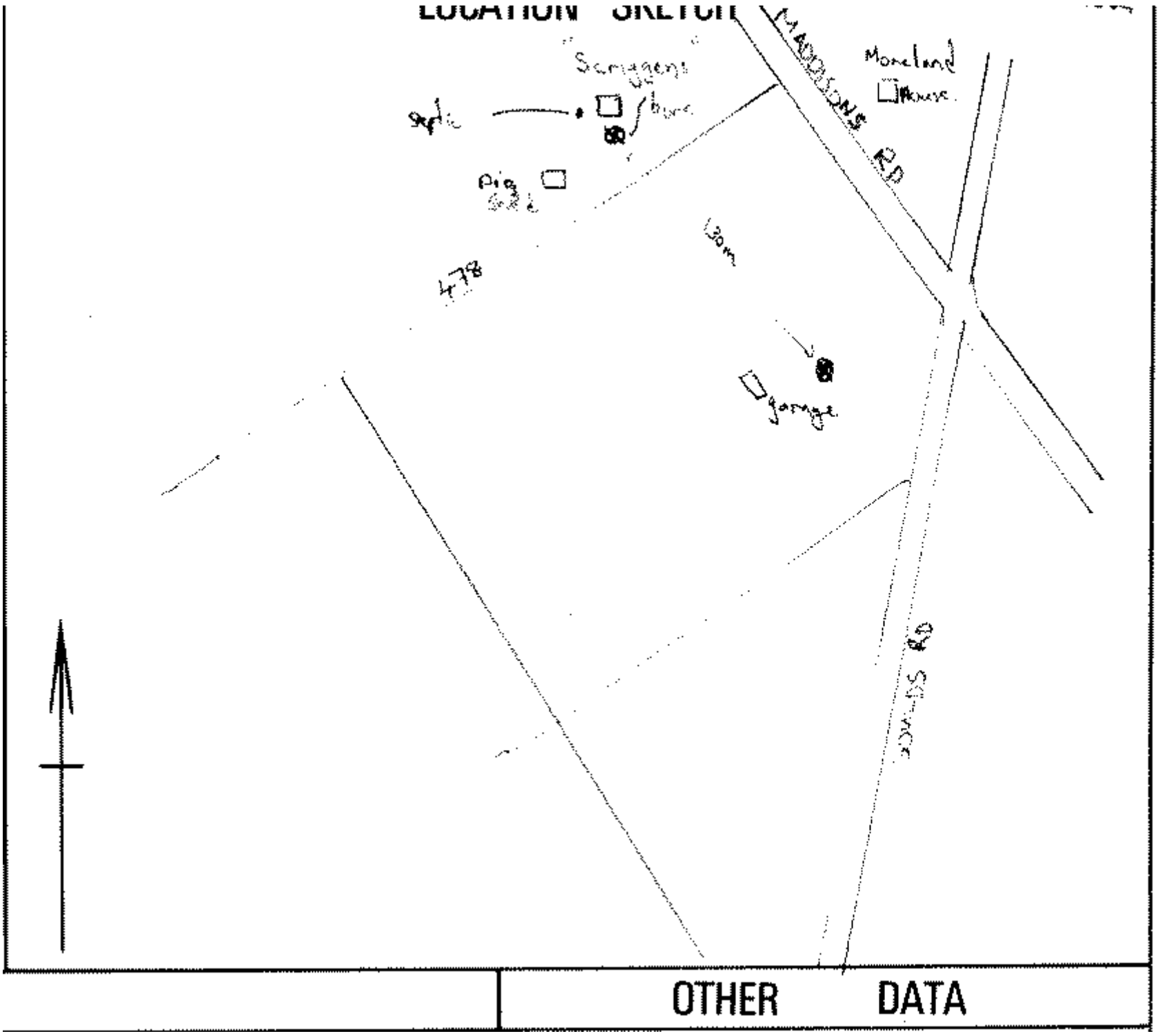
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Bore or Well No	M36/4346
Well Name	CNR MADDISONS & GOULDS RDS
Owner	MAIN M.R.

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Well Number	M36/4346	**File Number**	
Owner	MAIN M.R.	**Well Status**	Active (exist, present)
Street/Road	CNR MADDISONS & GOULDS RDS	**NZTM Grid Reference**	BX23:49967-69900
Locality	ROLLESTON	**NZTM X and Y**	1549967 - 5169900
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	26.80m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	39.12m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	15	**Calc Min 80%**	9.71m below MP (Estimated)
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	01 Apr 1991	**Max Tested Yield**	6 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	5 m
Drilling Method	Cable Tool	**Specific Capacity**	1.33 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		



Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	24.8	26.8				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Apr 1991	1	6.1	80.50892	4.57	4

No comments for this well

Bore Log

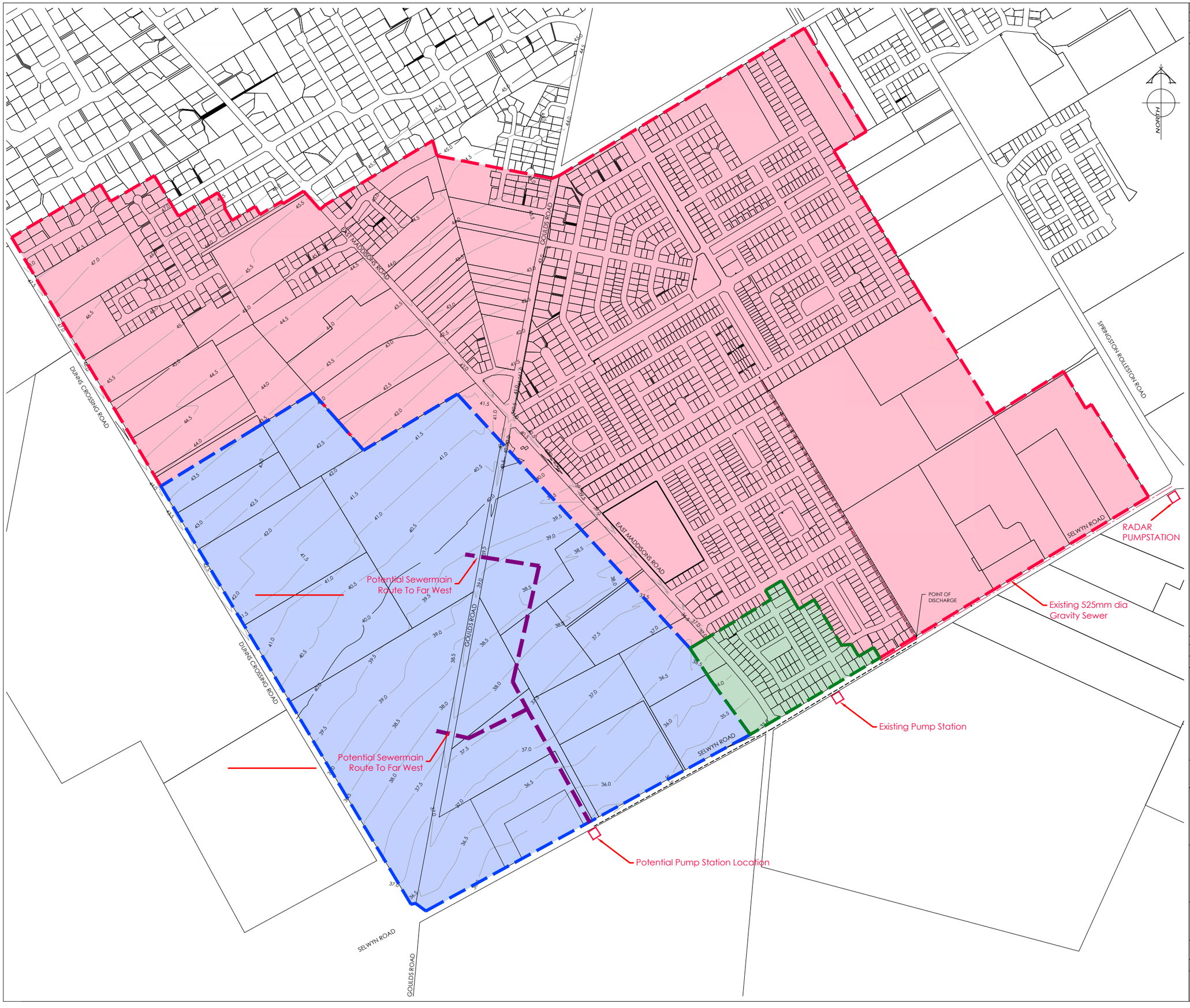
Borelog for well M36/4346

Grid Reference (NZTM): 1549968 mE, 5169901 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 39.1 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 28.5 m Drill Date: 01-Apr-1991

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Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
		4.00m	Not logged	RI
5		6.00m	Large to medium gravel, small amount of silt	RI
		8.00m	Silt	RI
10		11.50m	Gravel and silt	RI
		14.00m	Very tight clay, small shingle	RI
15		16.00m	Tight clay and shingle	RI
		18.00m	Tight clay, small gravel	RI
		18.50m	Clay and gravel, not as tight	RI
		19.00m	Gravel, some water	RI
20		21.00m	Tight clay gravel	RI
		22.00m	Tight clay and small to medium gravel, some amount of water	RI
		24.00m	Open medium gravel	RI
25		26.00m	Small to medium gravel	RI
		28.00m	Small gravel	RI
		28.50m	Grey silt with wood	BR

Appendix E – Sewer Catchment Plan



AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

NOTES :

TOTAL CATCHMENT AREA:

GRAVITY CATCHMENT AREA = 269.68ha

PUMPED CATCHMENT AREA = 130.40ha

LIFT STATION 1 CATCHMENT AREA = 11.02ha

SERVICES

EX.SS — STD. MH

FUTURE PRESSURE SS

FUTURE GRAVITY SS — STD. MH

	NAME	SIGNED	DATE
DESIGNED BY	JAMIE VERSTAPPEN		
CHECKED BY	ANDY HALL		

DAVIE LOVELL-SMITH
PLANNING SURVEYING ENGINEERING

116 Wrights Road P O Box 679 Christchurch 8140. New Zealand
Telephone: 03 379-0793 Website: www.dls.co.nz E-mail: office@dls.co.nz

JOB TITLE:

South West Sewer Rolleston

SHEET TITLE:

Catchment and Layout Plan

DRAWING STATUS

For Discussion

SCALE : 1:5000@A1 1:10000@A3

DATE : October 2019

CAD FILE : J:\20199\Eng\Drawings\South West Sewer Catchment_22-10-20.dwg

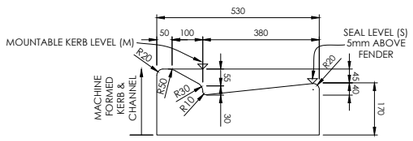
DRAWN : GC

DRAWING No : **P18727**

SHEET No: **E06.0**

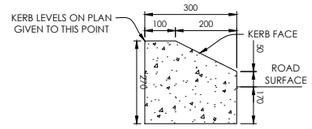
REVISION : **R0**

Appendix F – Typical Road Cross Sections



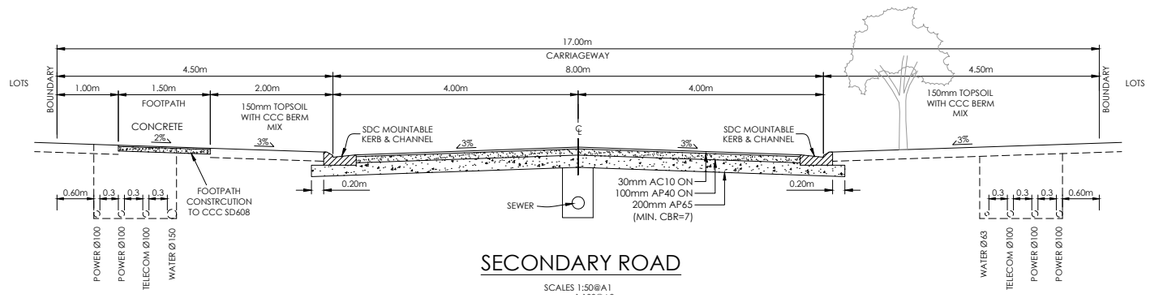
SDC MOUNTABLE KERB & CHANNEL

SCALE 1:10@A1
1:20@A3



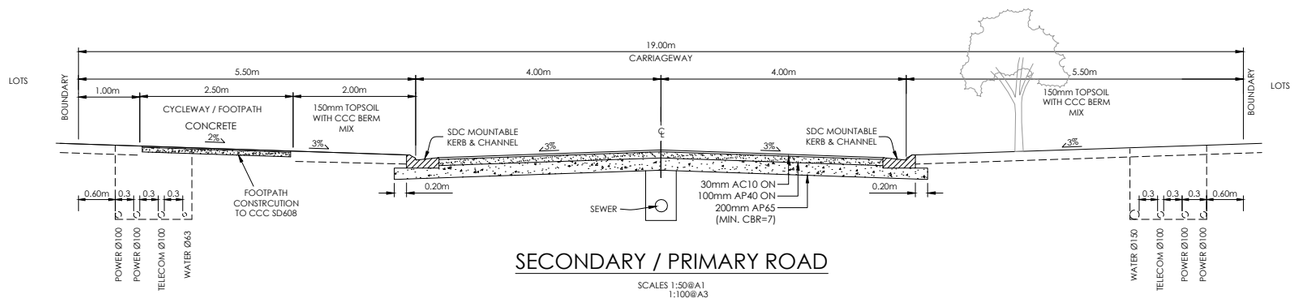
IN SITU MOUNTABLE MEDIAN KERB TO CCC SD603

SCALES 1:10@A1
1:20@A3



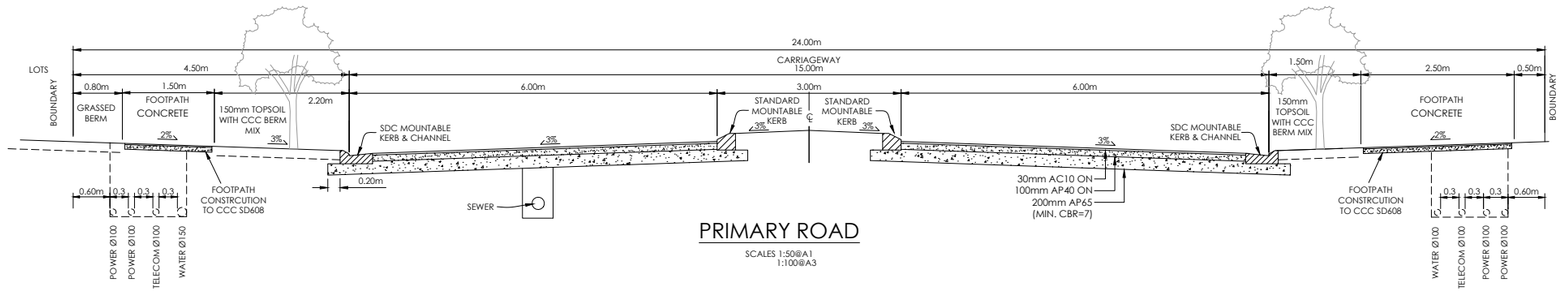
SECONDARY ROAD

SCALES 1:50@A1
1:100@A3



SECONDARY / PRIMARY ROAD

SCALES 1:50@A1
1:100@A3



PRIMARY ROAD

SCALES 1:50@A1
1:100@A3

AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

NOTES :

1) ALL WORKS IN ACCORDANCE WITH SDC CODE OF PRACTICE PARTS 1-11 STANDARDS, IF STANDARDS ARE UNSPECIFIED REFER TO CCC CSS PARTS 1-7.

2) ORIGIN OF LEVELS
LEVELS ARE IN TERMS OF MEAN SEA LEVEL (LYTTELTON VERTICAL DATUM 1937) PRIOR TO CANTERBURY EARTHQUAKES OF 2010 AND 2011.

3) METAL DEPTHS TO BE CONFIRMED OR INCREASED BY ENGINEER FOLLOWING CHECKING OF SUBGRADE CBR STRENGTH ONCE EXCAVATED.

4) ELECTRICITY & TELECOM SERVICES NOT SHOWN. REFER TO ELECTRICAL / TELECOM STREETLIGHT RETICULATION PLANS FOR RELEVANT DETAILS.

5) EXISTING SERVICES HAVE BEEN DIGITISED FROM SERVICE AUTHORITY PLANS; COMPLETENESS AND ACCURACY ARE NOT GUARANTEED. ALL SERVICES TO BE FULLY SEARCHED & PILOTED PRIOR TO TRENCHING.

6) CARRIAGEWAY & FOOTPATH ACCEPTANCE TESTING IN ACCORDANCE WITH SDC CODE OF PRACTICE PART 8, CCC CSS PART 6 & CCC IDS.

7) FOOTPATH BASECOURSE TESTING - MINIMUM CLEGG HAMMER VALUE OF 25 REQUIRED FOR FOOTPATHS & RESIDENTIAL CROSSINGS. 35 FOR COMMERCIAL CROSSINGS.

8) KERB & CHANNEL BASECOURSE TESTING - MINIMUM DRY DENSITY OF 2100kg/m³ WITH 75% EQUAL OR EXCEEDING 2150kg/m³.

9) ROAD BASECOURSE TESTING - MAXIMUM BENKELMAN BEAM DEFLECTION OF 2.0m WITH 95% OF RESULTS BELOW 1.6mm & RIGHT OF WAY 2.5m WITH 95% OF RESULT BELOW 2.0mm.

10) ALL KERB & FLAT CHANNELS TO BE TO SDC CoP; FD2.0

11) ALL AC FOOTPATHS TO CCC CSS SD607; SD608 CONCRETE.

12) DRAWINGS TO BE DISTRIBUTED AND READ AS A COMPLETE SET. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER FOR CLARIFICATION

HUGHES DEVELOPMENTS

	NAME	SIGNED	DATE
DESIGNED BY	JAMIE VERSTAPPEN		
CHECKED BY	ANDY HALL		

DAVIE LOVELL-SMITH
PLANNING SURVEYING ENGINEERING

116 Wrights Road P O Box 679 Christchurch 8140. New Zealand
Telephone: 03 379-0793 Website: www.dls.co.nz E-mail: office@dls.co.nz

JOB TITLE:

Faringdon
Far West
Rolleston

SHEET TITLE:

Roading Sections

DRAWING STATUS

For Discussion

SCALE : As Shown DATE : October 2020

CAD FILE : J:\20199\Eng\Drawings\P20199 CROSS SECTIONS.dwg DRAWN : GC

DRAWING No : **P.20199** SHEET No: **E03.2** REVISION : **R0**

Private Plan Change Request – Hughes Developments Limited
Appendix B – Integrated Transport Assessment

HUGHES DEVELOPMENTS

Faringdon Residential Development Rolleston

Transportation Assessment

CARRIAGEWAY CONSULTING

traffic engineering | transport planning

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1. Introduction

1.1. Hughes Developments Limited is seeking land use consent for residential development within Rolleston at two locations, towards the southeast and southwest of the existing Faringdon subdivision.

1.2. This Transportation Assessment sets out a detailed analysis of the transportation issues associated with the proposed residential activity including changes in travel patterns that are likely to arise. Where potential adverse effects are identified, 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 ODP areas lie to the immediate southeast and southwest of the existing (and largely constructed) Faringdon subdivision, towards the north of Selwyn Road and approximately 2.5km south of Rolleston town centre. The locations of the ODP areas in the context of the local area are shown in Figure 1 and in more detail in Figure 2. The ODP areas are presently zoned as Inner Plains within the Selwyn District Plan ("*District Plan*").

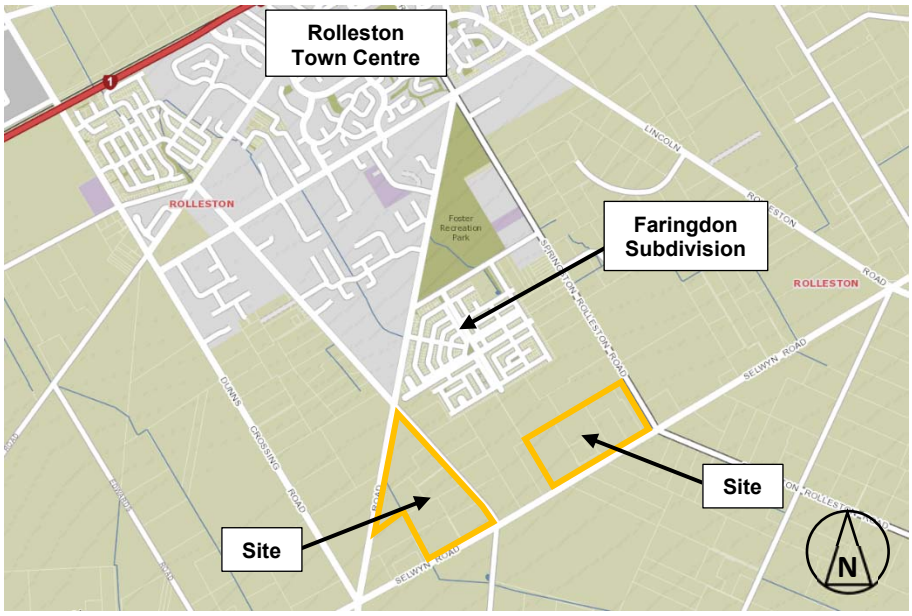


Figure 1: General Location of Proposed ODP Areas

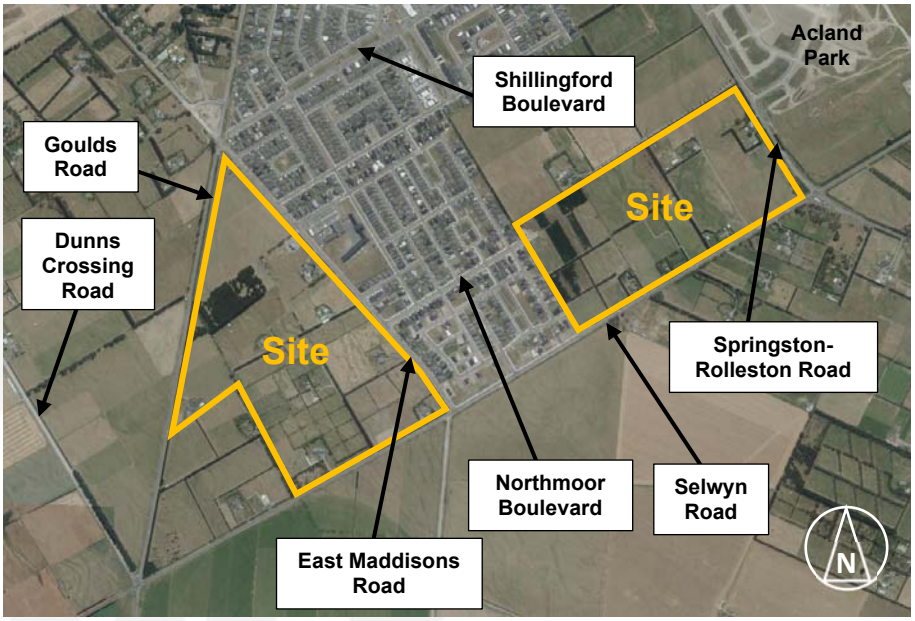


Figure 2: Aerial Photograph of Proposed ODP Areas and Environs

2.2. Road Hierarchy

2.2.1. The Selwyn District Plan classifies Selwyn Road and Springston-Rolleston Road as Arterial Roads, indicating a role of connecting areas of district importance including the district's townships and other key places and activities, including across district boundaries. As such, roads of this type primarily provide for through traffic.

2.2.2. Under the hierarchy, Goulds Road and East Maddisons Road are Collector Roads towards the north of Oak Tree Lane (approximately 1km north of the Goulds Road / East Maddisons Road intersection), described in the District Plan as having a role which distributes and collects local traffic within and between neighbourhood areas. They have a balance of a traffic movement function against a property access function that they also need to provide.

2.2.3. Towards the south of Oak Tree Lane and adjacent to the ODP area, Goulds Road and East Maddisons Road are Local Roads as are all other roads within Faringdon. These have a primary function of providing for property access.

3. Current Transportation Networks

3.1. Road Network (Southwestern ODP Area)

3.1.1. Towards the eastern side of the ODP area, East Maddisons Road has a sealed carriageway width of 11m with parking permitted on both sides, and a flat and straight alignment. The road is subject to a 60km/h speed limit. The eastern side of the road is characterised by multiple private driveways associated with the current extent of the Faringdon subdivision but the western (site) side is undeveloped.



Photograph 1: East Maddisons Road (Looking South)

3.1.2. At the northern extremity of the ODP area, East Maddisons Road meets Goulds Road at priority ('stop') intersection with Goulds Road retaining priority. On the immediate approach to the intersection, East Maddisons Road deviates towards the west such that it meets Goulds Road at 90-degrees. This scheme has recently been put in place as part of the Faringdon subdivision as previously East Maddisons Road met an acute angle. There are no auxiliary turning lanes at the intersection.



Photograph 2: East Maddisons Road / Goulds Road Intersection (Looking North)

3.1.3. Lemonwood School lies on the eastern side of East Maddisons Road. Based on information previously received, the school role is expected to be a maximum of 750 students, and there will also be a pre-school for up to 50 children. The school does not have direct vehicular access onto East Maddisons Road.

3.1.4. To the southeast, East Maddisons Road meets Selwyn Road at a priority ('give way') crossroads, where traffic on Selwyn Road retains the right of way. Sight distances for vehicles emerging from East Maddisons Road are excellent in both directions. There are no auxiliary lanes provided for vehicles turning into East Maddisons Road from Selwyn Road.





Photographs 3 and 4: Sight Distances to the Left and Right at the Selwyn Road / East Maddisons Road Intersection



Photograph 5: Selwyn Road / East Maddisons Road Intersection, Looking North from East Maddisons Road (South)

3.1.5. Along the southern edge of the ODP area, Selwyn Road has a 6.4m carriageway width, with grassed verges of 7-8m on either side. It has a flat and straight alignment, with a marked centreline but no edgeline markings. To the west of East Maddisons Road, Selwyn Road has an 80km/h speed limit.



Photograph 6: Selwyn Road (Looking West)

3.1.6. Approximately 1.1km southwest of East Maddisons Road, Selwyn Road meets Goulds Road at a priority ('stop') controlled intersection, with Selwyn Road retaining priority. Goulds Road meets at an acute angle of around 60 degrees but sightlines in each direction remain good. There are no auxiliary turning lanes at the intersection.



Photograph 7: Selwyn Road / Goulds Road Intersection (Looking South)

3.1.7. As shown on Photograph 7, there is a fifth leg at the intersection of Dunns Crossing Road. This joins Goulds Road just 15m north of Selwyn Road, and traffic must give-way at the intersection.

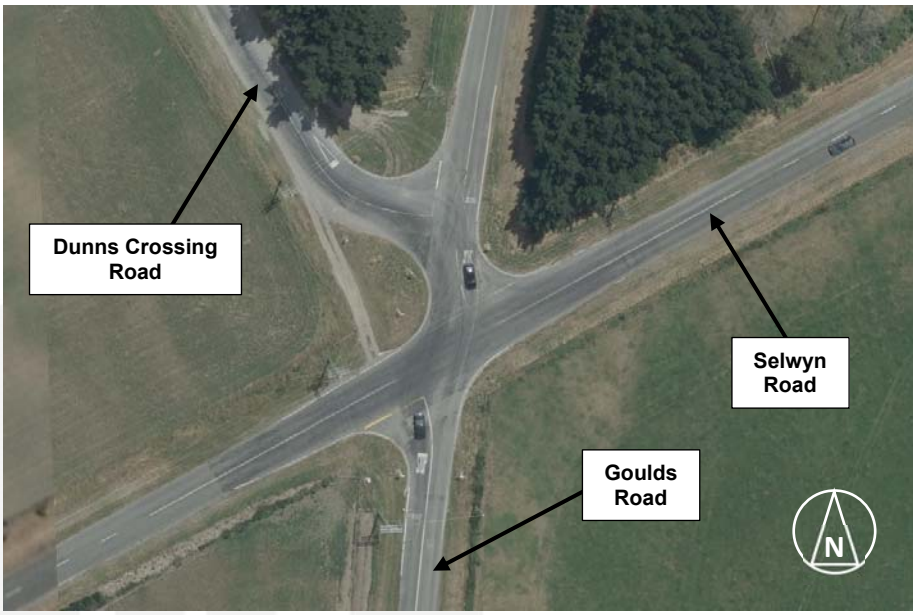


Figure 3: Aerial Photograph of Selwyn Road / Goulds Road / Dunns Crossing Road Intersection

3.1.8. West of this intersection, the speed limit on Selwyn Road increases to 100km/h and the road provides a connection to rural areas before terminating at the Selwyn River.

3.1.9. North of Selwyn Road, Goulds Road has a flat and straight alignment with a 6.5m carriageway width and wide grassed verges of 7-8m on either side. It is subject to an 80km/h speed limit and has a centreline but no edgeline markings.



Photograph 8: Goulds Road (Looking North)

3.1.10. Some 1.4km northeast of this intersection, Goulds Road meets East Maddison Road (discussed previously) before then connecting to other district roads that provide a connection into Rolleston town centre.

3.2. Road Network (Southeastern ODP Area)

3.2.1. Selwyn Road runs along the southern side of the ODP area. Immediately adjacent to the ODP area, the road has a 6.4m carriageway width, with grassed verges of 7-8m on either side. It has a flat and straight alignment, with a marked centreline but no edgeline markings, and has a speed limit of 80km/h.



Photograph 9: Selwyn Road Adjacent to ODP Area (Looking West)

3.2.2. However, immediately west of the ODP area lies an existing developed area of Faringdon. Along this section, Selwyn Road is subject to a 60km/h speed limit and has a number of driveways and a carriageway that has been widened to 9m, although at present this is divided as 6m for the eastbound traffic lane and 3m for the westbound lane.



Photograph 10: Selwyn Road Adjacent to Faringdon (Looking East)

3.2.3. The location where the two carriageway widths meet represents the southwestern corner of the ODP area. The layout is evidently temporary as there are no road markings or signage to indicate the reduced carriageway width.



Photograph 11: Selwyn Road Change of Carriageway Width and Speed Limit (Looking East)

3.2.4. Approximately 1850m from the existing edge of Faringdon, Selwyn Road meets Springston-Rolleston Road at a priority ('stop') controlled intersection, where traffic on Springston-Rolleston Road retain priority. The alignment of Springston-Rolleston Road curves slightly in this location, which increases sight distances for eastbound vehicles on Selwyn Road, but decreases them for westbound vehicles. The intersection does not have any auxiliary turning lanes, but there is a small amount of flaring which can be used by turning traffic.



Photograph 12: Springston-Rolleston Road / Selwyn Road Intersection (Looking South)

3.2.5. Springston-Rolleston Road forms the eastern edge to the ODP area. This presently has a variable carriageway width, notionally around 9m (two traffic lanes of 3.5m width each, with a 1m shoulder on both sides) but there is widening provided for the main entrance into the Acland Park subdivision, currently under construction, and which has auxiliary turning lanes.



Photograph 13: Springston-Rolleston Road (Looking North)



Photograph 14: Springston-Rolleston Showing Auxiliary Lanes into Acland Park (Looking South)

3.2.6. Further south, Springston-Rolleston Road turns towards the southeast and connects to the township of Lincoln. North of the ODP area, Springston-Rolleston Road meets Lowes Road at a four-arm roundabout. The northern continuation of Springston-Rolleston Road is known as Tennyson Street, and this provides a roading linkage to Rolleston town centre and to Main South Road (State Highway 1).

3.3. Non-car Modes of Transport

3.3.1. As the ODP areas represent the edge of the current urban development of Rolleston, footpath provision is intermittent and largely aligned with the extent of development. As such, there are footpaths along the eastern side of East Maddison Road, the northern side of Selwyn Road (adjacent to the current extent of Faringdon) and on the eastern side of Springston-Rolleston Road adjacent to Acland Park. Certain of these are sufficiently wide to accommodate a shared walking and cycling path, although there is presently no signage to indicate shared use.



Photograph 15: Footpaths on East Maddisons Road and Selwyn Road

4. Future Changes to Land Use and Infrastructure

4.1. Rolleston Structure Plan

4.1.1. The Rolleston Structure Plan has now been implemented through Plan Change 7 to the District Plan. Nevertheless, the Structure Plan is helpful in setting out the high-level principles guiding growth within the town, and of particular importance are the proposed amendments to the transportation network both for motorised vehicles and non-car users which affect both ODP areas.



Figure 4: Extract from Figure 8.2 of Rolleston Structure Plan ("Main Roads – Primary Network")

4.1.2. The form of development shown on the Structure Plan highlights that in due course, there will be two east-west routes in the area, one of which passes through the southwestern ODP area (Northmoor Boulevard).

4.1.3. The roading network towards the north of the southeastern ODP area will be extended as far as Selwyn Road, with extensions of Hungerford Drive and Faringdon Boulevard. It should be noted however that the location of all of these roads is slightly different to what has subsequently been implemented through Outline Development Plan Area 6 (Faringdon).

4.1.4. Faringdon Boulevard (and its southern extension) and Springston-Rolleston Road will be cycle routes.



Figure 5: Extract from Figure 8.3 of Rolleston Structure Plan ("Cycleway Routes")

4.1.5. Public transport is to be improved within Rolleston. Although the roading patterns have changed slightly, the Structure Plan suggests that Northmoor Boulevard will have a "*potential service*" which will also run along part of East Maddisons Road.



Figure 6: Extract from Figure 8.4 of Rolleston Structure Plan ("Public Transport Route Patterns")

4.2. *Land Use Changes*

4.2.1. The District Plan sets out that there are a number of residential areas in the immediate vicinity of the proposed ODP areas.

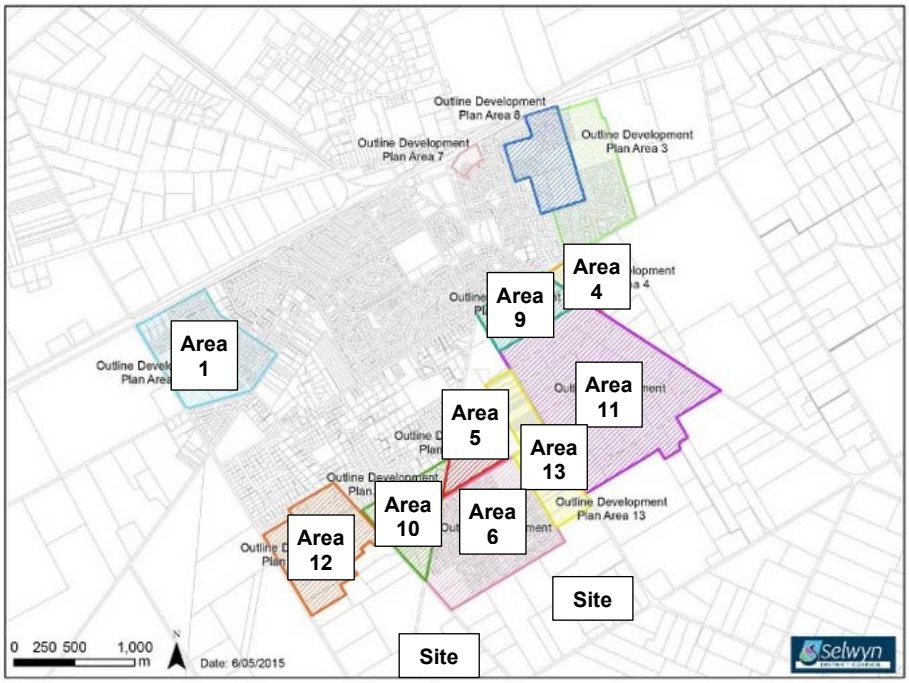


Figure 7: Confirmed Residential Areas Set Out in the Selwyn District Plan in the Vicinity of the ODP Areas

4.2.2. Development of Rolleston is continuing and therefore for the purposes of assessing the proposed ODP areas, it has been assumed that each of these areas noted above is fully developed. This is discussed further below.

5. Current and Future Transportation Patterns

5.1. Traffic Flows

5.1.1. Selwyn District Council carries out regular traffic counts on the key vehicle routes throughout the district. However, as noted above, there is ongoing development in the vicinity of the two ODP areas and therefore current traffic flows do not indicate future traffic flows particularly once the identified ODP areas discussed previously in this report are developed.

5.1.2. As a result of this, the Council has made available its microsimulation model for the Rolleston area. In brief, this transportation model includes the future land uses in the area, and assigns the likely traffic generation of these onto the surrounding road network. It is understood that the Council considers that the model reflects the most likely scenario for development in the Rolleston area, as described previously in this report. All modelling work included in this report was undertaken by the Council's preferred transport modelling consultants.

5.1.3. For this assessment, the model used allows for full development of the ODP areas plus known other developments in the area (such as Lemonwood School). A manual assignment has been used to recalculate the traffic flows at the East Maddisons Road / Goulds Road intersection as the model allow for a roundabout to be constructed in this location, which is unlikely to happen for some considerable time (if at all).

5.1.4. The forecast traffic flows at the intersections closest to the ODP areas are set out below.

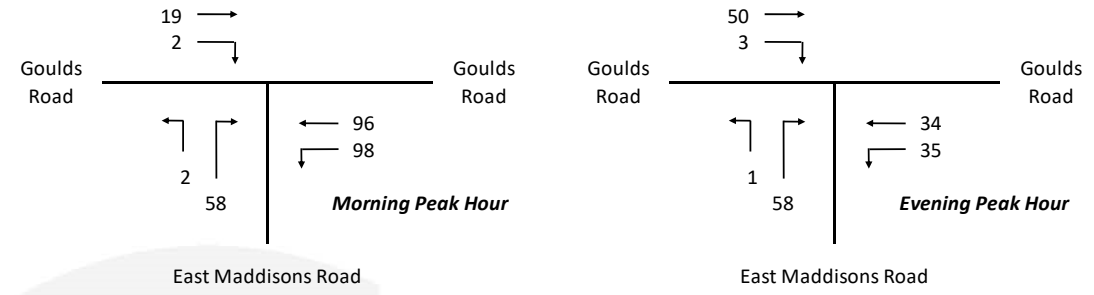


Figure 8: Anticipated Traffic Flows at the Goulds Road / East Maddisons Road Intersection with Confirmed Development (Without Proposed ODP areas)

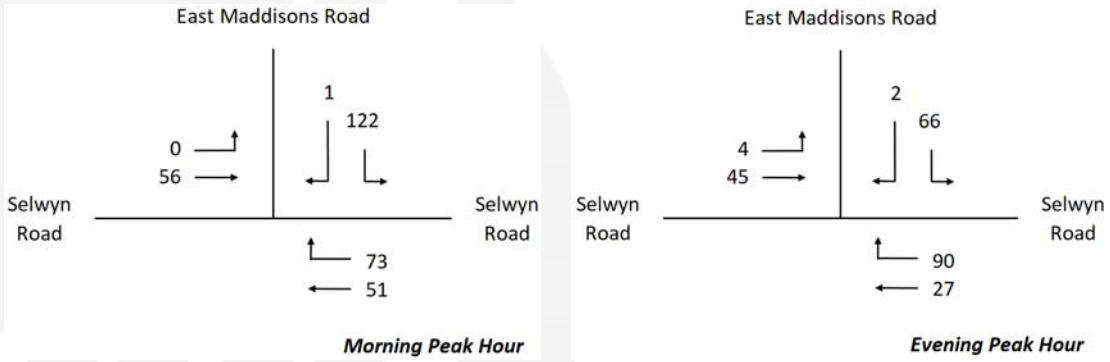


Figure 9: Anticipated Traffic Flows at the Selwyn Road / East Maddisons Road Intersection, with Confirmed Development (Without Proposed ODP areas)

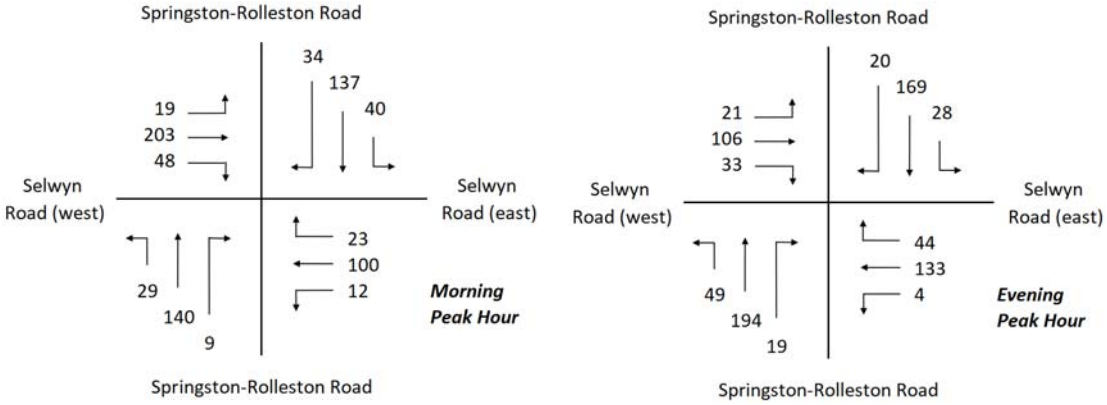


Figure 10: Anticipated Traffic Flows at the Selwyn Road / Springston-Rolleston Road Intersection, with Confirmed Development (Without Proposed ODP areas)

5.1.5. The data shows that even with development of existing ODP areas, traffic flows remain relatively modest.

5.1.6. The microsimulation software provides an expected level of service for the intersections, but a more detailed evaluation has been carried out using the computer software program Sidra Intersection and the results are summarised below.

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
East Maddisons Road (southeast)	L	5.8	0.0	A	7.1	0.0	A
	R	6.5	0.2	A	6.1	0.2	A
Goulds Road (northeast)	L	6.4	0.0	A	6.4	0.0	A
Goulds Road (southwest)	R	7.5	0.0	A	7.1	0.0	A

Table 1: Anticipated Levels of Service at the Goulds Road / East Maddisons Road Intersection, with Confirmed Development (Without Proposed ODP areas)

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
Selwyn Road (northeast)	R	5.8	0.3	A	5.7	0.3	A
East Maddisons Road (northwest)	L	5.7	0.3	A	5.7	0.2	A
	R	6.1	0.0	A	6.0	0.0	A
Goulds Road (southwest)	L	5.6	0.0	A	5.6	0.0	A

Table 2: Anticipated Levels of Service at the Selwyn Road / East Maddisons Road Intersection, with Confirmed Development (Without Proposed ODP areas)

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
Springston - Rolleston Rd (south)	L	7.2	0.1	A	8.2	0.2	A
	R	7.6	0.1	A	8.6	0.2	A
Selwyn Road (east)	L	9.6	0.0	A	10.5	0.0	B
	T	11.3	0.7	B	13.7	1.3	B
	R	14.1	0.7	B	15.3	1.3	C
Springston - Rolleston Rd (north)	L	7.4	0.3	A	8.5	0.2	A
	R	7.6	0.3	A	8.8	0.2	A
Selwyn Road (west)	L	9.7	0.1	A	10.6	0.1	B
	T	12.4	1.9	B	13.0	0.9	B
	R	13.8	1.9	B	15.0	0.9	C

Table 3: Anticipated Levels of Service at the Selwyn Road / Springston-Rolleston Road Intersection, with Confirmed Development (Without Proposed ODP areas)

5.1.7. It can be seen that queues and delays are low, with good levels of service provided for each turning movement.

5.2. Non-Car Modes of Transport

5.2.1. The volumes of pedestrians and cyclists in the area are presently relatively low due to the limit extent of residential development. However it is anticipated that they will increase in due course on those parts of Selwyn Road and Springston-Rollestion Road as houses are constructed and occupied.

5.2.2. Similarly, the extent of public transport services is largely dependent upon the number of potential passengers in an area, which in this case is currently minimal. As the extent of residential development increases then the number of potential passengers will also increase, and this means that it is likely that bus services could be extended. At present though there are no scheduled bus services in the immediate area.

5.3. Road Safety

5.3.1. The NZTA Crash Analysis System has been used to identify the location and nature of the recorded traffic crashes in the vicinity of the ODP areas. All reported crashes between 2015 and 2019, plus the partial record for 2016, were identified on Goulds Road (East Maddisons Road to Selwyn Road), Selwyn Road (Goulds Road to Springston-Rolleston Road), Springston-Rolleston Road (across the ODP area frontage and to the immediate south of Selwyn Road), and East Maddisons Road (Goulds Road to Selwyn Road).

5.3.2. This showed that 16 crashes had been recorded, of which 7 occurred at the Selwyn Road / Springston-Rolleston Road intersection, 7 occurred at the Selwyn Road / Goulds Road intersection, and one each occurred at the East Maddisons Road / Goulds Road and East Maddisons Road / Selwyn Road intersections.

5.3.3. At the East Maddisons Road / Goulds Road intersection, the crash occurred when a driver turned right from Goulds Road (north) into East Maddisons Road (west) and lost control. The

crash did not result in any injuries. Since that time, the speed limit on the roads has been reduced from the then-prevailing 100km/h, which will assist in mitigating this type of crash.

5.3.4. At the East Maddisons Road / Selwyn Road intersection, the crash occurred when a driver turned right from Selwyn Road (east) into East Maddisons Road and lost control. The crash did not result in any injuries. A temporary speed limit of 30km/h was in place at the time, potentially due to construction works at Faringdon, but it appears that the driver was travelling more quickly than this.

5.3.5. Of the 7 crashes that occurred at the Selwyn Road / Springston-Rolleston Road intersection:

- One crash occurred when a vehicle travelling from Goulds Road (south) to Goulds Road (north) failed to give-way and struck an eastbound vehicle on Selwyn Road. The crash did not result in any injuries;
- One crash occurred when a southbound vehicle on Goulds Road failed to give-way and struck a vehicle turning from Selwyn Road (east) into Goulds Road. The crash resulted in minor injuries;
- Two crashes occurred when a vehicle travelling from Goulds Road (south) to Goulds Road (north) failed to give-way and struck a westbound vehicle on Selwyn Road. One crash resulted in minor injuries and the other resulted in no injuries;
- Three crashes occurred when a vehicle travelling from Goulds Road (north) to Goulds Road (south) failed to give-way and struck a westbound vehicle on Selwyn Road. One crash resulted in serious injuries, one crash resulted in minor injuries and one resulted in no injuries;

5.3.6. The crashes all involve a failure to give-way to another vehicle, with three involving northbound vehicles on Goulds Road. This is not uncommon within a high-speed rural area, but as set out below, the proposed development will result in measures that will address the issue at least in part.

5.3.7. Of the 7 crashes that occurred at the Selwyn Road / Springston-Rolleston Road intersection:

- Two crashes occurred when a vehicle travelling from Selwyn Road (west) failed to give-way and struck a northbound vehicle on Springston-Rolleston Road. One crash resulted in serious injuries and the other resulted in minor injuries;
- Two crashes occurred when a vehicle travelling from Selwyn Road (west) failed to give-way and struck a southbound vehicle on Springston-Rolleston Road. The crashes both resulted in minor injuries;
- One crash occurred when a vehicle travelling from Selwyn Road (east) failed to give-way and struck a southbound vehicle on Springston-Rolleston Road. The crash did not result in any injuries;
- One crash occurred when a vehicle travelling from Selwyn Road (west) and turning right onto Springston-Rolleston Road lost control and left the road. The crash resulted in minor injuries;
- One crash occurred when a vehicle turning right from Springston-Rolleston Road (north) onto Selwyn Road (west) was struck by another southbound vehicle that attempted to overtake it. The crash resulted in minor injuries;

5.3.8. Most of the crashes all involve a failure to give-way to another vehicle, although the direction of travel does not show any strong bias in either direction of travel. The lower speed limit in this area is likely to have resulted in changes to the crash patterns, but this may not yet be reflected in the data.

5.3.9. Overall, there are clusters of crashes at the Selwyn Road / Springston-Rolleston Road and Selwyn Road / Goulds Road intersections, and these are discussed further below.

5.3.10. It should be reiterated that traffic flows will increase in future as a result of increased development within the immediate area, and thus the crash numbers are likely to change due to road users having greater potential for conflict with one another. However, it can reasonably be anticipated that all new and improved roads will be constructed to meet current standards and accordingly, that no inherent significant safety risks will be introduced.

6. Proposal

6.1. The proposal is for two residential areas, with the southeastern area providing a total of 405 lots and the southwestern area providing 564 lots.



Figure 11: Outline Development Plan for Southwestern ODP Area

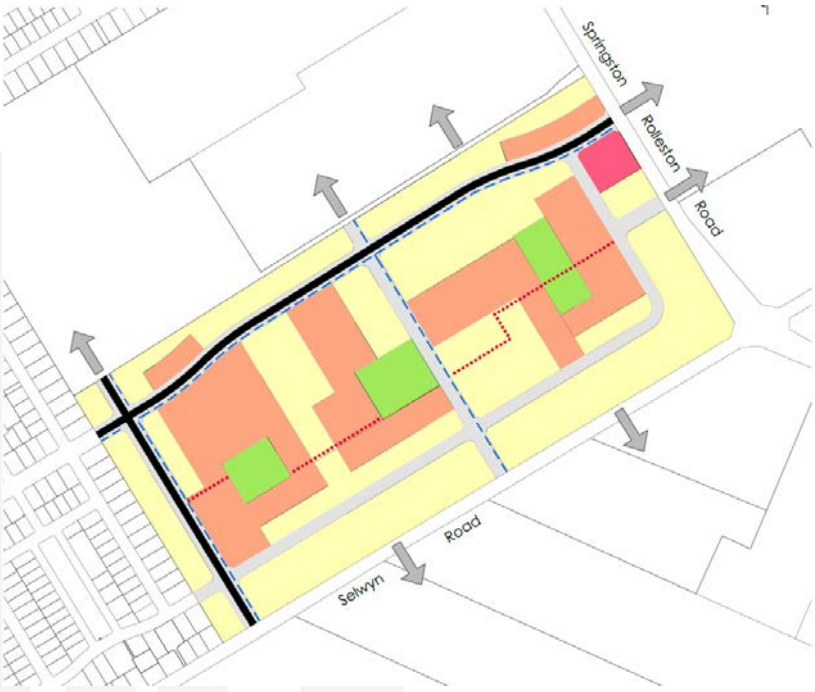


Figure 12: Outline Development Plan for Southeastern ODP Area

6.2. From a transportation perspective, each ODP area will have a number of linkages onto the adjacent roading network. The southwestern ODP area provides a main roading link between East Maddisons Road and Goulds Road, as an extension of Northmoor Boulevard. There are also two connections onto Selwyn Road. The southeastern ODP area provides an east-west

connection to Springston-Rolleston Road, also as an extension of Northmoor Boulevard, plus a north-south link that aligns with Faringdon Boulevard.

6.3. It is anticipated that each of the intersections at the ODP area boundaries and within the ODP areas will operate as priority intersections (rather than roundabouts).

7. Traffic Generation and Distribution

7.1. Traffic Generation

7.1.1. 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.

7.1.2. In this instance, the locations of the ODP areas represents an extension to the urban area of Rolleston, and as a result, it is considered that a rate of 8 vehicle movements per day per residence is appropriate.

7.1.3. An allowance has been made for each dwelling to generate 1 vehicle movement in the peak hours. In the morning peak hour, 90% of these are likely to be exiting the development, with 65% of the generated vehicle movements entering the development in the evening peak hour.

7.1.4. This suggests the following traffic generation:

Scenario	Traffic Volumes		
	In	Out	Total
Morning Peak Hour	56	508	564
Evening Peak Hour	367	197	564
Daily	1,128	1,128	4,512

Table 4: Traffic Generation of Southwestern Area

Scenario	Traffic Volumes		
	In	Out	Total
Morning Peak Hour	41	364	405
Evening Peak Hour	263	142	405
Daily	1,620	1,620	3,240

Table 5: Traffic Generation of Southeastern Area

7.2. Trip Distribution

7.2.1. The microsimulation model has been used to determine the trip distribution. This has different distributions for each direction of travel and for the morning and evening peak hours, but on average shows the following:

- Towards State Highway 1 east: 14%
- Selwyn Road east: 16%
- Springston-Rolleston Road: 4%
- State Highway 1 west: 0%
- North of State Highway 1: 6%
- Rolleston town centre: 15%
- Other locations outside Rolleston (unspecified): 6%
- Internal movements: 39%

7.2.2. The data shows a high degree of trip-making that remains internal to the ODP areas.

7.2.3. The roading network towards the south of Rolleston generally comprises higher speed, rural roads, where drivers do not have to give-way to other vehicles. Conversely, the roading network within Rolleston has an urban speed limit and numerous locations where drivers must slow down or stop for other vehicles. It is therefore considered more likely that where drivers have a choice, they will use Selwyn Road rather than using the Rolleston urban road network. The vehicles have been assigned onto the network on this basis.

Direction	Routes	Traffic Volumes			
		Morning Peak Hour		Evening Peak Hour	
		In	Out	In	Out
Towards State Highway 1 east (14%)	50% on East Maddisons Road (north) 50% on Goulds Road (north)	4 4	36 36	26 26	14 14
Selwyn Road east (16%)	50% on East Maddisons Road (south) to Selwyn Road 50% direct to Selwyn Road	4 4	41 41	29 29	16 16
Springston-Rolleston Road (4%)	50% on East Maddisons Road (south) to Selwyn Road 50% direct to Selwyn Road	1 1	10 10	7 7	4 4
North of State Highway 1 (6%)	50% on East Maddisons Road (north) 50% on Goulds Road (north)	2 2	15 15	11 11	6 6
Rolleston town centre (15%)	50% on East Maddisons Road (north) 50% on Goulds Road (north)	4 4	38 38	28 28	15 15
Other locns outside Rolleston (6%)	Not assigned	3	30	22	12
Internal movements (39%)	Not assigned	22	198	143	77
Total	-	56	508	367	197

Table 6: Traffic Distribution of Southwestern Area

Direction	Routes	Traffic Volumes			
		Morning Peak Hour		Evening Peak Hour	
		In	Out	In	Out
Towards State Highway 1 east (14%)	All on Springston-Rolleston Road (north)	6	51	37	20
Selwyn Road east (16%)	50% on Springston-Rolleston Road to Selwyn Road 50% direct to Selwyn Road	3 3	29 29	21 21	11 11
Springston-Rolleston Road (4%)	50% on Springston-Rolleston Road to Selwyn Road 50% direct to Selwyn Road	1 1	7 7	5 5	3 3
North of State Highway 1 (6%)	All on Springston-Rolleston Road (north)	2	22	16	9
Rolleston town centre (15%)	All on Springston-Rolleston Road (north)	6	55	39	21
Other locns outside Rolleston (6%)	Not assigned	2	22	16	9
Internal movements (39%)	Not assigned	16	142	103	55
Total	-	41	364	263	142

Table 7: Traffic Distribution of Southeastern Area

8. Effects on the Transportation Networks

8.1. Roading Network Capacity

8.1.1. The computer software program Sidra Intersection has again been used to assess the effects of the increased traffic volumes at the nearby intersections, and the results are summarised below.

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
East Maddisons Road (southeast)	L	5.9	0.0	A	7.3	0.0	A
	R	7.4	0.8	A	7.0	0.4	A
Goulds Road (northeast)	L	6.4	0.0	A	6.4	0.0	A
Goulds Road (southwest)	R	7.6	0.0	A	7.5	0.0	A

Table 8: Anticipated Levels of Service at the Goulds Road / East Maddisons Road Intersection, with Confirmed Development (With Proposed ODP Areas)

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
Selwyn Road (northeast)	R	5.9	0.4	A	5.8	0.6	A
East Maddisons Road (northwest)	L	5.9	0.5	A	5.8	0.2	A
	R	6.3	0.0	A	6.4	0.0	A
Goulds Road (southwest)	L	5.6	0.0	A	5.6	0.0	A

Table 9: Anticipated Levels of Service at the Selwyn Road / East Maddisons Road Intersection, with Confirmed Development (With Proposed ODP Areas)

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
Springston - Rolleston Rd (south)	L	7.2	0.1	A	8.2	0.2	A
	R	7.7	0.1	A	8.7	0.2	A
Selwyn Road (east)	L	9.7	0.0	A	10.5	0.0	B
	T	11.6	0.9	B	16.0	3.0	C
	R	16.7	0.9	C	18.6	3.0	C
Springston - Rolleston Rd (north)	L	7.3	0.3	A	8.4	0.3	A
	R	7.6	0.3	A	8.9	0.3	A
Selwyn Road (west)	L	9.7	0.1	A	10.7	0.1	B
	T	15.6	4.8	C	14.3	1.7	B
	R	17.1	4.8	C	17.9	1.7	C

Table 10: Anticipated Levels of Service at the Selwyn Road / Springston-Rolleston Road Intersection, with Confirmed Development (With Proposed ODP Areas)

8.1.2. It can be seen that although the queues and delays increase slightly from those without the ODP areas in place, they remain relatively low. In this regard, delays of 19 seconds (the greatest forecast) are not unreasonable for the weekday peak hours. Good levels of service are provided for each turning movement. On this basis, no revisions are proposed to the intersection geometries.

8.1.3. One outcome of the expected traffic distribution is that the extent of increase through the Selwyn Road / Goulds Road intersection will be very low. This intersection has therefore not been considered in further detail.

8.1.4. It is understood that the existing roading environment will be revised as a result of the development of the ODP areas. In response to the frontage changing from rural to urban, it can be expected that the carriageways will be widened (in a similar fashion to the way in which that section of Selwyn Road adjacent to Faringdon has been widened) and will be reconstructed with an urban formation that includes kerbs and footpaths. Although details of this will only be provided at the time of subdivision, there are no reasons why such improvement schemes could not be implemented on view of the wide road reserves.

8.1.5. It is also expected that the opportunity will be taken to reduce the speed limits of Goulds Road and Selwyn Road, and potentially also Springston-Rolleston Road. In each case, it would be appropriate for the 80km/h speed limit to be lowered to 60km/h, to be consistent with East Maddisons Road and the existing section of Selwyn Road adjacent to Faringdon.

8.2. Non-Car Modes of Transport

8.2.1. As a result of the proposed development areas, it can be expected that pedestrian volumes in the immediate area will increase. However the inclusion of a footpath along one side of Goulds Road, Selwyn Road and the affected part of Springston-Rolleston Road, plus a second footpath along the western side of East Maddisons Road will accommodate likely volumes. Such provision will be particularly important for those walking to and from school.

8.2.2. It is anticipated that the roads within the ODP areas will meet the Council's standards for new roads, including the provisions of footpaths and cycling infrastructure where necessary, and therefore no further comment has been made on the internal road network.

8.2.3. Although the provision of a bus service is beyond the scope of a resource consent application, the internal roading network creates the ability to form carriageway widths that are suitable for a service to pass through the site in future, should such a service operate.

8.3. Road Safety

8.3.1. The crash history in the vicinity of the ODP areas does not indicate that there are any particular features or factors that would affect, or be affected by, their development. Although there is a cluster of crashes at the Selwyn Road / Goulds Road and Selwyn Road / Springston – Rolleston Road intersections, the ODP areas will enable a reduction in the speed limit on both roads, which will therefore support a safer environment. Further, there is not expected to be any significant increase in traffic flows at the Selwyn Road / Goulds Road intersection.

8.3.2. The new roads which are being provided due to development in the area will meet current standards, including for non-motorised travel. and therefore it is unlikely that any new road safety issues will be introduced. Further, the flat and straight alignment of the frontage roads means that sight distances at the proposed new intersections will be excellent.

9. Statutory Planning Matters

9.1. Structure Plan

9.1.1. The Rolleston Structure Plan provides the overarching framework within which development of the ODP areas is expected to take place. A comparison has therefore been made in detail with these.

9.1.2. For the southwestern area, a road link is shown on the Structure Plan from East Maddisons Road to Goulds Road, being the continuation of an east-west route that lies further to the east. Within the ODP, the link is provided. It is not straight but curvilinear, and connects to East Maddisons Road further south in order to align with Northmoor Boulevard (which forms the east-west route).

9.1.3. For the southwestern area, the only cycling link is along Selwyn Road and this can be provided as part of the necessary upgrading of the road. A possible bus route is also shown on the northern part of East Maddisons Road but again, the upgrading of the road to provide this is not precluded.

9.1.4. For the southeastern area, two north-south links are shown as the extensions of Faringdon Boulevard and Hungerford Drive. These are shown on the ODP. The ODP also shows an east-west link to Springston-Rolleston Road but this is further north in the Structure Plan. It is understood however that the resource consents that have been granted for Faringdon resulted in the relocation of this link to the south meaning that it is now within the ODP area.

9.1.5. For the southwestern area, one cycling link is along Selwyn Road and this can be provided as part of the necessary upgrading of the road. A second link is along the extension of Faringdon Boulevard and this can be provided. A possible bus route is also shown on east-west route (Northmoor Boulevard) and this can be provided subject to a suitable design for the road.

9.1.6. Accordingly, it is considered that the ODPs are in accordance with the Structure Plan for the area.

9.2. District Plan

9.2.1. The District Plan sets out a number of transportation-related policies and rules with which any new development is expected to comply. Since the proposal at present is at a high level, it is not possible to undertake a detailed evaluation of the extent of compliance with these but an initial assessment has been carried out.

9.2.2. It is considered likely that there will be non-compliances with the separation of vehicle crossings and driveways, and sightlines from driveways, as these issues commonly occur within residential subdivisions due to the greater frequency of intersections and the lot density meaning that inevitable, some driveways are closer to intersections than anticipated. A full assessment will be required of these in due course but it is likely that the lower speed environment and road user familiarity will provided mitigation for any shortfalls.

9.2.3. The extent of any non-compliances can also be minimised by specifying the locations of driveways at the more sensitive lots.

9.2.4. For completeness, if direct driveways are proposed onto higher speed roads, then the speed limits will need to be reduced in order to ensure that vehicles can manoeuvre safely.

9.2.5. On this basis, at this stage we do not consider that the ODPs have any elements which preclude justified non-compliances with the District Plan, but acknowledge that this will need to be assessed in more detail when the relevant consents are applied for.

9.2.6. Consequently, subject to these caveats, the ODPs can be supported from a transportation perspective.

10. Conclusions

10.1. This report has identified, evaluated and assessed the various transport and access elements of two proposed ODPs which will facilitate residential subdivisions. Overall it is considered that the traffic generated by the development of the ODP areas can be accommodated on the adjacent roading network without capacity or efficiency issues arising, even allowing for development of surrounding residential areas. Intersection modelling using data extracted from the Council's microsimulation transport model shows that levels of service at all intersections remain good, with low queues and delays, and accordingly no improvement measures are required at any locations.

10.2. The crash history in the vicinity of the site does not indicate that there would be any adverse safety effects from the proposal. However the future increase in urbanisation of the area creates the opportunity for the Council to review (and lower) the current speed limits on Goulds Road, Selwyn Road and Springston-Rolleston Road which will provide an overall safer roading environment.

10.3. In view of the increased traffic flows on Goulds Road, Selwyn Road and Springston-Rolleston Road, these roads will need upgrading from their current rural formation. There are no constraints to this occurring.

10.4. The proposal is likely to be in accordance with the requirements of the District Plan, other than in respect of the separation distances at intersections and sight distances at vehicle crossings close to intersections. However, the majority of the shortfalls in the separation distances are likely to be small, and as the vast majority of drivers in the area will be familiar with the roading layout, it is likely that non-compliances could be supported.

10.5. The proposed ODPs are also in accordance with the Structure Plan for the area.

10.6. Overall, and subject to the preceding comments, the ODPs can be supported from a traffic and transportation perspective and it is considered that there are no traffic and transportation reasons why they could not be approved.

Carriageway Consulting Limited
December 2019



CARRIAGEWAY
CONSULTING

traffic engineering | transport planning

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Private Plan Change Request – Hughes Developments Limited
Appendix C – Economic Assessment –Significant Development Assessment

m.e
market economics
research & consulting

5 November 2020

Jake Hughes
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Faringdon South East, West and Far West Significant Development

Introduction

Hughes Developments Ltd (HDL) has proposed changes to the Selwyn District Plan by rezoning three blocks of land south of Rolleston from rural (Rural Inner Plains) to urban (mostly residential), which are called Faringdon South East, Faringdon South West and Faringdon Far West (FSEWFW).

As part of the planning process HDL has commissioned Market Economics (M.E) to conduct an economic assessment of whether FSEWFW will provide significant development capacity. The scope of this memo is to assess the significance of the residential capacity enabled in FSEWFW, in terms of the relative scale and size in the local economy. We understand that this memo will be used to support a Private Plan Change and assessment within the new framework set out in the National Policy Statement on Urban Development (NPS-UD).

It is acknowledged that NPS-UD states that "*Every regional council must include criteria in its regional policy statement for determining what plan changes will be treated, for the purpose of implementing Policy 8, as adding significantly to development capacity*."[1] The NPS-UD only came into force in August 2020, therefore no council has yet defined the criteria for assessing what constitutes 'significance' in terms of development capacity. It may be that the criteria to be adopted by Environment Canterbury in the Regional Policy Statement (RPS) would be wider than what is assessed in this memo.

Notwithstanding the lack of certainty around criteria that will be adopted, we consider that it is likely that relative scale and size of additional development capacity within the context of the local economy may be important criteria.

[1] National Policy Statement on Urban Development 2020 – s3.8(3).

Local Context

Rolleston is the largest town in the Selwyn District, in 2020 it had a population of over 21,900[2] who lived in over 6,440 dwellings[3]. Market Economics forecasts show that strong growth in the District is expected to continue in the future[4]. Rolleston is likely to play an important role accommodating both new residents and economic activity within the District.

In 2017, Selwyn District Council (SDC) and Greater Christchurch Partnership (GCP) conduct research into the quantum of urban land demanded and supplied, across the District and the wider Greater Christchurch Urban area. This research suggested that there could be a shortage of urban land in Selwyn District and Rolleston, which may eventuate in the long term (later part of this decade).[5] As a result, the GCP released a Future Development Strategy that updated settlement patterns in Selwyn District.[6] The strategy defined future development areas, which includes the FSEWFW sites.

We consider that an update of the GCP assessment would (again) show insufficient zoned capacity to meet demands in Selwyn District.[7] This is because growth over the last four years has matched or exceeded expectations, and the time period has shifted forward three years since the last assessment. This means that shortages projected for Selwyn may now occur in the medium term, i.e. at some point between 2026-2028.

Faringdon South East, West and Far West Developments

Faringdon South East, South West and Far West developments are located on the southern edge of Rolleston, within the SDC Infrastructure Boundary. The sites are adjacent to two Special Housing areas that were developed under the Housing Accord (Acland and Faringdon South). Immediately north of the site is Faringdon, which was developed by HDL over the last decade.

The FSEWFW sites are proposed to be developed over the coming decade, with subdivisions occurring in more than 5 stages. HDL is aiming for consents to be completed in 2020, while earthworks and infrastructure is expected to occur 2021 to 2028, with sales of land being completed around 2027 or 2028.[8] The development is proposed to enable over 1700 new dwellings to be developed in Rolleston.

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[2] Stats New Zealand (2020) Estimated Resident Population for SA2, at 30 June (1996-2020) (Annual-Jun).
[3] Stats New Zealand (2019) 2018 Census – Private Dwellings (occupied, unoccupied and under construction).
[4] Market Economics (2020) Selwyn Capacity for Growth Model and Economic Forecasts.
[5] Greater Christchurch Partnership (2018) Greater Christchurch Housing and Business Capacity Assessment.
[6] Greater Christchurch Partnership (2019) Our Space 2018-2048: Greater Christchurch Settlement Pattern Update Whakahāngai O Te Hōrapa Nohoanga
[7] National Policy Statement on Urban Development 2020 – Part 4 Timeframes for Implementation, Housing Assessment must be complete by 31 July 2021.
[8] Note that this development path may be conservative. HDL's previous development in Rolleston, which had a similar capacity to FSEWFW, was completed in about three years.

FSEWFW relative to existing Rolleston

The residential capacity enabled within FSEWFW sits within the context of Rolleston's existing housing stock of approximately 6,440 dwellings. In this context FSEW would represent around 27% more dwellings than currently exist in Rolleston.

It is rare for a development to increase the size of an existing urban area by more than 10%. As such it is considered that FSWEFW development capacity would be significant within the context of the existing scale of Rolleston urban area.

FSEWFW relative to growth in Rolleston

The residential capacity enabled within FSEWFW also sits within the context of new dwelling construction in Rolleston, which has been built at a rate of approximately 650 new dwellings per annum[9]. In the last 12 months Rolleston had almost 1,000 new dwelling consents issued, with last month was a record high of 107 consents.[10]

Based on our economic assessment, we consider it likely that dwellings in FSEWFW could be built over a 10 year period. Table 1.1 shows the development timeframes that have been assumed in this assessment. Based on this development path, the residential population in the area could grow from 283 in 2022 to over 4,530 by 2029.

The new dwelling construction within FSWE could peak at around 30% to 45% of the annual dwelling construction in Rolleston (2026 and 2027). This is a sizable share of the growth that is expected in Rolleston. We consider that FSEWFW development capacity would be significant within the context of Rolleston's future growth outlook.

Table 1.1: Development Timeframes of Faringdon South East and West

Timeframes - FSEWFW	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Consenting										
Land Development		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7	Stage 8	
Build Develompment			100	200	200	250	300	300	250	130
Residents			283	849	1,416	2,123	2,973	3,822	4,530	4,530

[9] Stats New Zealand (2020) Building Consents – 2016 - 2020.
[10] Stats New Zealand (2020) Building consents issued: September 2020 New dwellings consented by statistical area 2.

Findings

We consider that the development of Faringdon South East, West and Far West would produce significant development capacity, both in the context of the existing scale of Rolleston and the growth in future dwelling construction. Also our previous research suggests that the development is likely to generate significant economic benefits, in terms of jobs and economic activity.

Based on the existing research, there is likely to be a shortage of residential capacity in the coming decade, both in Selwyn and Rolleston. There is a clear case for more residential land to be zoned to meet the needs of the community. This was recognised during the development of the 2019 Future Development Strategy that identified FSEWFW as a future development area.

Finally, it was beyond the scope of this memo to address the aspects of development capacity set out in s3.8(2) of the NPS-UD. These aspects being that development capacity, *'would contribute to well-functioning urban environment', 'is well-connected along transport corridors'* and meet the yet to be defined RPS criteria. We understand that other experts have been commissioned to address these aspects.

Rodney Yeoman

Associate Director

Market Economics

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Private Plan Change Request – Hughes Developments Limited
Appendix D – Geotechnical Assessment

23 October 2020

Hughes Developments Ltd
Christchurch

Attn: Kelvin Back

RE: Geotechnical Summary Letter - Faringdon Far West, Rolleston, Christchurch
(Our Reference: 12903.000.000_103)

1 Introduction

ENGEO Ltd was requested by Hughes Developments Ltd to provide a geotechnical summary letter for the property at Faringdon Far West, Rolleston, Christchurch. The purpose of the letter is to support several geotechnical reports previously completed by ENGEO. This document should be considered supplementary to the reports outlined below and the full reports should be consulted for further detail.

2 Site Description

We understand that the Faringdon Far West development is the area bordered by East Maddisons Road, Selwyn Road and Goulds Road, southwest of the existing Faringdon Development. The approximate site location is shown in Appendix 1 of this report. ENGEO has previously completed the following geotechnical reports within this site:

- 597 East Maddisons Road dated 3 September 2020.
- 92 Dunns Crossing Road dated 13 December 2020.
- 108 Dunns Crossing Road dated 8 November 2019.
- 3/144 Dunns Crossing Road dated 14 August 2020.

3 Geotechnical Investigation Summary

Our geotechnical investigations comprised of machine excavated test pits and hand augers with associated Scala penetrometer tests. The investigations revealed subsurface conditions across the site are consistent with the published geological mapping. Broadly, the subsurface conditions were topsoil overlying sandy gravel. In some testing locations, silt and sand deposits were encountered that are inferred to be in filled paleo channels where they have not remained as channel features.

Based on surrounding ECan boreholes, groundwater was typically recorded at over 5 m deep and up to approximately 10 m deep.

In none of the subsurface investigations completed to date or ECan boreholes reviewed, did we encounter any ground conditions inconsistent with the rest of the site. Therefore, based on the scope of testing completed to date, we consider that the site can be assessed as a large block with no specific areas of concern.

4 Geotechnical Recommendations Summary

Based on our site investigation and observations, and owing to the nature of the subsurface materials and depth to groundwater at the site, we consider the potential for liquefaction and lateral spreading on the site to be very low.

We therefore consider the site of the proposed subdivision to have Technical Category 1 (TC1) future land performance whereby future land damage from liquefaction unlikely, and ground settlements are expected to be within normally accepted tolerances.

Site specific testing will be required for Building Consent, to confirm the bearing materials and bearing capacity. For preliminary design, we anticipate that a geotechnical Ultimate Bearing Capacity of 300 kPa may be assumed for foundations bearing on native sandy gravel or engineered fill, below any topsoil. All topsoil shall be stripped from within building footprints.

5 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the Client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ / ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by



Jed Watts

Engineering Geologist

Report reviewed by



Greg Martin, CMEngNZ (PEngGeol)

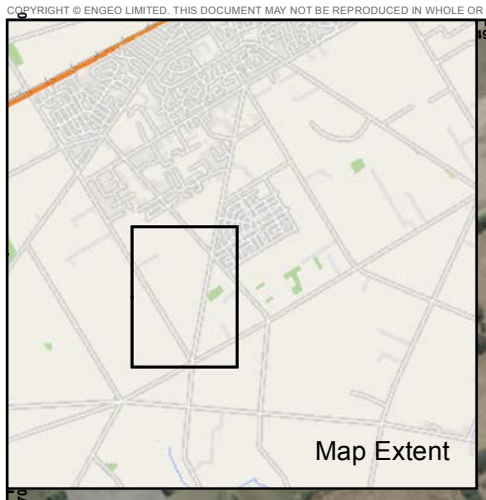
Principal Engineering Geologist

Attachments:

- *Site plan*

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DATE PLOTTED: 23 October 2020 9:22:49 am BY: NFlatman



3/144
Dunns Crossing Road

597
East Maddisons Road

108
Dunns Crossing Road

92
Dunns Crossing Road

Legend

Site boundary

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

0 50 100
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

PATH: Z:\Projects\12901 to 13000\12903 - Faringdon South Subdivision\102_Far West\01_GIS\Fig01.mxd

ENGEO

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Title: Site location plan

Client: Hughes Developments

Project: Faringdon Far West

Designed: NF
Drawn: NF
Checked: DRAFT
Date: Oct 20

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: 1

Size: A3

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR



ENGEO

Expect Excellence

Geotechnical Investigation

3/144 Dunns Crossing Road

Rolleston

Christchurch

Submitted to:

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14.08.2020

12903.001.000_91

ACENZ

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Table 1: Summary of subsurface Investigations

Table 2: Generalised Summary of ECan Boreholes

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Figure 1: Site Location Plan

Figure 2: Historical Aerial Photo – 1990 - 1994

Figure 3: Nearby ECan Borehole Locations

Appendices

Appendix 1: Site Plan and Inferred Paleo Channels

Appendix 2: ENGEO Hand Auger and Test Pit Logs

Appendix 3: ECan Borelogs

ENGEO Document Control:

Report Title	Geotechnical Investigation - 3/144 Dunns Crossing Road, Rolleston			
Project No.	12903.001.000	Doc ID	91	
Client	Hughes Developments Ltd	Client Contact	Kelvin Back	
Distribution (PDF)	Kelvin Back			
Date	Revision Details/Status	WP	Author	Reviewer
14/08/2020	Issued to Client	JT	JRW	GM

1 Introduction

ENGEO Ltd was requested by Hughes Developments Ltd to undertake a geotechnical investigation of the property at 3/144 Dunns Crossing Road, Rolleston, Christchurch, as outlined in our variation proposal (ref: P2020.004.581_01).

The purpose of this assessment was to conceptualise a geological model of the site, assess the likely future land performance, comment on the suitability of the site for residential subdivision, address the requirements of Section 106 of the Resource Management Act (RMA) and provide recommendations for subdivision works and foundations for typical timber framed residential dwellings.

Our scope of works included the following:

- Complete a desktop study of relevant available geotechnical and geological publications, including the NZ Geotechnical and Environment Canterbury Databases;
- Undertake a geotechnical site walkover;
- Undertake five hand auger boreholes with associated Scala penetrometer tests to assess the near surface material types and strength characteristics;
- Organise and technically supervise the excavation of six test pits, including geotechnical logging of the exposed soils; and
- Preparation of this report outlining our findings on the ground conditions and the suitability of the site for residential subdivision, including geotechnical advice on the likely foundation Technical Category, conceptual foundation recommendations for typical timber framed residential dwellings, and address likely geohazards as required by Section 106 of the RMA.

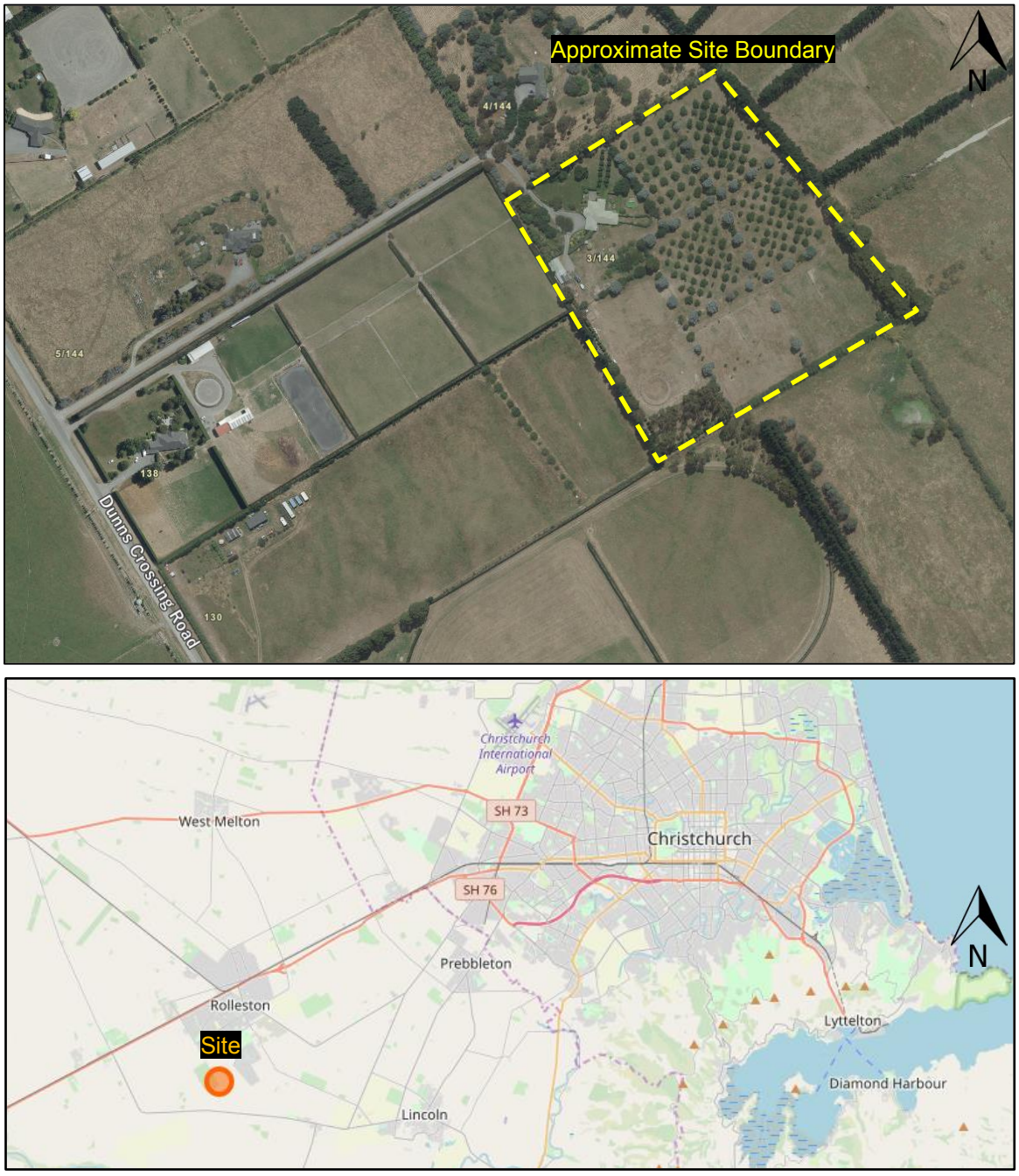
2 Site Description

The site comprises of one property with a total area of four hectares and the following legal description (Canterbury Maps):

- Lot 3 DP 70352 BLK III

The site is located approximately 3 km southwest of Rolleston town centre and is bound on all sides by rural properties (Figure 1).

Figure 1: Site Location Plan



Images sourced from Canterbury Maps and "© OpenStreetMap contributors". Not to scale.

3 Geological Model

3.1 Regional Geology

The site has been regionally mapped by GNS (Forsyth et al., 2008) as being underlain by brownish grey river alluvium (Q2a).

3.2 Geomorphology

The site comprises relatively flat ground, with gentle undulations and depressions in some areas. As evident on aerial imagery (Canterbury Maps, 2019) and observed during our site walkover conducted on 5 August 2020, undulating and depressed ground can be attributed to paleo-channels, which traverse the site in a general northwest to southeast direction (Figure 2). Based on observations, sandy silt deposits with variable thickness are expected to have in-filled the paleo-channels where they have not remained as channel features. Inferred paleo-channels have been mapped to give an indication of areas with potential channel in-fill (Appendix 1).

Figure 2: Historical Aerial Photo – 1990 - 1994



Image sourced from Canterbury Maps. Not to scale.

3.3 Geohazards

3.3.1 Seismicity

There are no known or mapped faults in the immediate area of the site, however the site may be at risk of ground shaking induced by movement of proximal or distal faults.

The site is located between two recently discovered fault systems, the Greendale Fault and the Port Hills Fault, the ruptures of which initiated the ongoing Canterbury Earthquake Sequence (CES). The Greendale Fault has been mapped approximately 6 km north / northwest of the site and trends roughly east-west with a surface rupture length of approximately 28 km (GNS, 2015), while the Port Hills Fault remains unmapped as the fault did not rupture at the surface. Movement on the Port Hills Fault is believed to have extended to within 1 km to 2 km below ground surface.

Large regional areas of faulting (GNS, 2015) namely the Ashley Fault, Porters Pass - Amberley Fault Zone, and the Hope and Alpine Faults, are further afield but present a high seismic hazard to the Christchurch area due to the anticipated size of earthquakes generated. The largest of these faults is the Alpine Fault, which has a return period of 250 - 300 years and is expected to produce a M8 earthquake. The last rupture on the Alpine Fault is believed to have occurred in 1717 (Pettinga et al., 2001).

3.3.2 Liquefaction and Lateral Spreading

The site is located in an area mapped where “damaging liquefaction is unlikely” (NZGD Map CGD5140, 2012), and a “zone of very low liquefaction potential” (GNS, 2006).

3.4 Site Investigation

Site investigations to assess the shallow subsurface material types and strength characteristics were undertaken by ENGEO on 7 August 2020. Six test pits and five hand auger investigations with associated Scala Penetrometer tests were completed to a maximum depth of 2.3 m below ground level.

The investigations revealed subsurface conditions across the site are consistent with the published geological mapping, as summarised in Table 1. Hand auger and test pit logs are attached as Appendix 2 of this report.

Table 1: Summary of Subsurface Investigations

Soil Type	Depth to Top of Layer (m)	General Layer Thickness (m)	Density / Consistency	Additional Comments
TOPSOIL	0.0	0.1 – 0.3	Stiff to Very Stiff	-
Sandy GRAVEL	0.3	Unknown	Medium Dense to Very Dense	Tightly packed and consistent across the site. A thin lens of loosely packed fine to medium gravel was encountered at approximately 1 m depth across the test pit locations.

3.5 ECan Boreholes

A review of six deep ECan borehole logs was conducted. The first (M36/4449 & M36/4387), are located on-site, and appear to be water wells providing the properties irrigation and domestic supply. The other boreholes are located to the north (M36/4450), east (M36/20535), south (BX23/0895) and west (M36/7416) of the site.

Well logs from the six holes of interest are attached to this report as Appendix 3 and summarised in Table 2.

Table 2: Generalised Summary of ECan Boreholes

ECan Borehole	Total Depth (m)	Water Level Below Ground Level (m)	Generalised Borelog as Logged by Driller
M36/5041	34	9.73	Gravel with silt and sand to 34 m depth.
M36/0016	15.2	9.85	Sandy gravel to 15.2 m depth.
M36/5042	32.5	9.97	Sandy gravel to 32.5 m depth.
M36/5038	32	9.58	Sandy gravel to 32 m depth.

Figure 3: Nearby ECan Borehole Locations



Aerial photograph sourced from Canterbury Maps. Not to scale.

3.6 Groundwater

Groundwater is recorded in the surrounding boreholes between approximately 9 to 10 m depth.

3.7 Site Seismic Class

In accordance with NZS 1170.5:2004, Class D applies to this particular site, defining it as a 'deep soft soil site'.

4 Liquefaction Analysis

Owing to the nature of the subsurface materials and depth to groundwater at the site, we consider the potential for liquefaction and lateral spreading on the site to be very low.

We therefore consider future land performance to be in line with Technical Category 1 (TC1), whereby future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances.

5 RMA Section 106 Requirements and Suitability to Subdivide

Section 106 of the Resource Management Act 1991 states a consent authority may refuse to grant a subdivision consent, or may grant a consent subject to specific consent conditions if it considers that:

- There is a significant risk from natural hazards; or
- Sufficient provision has not been made for legal or physical access to each allotment to be created by the subdivision.

An assessment of the risk from natural hazards as required by the RMA includes the following:

- The likelihood of natural hazards occurring (whether individually or in combination);
- The material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and
- Any likely subsequent use of the land in respect of which the consent is sought that would accelerate, worsen, or result in material damage of the kind referred to in paragraph (b).

We have assessed the risk of natural hazards at the site in accordance with Section 106 of the Resource Management Act (RMA) and considered the risk to the site from rockfall, inundation (debris), slope stability, subsidence, flooding and tsunami. Based on our observations and the nature of the site, its performance during the CES, and the site's distance from the nearest significant watercourse, we consider it is unlikely for the site to be subject to natural hazards such as rockfall, inundation (debris), slope stability, subsidence, flooding and tsunami. As such, the site is considered suitable for subdivision from a geotechnical perspective.

6 Geotechnical Recommendations

6.1 Earthworks

Earthworks carried out for the subdivision shall be in accordance with NZS 4404:2010, Land Development and Subdivision Infrastructure and NZS 4431:1989, Code of Practice for Earth filling for Residential Development. In particular, any areas to receive fill should be stripped of all vegetation, topsoil, non-engineered fill, soft or organic soils prior to fill placement.

Fill may comprise clean natural sandy gravel or silty soils, or clean imported soils and / or granular fill, compacted to achieve no less than 95% of maximum dry density. Fill faces steeper than 2V:1H and higher than 600 mm should be retained and referred back to ENGEO. Although unlikely, where any springs or groundwater seeps are encountered, they should be intercepted with suitable drainage and discharged to a Council approved outlet.

All unretained batters of pond and stormwater drains constructed with the native sandy gravel material should be at an inclination no steeper than 1V:3H, with protection schemes in place to control erosion of the formed batters within the waterways.

A comprehensive earthworks specification should be provided to the earthworks contractor prior to starting excavations and an inspection / testing regime agreed, along with a robust erosion and sediment control plan.

6.2 Subdivision Roading

Vegetation, any organic or deleterious material, topsoil and non-engineered fill should be removed from the site under pavement areas prior to aggregate placement. Based on our observations during testing, we consider the natural ground below the topsoil at the site should provide an adequate subgrade for the proposed pavement areas.

6.3 Stormwater Control

Concentrated stormwater flows from all impermeable areas must be collected and carried in sealed pipes to the Council system or an alternative disposal point subject to approval from Council. Uncontrolled stormwater must not be allowed to saturate the ground as this will potentially affect future foundation performance both statically and during future seismic activity.

6.4 Foundations

Foundations for future proposed residential dwellings within the subdivision may comprise shallow pad, strip, or slab foundations designed in accordance with the provisions of NZS 3604 Timber Framed Buildings.

Site specific testing will be required for Building Consent, to confirm the bearing materials and capacity. For preliminary design, we anticipate that a geotechnical Ultimate Bearing Capacity of 300 kPa may be assumed for foundations bearing on sandy gravel or engineered fill, below any topsoil. All topsoil shall be stripped from within building footprints, we anticipate this to be typically below 0.3 m depth based on our subsurface investigations.

7 References

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The Ministry of Business, Innovation, and Employment (2016). New Zealand Geotechnical Database. Retrieved August 2020, from https://www.nzgd.org.nz.

8 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by



Jed Watts

Engineering Geologist

Report reviewed by



Greg Martin, CMEngNZ (PEngGeol)

Principal Engineering Geologist

APPENDIX 1:

Site Plan and Inferred Paleo Channels

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DATE PLOTTED: 13 August 2020 8:55:54 pm BY: NFlatman



PATH: Z:\Projects\12901 to 13000\12903 - Faringdon South Subdivision\057_3-144 Dunns Crossing Road\04_GIS\Fig01.mxd

ENGEO
Tauranga Office
1/314 Maunganui Road
Mount Maunganui, Tauranga 3116
Tel: 07 777 0209, www.engeo.co.nz

Title: Geotechnical Site Plan

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Client: Hughes Developments Ltd		Figure No: 1
Project: 3/144 Dunns Crossing Road Rolleston	Designed: NF Drawn: JW Checked: GM Date: Aug 20	Size: A4
Proj No: 12903.000.003	Scale: 1:2,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 2:

ENGEO Hand Auger and Test Pit Logs

LOG OF AUGER HA01

Geotechnical Investigation
3/144 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 07/08/2020
Hole Depth : 0.4 m
Hole Diameter : mm

Shear Vane No : N/A
Logged By : JC
Reviewed By : JW
Latitude : 172.3744
Longitude : -43.62188

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	Sandy SILT with trace rootlets and gravel; brown. Low plasticity. Sand, fine to medium. Gravel, fine to coarse, subrounded to subangular [TOPSOIL].				D	F-St	
	A	GW	Sandy fine to coarse GRAVEL; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.					D	
0.5			End of Hole Depth: 0.4 m Termination Condition: Target depth						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.4 m.
Scala Penetrometer met target depth at 0.5 m.
Standing groundwater was not encountered.
TS = TOPSOIL

A = ALLUVIUM

GEOTECH HAND AUGER 2020.08.07 - 3-144 DUNNS CROSSING ROAD.GPJ NZ DATA TEMPLATE 2.GDT 11/8/20

LOG OF AUGER HA02

Geotechnical Investigation
3/144 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 07/08/2020
Hole Depth : 0.35 m
Hole Diameter : mm

Shear Vane No : N/A
Logged By : JC
Reviewed By : JW
Latitude : 172.37531
Longitude : -43.62104

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	Sandy SILT with trace rootlets and gravel; brown. Low plasticity. Sand, fine to medium. Gravel, fine to coarse, subrounded to subangular [TOPSOIL].				D	F-St	
	A	GW	Sandy fine to coarse GRAVEL; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.						
0.5			End of Hole Depth: 0.35 m Termination Condition: Target depth						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.35 m.
Scala Penetrometer met target depth at 0.5 m.
Standing groundwater was not encountered.
TS = TOPSOIL

A = ALLUVIUM

GEOTECH HAND AUGER 2020.08.07 - 3-144 DUNNS CROSSING ROAD.GPJ NZ DATA TEMPLATE 2.GDT 11/8/20

LOG OF AUGER HA03

Geotechnical Investigation
3/144 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 07/08/2020
Hole Depth : 0.3 m
Hole Diameter : mm

Shear Vane No : N/A
Logged By : JC
Reviewed By : JW
Latitude : 172.37435
Longitude : -43.62136

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	Sandy SILT with trace rootlets and gravel; brown. Low plasticity. Sand, fine to medium. Gravel, fine to coarse, subrounded to subangular [TOPSOIL].				D	F-St	
	A	GW	Sandy fine to coarse GRAVEL; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.					MD	
0.5			End of Hole Depth: 0.3 m Termination Condition: Target depth						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m.
Scala Penetrometer met target depth at 0.5 m.
Standing groundwater was not encountered.
TS = TOPSOIL

A = ALLUVIUM

GEOTECH HAND AUGER 2020.08.07 - 3-144 DUNNS CROSSING ROAD.GPJ NZ DATA TEMPLATE 2.GDT 11/8/20

LOG OF AUGER HA04

Geotechnical Investigation
3/144 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 07/08/2020
Hole Depth : 0.35 m
Hole Diameter : mm

Shear Vane No : N/A
Logged By : JC
Reviewed By : JW
Latitude : 172.3746
Longitude : -43.62035

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	Sandy SILT with trace rootlets and gravel; brown. Low plasticity. Sand, fine to medium. Gravel, fine to coarse, subrounded to subangular [TOPSOIL].				D	F-St	
	A	GW	Sandy fine to coarse GRAVEL; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.					MD	
0.5			End of Hole Depth: 0.35 m Termination Condition: Target depth						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.35 m.
Scala Penetrometer met target depth at 0.6 m.
Standing groundwater was not encountered.
TS = TOPSOIL

A = ALLUVIUM

GEOTECH HAND AUGER 2020.08.07 - 3-144 DUNNS CROSSING ROAD.GPJ NZ DATA TEMPLATE 2.GDT 11/8/20

LOG OF AUGER HA05

Geotechnical Investigation
3/144 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 07/08/2020
Hole Depth : 0.3 m
Hole Diameter : mm

Shear Vane No : N/A
Logged By : JC
Reviewed By : JW
Latitude : 172.37354
Longitude : -43.62115

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	Sandy SILT with trace rootlets and gravel; brown. Low plasticity. Sand, fine to medium. Gravel, fine to coarse, subrounded to subangular [TOPSOIL].				D	F-St	
0.5	ALLUVIUM	GW	Sandy fine to coarse GRAVEL; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.					MD-D	
			End of Hole Depth: 0.3 m Termination Condition: Target depth						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m.
Scala Penetrometer met target depth at 0.3 m.
Standing groundwater was not encountered.
TS = TOPSOIL

A = ALLUVIUM

GEOTECH HAND AUGER 2020.08.07 - 3-144 DUNNS CROSSING ROAD.GPJ NZ DATA TEMPLATE 2.GDT 11/8/20

LOG OF TEST PIT TP01

Geotechnical Investigation
3/144 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 07/08/2020
Max Test Pit Depth : 2.3 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : JC
Reviewed By : JW
Latitude : 172.37377
Longitude : -43.62161

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	Sandy SILT with minor gravel and rootlets; brown. Low plasticity. Sand, fine to coarse. Gravel, fine to coarse, subrounded to subangular [TOPSOIL].					St-VSt		
0.3	ALLUVIUM			Sandy fine to coarse GRAVEL with minor cobbles; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse. Trace silt encountered from 0.3 to 0.5 m depth.				D			
0.5											
1.0			GW	150 mm lens of loosely packed fine to medium gravel encountered at 1 m depth.					Tightly Packed		
1.5								M			
2.0											
2.3				Depth of Excavation: 2.3 m Termination Condition: Target depth							
2.5											

Test pit met target depth.

Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2020.08.07 - 3-144 DUNNS CROSSING ROAD.GPJ NZ MASTER DATA TEMPLATE.GDT 13/8/20

LOG OF TEST PIT TP02

Geotechnical Investigation
3/144 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 07/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : JC
Reviewed By : JW
Latitude : 172.37494
Longitude : -43.62163

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	Sandy SILT with minor gravel and rootlets; brown. Low plasticity. Sand, fine to coarse. Gravel, fine to medium, subrounded to subangular [TOPSOIL].					St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.				D	Tightly Packed		
1.0			SW	Gravelly fine to coarse SAND; grey. Well graded. Gravel, fine to coarse.					MD-D		
1.5			GW	Sandy fine to coarse GRAVEL with minor cobbles; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse. 100 mm to 150 mm lens of loosely packed fine to medium gravel encountered at 1 m depth.				M	Tightly Packed		
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Test pit met target depth.

Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2020.08.07 - 3-144 DUNNS CROSSING ROAD.GPJ NZ MASTER DATA TEMPLATE.GDT 13/8/20

LOG OF TEST PIT TP03

Geotechnical Investigation
3/144 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 07/08/2020
Max Test Pit Depth : 2.1 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : JC
Reviewed By : JW
Latitude : 172.37575
Longitude : -43.62133

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	Sandy SILT with minor gravel and rootlets; brown. Low plasticity. Sand, fine to coarse. Gravel, fine to coarse, subrounded to subangular [TOPSOIL].				D	St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse. Trace silt encountered from 0.3 to 0.5 m depth.				M	Tightly packed		
1.0				100 mm lens of loosely packed fine to medium gravel encountered at 1.2 m depth.							
1.5											
2.0				Depth of Excavation: 2.1 m Termination Condition: Target depth							
2.5											

Test pit met target depth.

Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2020.08.07 - 3-144 DUNNS CROSSING ROAD.GPJ NZ MASTER DATA TEMPLATE.GDT 13/8/20

LOG OF TEST PIT TP04

Geotechnical Investigation
3/144 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd **Shear Vane No** : N/A
Date : 07/08/2020 **Logged By** : JC
Max Test Pit Depth : 2.3 m **Reviewed By** : JW
Digger Type/Size : 24 Tonne **Latitude** : 172.37497
Bucket Type/Size : Bucket Excavator **Longitude** : -43.62056

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	Sandy SILT with some gravel and trace rootlets; brown. Low plasticity. Sand, fine to medium. Gravel, fine to coarse, subrounded to subangular [TOPSOIL].				D	St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.							
1.0											
1.5				<100 mm lens of loosely packed fine to medium gravel encountered at 1.2 m depth.				M	Tightly Packed		
2.0											
2.5				Depth of Excavation: 2.3 m Termination Condition: Target depth							

Test pit met target depth.

Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2020.08.07 - 3-144 DUNNS CROSSING ROAD.GPJ NZ MASTER DATA TEMPLATE.GDT 13/8/20

LOG OF TEST PIT TP05

Geotechnical Investigation
3/144 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 07/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : JC
Reviewed By : JW
Latitude : 172.37453
Longitude : -43.62077

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	Sandy SILT with some gravel and trace rootlets; brown. Low plasticity. Sand, fine to medium. Gravel, fine to coarse, subrounded to subangular [TOPSOIL].				D	St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse. Trace silt encountered from 0.3 to 0.6 m depth. 200 to 300 mm lens of loosely packed fine to medium gravel encountered at 0.7 m depth.				M	Tightly Packed		
1.0											
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Test pit met target depth.

Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2020.08.07 - 3-144 DUNNS CROSSING ROAD.GPJ NZ MASTER DATA TEMPLATE.GDT 13/8/20

LOG OF TEST PIT TP06

Geotechnical Investigation
3/144 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 07/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : JC
Reviewed By : JW
Latitude : 172.37404
Longitude : -43.62051

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	Sandy SILT with some gravel and trace rootlets; brown. Low plasticity. Sand, fine to medium. Gravel, fine to coarse, subrounded to subangular [TOPSOIL].				D	St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse. Trace silt encountered from 0.3 to 0.6 m depth.				M	Tightly Packed		
1.0				100 mm lens of loosely packed fine to medium gravel encountered at 1.3 m depth.							
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Test pit met target depth.

Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2020.08.07 - 3-144 DUNNS CROSSING ROAD.GPJ NZ MASTER DATA TEMPLATE.GDT 13/8/20

APPENDIX 3:

ECan Borelogs

Bore or Well No	M36/5041
Well Name	DUNNS CROSSING ROAD
Owner	KAJENS TRADING DEVELOPMENT LTD

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/5041	**File Number**	CO6C/10302
Owner	KAJENS TRADING DEVELOPMENT LTD	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING ROAD	**NZTM Grid Reference**	BX23:49507-69990
Locality	ROLLESTON	**NZTM X and Y**	1549507 - 5169990
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	32.00m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	6.80m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	40.47m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	10	**Calc Min 80%**	9.73m below MP (Estimated)
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	01 Feb 1997	**Max Tested Yield**	5 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	13 m
Drilling Method	Cable Tool	**Specific Capacity**	0.40 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	30	32				

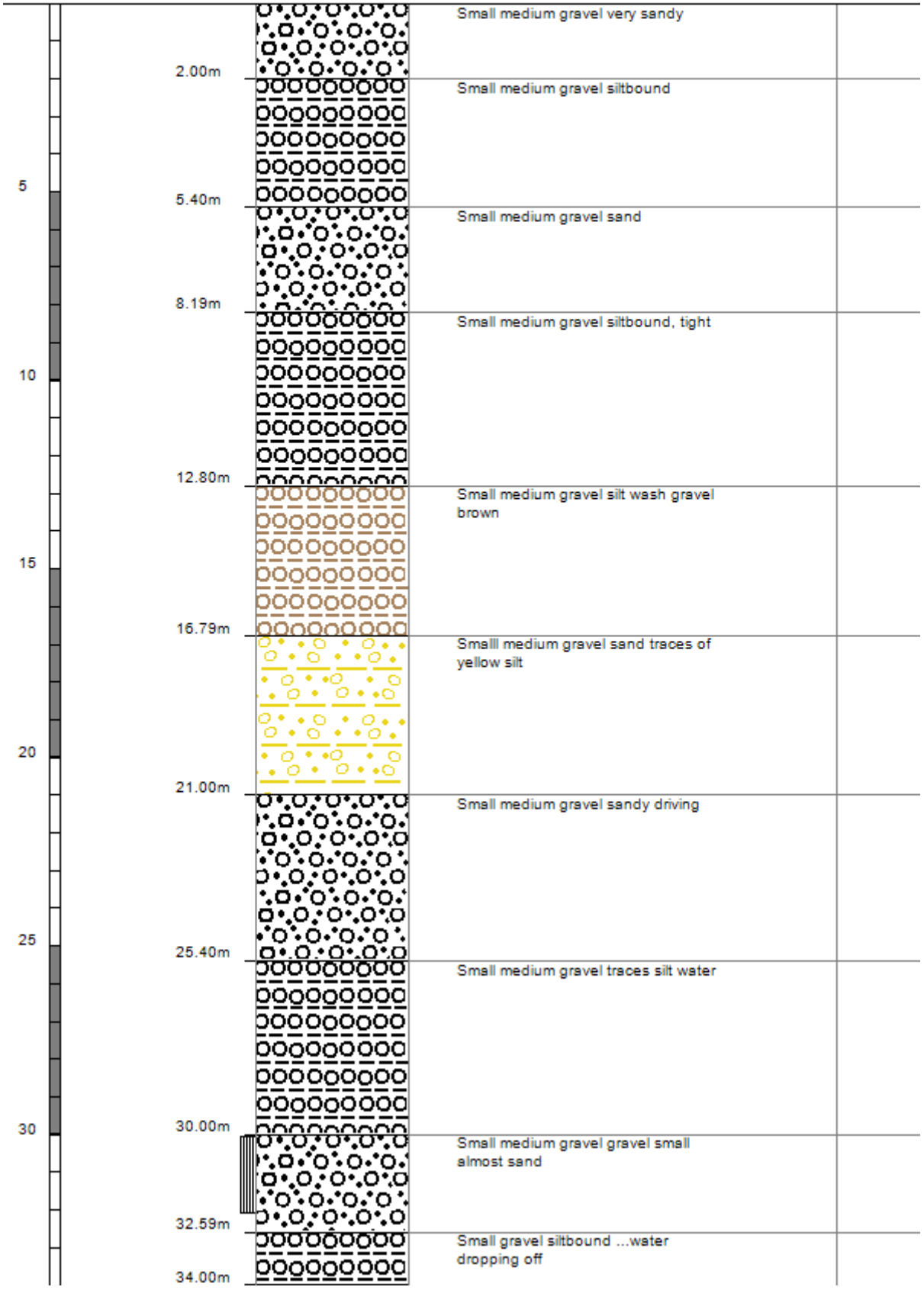
Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Feb 1997	1	5.1	67.31074	12.8	2

No comments for this well

Borelog for well M36/5041

Grid Reference (NZTM): 1549508 mE, 5169991 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.5 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 34.0 m Drill Date: 01-Feb-1997



Bore or Well No	M36/0016
Well Name	Goulds Road
Owner	WADE.A.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/0016	**File Number**	
Owner	WADE.A.	**Well Status**	Not Used
Street/Road	Goulds Road	**NZTM Grid Reference**	BX23:49707-70190
Locality	ROLLESTON	**NZTM X and Y**	1549707 - 5170190
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	14.00m	**Water Level Count**	0
Diameter	51mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	40.62m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	3	**Calc Min 80%**	9.85m below MP (Estimated)
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	0
Drill Date	29 Aug 1932	**Max Tested Yield**	
Driller	Pearson	**Drawdown at Max Tested Yield**	
Drilling Method	Unknown	**Specific Capacity**	
Casing Material	STEEL	**Last Updated**	06 Mar 2001
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

No screen data for this well

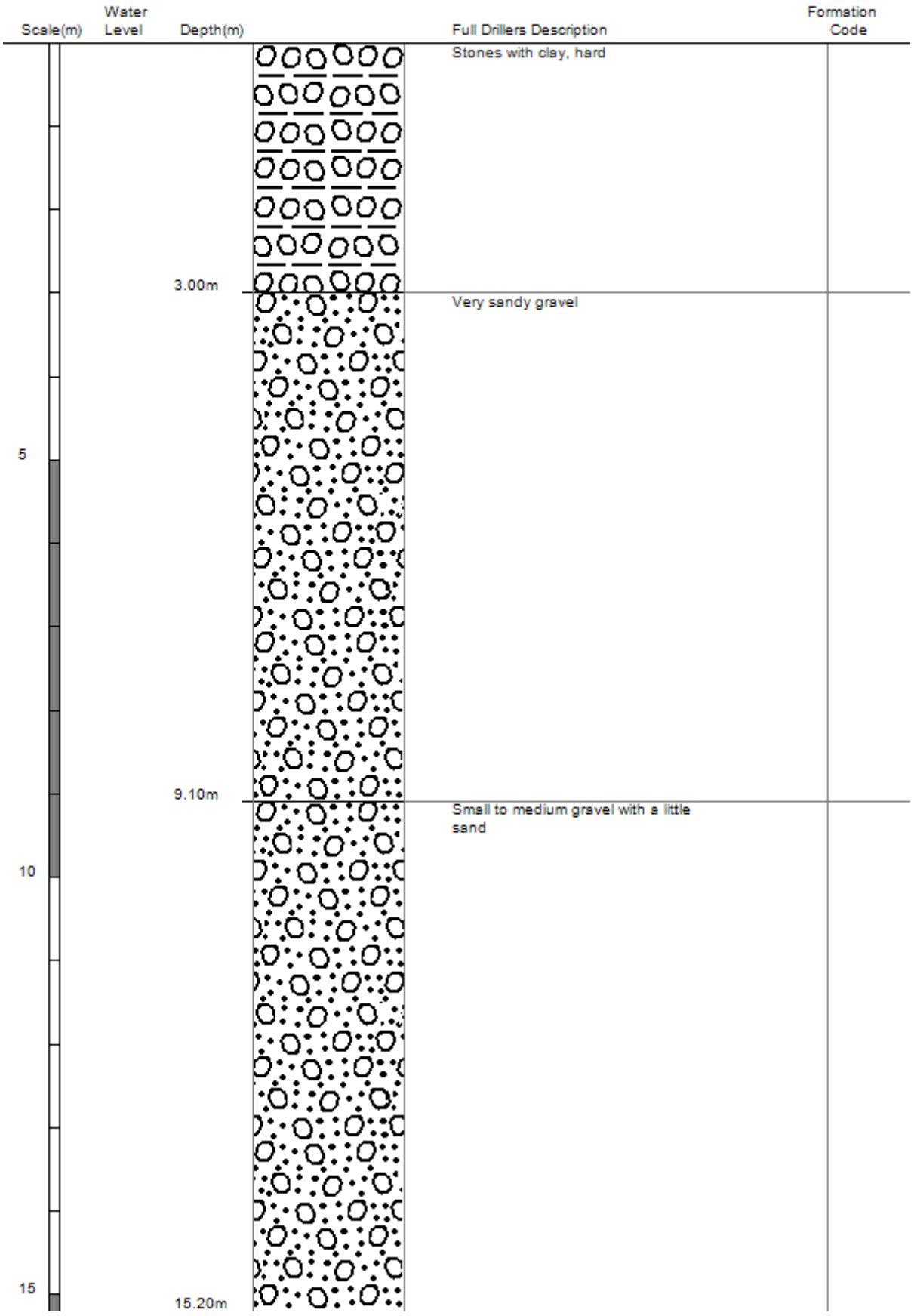
No step tests for this well

No comments for this well

Borelog for well M36/0016

Grid Reference (NZTM): 1549708 mE, 5170191 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.6 m +MSD Accuracy: < 2.5 m
Driller: Pearson
Drill Method: Unknown
Borelog Depth: 15.2 m Drill Date: 29-Aug-1932

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Bore or Well No	M36/5042
Well Name	DUNNS CROSSING ROAD
Owner	KAJENS TRADING DEVELOPMENT LTD

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/5042	**File Number**	CO6C/10303
Owner	KAJENS TRADING DEVELOPMENT LTD	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING ROAD	**NZTM Grid Reference**	BX23:49378-70190
Locality	ROLLESTION	**NZTM X and Y**	1549378 - 5170190
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	32.10m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	6.00m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	42.04m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	8	**Calc Min 80%**	9.97m below MP (Estimated)
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	01 Nov 1996	**Max Tested Yield**	5 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	12 m
Drilling Method	Cable Tool	**Specific Capacity**	0.41 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	30.1	32.1				

Step Tests

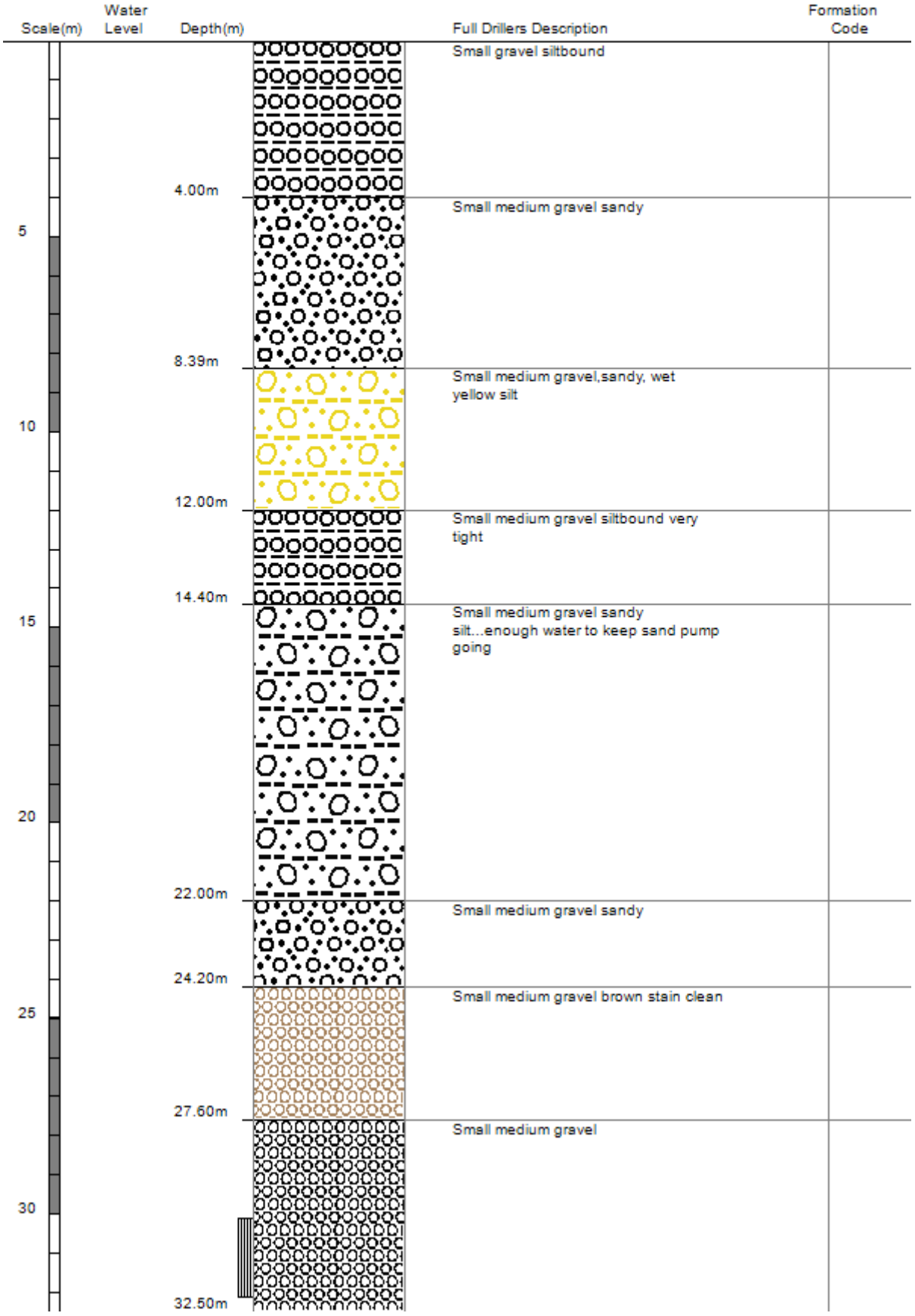
Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Nov 1996	1	5	65.99092	12.2	2

No comments for this well

Borelog for well M36/5042

Grid Reference (NZTM): 1549378 mE, 5170191 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 42.0 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 32.5 m Drill Date: 01-Nov-1996

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Bore or Well No	M36/5038
Well Name	DUNNS CROSSING ROAD
Owner	KAJENS TRADING DEVELOPMENT LTD

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/5038	**File Number**	CO6C/10010
Owner	KAJENS TRADING DEVELOPMENT LTD	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING ROAD	**NZTM Grid Reference**	BX23:49278-69840
Locality	ROLLESTON	**NZTM X and Y**	1549278 - 5169840
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	32.10m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	6.30m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	40.38m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	7	**Calc Min 80%**	9.58m below MP (Estimated)
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	01 Nov 1996	**Max Tested Yield**	24 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	9 m
Drilling Method	Cable Tool	**Specific Capacity**	2.84 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	30.1	32.1				

Step Tests

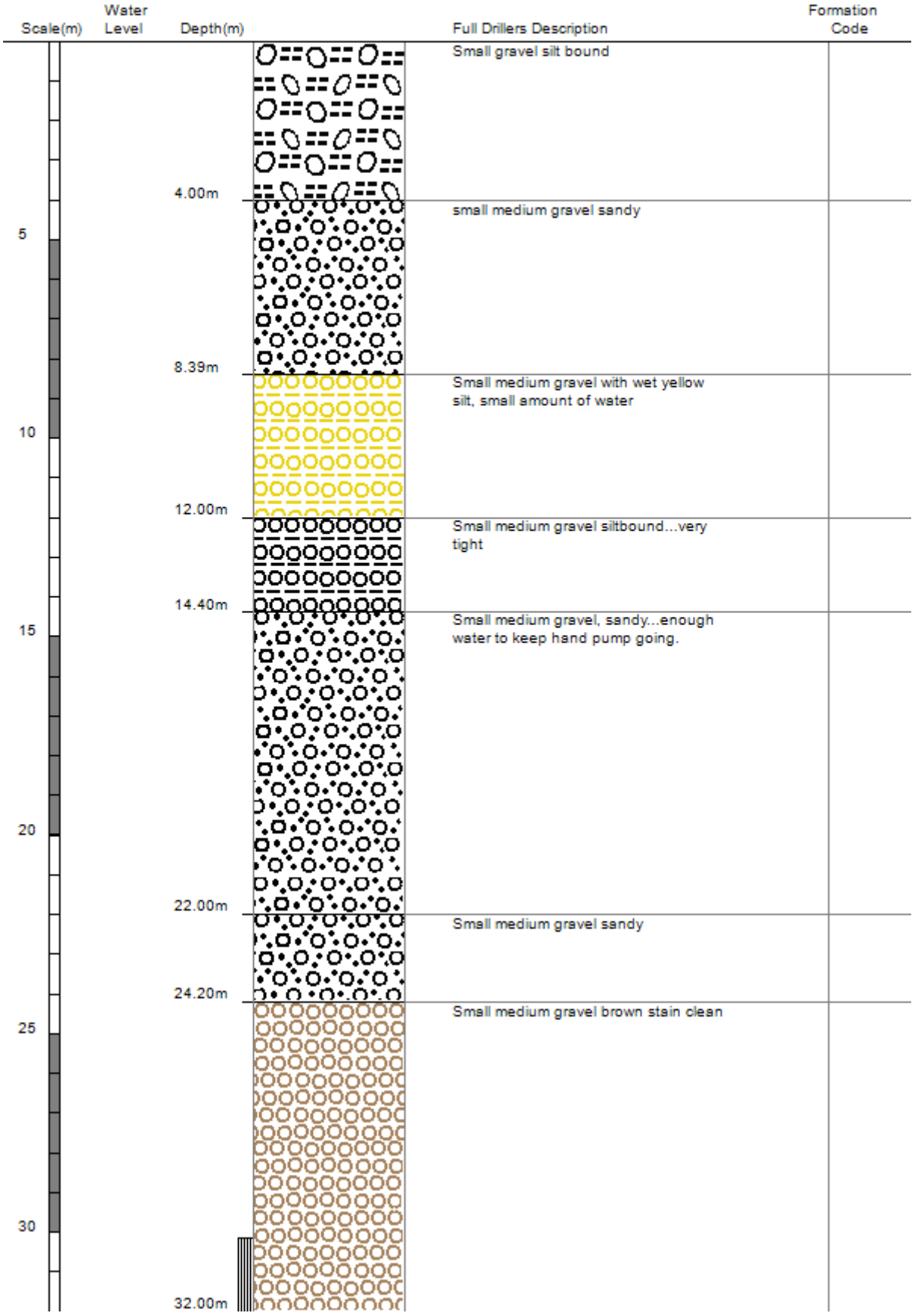
Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Nov 1996	1	24.1	318.076233	8.5	2

No comments for this well

Borelog for well M36/5038

Grid Reference (NZTM): 1549278 mE, 5169841 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.4 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 32.0 m Drill Date: 01-Nov-1996

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha





ENGEO

Expect Excellence

Geotechnical Investigation

108 Dunns Crossing Road

Rolleston

Christchurch

Submitted to:

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08.11.2019

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ACENZ

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Figure 2: Historical Aerial Imagery – 1990 to 1994

Figure 3: Nearby ECan Borehole Locations

Appendices

Appendix 1: Site Plan and Inferred Paleo Channels

Appendix 2: ENGEO Hand Auger and Test Pit Logs

Appendix 3: ECan Boreholes

ENGEO Document Control:

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Client	Hughes Developments Ltd	Client Contact	Kelvin Black	
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Date	Revision Details/Status	WP	Author	Reviewer
08/11/2019	Issued to Client	JB	KF	GM

1 Introduction

ENGEO Ltd was requested by Hughes Developments Ltd to undertake a geotechnical investigation of the property at 108 Dunns Crossing Road, Rolleston, Christchurch, as outlined in our variation proposal (ref: P2019.002.259_01).

The purpose of this assessment was to conceptualise a geological model of the site, assess the likely future land performance, comment on the suitability of the site for residential subdivision, address the requirements of Section 106 of the Resource Management Act (RMA) and provide recommendations for subdivision works and foundations for typical timber framed residential dwellings.

Our scope of works included the following:

- Complete a desktop study of relevant available geotechnical and geological publications, including the NZ Geotechnical and Environment Canterbury Databases;
- Undertake a geotechnical site walkover;
- Undertake sixteen hand auger boreholes with associated Scala penetrometer tests to assess the near surface material types and strength characteristics;
- Organise and technically supervise the excavation of fourteen test pits, including geotechnical logging of the exposed soils; and
- Preparation of this report outlining our findings on the ground conditions and the suitability of the site for residential subdivision, including geotechnical advice on the likely foundation Technical Category, conceptual foundation recommendations for typical timber framed residential dwellings, and address likely geohazards as required by Section 106 of the RMA.

2 Site Description

The site covers a total area of 10.1 ha and has the following legal description (Canterbury Maps):

- 108 Dunns Crossing Road - Lot 2 DP 61278.

It is located approximately 3 km southwest of Rolleston town centre. The site is bound to the southwest by Dunns Crossing Road, and all other sides by rural properties (Figure 1).

Figure 1: Site Location Plan



Images sourced from Canterbury Maps and "© OpenStreetMap contributors". Not to scale.

3 Geological Model

3.1 Regional Geology

The site has been regionally mapped by GNS (Forsyth et al., 2008) as being underlain by brownish grey river alluvium (Q2a).

3.2 Geomorphology

The site comprises relatively flat ground, with gentle undulations and depressions in some areas. As evident on aerial imagery (Canterbury Maps, 2019) and observed during our site walkover conducted on 4 November 2019, undulating and depressed ground can be attributed to paleo-channels, which traverse the site in a general northwest to southeast trend (Figure 2). Based on observations, silty sand deposits with variable thickness (up to 0.8 m) are expected to have in-filled the paleo-channels where they have not remained as channel features. Inferred paleo-channels have been mapped to give an indication of areas with potential channel in-fill (Appendix 1).

Figure 2: Historical Aerial Imagery – 1990 to 1994



Image sourced from Canterbury Maps. Not to scale.

3.3 Geohazards

3.3.1 Seismicity

There are no known or mapped faults in the immediate area of the site, however the site may be at risk of ground shaking induced by movement of proximal or distal faults.

The site is located between two recently discovered fault systems, the Greendale Fault and the Port Hills Fault, the ruptures of which initiated the ongoing Canterbury Earthquake Sequence (CES). The Greendale Fault has been mapped approximately 5.6 km north / northwest of the site and trends roughly east-west with a surface rupture length of approximately 28 km (GNS, 2015), while the Port Hills Fault remains unmapped as the fault did not rupture at the surface. Movement on the Port Hills Fault is believed to have extended to within 1 km to 2 km below ground surface.

Large regional areas of faulting (GNS, 2015) namely the Ashley Fault, Porters Pass - Amberley Fault Zone, and the Hope and Alpine Faults, are further afield but present a high seismic hazard to the Christchurch area due to the anticipated size of earthquakes generated. The largest of these faults is the Alpine Fault, which has a return period of 250 - 300 years and is expected to produce a M8 earthquake. The last rupture on the Alpine Fault is believed to have occurred in 1717 (Pettinga et al., 2001).

3.3.2 Liquefaction and Lateral Spreading

The site is located in an area mapped where “damaging liquefaction is unlikely” (NZGD Map CGD5140, 2012), and a “zone of very low liquefaction potential” (GNS, 2006).

3.4 Site Investigation

Site investigations to assess the shallow subsurface material types and strength characteristics were undertaken by ENGEO on 4 November 2019. The investigations comprised sixteen hand auger boreholes and fourteen test pit investigations with associated Scala penetrometer tests.

The investigations revealed subsurface conditions across the site are consistent with the published geological mapping, as summarised in Table 1. Hand auger and test pit logs are included in Appendix 2 of this report.

Table 1: Summary of Subsurface Conditions

Soil Type	Depth to Top of Layer (m)	General Layer Thickness (m)	Density / Consistency	Additional Comments
TOPSOIL	0.0	0.1 – 0.3	Soft to Firm	-
Silty SAND	0.2	0.7 – 0.8	Loose to Dense	Present in TP09 and TP11
Sandy Gravel	0.1 – 1.0	Unknown	Medium Dense to Very Dense	Consistent across the site

3.5 ECan Boreholes

A review of four deep ECan borehole logs was conducted. The first (M36/4450), is located on-site, and appears to be a water well servicing the properties irrigation. The other boreholes are located to the north (M36/5038), north east (M36/5041) and south (M36/4449) of the site. A borehole is located west of Dunns Crossing Road (M36/8130) but has no borehole data for the first 54 m of the soil profile on Canterbury Maps (Figure 3)

Well logs from the four holes of interest are presented in Appendix 3 and summarised in Table 2.

Table 2: Generalised Summary of ECan Boreholes

ECan Borehole	Total Depth (m)	Water level (m)	Generalised borelog as logged by driller
M36/4449	24	7.7	Gravel to 24 m with a layer of clay from 12 to 14 m and sandy gravel from 14 to 18 m.
M36/4450	26	8.1	Gravel to 26 m with a layer of clay from 12 to 18 m, 22 to 24 m and 26 o 26.5 m.
M36/5038	32	8.5	Silt bound gravel to 4 m and gravel to 32 m with a layer of silty gravel 12 to 14.4 m.
M36/5041	34	8.6	Gravel to 34 m with layers of silt bound gravel from 2 to 5.4 m and 8.2 to 12.8 m.

Figure 3: Nearby ECan Borehole Locations



Aerial photograph sourced from Canterbury Maps. Not to scale.

3.6 Groundwater

Groundwater is recorded in the surrounding boreholes between approximately 7.7 m and 8.6 m depth.

3.7 Site Seismic Class

In accordance with NZS 1170.5:2004, Class D applies to this particular site, defining it as a 'deep soft soil site'.

4 Liquefaction Assessment

Owing to the nature of the subsurface materials and depth to groundwater at the site, we consider the potential for liquefaction and lateral spreading on the site to be very low.

We therefore consider future land performance to be in line with Technical Category 1 (TC1), whereby future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances.

5 RMA Section 106 Requirements and Suitability to Subdivide

Section 106 of the Resource Management Act 1991 states a consent authority may refuse to grant a subdivision consent, or may grant a consent subject to specific consent conditions if it considers that:

- There is a significant risk from natural hazards; or
- Sufficient provision has not been made for legal or physical access to each allotment to be created by the subdivision.

An assessment of the risk from natural hazards as required by the RMA includes the following:

- The likelihood of natural hazards occurring (whether individually or in combination);
- The material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and
- Any likely subsequent use of the land in respect of which the consent is sought that would accelerate, worsen, or result in material damage of the kind referred to in paragraph (b).

We have assessed the risk of natural hazards at the site in accordance with Section 106 of the Resource Management Act (RMA) and considered the risk to the site from rockfall, inundation (debris), slope stability, subsidence, flooding and tsunami. Based on our observations and the nature of the site, its performance during the CES, and the site's distance from the nearest significant watercourse, we consider it is unlikely for the site to be subject to natural hazards such as rockfall, inundation (debris), slope stability, subsidence, flooding and tsunami. As such, the site is considered suitable for subdivision from a geotechnical perspective.

6 Geotechnical Recommendations

6.1 Earthworks

Earthworks carried out for the subdivision shall be in accordance with NZS 4404:2010, Land Development and Subdivision Infrastructure and NZS 4431:1989, Code of Practice for Earth filling for Residential Development. In particular, any areas to receive fill should be stripped of all vegetation, topsoil, non-engineered fill, soft or organic soils prior to fill placement.

Fill may comprise clean natural sandy gravel or silty soils, or clean imported soils and / or granular fill, compacted to achieve no less than 95% of maximum dry density. Fill faces steeper than 2V:1H and higher than 600 mm should be retained and referred back to ENGEO. Although unlikely, where any springs or groundwater seeps are encountered, they should be intercepted with suitable drainage and discharged to a Council approved outlet.

All unretained batters of pond and stormwater drains constructed with the native sandy gravel material should be at an inclination no steeper than 1V:3H, with protection schemes in place to control erosion of the formed batters within the waterways.

A comprehensive earthworks specification should be provided to the earthworks contractor prior to starting excavations and an inspection / testing regime agreed, along with a robust erosion and sediment control plan.

6.2 Subdivision Roading

Vegetation, any organic or deleterious material, topsoil and non-engineered fill should be removed from the site under pavement areas prior to aggregate placement. Based on our observations during testing, we consider the natural ground below the topsoil at the site should provide an adequate subgrade for the proposed pavement areas.

6.3 Stormwater Control

Concentrated stormwater flows from all impermeable areas must be collected and carried in sealed pipes to the Council system or an alternative disposal point subject to approval from Council. Uncontrolled stormwater must not be allowed to saturate the ground as this will potentially affect future foundation performance both statically and during future seismic activity.

6.4 Foundations

Foundations for future proposed residential dwellings within the subdivision may comprise shallow pad, strip, or slab foundations designed in accordance with the provisions of NZS 3604 Timber Framed Buildings.

Site specific testing will be required for Building Consent, to confirm the bearing materials and capacity. For preliminary design, we anticipate that a geotechnical Ultimate Bearing Capacity of 300 kPa may be assumed for foundations bearing on sandy gravel or engineered fill, below any topsoil. We anticipate this to be typically below 0.3 m depth based on our subsurface investigations.

7 References

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The Ministry of Business, Innovation, and Employment (2016). New Zealand Geotechnical Database. Retrieved November 2019, from https://www.nzgd.org.nz.

8 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by



Kristian Fairley

Engineering Geologist



Jed Watts

Engineering Geologist

Report reviewed by



Greg Martin, CMEngNZ (PEngGeol)

Principal Engineering Geologist

APPENDIX 1:

Site Plan and Inferred Paleo Channels

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DATE PLOTTED: 07 November 2019 8:54:59 am BY: NFlatman





Legend

- Hand auger locations
- Test pit locations
- Flow Path
- Site boundary

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

ENGEO

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Tel: 03 328 9012, www.engeo.co.nz

Title: Site Location Plan

Client: Hughes Developments Ltd		Figure No: 1
Project: 108 Dunns Crossing Road Rolleston	Designed: NF Drawn: NF Checked: XX Date: Nov 19	Size: A3
Proj No: 12903.001.000	Scale: 1:2,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

PATH: Z:\Projects\12901 to 13000\12903 - Farrington South Subdivision\052_108 Dunns Crossing Road - Enviro\05_CAD-GIS & Figures\Fig_01 landscape.mxd

APPENDIX 2:

ENGEO Hand Auger and Test Pit Logs

LOG OF AUGER HA01

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.624284
Longitude : 172.375188

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA02

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.623539
Longitude : 172.375633

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	St	98/15
			Trace gravel from 0.2 m depth.						
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA03

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.624218
Longitude : 172.374109

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			Gravel becomes minor from 0.2 m depth. Gravel, fine, subangular to subrounded.						
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA04

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

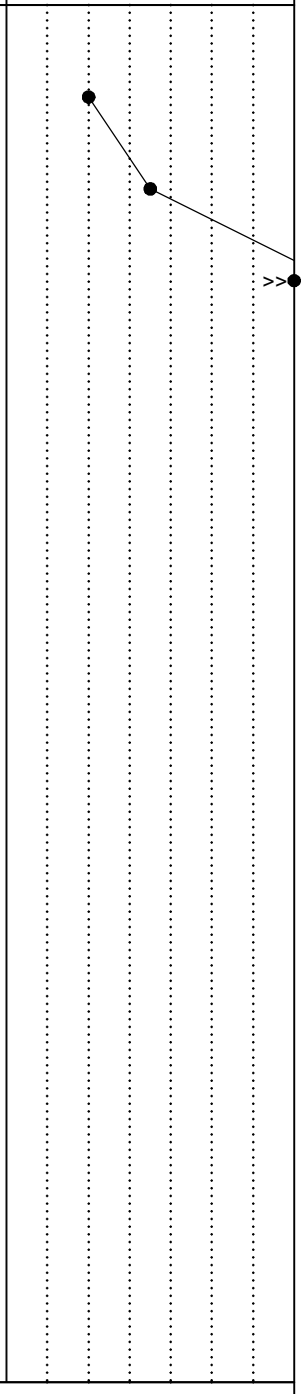
Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.624599
Longitude : 172.373074

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand, trace gravel, wood and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm



Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA05

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.625011
Longitude : 172.373546

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand, trace gravel, wood and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

0.5

1.0

1.5

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA06

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.62482
Longitude : 172.372715

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
	A	ML	Sandy SILT with trace gravel; greyish brown. Poorly graded. Sand, fine.				M	St-VSt	
			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.8 m depth.
Standing groundwater was not encountered.
A = ALLUVIUM

LOG OF AUGER HA07

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.625244
Longitude : 172.372951

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0	TOPSOIL	ML	SILT with minor sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			Trace gravel encountered from 0.2 m depth.						
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

GEOTECH HAND AUGER 2019.11.07 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

LOG OF AUGER HA08

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.625581
Longitude : 172.37221

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0	TOPSOIL	ML	SILT with minor sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			Trace gravel encountered from 0.2 m depth.						
	A	ML	Sandy SILT with trace gravel; greyish brown. Poorly graded. Sand, fine to medium.					St-VSt	
			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered.
A = ALLUVIUM

GEOTECH HAND AUGER 2019.11.07 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

LOG OF AUGER HA09

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.625131
Longitude : 172.371905

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with minor sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA10

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

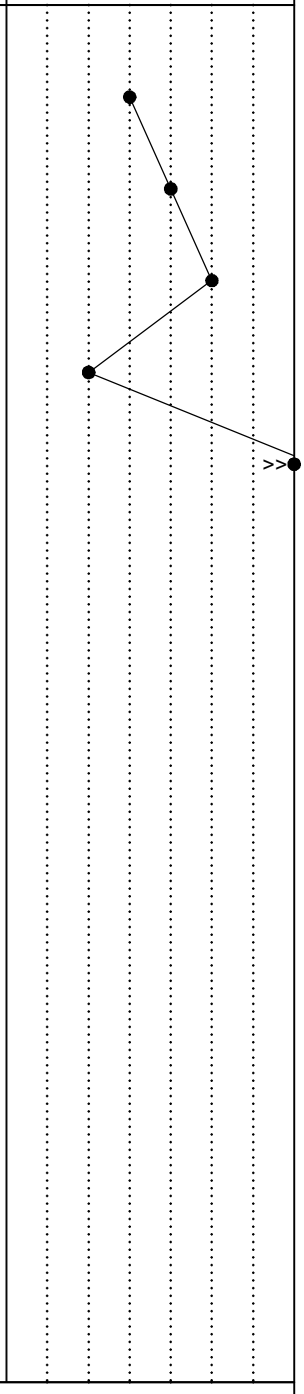
Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.624514
Longitude : 172.372119

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with minor sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
	A	ML	Sandy SILT with trace gravel; greyish brown. Poorly graded. Sand, fine to medium.					St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm



Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered.
A = ALLUVIUM

GEOTECH HAND AUGER 2019.11.07 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

LOG OF AUGER HA11

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.62435
Longitude : 172.371175

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with minor sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA12

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.623729
Longitude : 172.371551

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.0	TOPSOIL	ML	SILT with minor sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Poorly graded. Sand, fine to medium.					St-VSt	
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal						
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.5 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered.
A = ALLUVIUM

LOG OF AUGER HA13

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.622894
Longitude : 172.373074

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand, minor gravel and trace rootlets; brown. Low plasticity. Sand, fine. Gravel, fine, subangular to subrounded [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA14

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

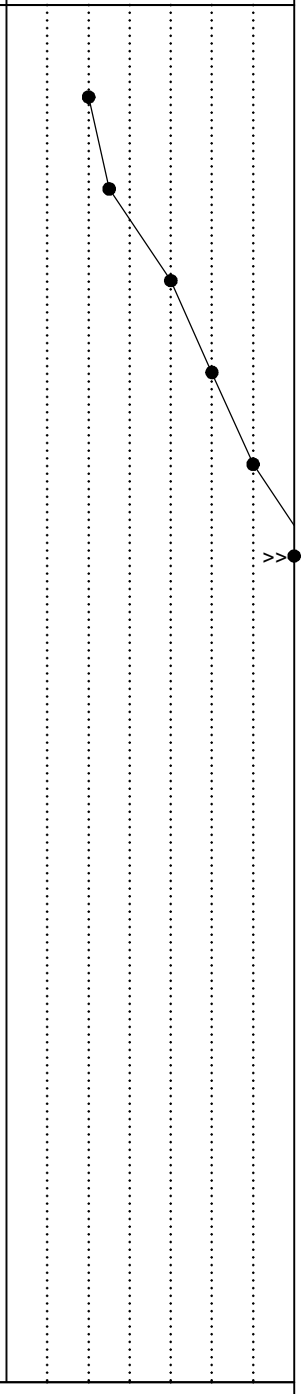
Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.622343
Longitude : 172.374581

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand, minor gravel and trace rootlets; brown. Low plasticity. Sand, fine. Gravel, fine, subangular to subrounded [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm



Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered.

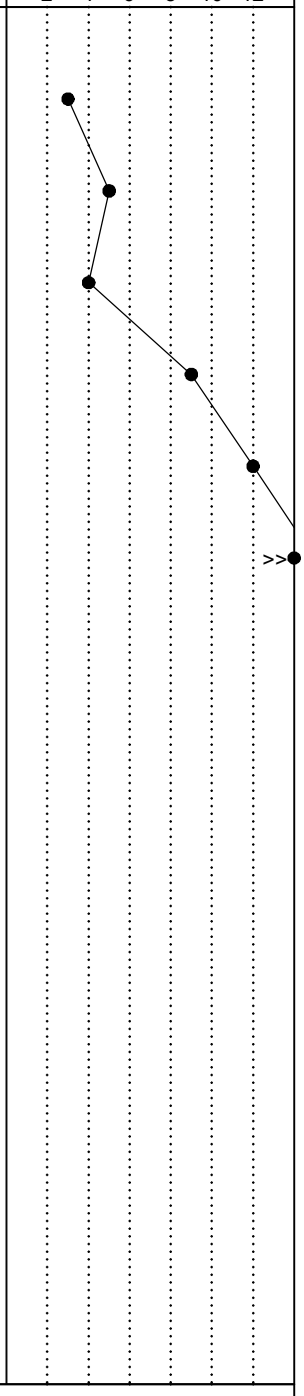
LOG OF AUGER HA15

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.623853
Longitude : 172.373841

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0	TOPSOIL	ML	SILT with minor sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	F-St	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						



Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA16

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.623384
Longitude : 172.37346

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with minor sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	F-St	
	ALLUVIUM	ML	SILT with some sand and trace gravel; greyish brown. Low plasticity. Sand, fine.					St-VSt	
			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 1.3 m depth.
Standing groundwater was not encountered.
A = ALLUVIUM

GEOTECH HAND AUGER 2019.11.07 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

LOG OF TEST PIT TP01

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623566
Longitude : 172.374608

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F		
	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium.				D			
0.5				Sandy fine to coarse GRAVEL; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
				Becomes moist from 0.7 m depth.							
1.0				Trace cobble from 0.9 m depth.					MD-D		
			GW								
1.5								M			
				Cobble becomes minor from 1.7 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP02

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623119
Longitude : 172.374217

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to medium GRAVEL with trace silt and rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.					MD-D		
1.0			SW	Gravelly fine to coarse SAND; brownish grey. Well graded. Gravel, fine to coarse, subangular to subrounded.				M	MD-D		
1.5			GW	Sandy fine to coarse GRAVEL with trace cobble; grey. Well graded, subangular to subrounded. Sand, fine to coarse. Trace rootlets encountered from 1.5 m depth.					MD-D		
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2019.11.05 - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 8/11/19

LOG OF TEST PIT TP03

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.624211
Longitude : 172.372983

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace silt and rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		
1.0				No silt and trace cobbles encountered from 1.0 m depth.							
1.5				Becomes moist and grey from 1.2 m depth. Sand becomes some from 1.4 to 1.6 m depth.				M			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP04

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623729
Longitude : 172.372618

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		
1.0				Trace silt and trace cobbles encountered from 1.0 m depth.							
				Becomes moist from 1.2 m depth.				M			
1.5				Sand becomes some from 1.7 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP05

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne
Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.6239
Longitude : 172.374871

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.0				Sand becomes trace from 0.8 to 1.0 m depth.							
1.5				Trace cobbles encountered from 1.2 m depth.							
2.0				Depth of Excavation: 1.9 m Termination Condition: Practical refusal							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met practical refusal
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

Loosely packed gravel and pit collapse from 0.5 to 1.9 m depth.
TS = TOPSOIL

LOG OF TEST PIT TP06

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne
Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623947
Longitude : 172.37603

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		
1.0				Becomes moist and trace silt encountered from 0.7 m depth.				M			
1.5				No rootlets encountered from 1.4 m depth. Trace cobbles encountered from 1.5 m depth. Sand becomes some from 1.7 to 1.8 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP07

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623251
Longitude : 172.375413

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace silt, cobble and rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
				Becomes grey from 0.8 m depth.							
1.0				Cobbles becomes minor from 1.2 m depth.							
1.5				Sand becomes some from 1.8 to 1.9 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 >>

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP08

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.622696
Longitude : 172.375236

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace silt, cobble and rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
				Becomes grey from 0.6 m depth.							
1.0				No rootlets encountered from 0.8 to 1.2 m depth.							
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP09

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.622572
Longitude : 172.373809

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		SM	Silty fine to medium SAND with trace gravel; brownish grey. Poorly graded. Becomes grey with orange mottles from 0.8 m depth.					MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace silt and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse. Trace cobbles encountered from 1.3 m depth. Sand becomes some from 1.7 to 1.8 m depth.				M	MD-D		
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP10

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne
Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623232
Longitude : 172.372307

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace silt and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.0											
1.5				No rootlets encountered from 1.6 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP11

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623923
Longitude : 172.371942

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		4
0.5	ALLUVIUM		SM	Silty fine to medium SAND with trace gravel and rootlets; brownish grey. Poorly graded.					MD-D		12
1.0			GW	Sandy fine to coarse GRAVEL with trace rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		>>
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP12

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.624622
Longitude : 172.374447

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F		
	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.					MD-D		
0.5				Sandy fine to coarse GRAVEL with trace silt, cobble and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
1.0								M			
			GW						MD-D		
1.5				Cobbles becomes minor from 1.4 m depth.							
				No rootlets encountered from 1.6 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP13

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.62475
Longitude : 172.371561

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse. Becomes moist from 0.6 m depth. Becomes grey from 0.9 m depth.				M	MD-D		
1.0											
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP14

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623982
Longitude : 172.370928

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		2 4 6 8 10 12
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse. No rootlets encountered from 0.5 m depth. Becomes grey and trace cobbles encountered from 0.7 m depth.				M	MD-D		>>
1.0											
1.5				Trace rootlets encountered from 1.8 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Test pit met target depth.
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

APPENDIX 3:

ECan Boreholes

Bore or Well No	M36/4449
Well Name	DUNNS CROSSING RD
Owner	TYACK GJ & FR

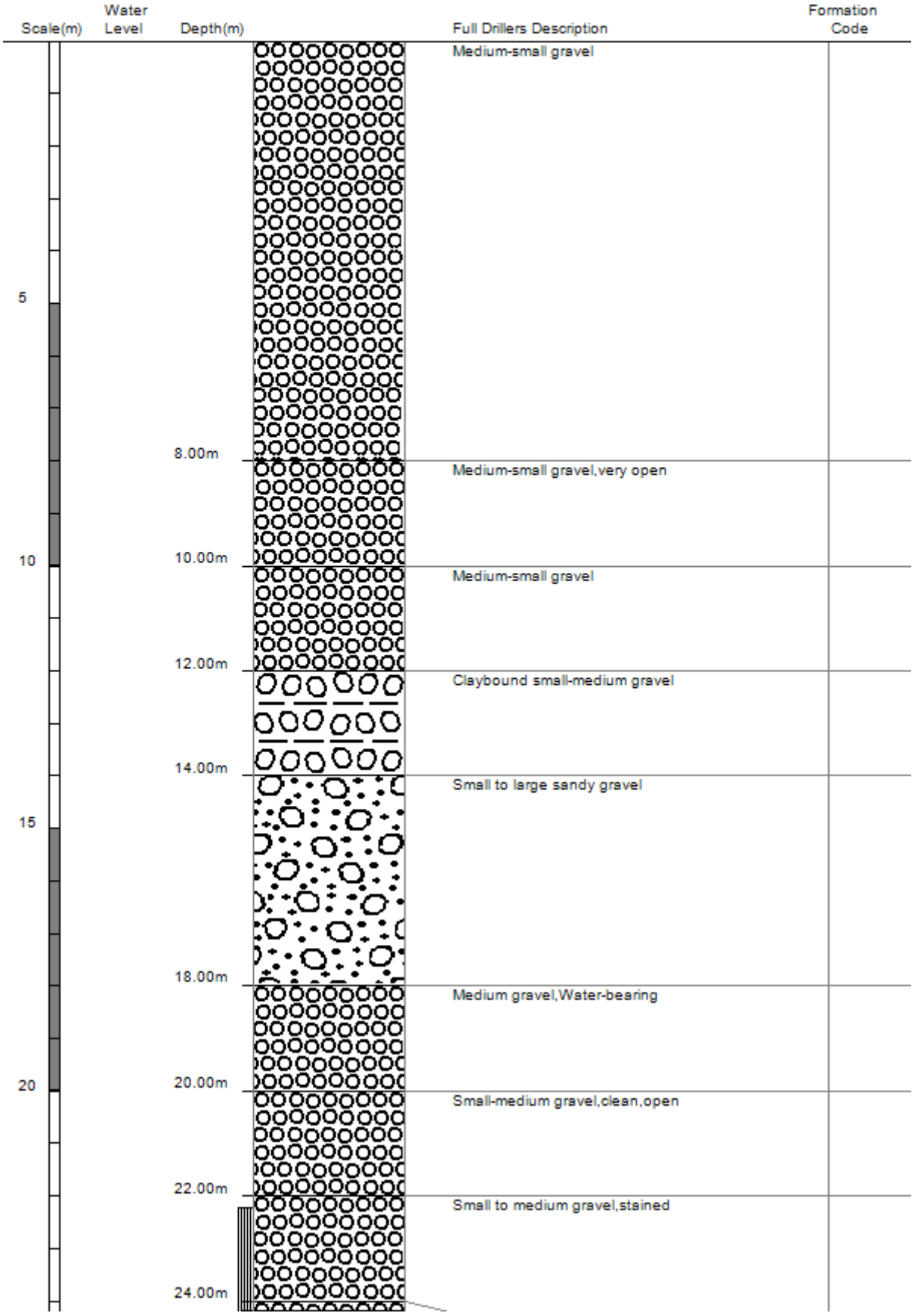
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/4449	**File Number**	CO6C/02046
Owner	TYACK GJ & FR	**Well Status**	Not Used
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49508-69470
Locality	ROLLESTON	**NZTM X and Y**	1549508 - 5169470
Location Description	LOT 1	**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Irrigation,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	24.20m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	38.81m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	9	**Calc Min 95%**	7.70m below MP
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	09 Jun 1992	**Max Tested Yield**	6 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	5 m
Drilling Method	Cable Tool	**Specific Capacity**	1.36 l/s/m
Casing Material		**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Borelog for well M36/4449

Grid Reference (NZTM): 1549508 mE, 5169471 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 38.8 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 24.2 m Drill Date: 09-Jun-1992

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Bore or Well No	M36/4450
Well Name	DUNNS CROSSING RD
Owner	Mr & Mrs L K & J C Blackmore

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/4450	**File Number**	CO6C/02046
Owner	Mr & Mrs L K & J C Blackmore	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49388-69660
Locality	ROLLESTON	**NZTM X and Y**	1549388 - 5169660
Location Description	DP61278 LOT 2	**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Irrigation,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	25.20m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	39.62m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	8	**Calc Min 95%**	8.10m below MP
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	09 Apr 1992	**Max Tested Yield**	6 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	6 m
Drilling Method	Cable Tool	**Specific Capacity**	1.00 l/s/m
Casing Material		**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	23.2	25.2				

Step Tests

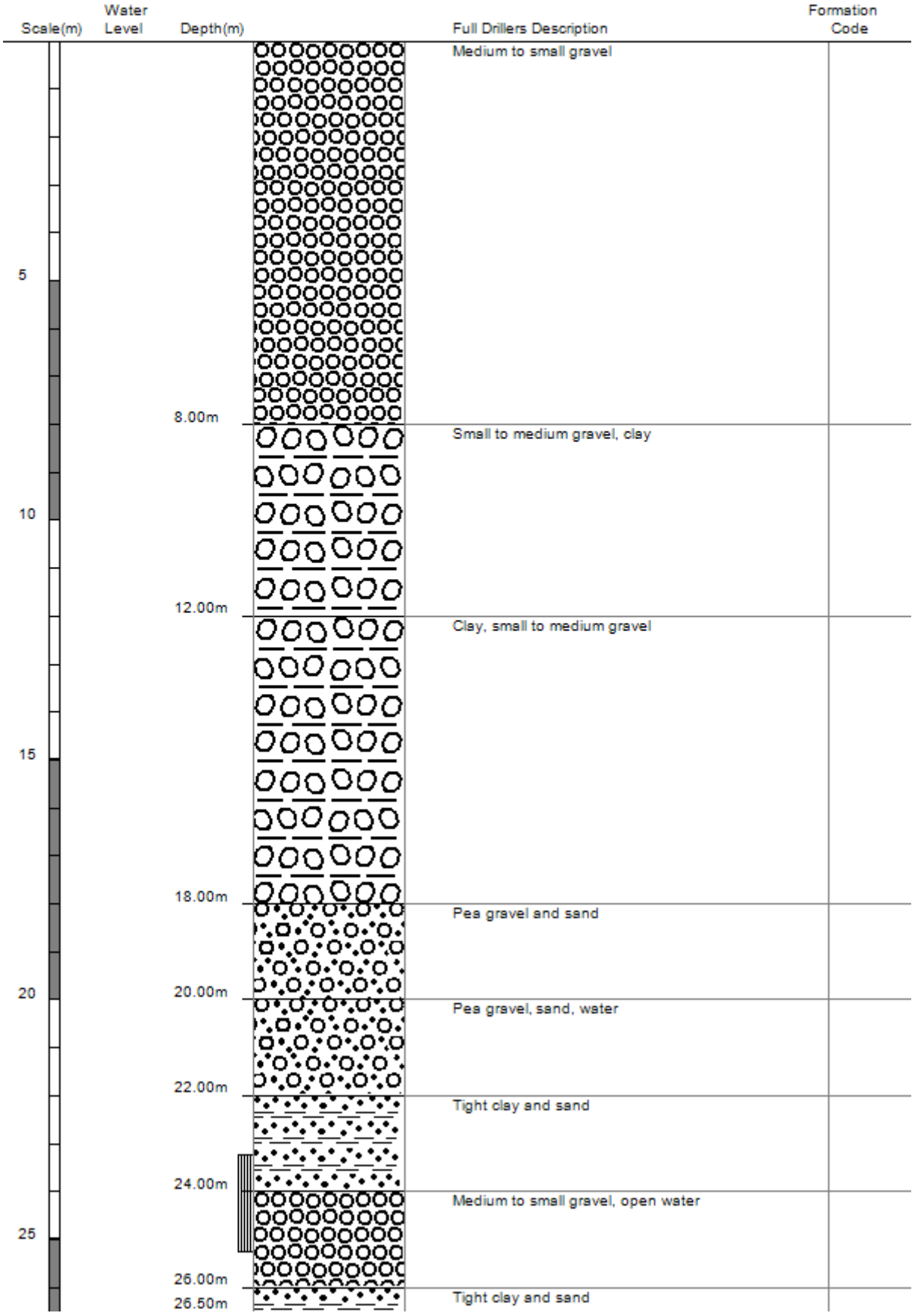
Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
09 Apr 1992	1	6.1	80.50892	6.1	0

No comments for this well

Borelog for well M36/4450

Grid Reference (NZTM): 1549388 mE, 5169661 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 39.6 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 26.5 m Drill Date: 09-Apr-1992

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Bore or Well No	M36/5038
Well Name	DUNNS CROSSING ROAD
Owner	KAJENS TRADING DEVELOPMENT L TD

Well Number	M36/5038	**File Number**	CO6C/10010
Owner	KAJENS TRADING DEVELOPMENT L TD	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING ROAD	**NZTM Grid Reference**	BX23:49278-69840
Locality	ROLLESTON	**NZTM X and Y**	1549278 - 5169840
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	32.10m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	6.30m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	40.38m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	7	**Calc Min 95%**	8.50m below MP
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	01 Nov 1996	**Max Tested Yield**	24 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	9 m
Drilling Method	Cable Tool	**Specific Capacity**	2.84 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	30.1	32.1				

Step Tests

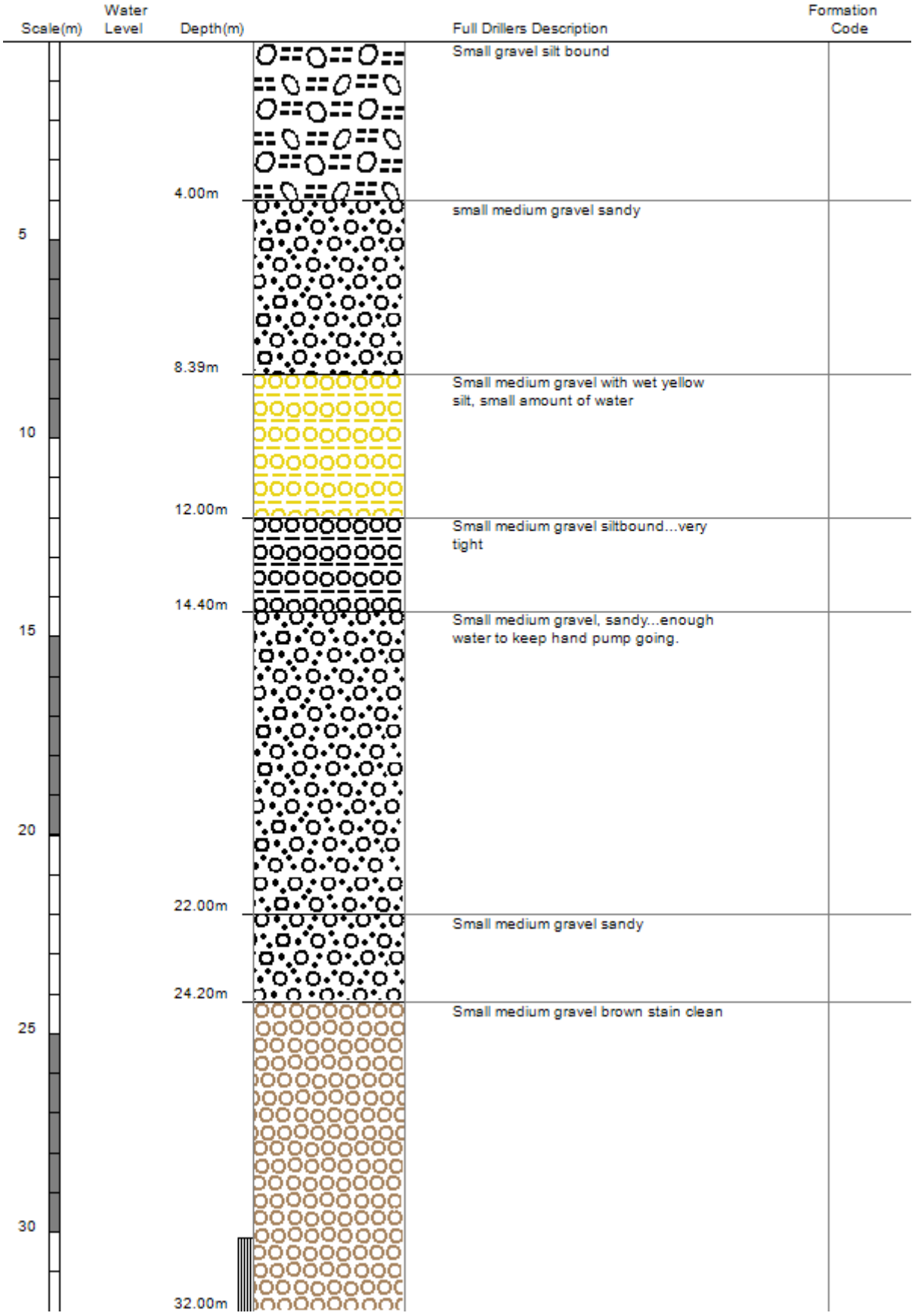
Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Nov 1996	1	24.1	318.076233	8.5	2

No comments for this well

Borelog for well M36/5038

Grid Reference (NZTM): 1549278 mE, 5169841 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.4 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 32.0 m Drill Date: 01-Nov-1996

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Bore or Well No	M36/5041
Well Name	DUNNS CROSSING ROAD
Owner	KAJENS TRADING DEVELOPMENT L TD

Well Number	M36/5041	**File Number**	CO6C/10302
Owner	KAJENS TRADING DEVELOPMENT L TD	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING ROAD	**NZTM Grid Reference**	BX23:49507-69990
Locality	ROLLESTON	**NZTM X and Y**	1549507 - 5169990
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	32.00m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	6.80m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	40.47m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	10	**Calc Min 95%**	8.60m below MP
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	01 Feb 1997	**Max Tested Yield**	5 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	13 m
Drilling Method	Cable Tool	**Specific Capacity**	0.40 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	30	32				

Step Tests

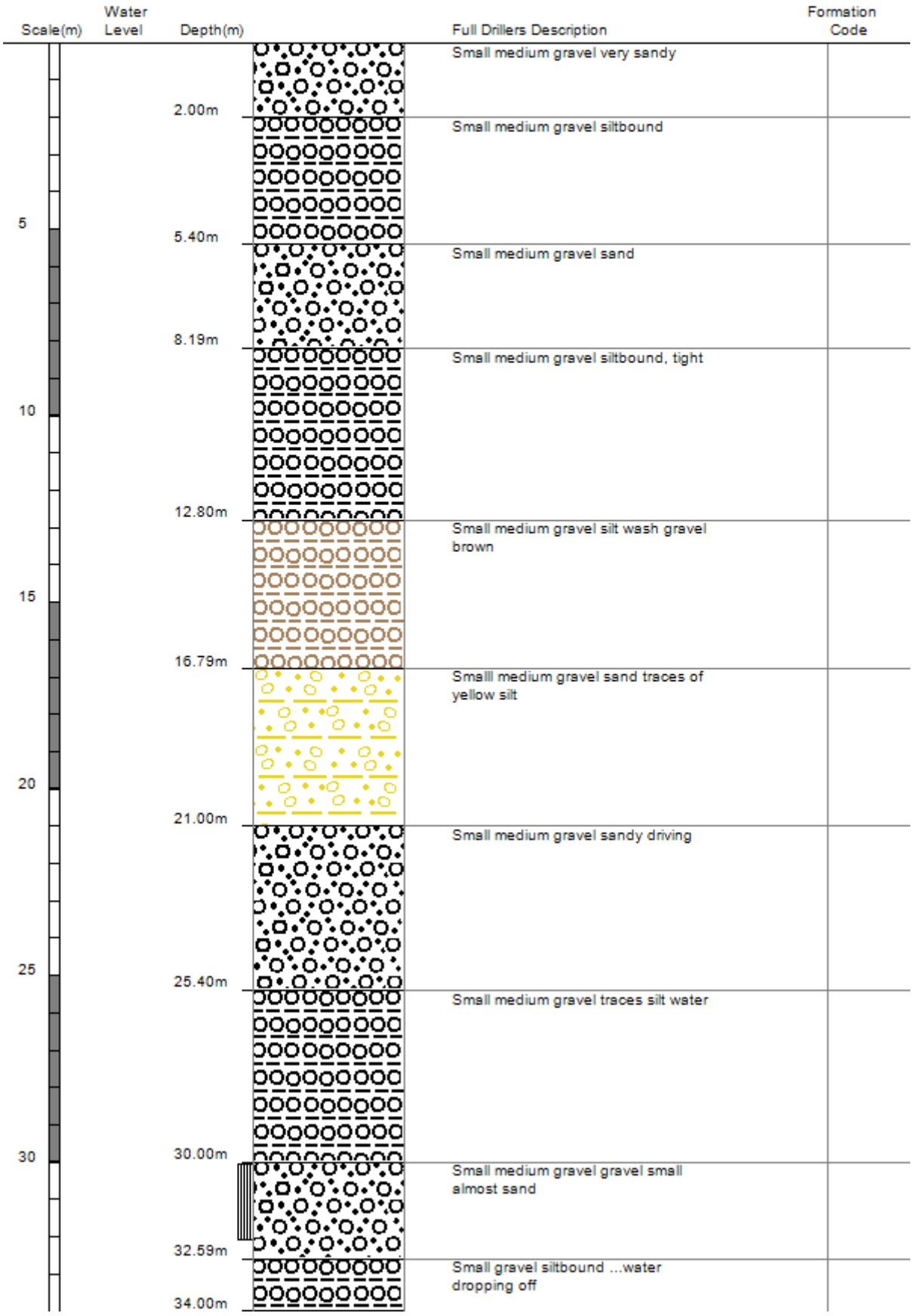
Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Feb 1997	1	5.1	67.31074	12.8	2

No comments for this well

Borelog for well M36/5041

Grid Reference (NZTM): 1549508 mE, 5169991 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.5 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 34.0 m Drill Date: 01-Feb-1997

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha





ENGEO

Expect Excellence

Revised Geotechnical Investigation

92 Dunns Crossing Road

Rolleston

Christchurch

Submitted to:

Hughes Developments Ltd

Christchurch

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13.12.2019
12903.001.000_02

ACENZ

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Appendix 2: ENGEO Hand Auger and Test Pit Logs

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ENGEO Document Control:

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Project No.	12903.001.000	Doc ID	02	
Client	Hughes Developments Ltd	Client Contact	Kelvin Back	
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Date	Revision Details/Status	WP	Author	Reviewer
2019/12/06	Issued to Client	JT	KF	GM
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1 Introduction

ENGEO Ltd was requested by Hughes Developments Ltd to undertake a geotechnical investigation of the property at 92 Dunns Crossing Road, Rolleston, Christchurch, and a neighbouring section off Goulds Road, as outlined in our variation proposal (ref: P2019.002.259_01).

The purpose of this assessment was to conceptualise a geological model of the site, assess the likely future land performance, comment on the suitability of the site for residential subdivision, address the requirements of Section 106 of the Resource Management Act (RMA) and provide recommendations for subdivision works and foundations for typical timber framed residential dwellings.

Our scope of works included the following:

- Complete a desktop study of relevant available geotechnical and geological publications, including the NZ Geotechnical and Environment Canterbury Databases;
- Undertake a geotechnical site walkover;
- Undertake forty hand auger boreholes with associated Scala penetrometer tests to assess the near surface material types and strength characteristics;
- Organise and technically supervise the excavation of forty-five test pits, including geotechnical logging of the exposed soils; and
- Preparation of this report outlining our findings on the ground conditions and the suitability of the site for residential subdivision, including geotechnical advice on the likely foundation Technical Category, conceptual foundation recommendations for typical timber framed residential dwellings, and address likely geohazards as required by Section 106 of the RMA.

ENGEO previously issued a Geotechnical Investigation report dated 6 December 2019 (ref: 12903.001.000_01), which included thirty-three hand augers and thirty-two test pit investigations. Our testing scope was reduced, due to three paddocks being unavailable for testing at that time. Subsurface testing has now been completed in the three remaining paddocks, finalising the testing for this site. This version of our report supersedes our original report for the site dated 6 December 2019.

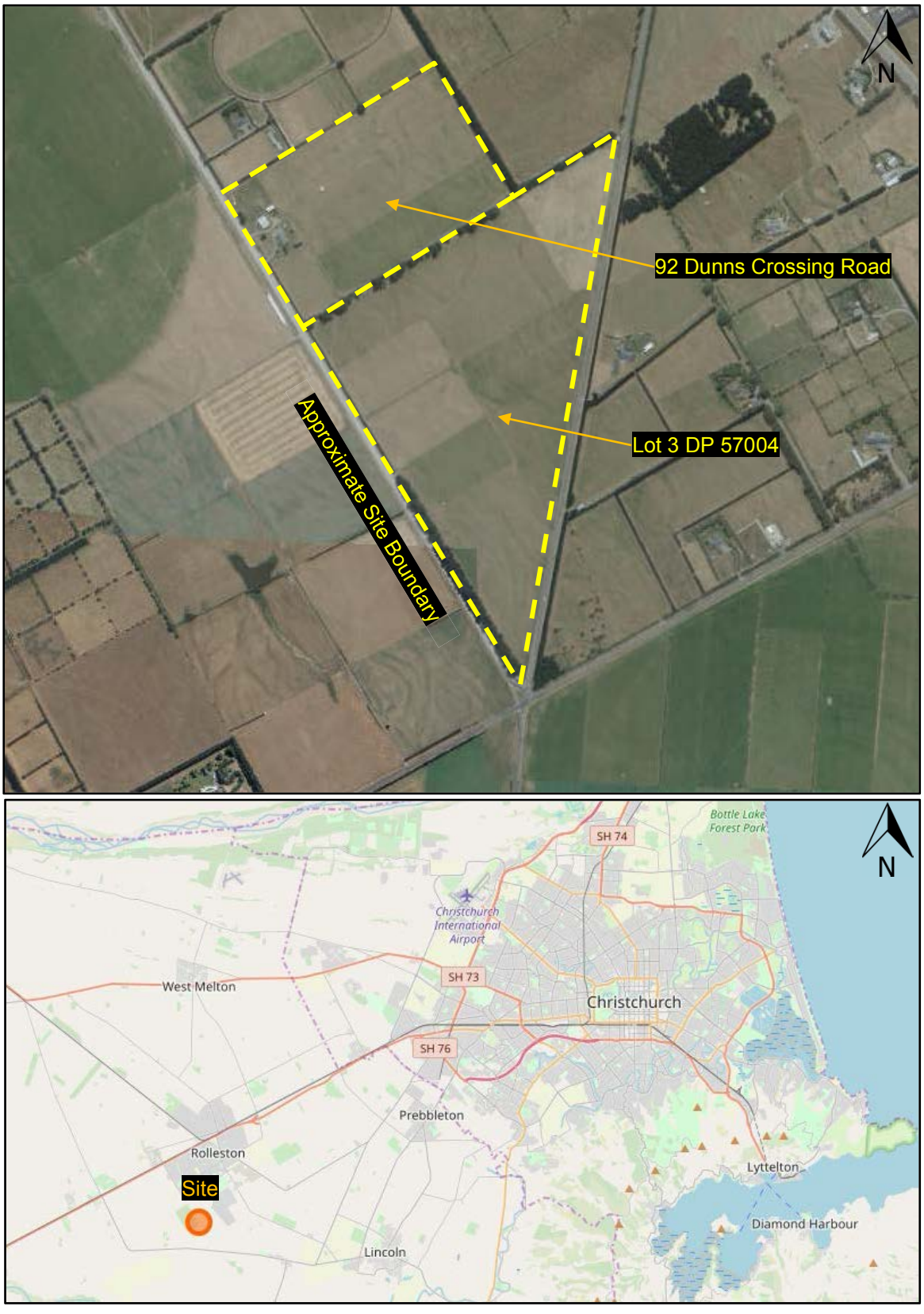
2 Site Description

The site comprises of two properties with a total area of 30.8 ha and have the following legal descriptions (Canterbury Maps):

- 92 Dunns Crossing Road - Lot 1 DP 61278 – 10.1 ha
- Lot 3 DP 57004 – 20.7 ha

They are located approximately 3 km southwest of Rolleston town centre. They are both bound to the southwest by Dunns Crossing Road. 92 Dunns Crossing Road is bound to all other sides by rural properties, whereas the neighbouring property is bound to the east by Goulds Road (Figure 1).

Figure 1: Site Location Plan



Images sourced from Canterbury Maps and "© OpenStreetMap contributors". Not to scale.

3 Geological Model

3.1 Regional Geology

The site has been regionally mapped by GNS (Forsyth et al., 2008) as being underlain by brownish grey river alluvium (Q2a).

3.2 Geomorphology

The site comprises relatively flat ground, with gentle undulations and depressions in some areas. As evident on aerial imagery (Canterbury Maps, 2019) and observed during our site walkover conducted on 21 November 2019, undulating and depressed ground can be attributed to paleo-channels, which traverse the site in a general northwest to southeast direction (Figure 2). Based on observations, sandy silt deposits with variable thickness (up to 0.6 m) are expected to have in-filled the paleo-channels where they have not remained as channel features. Inferred paleo-channels have been mapped to give an indication of areas with potential channel in-fill (Appendix 1).

Figure 2: Historical Aerial Photo – 1940 to 1944

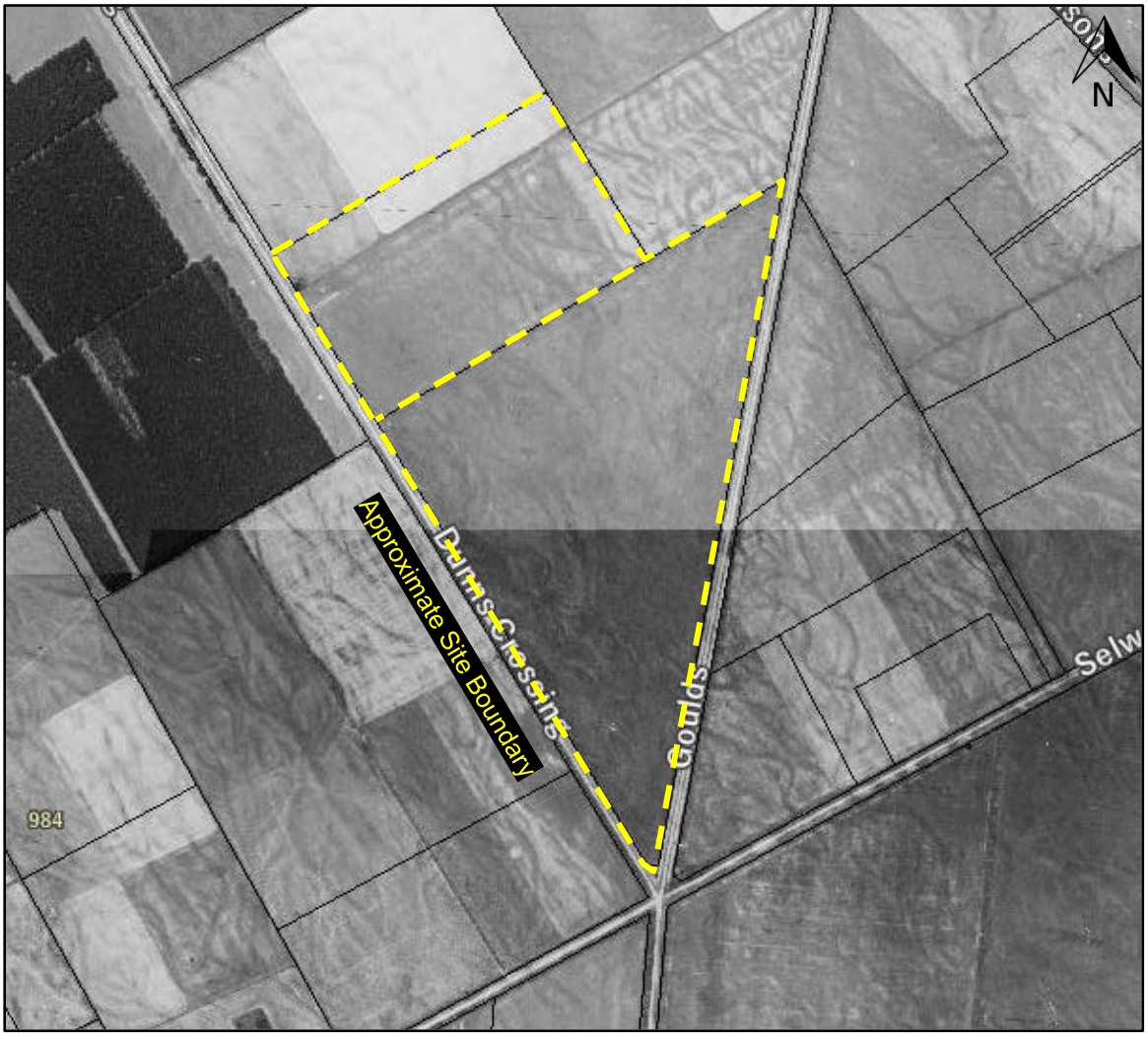


Image sourced from Canterbury Maps. Not to scale.

3.3 Geohazards

3.3.1 Seismicity

There are no known or mapped faults in the immediate area of the site, however the site may be at risk of ground shaking induced by movement of proximal or distal faults.

The site is located between two recently discovered fault systems, the Greendale Fault and the Port Hills Fault, the ruptures of which initiated the ongoing Canterbury Earthquake Sequence (CES). The Greendale Fault has been mapped approximately 6 km north / northwest of the site and trends roughly east-west with a surface rupture length of approximately 28 km (GNS, 2015), while the Port Hills Fault remains unmapped as the fault did not rupture at the surface. Movement on the Port Hills Fault is believed to have extended to within 1 km to 2 km below ground surface.

Large regional areas of faulting (GNS, 2015) namely the Ashley Fault, Porters Pass - Amberley Fault Zone, and the Hope and Alpine Faults, are further afield but present a high seismic hazard to the Christchurch area due to the anticipated size of earthquakes generated. The largest of these faults is the Alpine Fault, which has a return period of 250 - 300 years and is expected to produce a M8 earthquake. The last rupture on the Alpine Fault is believed to have occurred in 1717 (Pettinga et al., 2001).

3.3.2 Liquefaction and Lateral Spreading

The site is located in an area mapped where “damaging liquefaction is unlikely” (NZGD Map CGD5140, 2012), and a “zone of very low liquefaction potential” (GNS, 2006).

3.4 Site Investigation

Site investigations to assess the shallow subsurface material types and strength characteristics were undertaken by ENGEO from 22 November to 6 December 2019. Forty-five test pits and forty-one hand auger investigations with associated Scala Penetrometer tests were completed to a maximum depth of 2.1 m below ground level. An extra hand auger investigation was required due to the shape of the site, and the grid pattern adopted to accurately plan the testing locations.

The investigations revealed subsurface conditions across the site are consistent with the published geological mapping, as summarised in Table 2. Hand auger and test pit logs are attached as Appendix 2 of this report.

Table 1: Summary of Hand Auger Investigations

Soil Type	Depth to Top of Layer (m)	General Layer Thickness (m)	Density / Consistency	Additional Comments
TOPSOIL	0.0	0.1 – 0.2	Firm to Stiff	-
Sandy SILT	0.1 – 0.2	0.1 – 0.5	Firm to Very Stiff	Consistent across the site

Table 2: Summary of Test Pit Investigations

Soil Type	Depth to Top of Layer (m)	General Layer Thickness (m)	Density / Consistency	Additional Comments
TOPSOIL	0.0	0.1 – 0.3	Firm to Stiff	-
SILT	0.1 – 0.3	0.2 – 0.3	Stiff to Very Stiff	Present in TP11, 22, 24 and 40
Silty SAND / SAND	0.3 – 0.6	0.2 – 0.5	Medium Dense to Dense	Silty sand present in TP09, 11 and sand present in TP36
Sandy GRAVEL	0.1 – 1.0	Unknown	Medium Dense to Very Dense	Consistent across the site Noticeable sand increase in TP03, 04, and 09

3.5 ECan Boreholes

A review of six deep ECan borehole logs was conducted. The first (M36/4449 & M36/4387), are located on-site, and appear to be water wells providing the properties irrigation and domestic supply. The other boreholes are located to the north (M36/4450), east (M36/20535), south (BX23/0895) and west (M36/7416) of the site.

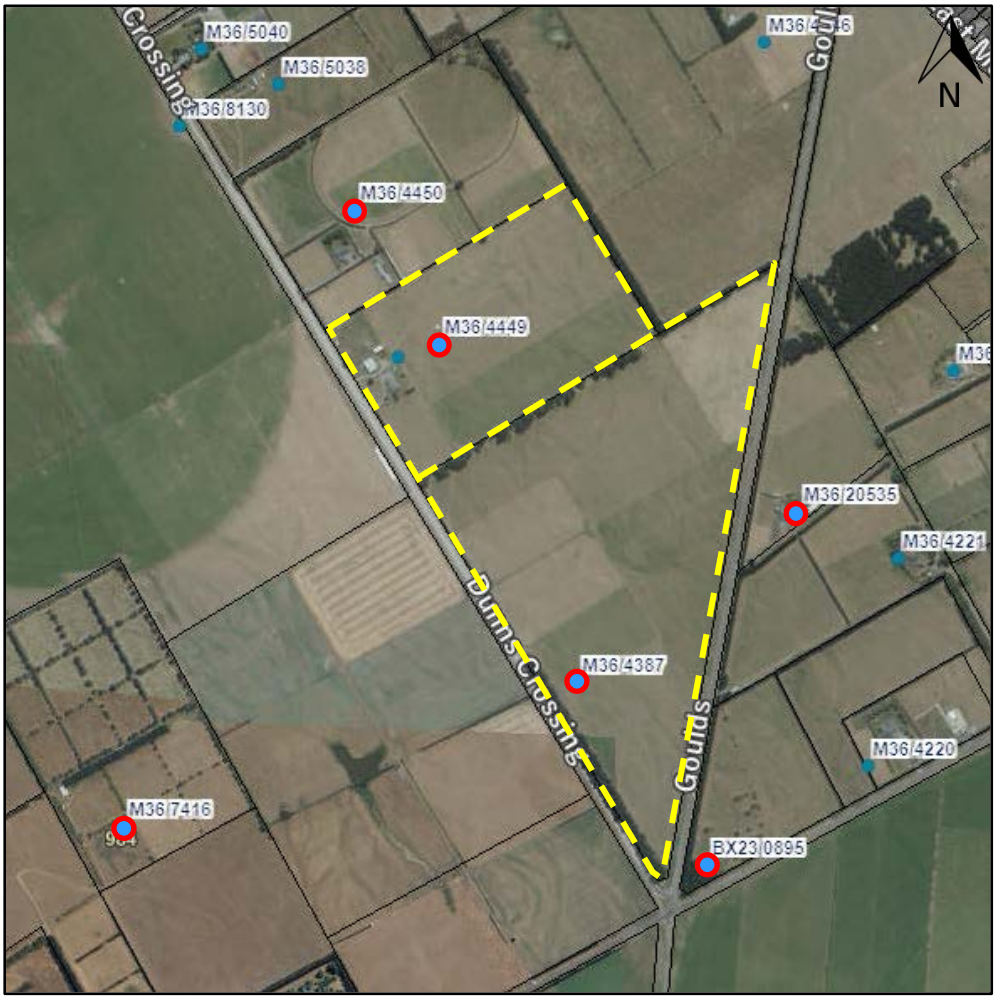
Well logs from the six holes of interest are attached to this report as Appendix 3 and summarised in Table 3.

Table 3: Generalised Summary of ECan Boreholes

ECan Borehole	Total Depth (m)	Water Level Below Ground Level (m)	Generalised Borelog as Logged by Driller
BX23/0895	53	5.35	Varying sandy and silty gravel layers to 53 m.
M36/20535	30	7.1	Topsoil to 0.3 m with gravel from 0.3 to 30 m.
M36/4387	35	6.5	Grey / sandy gravel to 35 m, with a layer of clay-bound gravel from 6.6 to 20.7 m.
M36/4449	24	7.7	Gravel to 24 m with a layer of clay from 12 to 14 m and sandy gravel from 14 to 18 m.

ECan Borehole	Total Depth (m)	Water Level Below Ground Level (m)	Generalised Borelog as Logged by Driller
M36/4450	26	8.1	Gravel to 26 m with a layer of clayey gravel from 12 to 18 m, clay and sand from 22 to 24 m and 26 to 26.5 m.
M36/7416	47	5.18	Sandy gravel to 16.8 with a layer of clay-bound sandy gravel from 5.6 to 14.7 m, and predominant gravel to 23 m. Logs not available from 23 to 47 m.

Figure 3: Nearby ECan Borehole Locations



Aerial photograph sourced from Canterbury Maps. Not to scale.

3.6 Groundwater

Groundwater is recorded in the surrounding boreholes between approximately 5.18 m and 8.1 m depth.

3.7 Site Seismic Class

In accordance with NZS 1170.5:2004, Class D applies to this particular site, defining it as a 'deep soft soil site'.

4 Liquefaction Analysis

Owing to the nature of the subsurface materials and depth to groundwater at the site, we consider the potential for liquefaction and lateral spreading on the site to be very low.

We therefore consider future land performance to be in line with Technical Category 1 (TC1), whereby future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances.

5 RMA Section 106 Requirements and Suitability to Subdivide

Section 106 of the Resource Management Act 1991 states a consent authority may refuse to grant a subdivision consent, or may grant a consent subject to specific consent conditions if it considers that:

- There is a significant risk from natural hazards; or
- Sufficient provision has not been made for legal or physical access to each allotment to be created by the subdivision.

An assessment of the risk from natural hazards as required by the RMA includes the following:

- The likelihood of natural hazards occurring (whether individually or in combination);
- The material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and
- Any likely subsequent use of the land in respect of which the consent is sought that would accelerate, worsen, or result in material damage of the kind referred to in paragraph (b).

We have assessed the risk of natural hazards at the site in accordance with Section 106 of the Resource Management Act (RMA) and considered the risk to the site from rockfall, inundation (debris), slope stability, subsidence, flooding and tsunami. Based on our observations and the nature of the site, its performance during the CES, and the site's distance from the nearest significant watercourse, we consider it is unlikely for the site to be subject to natural hazards such as rockfall, inundation (debris), slope stability, subsidence, flooding and tsunami. As such, the site is considered suitable for subdivision from a geotechnical perspective.

6 Geotechnical Recommendations

6.1 Earthworks

Earthworks carried out for the subdivision shall be in accordance with NZS 4404:2010, Land Development and Subdivision Infrastructure and NZS 4431:1989, Code of Practice for Earth filling for Residential Development. In particular, any areas to receive fill should be stripped of all vegetation, topsoil, non-engineered fill, soft or organic soils prior to fill placement.

Fill may comprise clean natural sandy gravel or silty soils, or clean imported soils and / or granular fill, compacted to achieve no less than 95% of maximum dry density. Fill faces steeper than 2V:1H and higher than 600 mm should be retained and referred back to ENGEO. Although unlikely, where any springs or groundwater seeps are encountered, they should be intercepted with suitable drainage and discharged to a Council approved outlet.

All unretained batters of pond and stormwater drains constructed with the native sandy gravel material should be at an inclination no steeper than 1V:3H, with protection schemes in place to control erosion of the formed batters within the waterways.

A comprehensive earthworks specification should be provided to the earthworks contractor prior to starting excavations and an inspection / testing regime agreed, along with a robust erosion and sediment control plan.

6.2 Subdivision Roading

Vegetation, any organic or deleterious material, topsoil and non-engineered fill should be removed from the site under pavement areas prior to aggregate placement. Based on our observations during testing, we consider the natural ground below the topsoil at the site should provide an adequate subgrade for the proposed pavement areas.

6.3 Stormwater Control

Concentrated stormwater flows from all impermeable areas must be collected and carried in sealed pipes to the Council system or an alternative disposal point subject to approval from Council. Uncontrolled stormwater must not be allowed to saturate the ground as this will potentially affect future foundation performance both statically and during future seismic activity.

6.4 Foundations

Foundations for future proposed residential dwellings within the subdivision may comprise shallow pad, strip, or slab foundations designed in accordance with the provisions of NZS 3604 Timber Framed Buildings.

Site specific testing will be required for Building Consent, to confirm the bearing materials and capacity. For preliminary design, we anticipate that a geotechnical Ultimate Bearing Capacity of 300 kPa may be assumed for foundations bearing on sandy gravel or engineered fill, below any topsoil. All topsoil shall be stripped from within building footprints, we anticipate this to be typically below 0.1 to 0.3 m depth based on our subsurface investigations.

7 References

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8 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by



Kristian Fairley
Engineering Geologist

Report reviewed by



Greg Martin, CMEngNZ (PEngGeol)
Principal Engineering Geologist



Jed Watts
Engineering Geologist

APPENDIX 1:

Site Plan and Inferred Paleo Channels

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DATE PLOTTED: 10 December 2019 11:09:31 am BY: NFlatman

1550000

N

TP42 HA40 TP40 HA41 TP41 HA38 HA39 TP33 TP38 HA34 TP02 TP39 TP37 TP34 HA06 HA05 HA37 TP03 TP06 HA08 HA35 TP36 TP07 HA04 TP35 HA07 TP05 HA36 TP09 HA10 HA09 TP01 HA01 HA03 TP08 TP20 HA12 TP04 HA11 HA21 TP11 HA02 TP10 TP18 HA22 HA14 TP19 HA13 HA19 TP13 HA20 TP12 TP16 TP45 HA15 TP17 HA17 TP44 HA18 HA25 TP14 TP43 TP15 TP21 TP31 HA16 HA23 HA24 TP22 HA27 HA26 TP24 TP23 HA29 TP32 HA28 TP25 HA31 TP26 HA30 TP30 HA32 TP27 TP29 TP28 HA33

Legend

- Site boundary
- Hand auger locations
- Test pit locations
- Flow path

0 10,000 20,000 Meters

Sourced from the LINZ Data Service and licensed for re-use under the Creative Commons Attribution 3.0 New Zealand licence

PATH: \\cre\file.nz\Projects\12901 to 13000\12903 - Farrington South Subdivision\054_92 Dunns Crossing Road - Enviro\06_CAD-GIS & Figures\Fig01.mxd

ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
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www.engeo.co.nz

Title: Site plan and inferred paleo channels

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project: 92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: 1

Size: A3

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 2:

ENGEO Hand Auger and Test Pit Logs

LOG OF AUGER HA01

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.626634
Longitude : 172.372952

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	Sandy SILT with trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine.				D	St-H	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

GEOTECH HAND AUGER 2019.11.27 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 4/12/19

LOG OF AUGER HA02

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.627341
Longitude : 172.373596

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	Sandy SILT with trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	Sandy SILT with minor gravel; greyish brown. Low plasticity. Sand, fine. Gravel, fine to medium, subangular to subrounded.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.7 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

GEOTECH HAND AUGER 2019.11.27 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 4/12/19

LOG OF AUGER HA03

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.626801
Longitude : 172.374937

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	Sandy SILT with minor gravel; greyish brown. Low plasticity. Sand, fine. Gravel, fine, subangular to subrounded.				D	F-St	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA04

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.626238
Longitude : 172.376311

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine. Gravel, fine, subangular to subrounded.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

GEOTECH HAND AUGER 2019.11.27 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 4/12/19

LOG OF AUGER HA05

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.625776
Longitude : 172.377469

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F	
	A	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine. Gravel, fine, subangular to subrounded.					St-VSt	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL, A = ALLUVIUM

LOG OF AUGER HA06

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.625827
Longitude : 172.378467

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
	A	ML	SILT with some sand; brown. Low plasticity. Sand, fine.					St-VSt	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL, A = ALLUVIUM

LOG OF AUGER HA07

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.626312
Longitude : 172.378918

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
	A	ML	SILT with some sand; brown. Low plasticity. Sand, fine.					St-VSt	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL, A = ALLUVIUM

LOG OF AUGER HA08

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.626009
Longitude : 172.379583

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	SILT with some sand; greyish brown. Low plasticity. Sand, fine. Becomes brownish grey and trace gravel encountered from 0.3 m depth.				D	VSt-H	
0.5			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA09

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.62663
Longitude : 172.378167

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					St	
	ALLUVIUM	ML	SILT with some sand; greyish brown. Low plasticity. Sand, fine.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

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LOG OF AUGER HA10

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.626452
Longitude : 172.377126

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	SILT with some sand; greyish brown. Low plasticity. Sand, fine. Trace gravel and sand observed from 0.3 m depth.				D	St-VSt	
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal						
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.5 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.7 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

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LOG OF AUGER HA11

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.627174
Longitude : 172.37697

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	SILT with some sand and trace gravel; greyish brown. Low plasticity. Sand, fine.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

GEOTECH HAND AUGER 2019.11.27 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 4/12/19

LOG OF AUGER HA12

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.626972
Longitude : 172.375908

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	SILT with some sand and trace gravel; greyish brown. Low plasticity. Sand, fine.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

GEOTECH HAND AUGER 2019.11.27 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 4/12/19

LOG OF AUGER HA13

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.627741
Longitude : 172.375608

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	Sandy SILT with minor gravel; greyish brown. Low plasticity. Sand, fine. Gravel, fine, subangular to subrounded.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA14

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.62757
Longitude : 172.374573

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine.				D	St-VSt	
			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

GEOTECH HAND AUGER 2019.11.27 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 4/12/19

LOG OF AUGER HA15

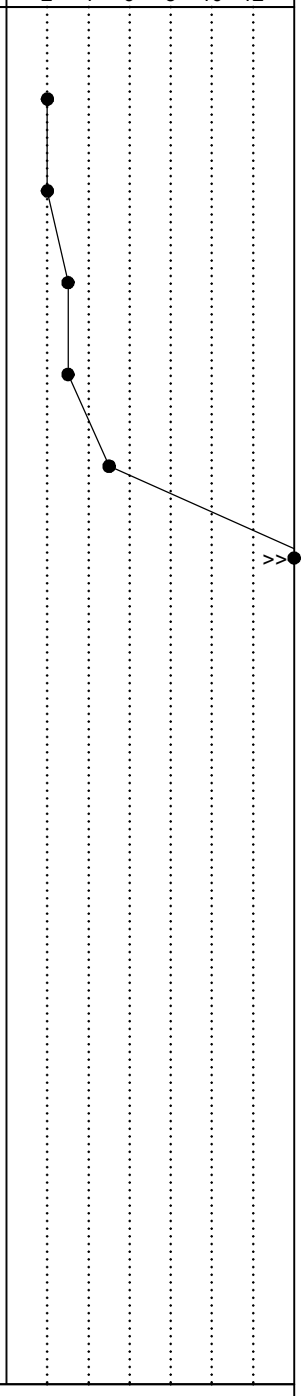
Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.628288
Longitude : 172.374337

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine.				D	F-VSt	
			Trace gravel and becomes brownish grey from 0.3 m depth.						
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal						
1.0									
1.5									

Scala Penetrometer



Hand auger met practical refusal at 0.5 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA16

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.6 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.629139
Longitude : 172.375002

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	Sandy SILT; greyish brown. Low plasticity. Sand, fine.				D	F-VSt	
0.5			Becomes light greyish brown from 0.3 m depth.						
			Trace gravel encountered from 0.5 m depth.						
			End of Hole Depth: 0.6 m Termination Condition: Practical refusal						
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.6 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.7 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA17

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.628389
Longitude : 172.375254

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	Sandy SILT; greyish brown. Low plasticity. Sand, fine.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

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LOG OF AUGER HA18

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.1 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.628587
Longitude : 172.376257

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.1 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.1 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA19

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.6 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.627815
Longitude : 172.376568

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	SILT with some sand; greyish brown. Low plasticity. Sand, fine.				D	F-St	
0.5		ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine.					St-VSt	
			End of Hole Depth: 0.6 m Termination Condition: Practical refusal						
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.6 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA20

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.627993
Longitude : 172.377662

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	SILT with some sand and trace gravel; greyish brown. Low plasticity. Sand, fine.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA21

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.627255
Longitude : 172.377872

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA22

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.627454
Longitude : 172.378955

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	SILT with some sand and trace gravel; greyish brown. Low plasticity. Sand, fine.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

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LOG OF AUGER HA23

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.629267
Longitude : 172.37593

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	Sandy SILT with trace gravel; brown. Low plasticity. Sand, fine.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA24

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

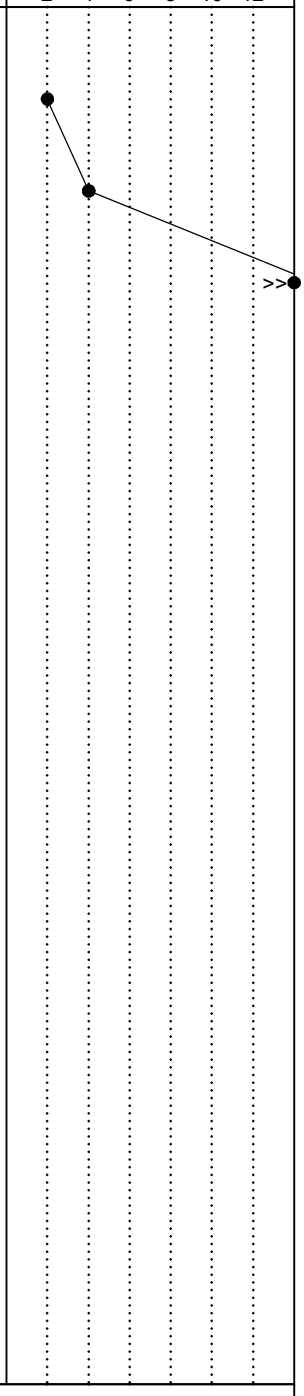
Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.629275
Longitude : 172.377732

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity [TOPSOIL].					S-F	
	ALLUVIUM	ML	Sandy SILT with minor gravel; brown. Low plasticity. Sand, fine. Gravel, fine, subangular to subrounded.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm



0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

GEOTECH HAND AUGER 2019.11.27 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 4/12/19

LOG OF AUGER HA25

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.1 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.628692
Longitude : 172.379095

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.1 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

0.5

>>

1.0

1.5

Hand auger met practical refusal at 0.1 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

GEOTECH HAND AUGER 2019.11.27 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 4/12/19

LOG OF AUGER HA26

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.629562
Longitude : 172.378456

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand and trace gravel; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA27

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.1 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.62955
Longitude : 172.377029

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F	
			End of Hole Depth: 0.1 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.1 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA28

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.630284
Longitude : 172.376702

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F	
	A	ML	Sandy SILT with trace gravel; brownish grey. Low plasticity. Sand, fine.					VSt-H	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.2 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL, A = ALLUVIUM

GEOTECH HAND AUGER 2019.11.27 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 4/12/19

LOG OF AUGER HA29

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.630074
Longitude : 172.375758

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand fine [TOPSOIL].						
	A	ML	Sandy SILT with trace gravel; brown. Low plasticity. Sand, fine.						
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL, A = ALLUVIUM

LOG OF AUGER HA30

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.63101
Longitude : 172.376531

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	Sandy SILT with minor gravel; greyish brown. Low plasticity. Sand, fine. Gravel, fine to medium, subangular to subrounded.				D	St-VSt	
			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

GEOTECH HAND AUGER 2019.11.27 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 4/12/19

LOG OF AUGER HA31

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.630521
Longitude : 172.37778

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine.				D	St-H	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA32

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.631356
Longitude : 172.377566

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TS	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand fine [TOPSOIL].					S-F	
	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine.				D	St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.
TS = TOPSOIL

LOG OF AUGER HA33

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 22/11/2019
Hole Depth : 0.6 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.632691
Longitude : 172.377909

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand fine [TOPSOIL].					F-St	
0.5	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine. Gravel becomes minor from 0.5 m depth. Gravel, fine to medium, subangular to subrounded.				D	VSt-H	
			End of Hole Depth: 0.6 m Termination Condition: Practical refusal						
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.6 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA34

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 06/12/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/MK
Reviewed By : JW
Latitude : -43.625477
Longitude : 172.376421

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine.				D	St-H	
0.5			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
1.0									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA35

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 06/12/2019
Hole Depth : 0.1 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/MK
Reviewed By : JW
Latitude : -43.625997
Longitude : 172.375209

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.1 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

0.5

1.0

Hand auger met practical refusal at 0.1 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA36

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 06/12/2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/MK
Reviewed By : JW
Latitude : -43.626541
Longitude : 172.373835

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	Sandy SILT with minor gravel; greyish brown. Low plasticity. Sand, fine. Gravel, fine, subangular to subrounded.				D	VSt-H	
0.5			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
1.0									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA37

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 06/12/2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/MK
Reviewed By : JW
Latitude : -43.625788
Longitude : 172.374136

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine. Gravel becomes minor from 0.3 m depth. Gravel, fine, subrounded to rounded.				D	VSt-H	
0.5			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						
1.0									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA38

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 06/12/2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/MK
Reviewed By : JW
Latitude : -43.625065
Longitude : 172.374372

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine.				D	St-VSt	
0.5			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						
1.0									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA39

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 06/12/2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/MK
Reviewed By : JW
Latitude : -43.625291
Longitude : 172.375434

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
	A	ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine.					VSt-H	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.2 m depth.
Standing groundwater was not encountered.
A = ALLUVIUM

GEOTECH HAND AUGER 2019.12.XX - REMAINING HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 12/12/19

LOG OF AUGER HA40

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 06/12/2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/MK
Reviewed By : JW
Latitude : -43.624561
Longitude : 172.375659

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St	
	ALLUVIUM	ML	Sandy SILT with trace gravel and rootlets; greyish brown. Low plasticity. Sand, fine. No rootlets encountered from 0.3 m depth.				D	VSt-H	
0.5			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						
1.0									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA41

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 06/12/2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF/MK
Reviewed By : JW
Latitude : -43.624739
Longitude : 172.376636

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	St-VSt	
	A	ML	Sandy SILT with trace gravel and rootlets; greyish brown. Low plasticity. Sand, fine.					VSt-H	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered.
A = ALLUVIUM

GEOTECH HAND AUGER 2019.12.XX - REMAINING HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 12/12/19

LOG OF TEST PIT TP01

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.626724
Longitude : 172.37925

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	T		ML	Sandy SILT with trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	F-St		
0.5	ALLUVIUM		GW	Sandy fine to medium GRAVEL with some silt and trace rootlets; greyish brown with orange mottles. Well graded, subangular to subrounded. Sand, fine. Silt becomes trace and no rootlets from 0.5 m depth. Trace cobbles encountered from 0.9 m depth. Cobbles become minor from 1.3 m depth.				M	MD-D		
1.0											
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

T = TOPSOIL

GEOTECH TEST PIT LOG 2019.11.27 - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 4/12/19

LOG OF TEST PIT TP02

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.625528
Longitude : 172.379116

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand and tree roots; light brownish grey. Low plasticity. Sand, fine [TOPSOIL].					F-St		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium.				D	MD-D		
1.0				Trace cobbles and silt encountered from 0.6 m depth.							
1.5				No rootlets observed from 1.0 m depth.				M			
2.0				Cobbles become minor from 1.6 m depth.							
				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP03

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.625939
Longitude : 172.372464

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		ML	Sandy SILT with trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	St-VSt		
0.5	ALLUVIUM		SM	Silty fine to medium SAND with some gravel and trace rootlets; greyish brown. Well graded. Gravel, fine to medium, subangular to subrounded.					MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace silt; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.5				Trace cobbles encountered from 1.7 m depth.							
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

Noticeable sand increase from 0.8 m depth.

LOG OF TEST PIT TP04

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.6271
Longitude : 172.374267

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St		
0.5	ALLUVIUM		GW	Sandy fine to medium GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded.					MD-D		
			SM	Silty fine to medium SAND with minor gravel; greyish brown. Well graded. Gravel, fine to medium, subangular to subrounded.					MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL
Noticeable sand increase from 0.9 m depth.

LOG OF TEST PIT TP05

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 1.8 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.626522
Longitude : 172.375592

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St		2 4 6 8 10 12
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium.				M	MD-D		>>
				Trace cobbles and silt encountered from 0.6 m depth.							
1.0				No rootlets observed from 0.9 m depth.							
1.5				Becomes grey from 1.4 m depth.							
				Cobbles become minor from 1.7 m depth.							
2.0				Depth of Excavation: 1.8 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP06

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.626028
Longitude : 172.376879

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St		
0.4	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium. No silt encountered from 0.4 m depth. Cobbles become minor from 0.9 m depth. Sand becomes some from 1.2 m depth. No rootlets observed from 1.6 m depth.				M	MD-D		
1.9				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP07

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 1.8 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.626164
Longitude : 172.377786

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace cobbles; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium. Cobbles become minor from 0.6 m depth. Sand becomes some from 0.8 m depth.				M	MD-D		
1.0											
1.5											
2.0				Depth of Excavation: 1.8 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP08

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 1.8 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.626906
Longitude : 172.377587

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St		>>
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt, trace cobbles and rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse. No rootlets observed from 0.4 m depth.				M	MD-D		
1.0				Becomes grey and some sand from 1.2 m depth.							
1.5											
2.0				Depth of Excavation: 1.8 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP09

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.626677
Longitude : 172.376622

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	Sandy SILT with trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St		
0.5	ALLUVIUM		GW	Sandy fine to medium GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium.				M	MD-D		
				No silt encountered from 0.6 m depth.							
1.0				Trace cobbles encountered from 0.8 m depth.							
1.5			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.					MD-D		
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL
Noticeable sand increase from 1.7 m depth.

LOG OF TEST PIT TP10

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.627457
Longitude : 172.376289

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		ML	Sandy SILT with trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace silt; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse. No silt and trace cobbles encountered from 0.6 m depth. Sand becomes some from 1.0 m depth.				M	MD-D		
1.0											
1.5											
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

GEOTECH TEST PIT LOG 2019.11.27 - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 4/12/19

LOG OF TEST PIT TP11

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.627275
Longitude : 172.375259

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Sandy fine to medium GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium.				D	MD-D		
0.5			ML	SILT with some sand and trace gravel; brownish grey. Low plasticity. Sand, fine.					St-VSt		
			GW	Sandy fine to coarse GRAVEL with some silt; greyish brown with orange mottles. Well graded, subangular to subrounded. Sand, fine to medium. No silt encountered from 0.8 m depth.							
1.0				Sand becomes fine to coarse from 1.0 m depth.							
				Trace cobbles encountered from 1.2 m depth.				M	MD-D		
1.5				Sand becomes some from 1.8 m depth.							
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 >>

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP12

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.628017
Longitude : 172.374975

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine.				D	MD-D		
0.5				Sandy fine to coarse GRAVEL with trace rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
				No rootlets observed from 0.8 m depth.				M			
1.0				Trace cobbles encountered from 1.0 m depth.							
			GW						MD-D		
1.5				Cobbles become minor from 1.5 m depth.							
								W			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 >>

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP13

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.627819
Longitude : 172.373988

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Sandy fine to medium GRAVEL with some silt and trace rootlets; greyish brown with orange mottles. Well graded, subangular to subrounded. Sand, fine. Sand becomes some from 0.4 m depth.				D	MD-D		
0.5											
1.0			GW	Sandy fine to coarse GRAVEL; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.5				Trace cobbles encountered from 1.6 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL
Noticeable sand increase from 0.7 m depth.

LOG OF TEST PIT TP14

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.628684
Longitude : 172.374642

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand and silt; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium.				D	MD-D		
0.5			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
1.0				Cobbles become minor from 1.1 m depth.				M	MD-D		
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP15

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.628875
Longitude : 172.375619

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St		
	ALLUVIUM			Sandy fine to medium GRAVEL with some silt and trace rootlets; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium. Trace silt and sand becomes some from 0.4 m depth. Trace rootlets observed from 0.6 m depth.				M	MD-D		
1.4			GW	Fine to coarse GRAVEL with some sand and trace cobbles; grey. Well graded, subangular to subrounded.				W	MD-D		
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL
Loosely packed gravel encountered from 1.4 to 2.0 m depth.

GEOTECH TEST PIT LOG 2019.11.27 - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 4/12/19

LOG OF TEST PIT TP16

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.628098
Longitude : 172.375881

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St		
0.5	ALLUVIUM		GW	Sandy fine to medium GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine.				M	MD-D		
				Silt becomes trace from 0.6 m depth.							
				Gravel becomes fine to coarse from 0.8 m depth.							
1.0				Trace cobbles encountered from 1.0 m depth.							
				Cobbles become minor from 1.4 m depth.							
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP17

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.628312
Longitude : 172.376954

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; brownish grey. Well graded, subangular to subrounded. Sand, fine.				D	MD-D		
0.5			GW	Sandy fine to coarse GRAVEL with trace rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
				Sand becomes some from 0.8 m depth.							
				No rootlets observed from 0.9 m depth.							
1.0				Trace cobbles encountered from 1.1 m depth.							
			GW					M	MD-D		
1.5				Cobbles become minor from 1.6 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP18

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.627512
Longitude : 172.377228

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; brownish grey. Well graded, subangular to subrounded. Sand, fine.					MD-D		
0.5				Sandy fine to coarse GRAVEL with trace rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse. Sand becomes trace from 0.6 to 0.7 m depth. Trace cobbles encountered from 0.8 m depth.				D			
1.0			GW						MD-D		
1.5								M			
				Sand becomes trace from 1.8 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP19

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.627741
Longitude : 172.378285

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM			Sandy fine to medium GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium.				D			
0.5				No rootlets or silt observed from 0.6 m depth.							
				Gravel and sand become fine to coarse from 0.8 m depth.							
1.0			GW	Sand becomes some and trace cobbles encountered from 1.0 m depth.					MD-D		
								M			
1.5				Sand becomes trace from 1.7 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL
Loosely packed gravel encountered from 1.7 to 2.0 m depth.

LOG OF TEST PIT TP20

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 1.8 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.627003
Longitude : 172.378526

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		2 4 6 8 10 12
0.5	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. No silt encountered from 0.4 m depth.					MD-D		>>
1.0			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.5											
2.0				Depth of Excavation: 1.8 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP21

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.629026
Longitude : 172.37652

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
0.5	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. No silt encountered from 0.4 m depth.				D	MD-D		
1.0			GW	Sandy fine to coarse GRAVEL; grey. Well graded, subangular to subrounded. Sand, fine to coarse. Trace cobbles encountered from 1.0 m depth. Sand becomes some from 1.3 m depth.				M	MD-D		
1.5											
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 >>

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2019.11.27 - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 4/12/19

LOG OF TEST PIT TP22

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.62955
Longitude : 172.375318

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		ML	Sandy SILT with trace rootlets; light greyish brown. Low plasticity. Sand, fine to medium.				D	F-St		
0.5			GW	Fine to medium GRAVEL with some sand and silt; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium. No silt encountered from 0.6 m depth. Gravel and sand become fine to coarse from 0.8 m depth. Sand becomes trace from 1.1 to 1.3 m depth. Trace cobbles encountered from 1.4 m depth.				M	MD-D		
1.0											
1.5											
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP23

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.630024
Longitude : 172.377367

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM			Fine to coarse GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium.							
0.5				No silt encountered from 0.5 m depth.				D			
				Trace cobbles encountered from 0.6 m depth.							
1.0			GW	No rootlets observed from 1.0 m depth.					MD-D		
				Cobbles become minor from 1.3 m depth.							
1.5								M			
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP24

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.629807
Longitude : 172.376332

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
			ML	Sandy SILT with trace gravel and rootlets; greyish brown. Low plasticity. Sand, fine.					St-H		
0.5	ALLUVIUM		GW	Fine to medium GRAVEL with some sand and silt; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium.				D	MD-D		
			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.					MD-D		
1.0				Becomes moist from 1.0 m depth.							
				Sand becomes trace from 1.2 to 1.4 m depth.							
1.5								M			
				Sand becomes trace from 1.8 to 2.0 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP25

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.630517
Longitude : 172.376123

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
0.5	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine. No silt observed from 0.4 m depth.				D	MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine. Trace cobbles encountered from 0.9 m depth. Cobbles become minor from 1.4 m depth.				M	MD-D		
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2019.11.27 - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 4/12/19

LOG OF TEST PIT TP26

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 27/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.630801
Longitude : 172.377121

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium. No rootlets observed from 0.4 m depth.				D	MD-D		
0.5											
1.0			GW	Fine to coarse GRAVEL with some sand and trace rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.5				Trace cobbles encountered from 1.4 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2019.11.27 - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 4/12/19

LOG OF TEST PIT TP27

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 27/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.631612
Longitude : 172.376997

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium.				D	MD-D		>>
0.5				Fine to coarse GRAVEL with some sand, trace cobbles and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
1.0			GW					M	MD-D		
1.5				Cobbles become minor from 1.4 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP28

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 27/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.632226
Longitude : 172.377512

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine.					MD-D		
0.5			GW	Fine to coarse GRAVEL with some sand; grey. Well graded, subangular to subrounded. Sand, fine to coarse. Trace cobbles encountered from 0.7 m depth.				D	L-MD		
1.0											
1.5				Trace rootlets observed from 1.4 to 1.6 m depth. Becomes brownish grey from 1.7 m depth.				M			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL
Loosely packed gravel encountered from 0.5 to 1.0 m depth.

LOG OF TEST PIT TP29

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 27/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.632008
Longitude : 172.378017

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand and silt; greyish brown. Well graded, subangular to subrounded. Sand, fine.					MD-D		
0.5			GW	Fine to coarse GRAVEL with some sand and trace cobbles; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.5				Becomes wet from 1.8 m depth.							
2.0				Cobbles become minor from 1.9 m depth.				W			
				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP30

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 27/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.631103
Longitude : 172.378188

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine.					MD-D		
0.5			GW	Fine to coarse GRAVEL with some sand and trace cobbles; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
1.5			GW	Trace cobbles encountered from 1.4 m depth.				M	MD-D		
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 >>

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP31

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 27/11/2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.628972
Longitude : 172.378419

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		
0.5				Becomes moist from 0.6 m depth.							
			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded,subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.0											
1.5				Gravel becomes fine to medium from 1.4 to 1.6 m depth.							
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP32

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 27/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.630257
Longitude : 172.378612

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
0.5	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium.				D	MD-D		
				Gravel and sand become fine to coarse from 0.6 m depth. No silt encountered from 0.7 m depth.							
1.0											
1.5				Cobbles become minor from 1.5 m depth.				M			
				Sand becomes trace from 1.8 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth
Scala Penetrometer met practical refusal.
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP33

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.625244
Longitude : 172.377003

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Fine to coarse GRAVEL with some sand and silt; greyish brown. Well graded, subangular to subrounded. Sand, fine.				D	MD-D		>>
0.5				Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
1.0				Trace sand and gravel becomes fine to medium from 1.0 to 1.1 m depth.							
			GW					M	MD-D		
1.5				Cobbles become minor from 1.6 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

TS = TOPSOIL
Partial sidewall collapse observed from 0.8 to 1.2 m depth.

LOG OF TEST PIT TP34

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd **Shear Vane No** : N/A
Date : 05/12/2019 **Logged By** : KF/CR
Max Test Pit Depth : 2 m **Reviewed By** : JW
Digger Type/Size : 24 Tonne **Latitude** : -43.62571
Bucket Type/Size : Bucket Excavator **Longitude** : 172.37585

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
	ALLUVIUM			Fine to coarse GRAVEL with some sand, silt and trace cobbles; greyish brown. Well graded, subangular to subrounded. Sand, fine.				D			
0.5			GW						MD-D		
1.0											
1.5				Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M			
			GW						MD-D		
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP35

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.626261
Longitude : 172.374476

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM			Fine to coarse GRAVEL with some sand and silt; greyish brown. Well graded, subangular to subrounded. Sand, fine.				D			>>
0.5				Becomes grey with trace cobbles and no silt from 0.4 m depth.							
				Sand becomes fine to coarse from 0.6 m depth.							
			GW						MD-D		
1.0								M			
1.5				Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
			GW						MD-D		
				Cobbles become minor from 1.9 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP36

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.62611
Longitude : 172.373398

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt; greyish brown. Well graded, subangular to subrounded. Sand, fine.				D	MD-D		
			SW	Fine to coarse SAND with trace gravel; grey. Well graded.					MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP37

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.625636
Longitude : 172.37306

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Fine to coarse GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine.				D	MD-D		
0.5			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.					MD-D		
1.0			GW	Fine to coarse GRAVEL with some sand and trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.5				Sand becomes trace from 1.8 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP38

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.625349
Longitude : 172.373725

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
	ALLUVIUM		GW	Fine to coarse GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine.				D	MD-D		>>
0.5				Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
1.0				Sand becomes trace from 0.9 to 1.2 m depth.							
			GW					M	MD-D		
1.5				Cobbles become minor from 1.4 m depth.							
				No rootlets encountered from 1.6 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

TS = TOPSOIL

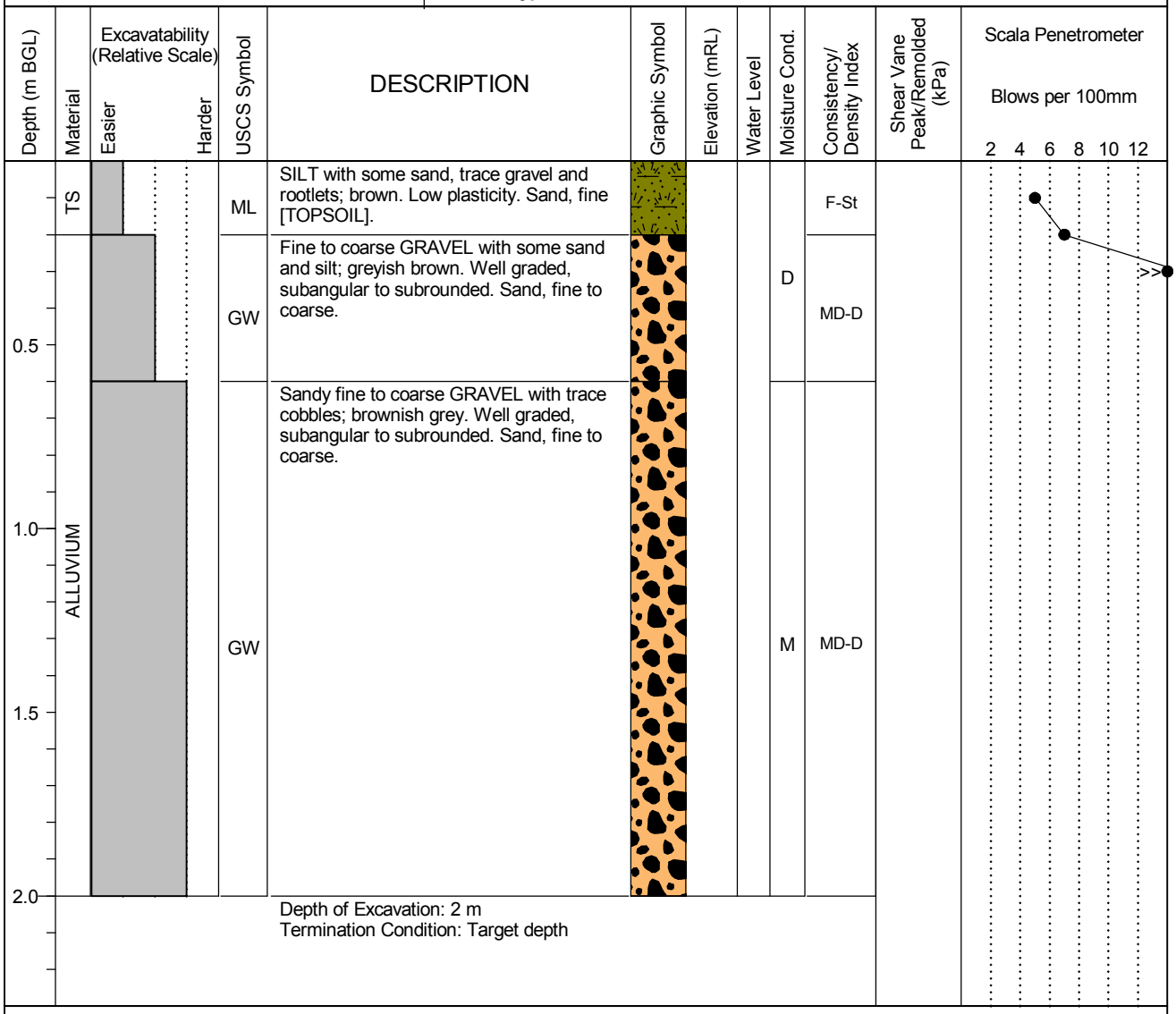
GEOTECH TEST PIT LOG 2019.12.XX - REMAINING TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 9/12/19

LOG OF TEST PIT TP39

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.625512
Longitude : 172.374782



Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2019.12.XX - REMAINING TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 9/12/19

LOG OF TEST PIT TP40

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.62479
Longitude : 172.375034

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine. Gravel becomes minor from 0.3 m depth.					St-VSt		
0.5			GW	Fine to coarse GRAVEL with some sand, silt and trace rootlets; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace cobbles and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.5				Cobbles become minor from 1.6 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP41

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.624988
Longitude : 172.376043

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
0.2	ALLUVIUM		GW	Fine to coarse GRAVEL with some sand; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		
0.5			GW	Sandy fine to coarse GRAVEL with trace cobbles; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse. Becomes moist from 1.0 m depth.				M			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

TS = TOPSOIL

LOG OF TEST PIT TP42

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.624293
Longitude : 172.376247

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Fine to coarse GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine.				D	MD-D		
0.5				Sandy fine to coarse GRAVEL with trace cobbles and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
				Sand becomes trace from 0.7 m depth.							
1.0			GW					M	MD-D		
1.5				Cobbles become minor from 1.4 m depth.							
				No rootlets encountered from 1.6 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

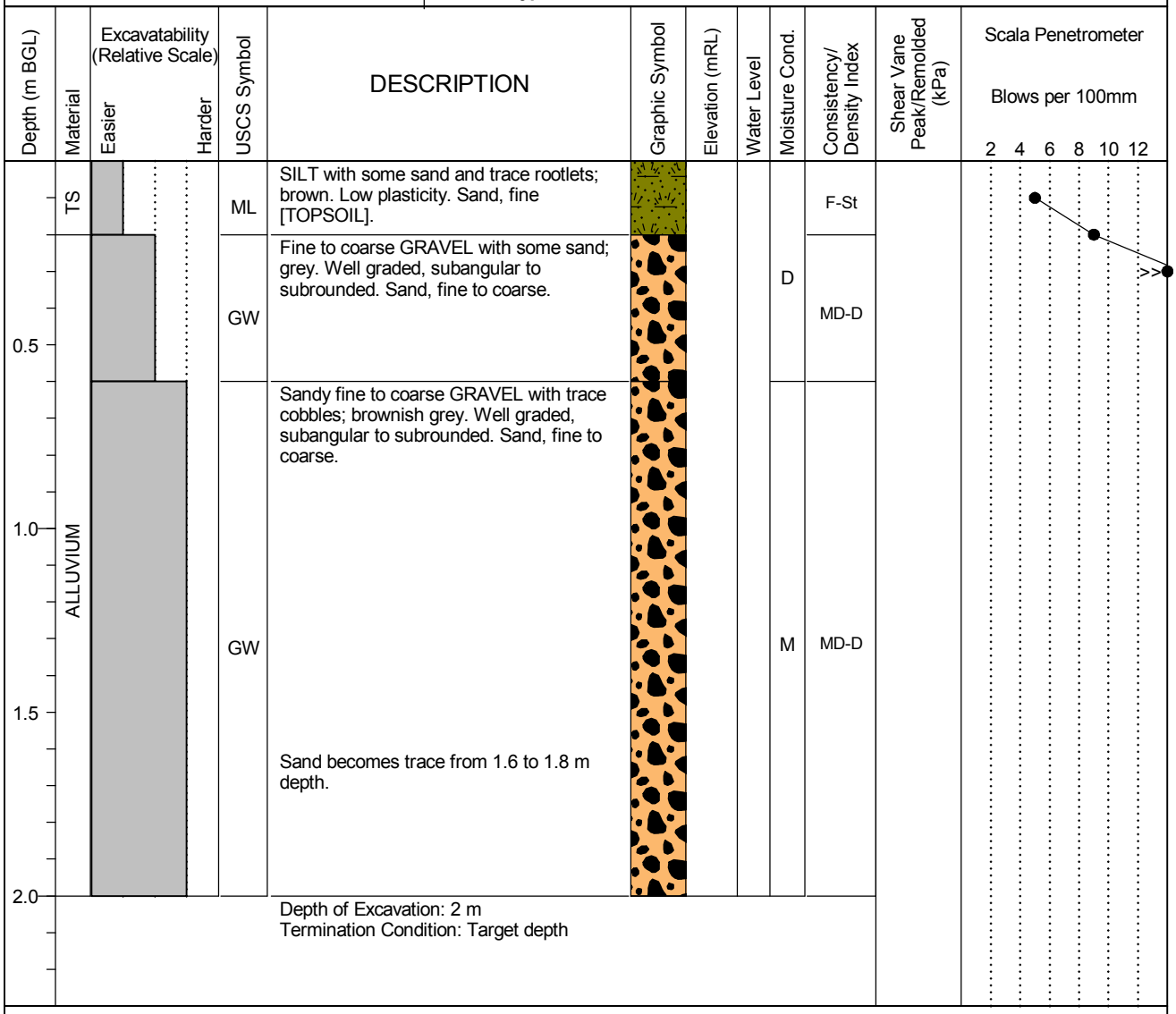
TS = TOPSOIL
Partial sidewall collapse observed from 0.4 m depth.
Noticeable sand decrease from 0.7 m depth.

LOG OF TEST PIT TP43

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.628731
Longitude : 172.377389



Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

TS = TOPSOIL

GEOTECH TEST PIT LOG 2019.12.XX - REMAINING TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 9/12/19

LOG OF TEST PIT TP44

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.628451
Longitude : 172.378087

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		4
0.5	ALLUVIUM		GW	Fine to coarse GRAVEL with some sand; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		6
1.0			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		8
1.5											10
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							12 >>

Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

GEOTECH TEST PIT LOG 2019.12.XX - REMAINING TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 9/12/19

LOG OF TEST PIT TP45

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2.1 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.62816
Longitude : 172.378736

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
0.5	ALLUVIUM		GW	Fine to coarse GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine.				D	MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace cobbles and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse. Sand becomes trace from 1.0 to 1.1 m depth.				M	MD-D		
1.5				Sand becomes trace from 1.5 to 1.7 m depth. Cobbles become minor from 1.8 m depth.							
2.0				Depth of Excavation: 2.1 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth.
Scala Penetrometer met target depth
Standing groundwater was not encountered.

TS = TOPSOIL
Partial sidewall collapse observed from 0.8 m depth.

APPENDIX 3:

ECan Borelogs

Bore or Well No	BX23/0895
Well Name	Selwyn Road
Owner	Mike & Tania Croucher

Environment Canterbury Regional Council
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Well Number	BX23/0895	**File Number**	
Owner	Mike & Tania Croucher	**Well Status**	Active (exist, present)
Street/Road	Selwyn Road	**NZTM Grid Reference**	BX23:49887-68726
Locality	Springston	**NZTM X and Y**	1549887 - 5168726
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic and Stockwater,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	53.50m	**Water Level Count**	1
Diameter	150mm	**Initial Water Level**	5.80m below MP
Measuring Point Description	Top of Casing	**Highest Water Level**	5.80m below MP
Measuring Point Elevation		**Lowest Water Level**	5.80m below MP
Elevation Accuracy		**First reading**	06 May 2019
Ground Level	0.45m below MP	**Last reading**	06 May 2019
Strata Layers	9	**Calc Min 95%**	
Aquifer Name		**Aquifer Tests**	0
Aquifer Type		**Yield Drawdown Tests**	1
Drill Date	16 Apr 2019	**Max Tested Yield**	
Driller	Clemence Drilling Contractors	**Drawdown at Max Tested Yield**	
Drilling Method	Rotary/Percussion	**Specific Capacity**	0.56 l/s/m
Casing Material	Steel	**Last Updated**	01 Oct 2019
Pump Type		**Last Field Check**	06 May 2019
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	51.5	53.5				

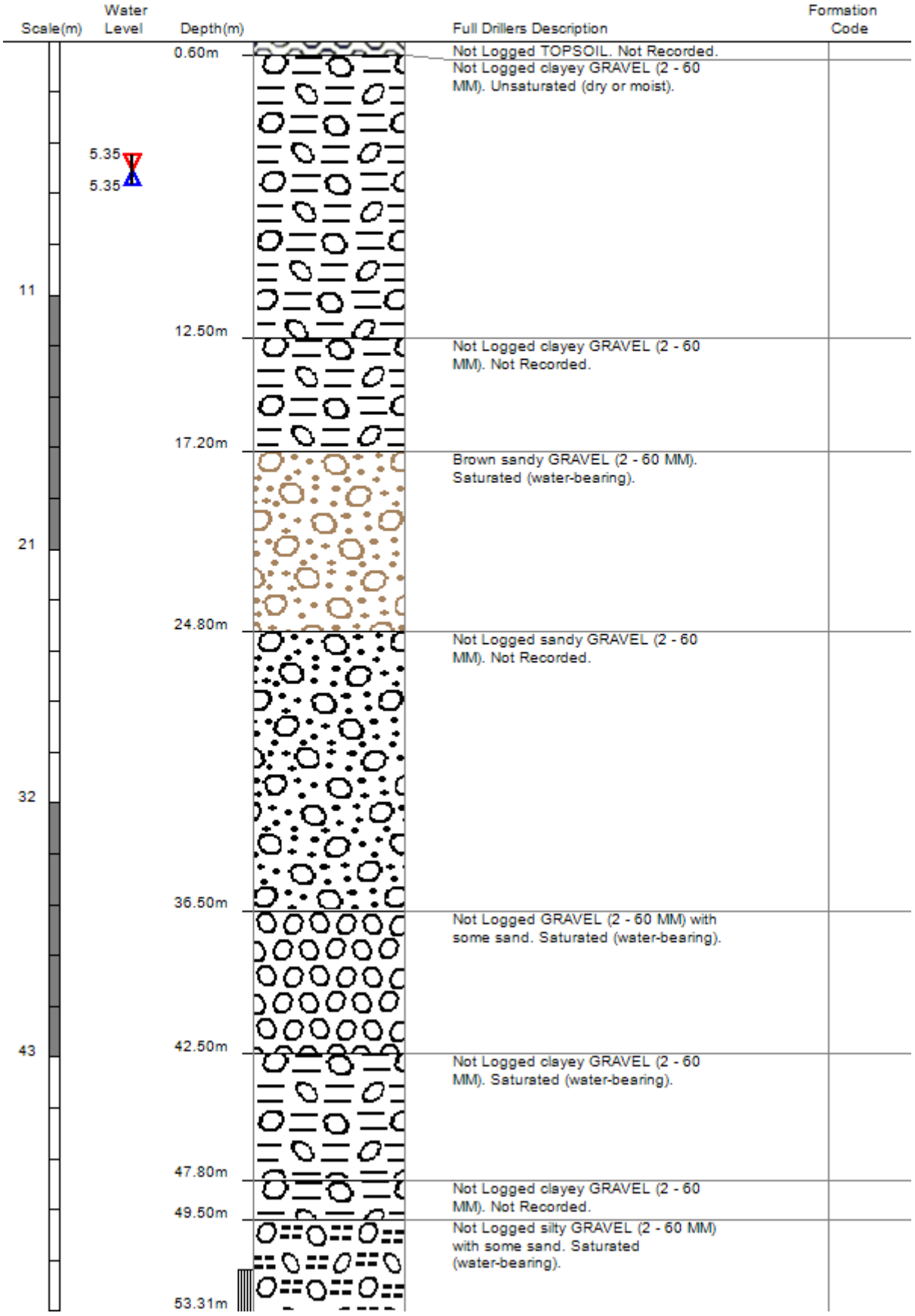
Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
06 May 2019	1	2.5	32.99546	4.5	15

Borelog for well BX23/0895

Grid Reference (NZTM): 1549888 mE, 5168727 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: m +MSD Accuracy:
Driller: Clemence Drilling Contractors
Drill Method: Rotary/Percussion
Borelog Depth: 53.3 m Drill Date: 16-Apr-2019

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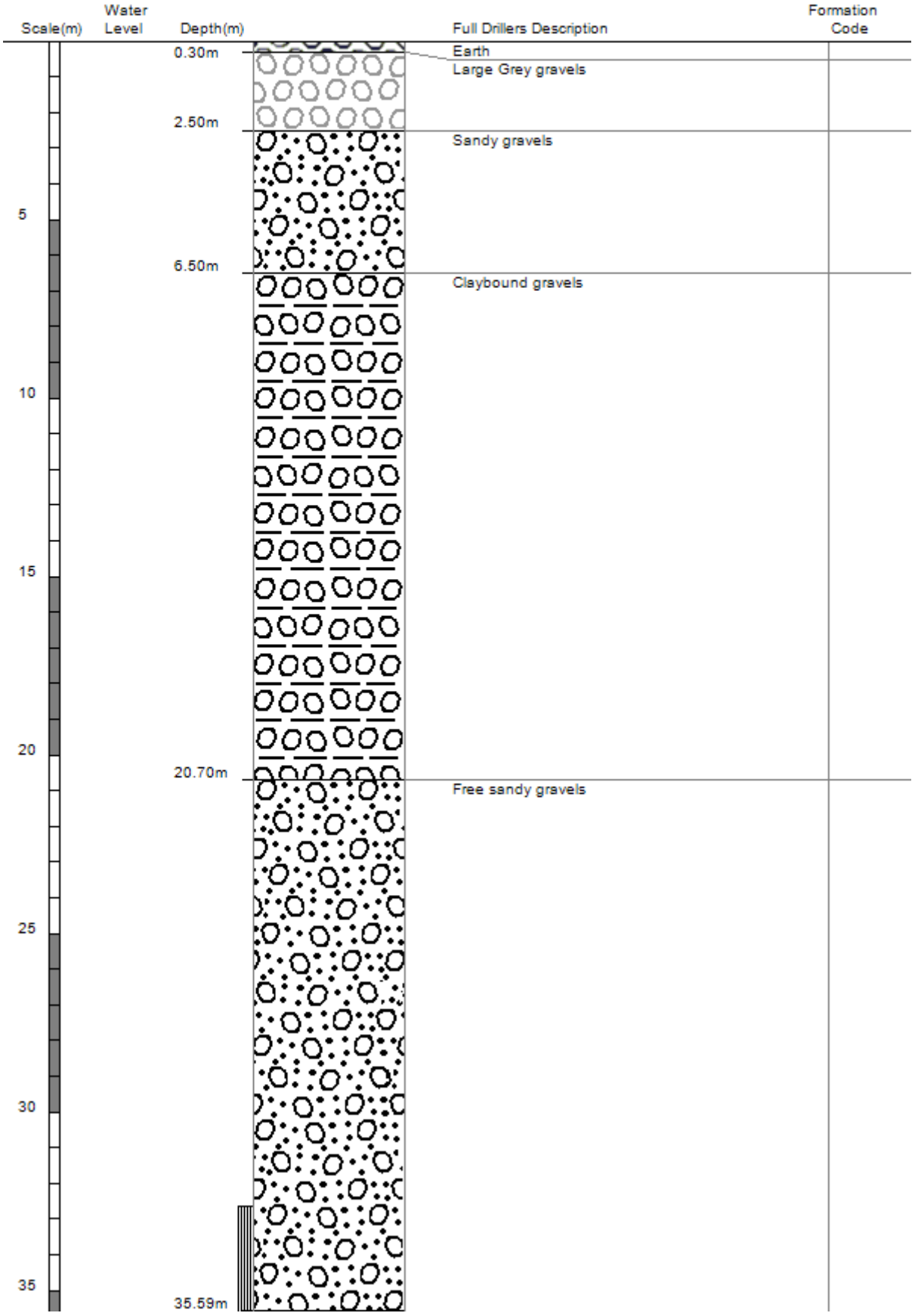
Bore or Well No	M36/4387
Well Name	DUNNS CROSSING RD
Owner	Mr & Mrs I & D C Robertson

Well Number	M36/4387	**File Number**	CO6C/02792
Owner	Mr & Mrs I & D C Robertson	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49703-68988
Locality	ROLLESTON	**NZTM X and Y**	1549703 - 5168988
Location Description		**Location Accuracy**	2 - 15m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	35.60m	**Water Level Count**	0
Diameter	200mm	**Initial Water Level**	5.65m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	36.46m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	+-2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	5	**Calc Min 95%**	6.50m below MP
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	2
Drill Date	11 Oct 1991	**Max Tested Yield**	18 l/s
Driller	McMillan Drilling Ltd	**Drawdown at Max Tested Yield**	10 m
Drilling Method	Rotary/Percussion	**Specific Capacity**	1.64 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	. es		

Borelog for well M36/4387

Grid Reference (NZTM): 1549704 mE, 5168988 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 36.5 m +MSD Accuracy: < 2.5 m
Driller: McMillan Drilling Ltd
Drill Method: Rotary/Percussion
Borelog Depth: 35.6 m Drill Date: 11-Oct-1991

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



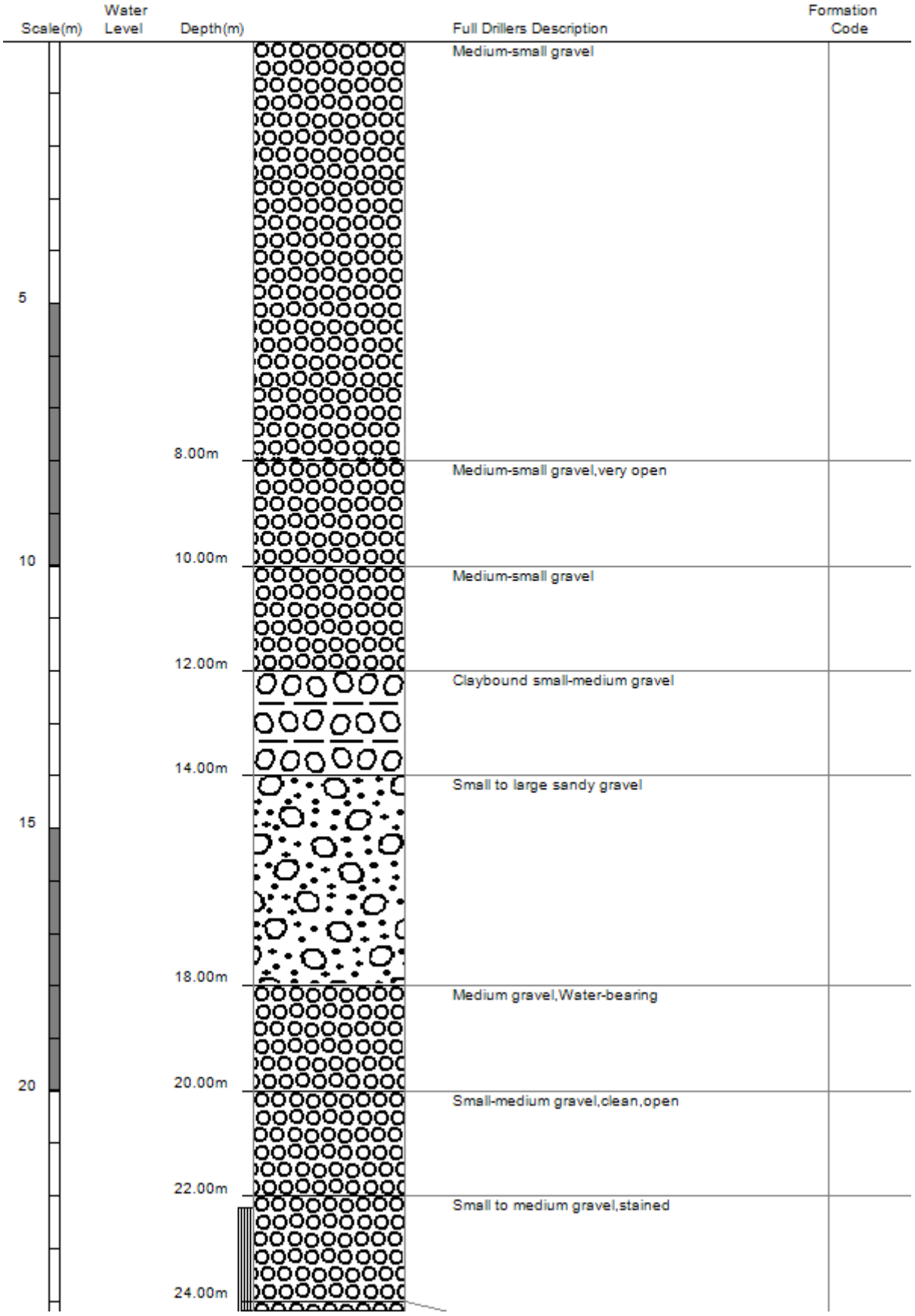
Bore or Well No	M36/4449
Well Name	DUNNS CROSSING RD
Owner	TYACKE & R

Well Number	M36/4449	**File Number**	CO6C/02046
Owner	TYACKE & R	**Well Status**	Not used
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49508-69470
Locality	ROLLEST ON	**NZTM X and Y**	1549508 - 5169470
Location Description	DT 1	**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Irrigation,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	24.20m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	38.81m above MSL(L yttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	<2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	9	**Calc Min 95%**	7.70m below MP
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	09 Jun 1992	**Max Tested Yield**	6 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	5 m
Drilling Method	Cable Tool	**Specific Capacity**	1.36 l/s/m
Casing Material		**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Borelog for well M36/4449

Grid Reference (NZTM): 1549508 mE, 5169471 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 38.8 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 24.2 m Drill Date: 09-Jun-1992

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Bore or Well No	M36/4450
Well Name	DUNNS CROSSING RD
Owner	Mr & Mrs L K & J C Blackmore

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/4450	**File Number**	CO6C/02046
Owner	Mr & Mrs L K & J C Blackmore	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49388-69660
Locality	ROLLESTON	**NZTM X and Y**	1549388 - 5169660
Location Description	DP61278 LOT 2	**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Irrigation,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	25.20m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	39.62m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	8	**Calc Min 95%**	8.10m below MP
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	09 Apr 1992	**Max Tested Yield**	6 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	6 m
Drilling Method	Cable Tool	**Specific Capacity**	1.00 l/s/m
Casing Material		**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	23.2	25.2				

Step Tests

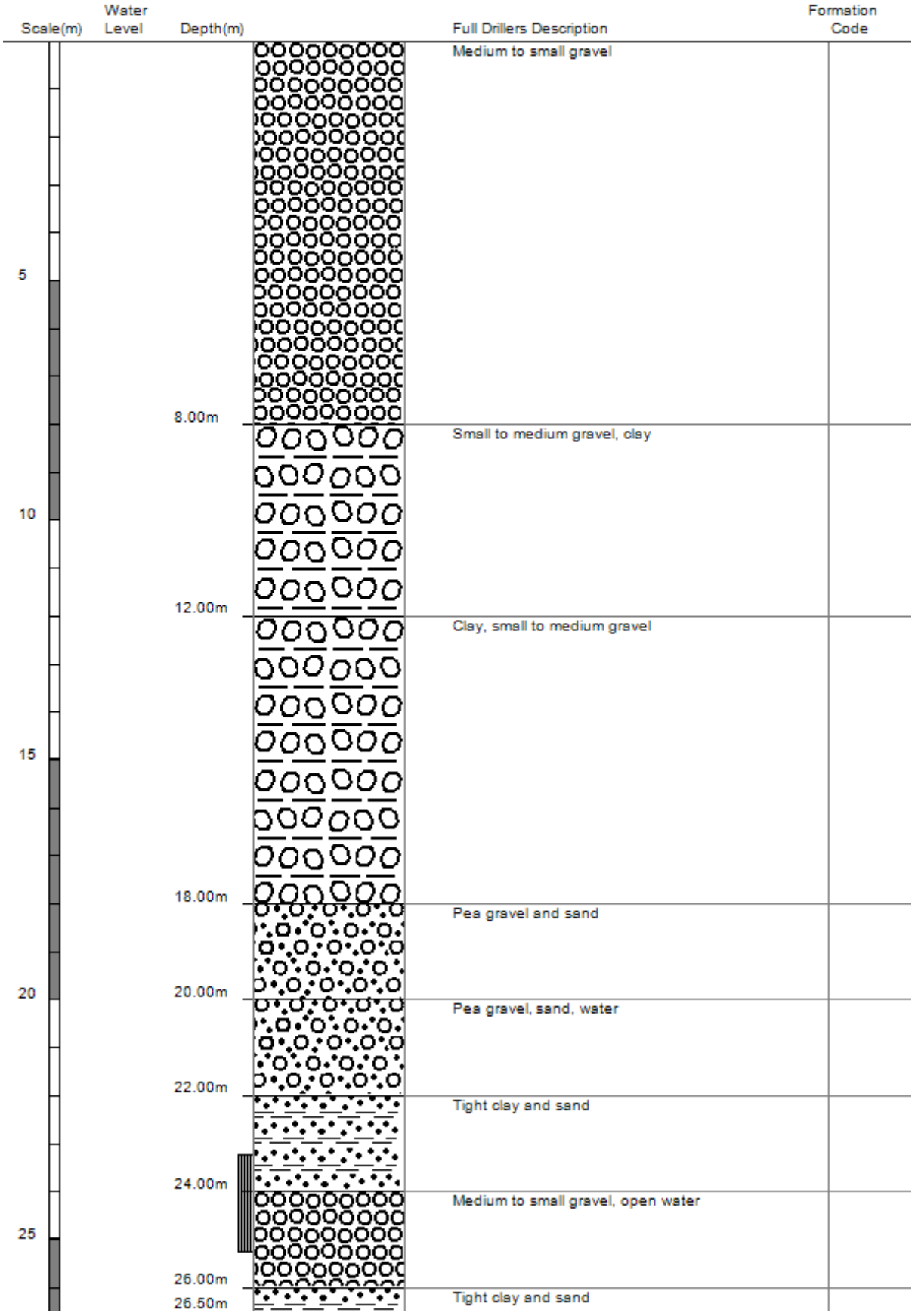
Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
09 Apr 1992	1	6.1	80.50892	6.1	0

No comments for this well

Borelog for well M36/4450

Grid Reference (NZTM): 1549388 mE, 5169661 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 39.6 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 26.5 m Drill Date: 09-Apr-1992

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Bore or Well No	M36/7416
Well Name	SELWYN ROAD
Owner	Hsyth Limited

Well Number	M36/7416	**File Number**	CO6C/20361
Owner	Hsyth Limited	**Well Status**	Active (exist, present)
Street/Road	SELWYN ROAD	**NZTM Grid Reference**	BX23:49058-68781
Locality	ROEST ON	**NZTM X and Y**	1549058 - 5168781
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Irrigation,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	46.90m	**Water Level Count**	0
Diameter	200mm	**Initial Water Level**	5.50m below MP
Measuring Point Description	ToC	**Highest Water Level**	
Measuring Point Elevation	35.86m above MSL(Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	<5 m	**First reading**	
Ground Level	0.32m below MP	**Last reading**	
Strata Layers	13	**Calc Min 95%**	11.10m below MP
Aquifer Name		**Aquifer Tests**	0
Aquifer Type		**Yield Drawdown Tests**	1
Drill Date	18 Aug 2003	**Max Tested Yield**	
Driller	McMillan Drilling Ltd	**Drawdown at Max Tested Yield**	
Drilling Method	Rotary/Percussion	**Specific Capacity**	3.83 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type		**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	44.9	46.9				

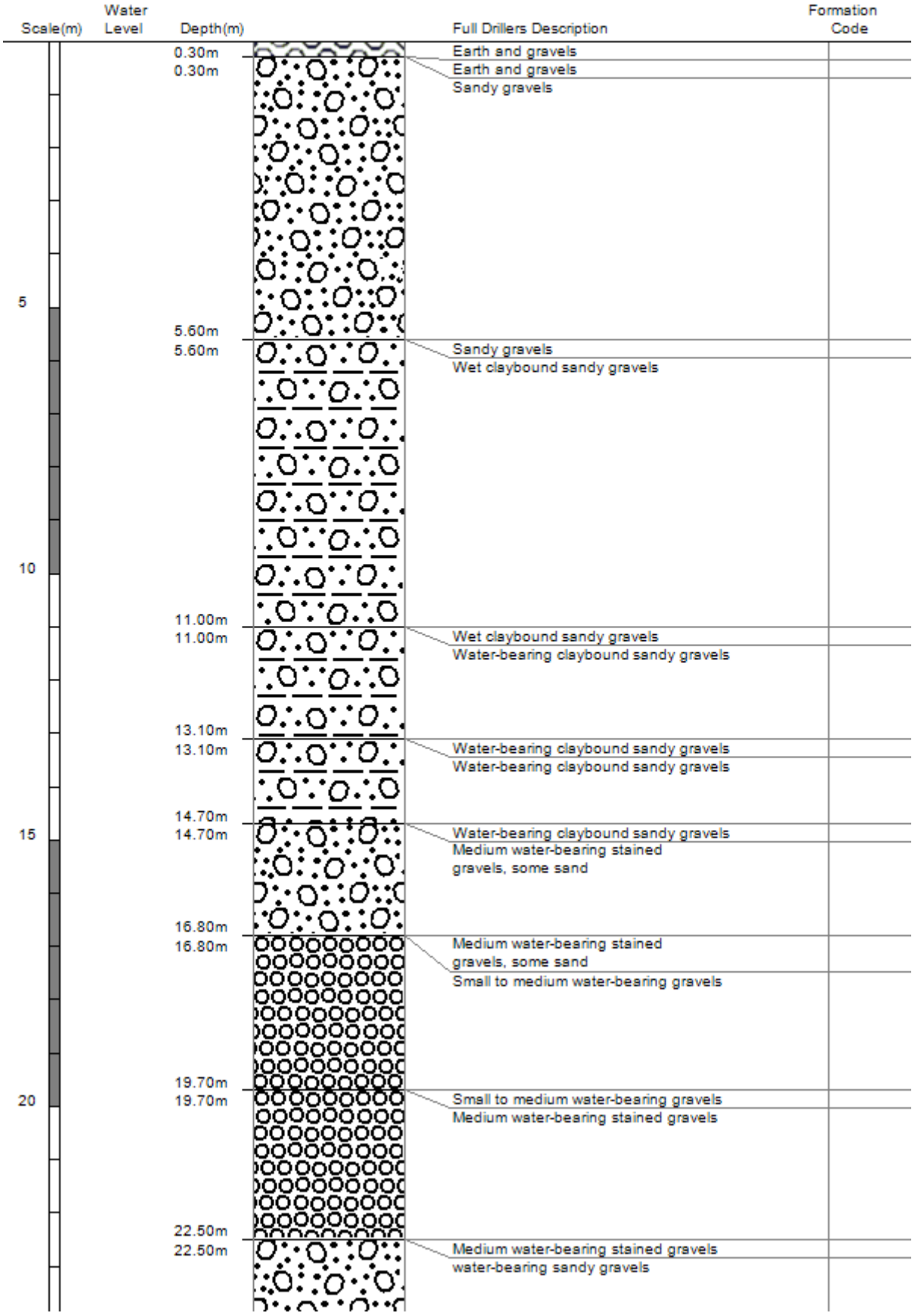
Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
18 Aug 2003	1	15.91128	209.999985	4.15	3

Borelog for well M36/7416

Grid Reference (NZTM): 1549058 mE, 5168781 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 35.5 m +MSD Accuracy: < 0.5 m
Driller: McMillan Drilling Ltd
Drill Method: Rotary/Percussion
Borelog Depth: 47.7 m Drill Date: 18-Aug-2003

Environment Canterbury Regional Council
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Bore or Well No	M36/20535
Well Name	870 Goulds Road
Owner	Mr S & Mrs M Baxter

Well Number	M36/20535	**File Number**	CO6C/31914
Owner	Mr S & Mrs M Baxter	**Well Status**	Active (exist, present)
Street/Road	870 Goulds Road	**NZTM Grid Reference**	BX23:50017-69231
Locality	Rolleston	**NZTM X and Y**	1550017 - 5169231
Location Description		**Location Accuracy**	10 - 50m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic and Stockwater,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	30.00m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	7.10m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	35.00m above MSL(Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	<5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	4	**Calc Min 95%**	
Aquifer Name		**Aquifer Tests**	0
Aquifer Type		**Yield Drawdown Tests**	0
Drill Date	04 Feb 2011	**Max Tested Yield**	
Driller	Daly Water Wells Ltd	**Drawdown at Max Tested Yield**	
Drilling Method	Rotary Rig	**Specific Capacity**	
Casing Material	STEEL	**Last Updated**	07 Dec 2011
Pump Type		**Last Field Check**	
Water Use Data	No		

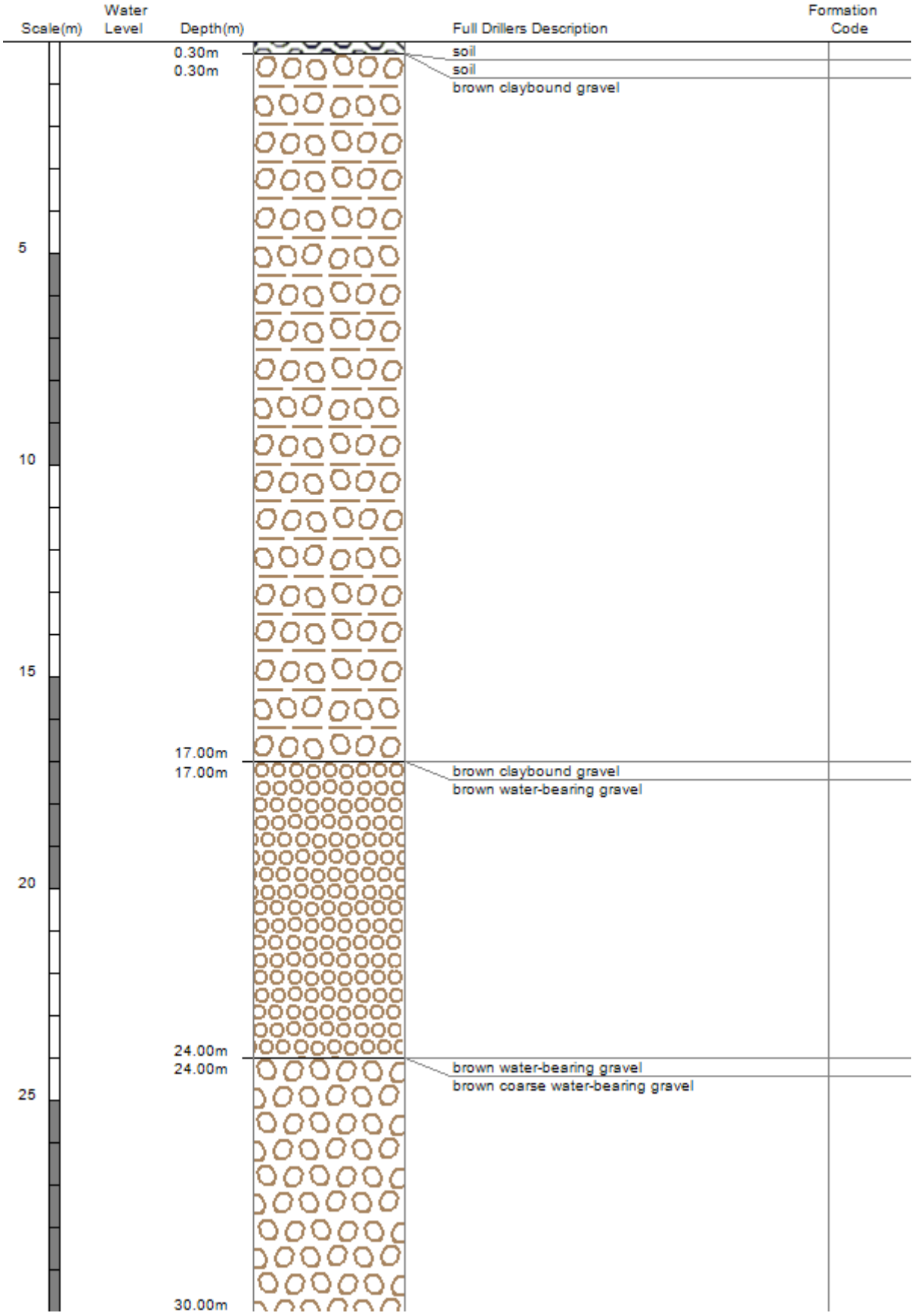
No screen data for this well

No step tests for this well

Borelog for well M36/20535

Grid Reference (NZTM): 1550018 mE, 5169231 mN
Location Accuracy: 10 - 50m
Ground Level Altitude: 35.0 m +MSD Accuracy: < 0.5 m
Driller: Daly Water Wells Ltd
Drill Method: Rotary Rig
Borelog Depth: 30.0 m Drill Date: 04-Feb-2011

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha





ENGEO

Expect Excellence

Geotechnical Investigation

597 East Maddisons Road

Rolleston

Christchurch

Submitted to:

Hughes Developments Ltd

Christchurch

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ACENZ

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ENGEO Document Control:

Report Title	Geotechnical Investigation - 597 East Maddisons Road, Rolleston			
Project No.	12903.000.005	Doc ID	97	
Client	Hughes Developments Ltd	Client Contact	Kelvin Back	
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Date	Revision Details/Status	WP	Author	Reviewer
03/09/2020	Issued to Client	BK	JRW	DEB

1 Introduction

ENGEO Ltd was requested by Hughes Developments Ltd to undertake a geotechnical investigation of the property at 597 East Maddisons Road, Rolleston, Christchurch, as outlined in our variation proposal (ref: P2020.001.804_01).

The purpose of this assessment is to develop a conceptual geological model of the site, assess the likely future land performance, comment on the suitability of the site for residential subdivision, address the requirements of Section 106 of the Resource Management Act (RMA), and provide recommendations for subdivision works and foundations for typical timber framed residential dwellings.

Our scope of works includes the following:

- Complete a desktop study of relevant available geotechnical and geological publications, including the NZ Geotechnical and Environment Canterbury Databases.
- Undertake a geotechnical site walkover.
- Undertake 29 hand auger boreholes with associated Scala penetrometer tests to assess the near surface material types and strength characteristics.
- Organise and observe the excavation of 26 test pits, including geotechnical logging of the exposed soils.
- Preparation of this report outlining our findings on the ground conditions and comment on the suitability of the site for residential subdivision, including the provision of the likely foundation Technical Category, conceptual foundation recommendations for typical timber framed residential dwellings, and discuss likely geohazards as required by Section 106 of the RMA.

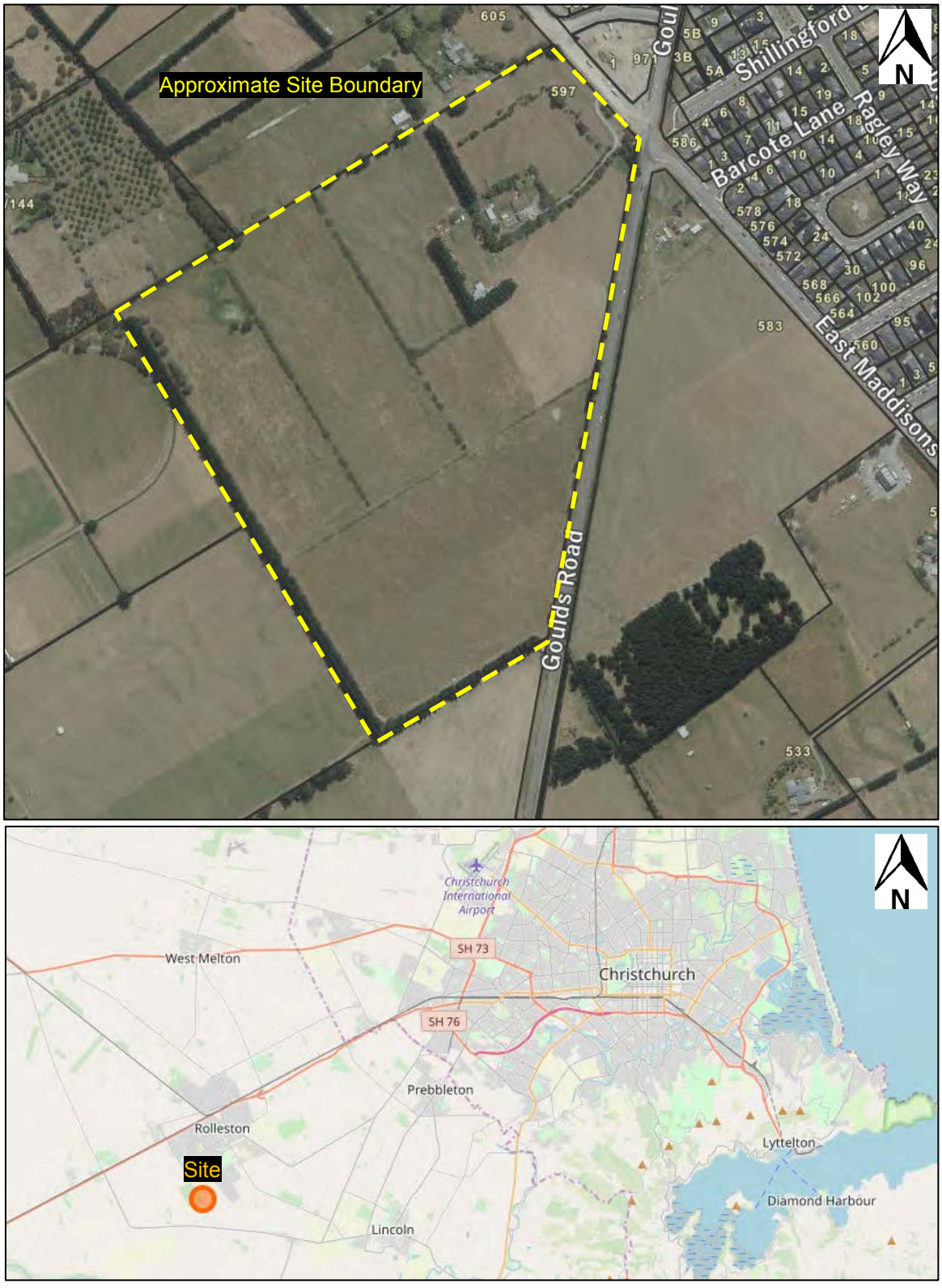
2 Site Description

The site comprises of one property with a total area of four hectares and the following legal description (Canterbury Maps):

- LOT 1 DP 57004 BLK III

The site is located approximately 3 km south of Rolleston town centre and is bound on all sides by rural properties (Figure 1).

Figure 1: Site Location Plan



Images sourced from Canterbury Maps and "© OpenStreetMap contributors". Not to scale.

3 Geological Model

3.1 Regional Geology

The site has been regionally mapped by GNS (Forsyth et al., 2008) as being underlain by brownish grey river alluvium (Q2a).

3.2 Geomorphology

The site comprises relatively flat ground, with gentle undulations and depressions in some areas. As evident on aerial imagery (Canterbury Maps, 2019) and observed during our site walkover conducted on 25 August 2020, undulating and depressed ground can be attributed to paleo-channels, which traverse the site in a general northwest to southeast direction (Figure 2). Based on observations, sandy silt deposits with variable thickness are expected to have in-filled the paleo-channels where they have not remained as channel features. Inferred paleo-channels have been mapped to give an indication of areas with potential channel in-fill (Appendix 1).

Figure 2: Historical Aerial Photo – 1970 - 1974



Image sourced from Canterbury Maps. Not to scale.

3.3 Geohazards

3.3.1 Seismicity

There are no known or mapped faults in the immediate area of the site, however the site may be at risk of ground shaking induced by movement of proximal or distal faults.

The site is located between two recently discovered fault systems, the Greendale Fault and the Port Hills Fault, the ruptures of which initiated the ongoing Canterbury Earthquake Sequence (CES). The Greendale Fault has been mapped approximately 6 km north / northwest of the site and trends roughly east-west with a surface rupture length of approximately 28 km (GNS, 2015), while the Port Hills Fault remains unmapped as the fault did not rupture at the surface. Movement on the Port Hills Fault is believed to have extended to within 1 km to 2 km below ground surface.

Large regional areas of faulting (GNS, 2015) namely the Ashley Fault, Porters Pass - Amberley Fault Zone, and the Hope and Alpine Faults, are further afield but present a high seismic hazard to the Christchurch area due to the anticipated size of earthquakes generated. The largest of these faults is the Alpine Fault, which has a return period of 250 - 300 years and is expected to produce a M8 earthquake. The last rupture on the Alpine Fault is believed to have occurred in 1717 (Pettinga et al., 2001).

3.3.2 Liquefaction and Lateral Spreading

The site is located in an area mapped where “damaging liquefaction is unlikely” (NZGD Map CGD5140, 2012), and a “zone of very low liquefaction potential” (GNS, 2006).

3.4 Site Investigation

Site investigations to assess the shallow subsurface material types and strength characteristics were undertaken by ENGEO on 27 and 28 August 2020. Twenty-six test pits and 29 hand auger investigations with associated Scala penetrometer tests were completed to a maximum depth of 2.2 m below ground level.

The investigations revealed subsurface conditions across the site are consistent with the published geological mapping, as summarised in Table 1. Hand auger and test pit logs are attached as Appendix 2.

Table 1: Summary of Subsurface Investigations

Soil Type	Depth to Top of Layer (m)	General Layer Thickness (m)	Density / Consistency	Additional Comments
TOPSOIL	0.0	0.1 – 0.3	Stiff to Very Stiff	-
Sandy GRAVEL	0.3	Unknown	Medium Dense to Very Dense	Tightly packed and consistent across the site

3.5 ECan Boreholes

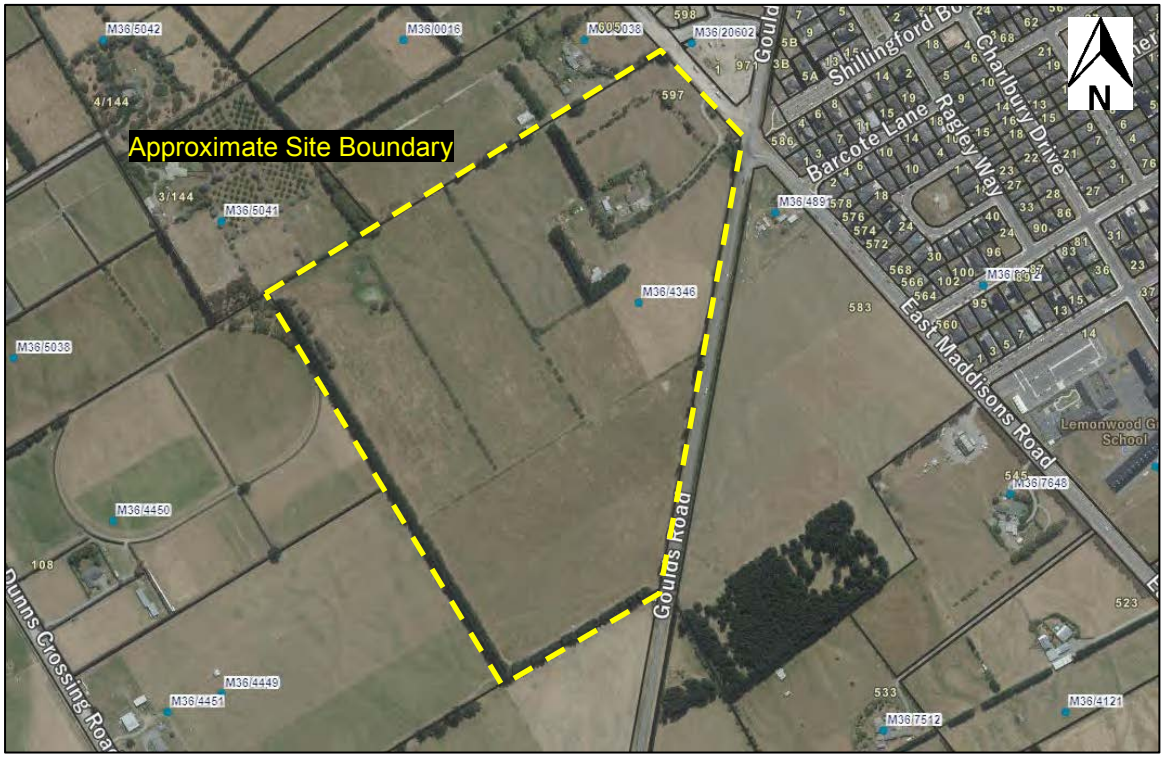
A review of five, deep ECan borehole logs was conducted. The first (M36/4346), is located on-site, and appear to be water wells providing the properties irrigation and domestic supply. The other boreholes are located to the east (M36/4891), north (M36/5041), south (M36/4449) and west (M36/7512) of the site.

Well logs from the five holes of interest are attached as Appendix 3 and summarised in Table 2.

Table 2: Generalised Summary of ECan Boreholes

ECan Borehole	Total Depth (m)	Water Level Below Ground Level (m)	Generalised Borelog as Logged by Driller
M36/4346	28.5	9.71	Gravel with silt and sand to 28.5 m depth. A layer of silt recorded from 6 to 8 m depth.
M36/4891	26.7	9.81	Gravel to 26.7 m depth.
M36/5041	34	9.73	Gravel with silt and sand to 34 m depth.
M36/4449	24.2	9.27	Gravel to 24.2 m depth.
M36/7512	29	9.32	Sandy gravel to 21.3 m depth.

Figure 3: Nearby ECan Borehole Locations



Aerial photograph sourced from Canterbury Maps. Not to scale.

3.6 Groundwater

Groundwater is recorded in the surrounding ECan boreholes at approximately 9 to 10 m depth.

3.7 Site Seismic Class

In accordance with NZS 1170.5:2004, Class D applies to this particular site, defining it as a 'deep soft soil site'.

4 Liquefaction Analysis

Owing to the nature of the subsurface materials and depth to groundwater at the site, we consider the potential for liquefaction and lateral spreading on the site to be very low.

We therefore consider future land performance to be in line with Technical Category 1 (TC1), whereby future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances.

5 RMA Section 106 Requirements and Suitability to Subdivide

Section 106 of the Resource Management Act 1991 states a consent authority may refuse to grant a subdivision consent, or may grant a consent subject to specific consent conditions if it considers that:

- There is a significant risk from natural hazards; or
- Sufficient provision has not been made for legal or physical access to each allotment to be created by the subdivision.

An assessment of the risk from natural hazards as required by the RMA includes the following:

- The likelihood of natural hazards occurring (whether individually or in combination);
- The material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and
- Any likely subsequent use of the land in respect of which the consent is sought that would accelerate, worsen, or result in material damage of the kind referred to in paragraph (b).

We have assessed the risk of natural hazards at the site in accordance with Section 106 of the Resource Management Act (RMA) and considered the risk to the site from rockfall, inundation (debris), slope stability, subsidence, flooding and tsunami. Based on our observations and the nature of the site, its performance during the CES, and the site's distance from the nearest significant watercourse, we consider it is unlikely for the site to be subject to natural hazards such as rockfall, inundation (debris), slope stability, subsidence, flooding and tsunami. As such, the site is considered suitable for subdivision from a geotechnical perspective.

6 Geotechnical Recommendations

6.1 Earthworks

Earthworks carried out for the subdivision shall be in accordance with NZS 4404:2010, Land Development and Subdivision Infrastructure and NZS 4431:1989, Code of Practice for Earth filling for Residential Development. In particular, any areas to receive fill should be stripped of all vegetation, topsoil, non-engineered fill, soft or organic soils prior to fill placement.

Fill may comprise clean native (site won) sandy gravel or silty soils, or clean imported soils and / or granular fill, compacted to achieve no less than 95% of maximum dry density. Fill faces steeper than 1V:1H and higher than 600 mm should be retained and referred back to ENGEO. Although unlikely, where any springs or groundwater seeps are encountered, they should be intercepted with suitable drainage and discharged to a Council approved outlet.

All unretained batters of pond and stormwater drains constructed with the native sandy gravel material should be at an inclination no steeper than 1V:3H, with protection schemes in place to control erosion of the formed batters within the waterways.

A comprehensive earthworks specification should be provided to the earthworks contractor prior to starting excavations and an inspection / testing regime agreed, along with a robust erosion and sediment control plan.

6.2 Subdivision Roading

Vegetation, any organic or deleterious material, topsoil and non-engineered fill under pavement areas should be removed from the site prior to aggregate placement. Based on our observations during testing, we consider the native ground below the topsoil at the site should provide an adequate subgrade for the proposed pavement areas.

6.3 Stormwater Control

Concentrated stormwater flows from all impermeable areas must be collected and carried in sealed pipes to the Council system or an alternative disposal point subject to approval from Council. Uncontrolled stormwater must not be allowed to saturate the ground as this will potentially affect future foundation performance both statically and during future seismic activity.

6.4 Foundations

Foundations for future proposed residential dwellings within the subdivision may comprise shallow pad, strip, or slab foundations designed in accordance with the provisions of NZS 3604 Timber Framed Buildings.

Site specific testing will be required for Building Consent, to confirm the bearing materials and capacity. For preliminary design, we anticipate that a geotechnical Ultimate Bearing Capacity of 300 kPa may be assumed for foundations bearing on native sandy gravel or engineered fill, below any topsoil. All topsoil shall be stripped from within building footprints. We anticipate building pad excavations to be typically 0.3 m depth based on our subsurface investigations.

6.5 Additional Considerations

The following should also be considered in further stages of the development:

- Development of an earthworks specification addressing site grading.
- Review of the geotechnical aspects of the site grading and foundation plans.
- Geotechnical observations and testing during construction.
- Lot specific geotechnical reports.

7 References

Canterbury Maps, Groundwater. Retrieved August 2020, from http://canterburymaps.govt.nz/Viewer.

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Selwyn District Council, Property Search, retrieved August 2020, from https://www.selwyn.govt.nz/my-property/rates/search-properties.

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Standards Association of New Zealand (2010). NZS 3604:2010. Timber Framed Buildings.

Standards Association of New Zealand (2010). NZS 4404:2010. Land Development and Subdivision Infrastructure.

The Ministry of Business, Innovation, and Employment (2016). New Zealand Geotechnical Database. Retrieved August 2020, from https://www.nzgd.org.nz.

8 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by



Jed Watts

Engineering Geologist

Report reviewed by



Don Bruggers, CMEngNZ (CPEng)

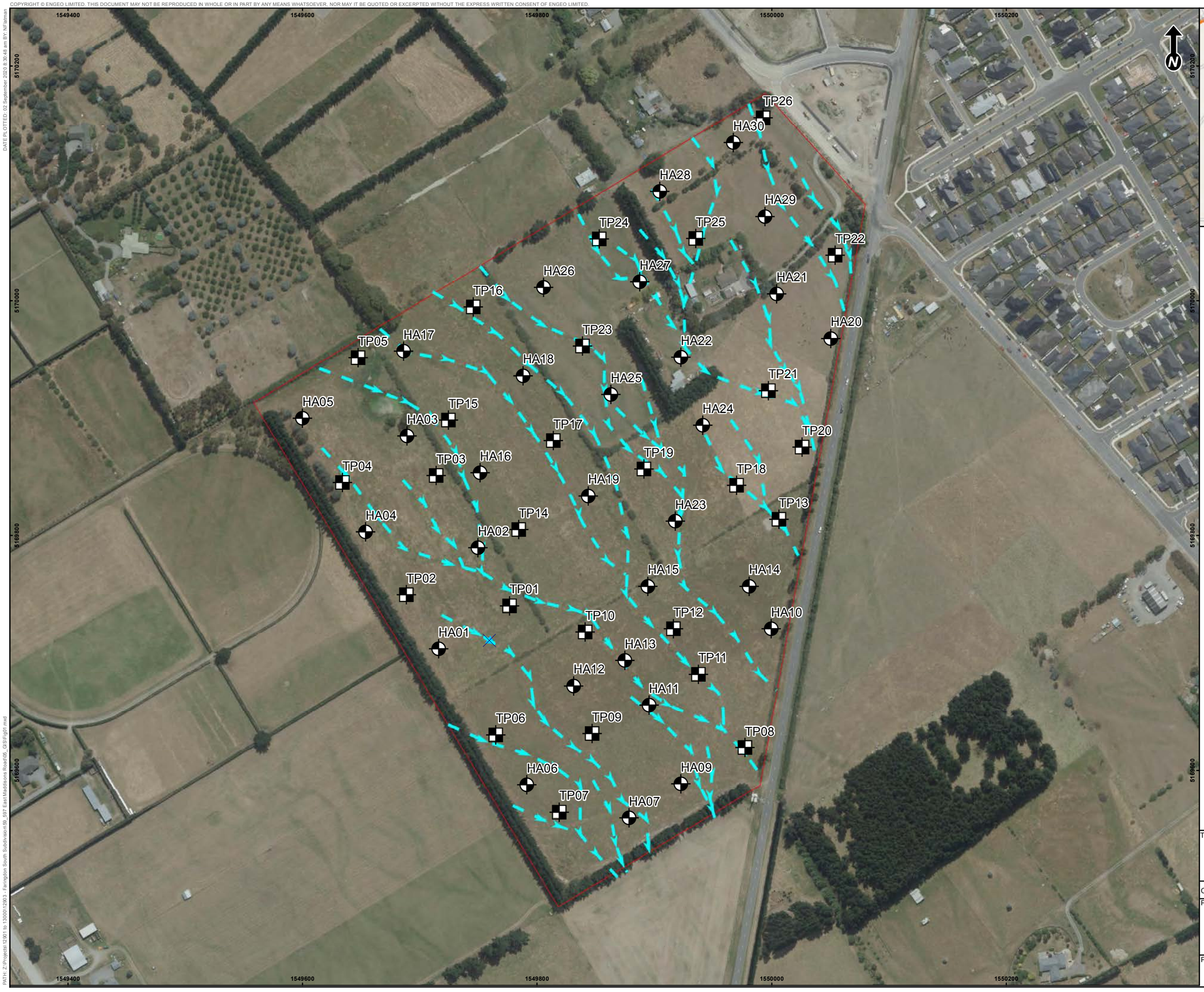
Principal Engineer

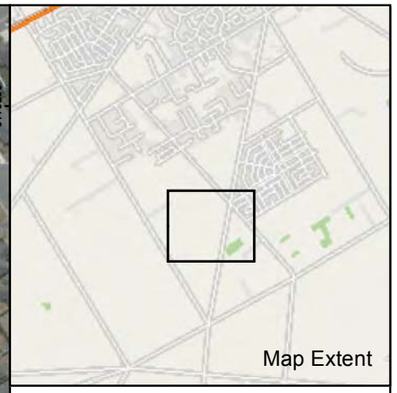
APPENDIX 1:

Site Plan and Inferred Paleo Channels

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DATE PLOTTED: 02 September 2020 8:30:48 am BY: NFlatman





Legend

- Hand auger locations
- Test pit locations
- Flow paths
- Site boundary

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

0 50 100
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Christchurch Office
124 Montreal Street Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title: Geotechnical Site Location Plan

Client: Hughes Developments		Figure No: 1
Project: 597 East Maddisons Road Rolleston	Designed: NF Drawn: NF Checked: DRAFT Date: Sep 20	Size: A3
Proj No: 12903.000.005	Scale: 1:3,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

PATH: Z:\Projects\12901 to 13000\12903 - Farringdon South Subdivision\59_597 East Maddisons Road\05_GIS\Fig01.mxd

APPENDIX 2:

ENGEO Hand Auger and Test Pit Logs

LOG OF TEST PIT TP01

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 1.95 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37761
Longitude : -43.62372

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L		2 4 6 8 10 12
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		>>
1.0											
1.5								W			
2.0				Depth of Excavation: 1.95 m Termination Condition: Target depth							

Test pit met target depth at 1.95 m.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

LOG OF TEST PIT TP02

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37648
Longitude : -43.62369

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L		>>
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth at 2 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

LOG OF TEST PIT TP03

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 1.9 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37681
Longitude : -43.62288

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Test pit met target depth at 1.9 m.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP04

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37574
Longitude : -43.62268

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L-MD		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.5 m depth.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Test pit met target depth at 2 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

LOG OF TEST PIT TP05

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37715
Longitude : -43.62459

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L-MD		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.5 m depth.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth at 2 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

LOG OF TEST PIT TP06

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 2.1 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37715
Longitude : -43.62459

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.5 m depth.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 2.1 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth at 2.1 m.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP07

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 2.1 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37798
Longitude : -43.62523

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L-MD		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		
1.0				Lens of loosely packed coarse gravel with limited fines approximately 100 mm thick encountered at 1.1 m depth.							
1.5								W			
2.0				Lens of loosely packed coarse gravel with limited fines approximately 100 mm thick encountered at 1.7 m depth. Depth of Excavation: 2.1 m Termination Condition: Target depth							

Test pit met target depth at 2.1 m.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP08

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 2.1 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37998
Longitude : -43.62481

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L-MD		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 2.1 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Test pit met target depth at 2.1 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP09

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 2.1 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37847
Longitude : -43.62461

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L-MD		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 2.1 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth at 2.1 m.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP10

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 2.2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37831
Longitude : -43.62379

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L-MD		
0.3			SM	Silty fine to medium SAND with trace rootlets; light brown with orange mottles. Poorly graded.					MD		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Lens of loosely packed coarse gravel with limited fines approximately 100 mm thick encountered at 2.0 m depth.							
				Depth of Excavation: 2.2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2, 4, 6, 8, 10, 12

Test pit met target depth at 2.2 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP11

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 2.1 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37929
Longitude : -43.62371

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L-MD		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 2.1 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2, 4, 6, 8, 10, 12

Test pit met target depth at 2.1 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP12

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 2.1 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37963
Longitude : -43.62408

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	T		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					L-MD		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 2.1 m Termination Condition: Target depth							

Test pit met target depth at 2.1 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP13

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.38028
Longitude : -43.62302

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TOPSOIL		SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].					MD		
	ALLUVIUM			Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse.				M			
0.5											
1.0			GW						Tightly Packed		
1.5								W			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth at 2 m.
Scala Penetrometer met practical refusal at 0.2 m depth.
Standing groundwater was not encountered
T = TOPSOIL

T = TOPSOIL

LOG OF TEST PIT TP14

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 1.9 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37768
Longitude : -43.62311

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TOPSOIL		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		>>
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Test pit met target depth at 1.9 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP15

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 1.9 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37693
Longitude : -43.6222

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TOPSOIL		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Test pit met target depth at 1.9 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP16

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 1.9 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37714
Longitude : -43.62138

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		2 4 6 8 10 12
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		>>
1.0											
1.5								W			
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Test pit met target depth at 1.9 m.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

LOG OF TEST PIT TP17

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 27/08/2020
Max Test Pit Depth : 1.9 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.378
Longitude : -43.62249

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TOPSOIL		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		>>
1.0											
1.5								W			
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

Test pit met target depth at 1.9 m.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered

LOG OF TEST PIT TP18

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 28/08/2020
Max Test Pit Depth : 2.2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.38001
Longitude : -43.62263

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
	ALLUVIUM		SP	Fine to medium SAND with minor silt; greyish brown. Poorly graded.					MD		
0.5			GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse.				M	Tightly Packed		
1.0											
1.5				Cobbles become minor from 1.5 m depth.				W			
2.0				Depth of Excavation: 2.2 m Termination Condition: Target depth							

Test pit met target depth at 2.2 m.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered
TS = TOPSOIL

TS = TOPSOIL

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP19

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 28/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37898
Longitude : -43.62251

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Test pit met target depth at 2 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP20

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 28/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.38064
Longitude : -43.62236

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
	ALLUVIUM		SP	Fine to medium SAND with minor silt; greyish brown. Poorly graded.					MD		
0.5			GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth at 2 m.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP21

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 28/08/2020
Max Test Pit Depth : 2.1 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.38041
Longitude : -43.62195

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
0.3	ALLUVIUM		SP	Fine to medium SAND with minor silt; greyish brown. Poorly graded.					L-MD		
0.5			GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse.				M	Tightly Packed		
1.0											
1.5				Sand lens from 1.6 m to 1.8 m depth observed in the side wall of the test pit.				W			
2.0				Depth of Excavation: 2.1 m Termination Condition: Target depth							

Test pit met target depth at 2.1 m.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered

LOG OF TEST PIT TP22

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 28/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.3809
Longitude : -43.621

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		
1.0											
1.5				Cobbles become minor from 1.5 m depth.				W			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Test pit met target depth at 2 m.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

LOG OF TEST PIT TP23

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 28/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.3783
Longitude : -43.62165

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					L-MD		
	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace rootlets; brownish grey. Well graded, subrounded to rounded. Sand, fine to coarse.				M	Tightly Packed		
0.5			SP	Fine to medium SAND with trace silt; greyish brown. Poorly graded.					MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse.				W	Tightly Packed		
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth at 2 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP24

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 28/08/2020
Max Test Pit Depth : 2.2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37851
Longitude : -43.6208

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.6 m depth.				M	Tightly Packed		>>
1.0											
1.5								W			
2.0				Depth of Excavation: 2.2 m Termination Condition: Target depth							

Test pit met target depth at 2.2 m.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered
TS = TOPSOIL

TS = TOPSOIL

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP25

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 28/08/2020
Max Test Pit Depth : 2.1 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37952
Longitude : -43.62084

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
0.5	ALLUVIUM		ML	Sandy SILT; greyish brown. Low plasticity. Sand, fine to medium.				M	St-VSt		
1.0			GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse.				W	Tightly Packed		
1.5											
2.0				Depth of Excavation: 2.1 m Termination Condition: Target depth							

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Test pit met target depth at 2.1 m.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered
TS = TOPSOIL

TS = TOPSOIL

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF TEST PIT TP26

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Date : 28/08/2020
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.38036
Longitude : -43.61991

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with minor sand; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded, subrounded to rounded. Sand, fine to coarse. Rootlets encountered up to 0.8 m depth.				M	Tightly Packed		
1.0											
1.5								W			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

Test pit met target depth at 2 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered
TS = TOPSOIL

TS = TOPSOIL

GEOTECH TEST PIT LOG 597 EAST MADDISONS ROAD - TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 3/9/20

LOG OF AUGER HA01

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37683
Longitude : -43.62418

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].				M	MD	
0.2									
0.3			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.4									
0.5									
0.6									
0.7									
0.8									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA02

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37732
Longitude : -43.62332

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	St-VSt	
0.2									
0.3			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.4									
0.5									
0.6									
0.7									
0.8									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA03

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37643
Longitude : -43.62237

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	St-VSt	
0.2									
0.3			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.4									
0.5									
0.6									
0.7									
0.8									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA04

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37611
Longitude : -43.6232

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	SM	Silty fine to medium SAND with trace gravel and rootlets; brown. Poorly graded [TOPSOIL].				M	MD	
0.2									
0.3			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.4									
0.5									
0.6									
0.7									
0.8									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA05

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37525
Longitude : -43.62211

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	St-VSt	
0.2									
0.3			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.4									
0.5									
0.6									
0.7									
0.8									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA06

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.38023
Longitude : -43.625

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA07

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37854
Longitude : -43.62532

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA08

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37922
Longitude : -43.62507

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA09

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37909
Longitude : -43.62383

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	St-VSt	
0.2									
0.3			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.4									
0.5									
0.6									
0.7									
0.8									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

LOG OF AUGER HA10

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37909
Longitude : -43.62435

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA11

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37797
Longitude : -43.62428

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA12

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37868
Longitude : -43.62398

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA13

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.38005
Longitude : -43.62343

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA14

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37897
Longitude : -43.62349

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA15

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.3774
Longitude : 43.62267

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	St-VSt	
0.2									
0.3			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.4									
0.5									
0.6									
0.7									
0.8									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA16

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37647
Longitude : -43.62162

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	St-VSt	
0.2									
0.3			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.4									
0.5									
0.6									
0.7									
0.8									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA17

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37759
Longitude : -43.62193

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	St-VSt	
0.2									
0.3			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.4									
0.5									
0.6									
0.7									
0.8									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA18

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 27/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.3784
Longitude : -43.62284

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	St-VSt	
0.2									
0.3			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.4									
0.5									
0.6									
0.7									
0.8									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA19

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 28/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.38087
Longitude : -43.62172

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

LOG OF AUGER HA20

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 28/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.38005
Longitude : -43.62137

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA21

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 28/08/2020
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37925
Longitude : -43.62172

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.3	ALLUVIUM	SM	SIlty fine to medium SAND; greyish brown. Poorly graded.					MD	
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.5 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA22

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 28/08/2020
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37934
Longitude : -43.62292

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.3	ALLUVIUM	SP	Fine to medium SAND with minor silt; greyish brown. Poorly graded.					MD	
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8

>>

Hand auger met practical refusal at 0.5 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA23

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 28/08/2020
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37975
Longitude : -43.62219

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.3	ALLUVIUM	SP	Fine to medium SAND with minor silt; greyish brown. Poorly graded.					MD	
0.4			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

LOG OF AUGER HA24

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 28/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37866
Longitude : -43.62205

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA25

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 28/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37789
Longitude : -43.6211

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	St-VSt	
0.2									
0.3			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.4									
0.5									
0.6									
0.7									
0.8									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA26

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 28/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37891
Longitude : -43.62116

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

LOG OF AUGER HA27

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 28/08/2020
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37915
Longitude : -43.62042

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.3	ALLUVIUM	SP	Fine to medium SAND with minor silt; greyish brown. Poorly graded.					MD	
0.4			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8

>>

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA28

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 28/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.38012
Longitude : -43.62061

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.2 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

LOG OF AUGER HA29

Geotechnical Investigation
597 East Maddisons Road
Faringdon
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 28/08/2020
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC/RB/JW
Reviewed By : JRW
Latitude : 172.37978
Longitude : -43.62013

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.1	TOPSOIL	ML	SILT with trace sand, gravel and rootlets; brown. Low plasticity [TOPSOIL].				M	St-VSt	
0.2			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 597 EAST MADDISONS ROAD - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

APPENDIX 3:

ECan Borelogs

Bore or Well No	M36/4346
Well Name	CNR MADDISONS & GOULDS RDS
Owner	MAIN M.R.

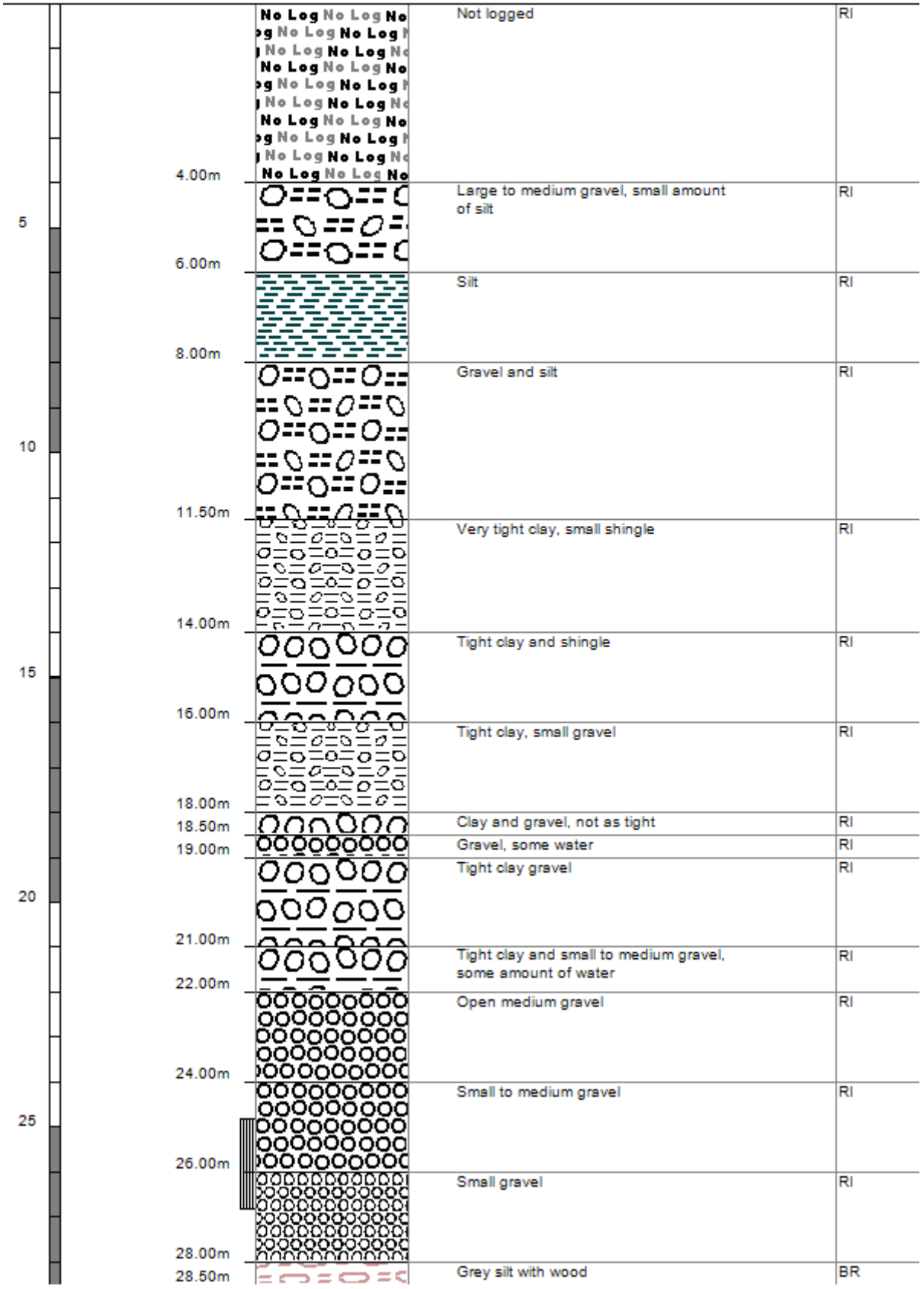
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/4346	**File Number**	
Owner	MAIN M.R.	**Well Status**	Active (exist, present)
Street/Road	CNR MADDISONS & GOULDS RDS	**NZTM Grid Reference**	BX23:49967-69900
Locality	ROLLESTON	**NZTM X and Y**	1549967 - 5169900
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	26.80m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	39.12m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	15	**Calc Min 80%**	9.71m below MP (Estimated)
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	01 Apr 1991	**Max Tested Yield**	6 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	5 m
Drilling Method	Cable Tool	**Specific Capacity**	1.33 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Borelog for well M36/4346

Grid Reference (NZTM): 1549968 mE, 5169901 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 39.1 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 28.5 m Drill Date: 01-Apr-1991

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Bore or Well No	M36/4891
Well Name	CNR MADDISONS & GOULDS ROAD
Owner	Mr & Ms B N & J A Stevens & Gray

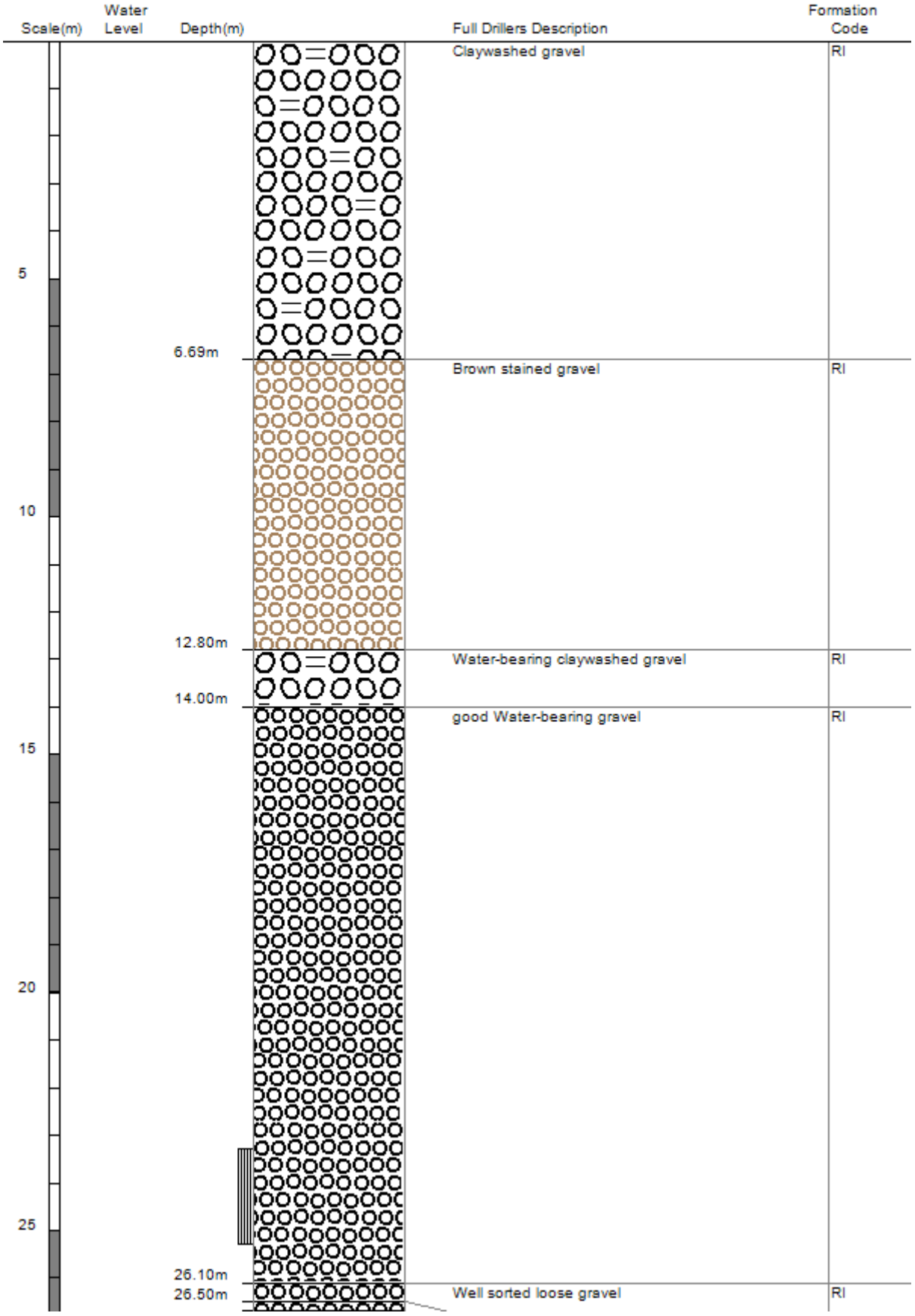
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/4891	**File Number**	CO6C/06015
Owner	Mr & Ms B N & J A Stevens & Gray	**Well Status**	Active (exist, present)
Street/Road	CNR MADDISONS & GOULDS ROAD	**NZTM Grid Reference**	BX23:50117-70000
Locality	ROLLESTON	**NZTM X and Y**	1550117 - 5170000
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic and Stockwater,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	25.25m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	7.38m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	39.15m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	6	**Calc Min 80%**	9.81m below MP (Estimated)
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	05 May 1995	**Max Tested Yield**	8 l/s
Driller	Clemence Drilling Contractors	**Drawdown at Max Tested Yield**	4 m
Drilling Method	Unknown	**Specific Capacity**	2.25 l/s/m
Casing Material	UNKNOWN	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Borelog for well M36/4891

Grid Reference (NZTM): 1550118 mE, 5170001 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 39.2 m +MSD Accuracy: < 2.5 m
Driller: Clemence Drilling Contractors
Drill Method: Unknown
Borelog Depth: 26.7 m Drill Date: 05-May-1995

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Bore or Well No	M36/5041
Well Name	DUNNS CROSSING ROAD
Owner	KAJENS TRADING DEVELOPMENT LTD

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/5041	**File Number**	CO6C/10302
Owner	KAJENS TRADING DEVELOPMENT LTD	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING ROAD	**NZTM Grid Reference**	BX23:49507-69990
Locality	ROLLESTON	**NZTM X and Y**	1549507 - 5169990
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	32.00m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	6.80m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	40.47m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	10	**Calc Min 80%**	9.73m below MP (Estimated)
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	01 Feb 1997	**Max Tested Yield**	5 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	13 m
Drilling Method	Cable Tool	**Specific Capacity**	0.40 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	30	32				

Step Tests

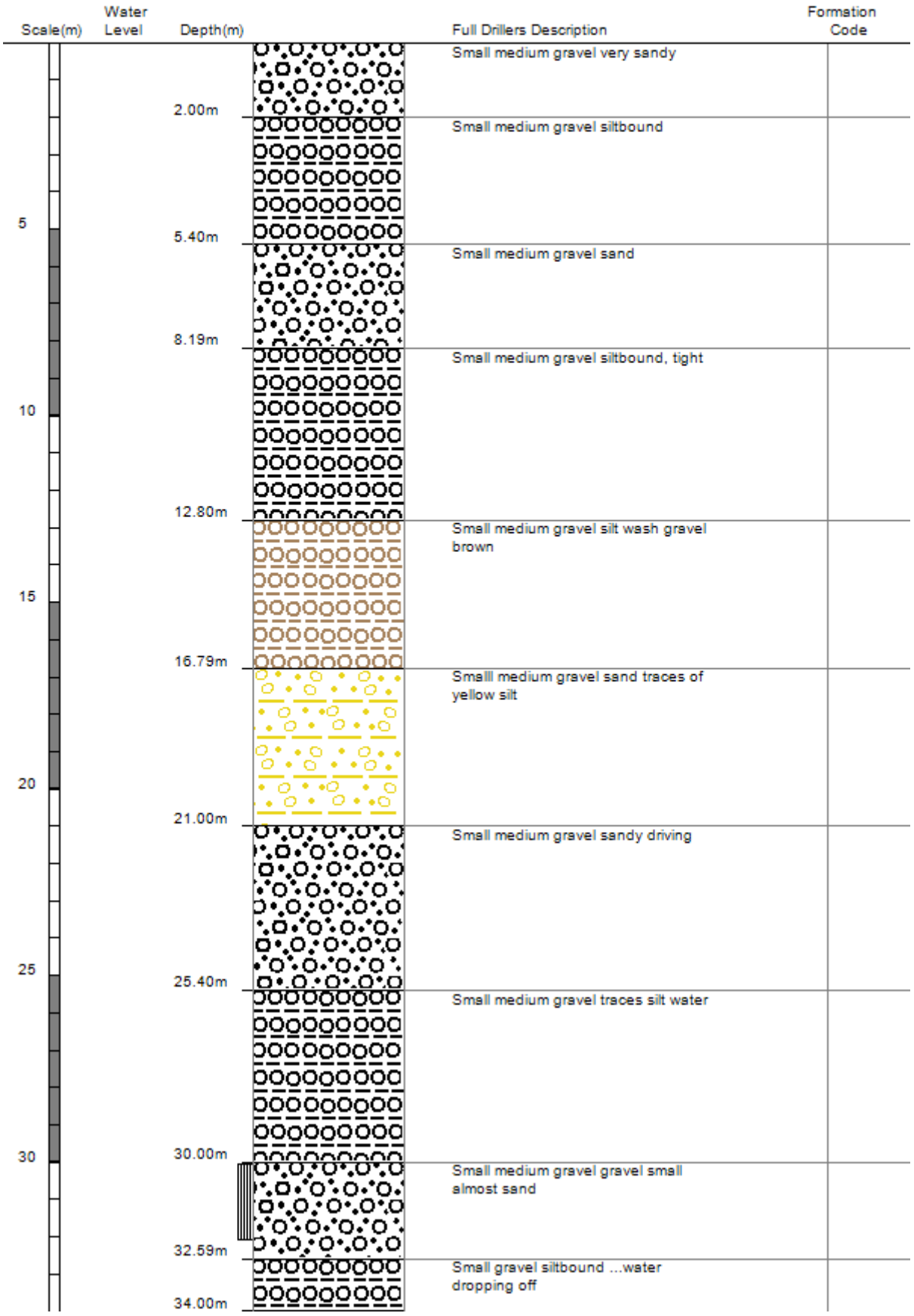
Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Feb 1997	1	5.1	67.31074	12.8	2

No comments for this well

Borelog for well M36/5041

Grid Reference (NZTM): 1549508 mE, 5169991 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.5 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 34.0 m Drill Date: 01-Feb-1997

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Bore or Well No	M36/4449
Well Name	DUNNS CROSSING RD
Owner	TYACK GJ & FR

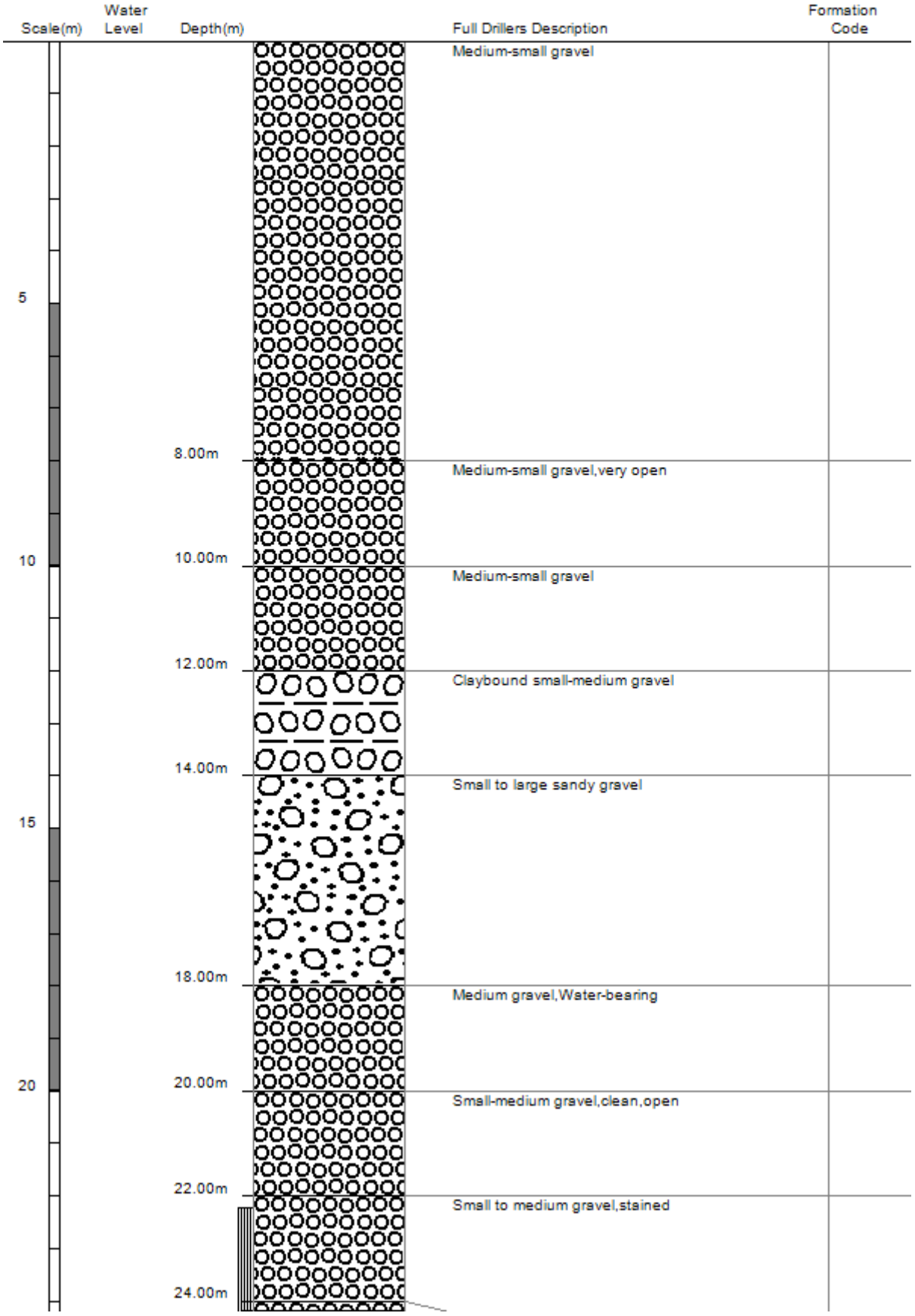
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/4449	**File Number**	CO6C/02046
Owner	TYACK GJ & FR	**Well Status**	Not Used
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49508-69470
Locality	ROLLESTON	**NZTM X and Y**	1549508 - 5169470
Location Description	LOT 1	**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Irrigation,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	24.20m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	38.81m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	9	**Calc Min 80%**	9.27m below MP (Estimated)
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	09 Jun 1992	**Max Tested Yield**	6 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	5 m
Drilling Method	Cable Tool	**Specific Capacity**	1.36 l/s/m
Casing Material		**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Borelog for well M36/4449

Grid Reference (NZTM): 1549508 mE, 5169471 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 38.8 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 24.2 m Drill Date: 09-Jun-1992

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Bore or Well No	M36/7512
Well Name	East Maddisons Road
Owner	Mr & Mrs A S & M M Baxter

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/7512	**File Number**	CO6C/21054
Owner	Mr & Mrs A S & M M Baxter	**Well Status**	Active (exist, present)
Street/Road	East Maddisons Road	**NZTM Grid Reference**	BX23:50237-69431
Locality	Rolleston	**NZTM X and Y**	1550237 - 5169431
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic and Stockwater,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	29.00m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	8.10m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	34.85m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	6	**Calc Min 80%**	9.32m below MP (Estimated)
Aquifer Name		**Aquifer Tests**	0
Aquifer Type		**Yield Drawdown Tests**	2
Drill Date	01 Dec 2003	**Max Tested Yield**	5 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	10 m
Drilling Method	Cable Tool	**Specific Capacity**	0.41 l/s/m
Casing Material	STEEL	**Last Updated**	08 Nov 2013
Pump Type		**Last Field Check**	
Water Use Data	No		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	27	29				

Step Tests

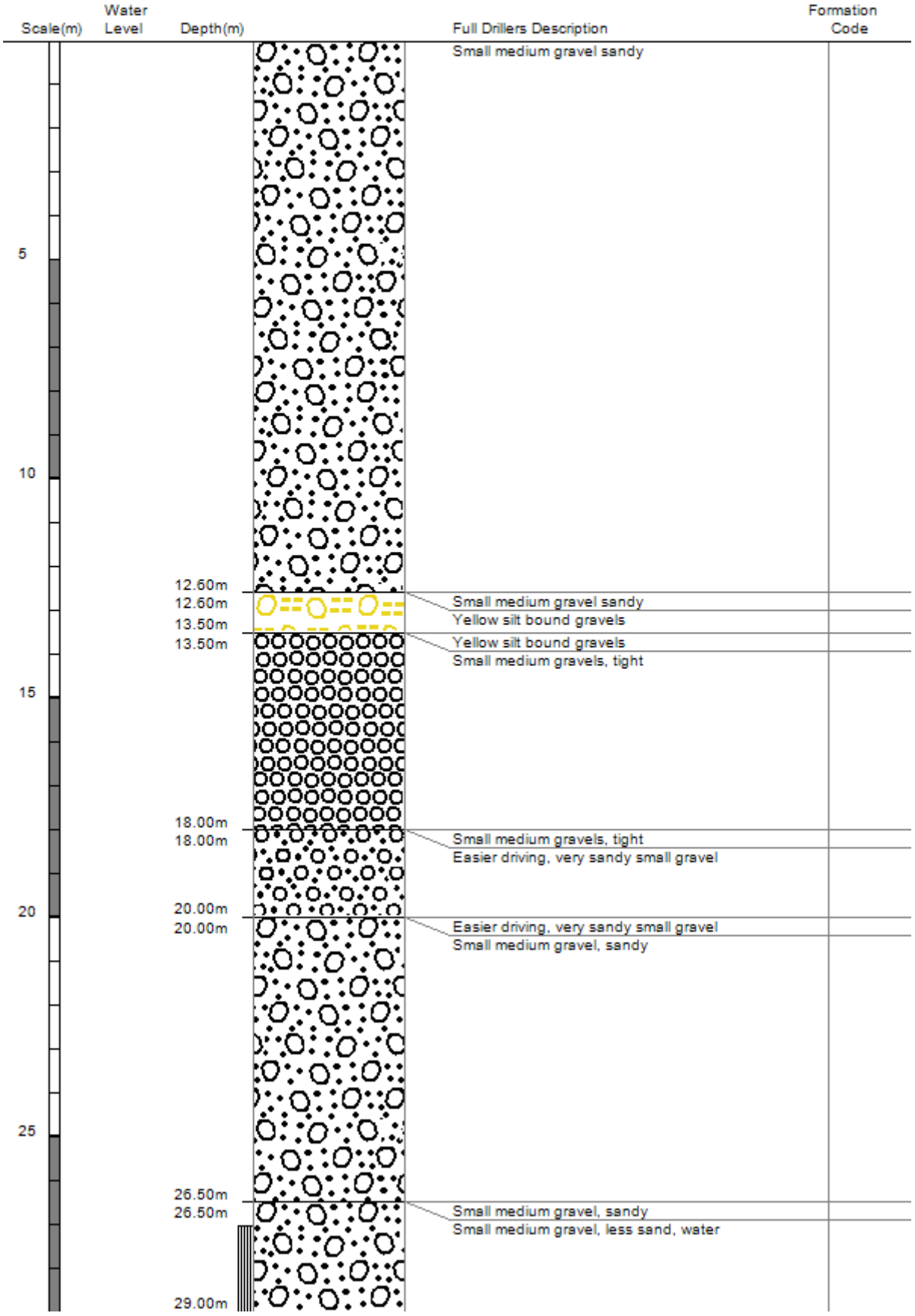
Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Dec 2003	1	1.5	19.7972755	3.65	2
01 Dec 2003	2	4.9	64.6711044	10.36	3

No comments for this well

Borelog for well M36/7512

Grid Reference (NZTM): 1550238 mE, 5169431 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 34.9 m +MSD Accuracy: < 0.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 29.0 m Drill Date: 01-Dec-2003

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Private Plan Change Request – Hughes Developments Limited
Appendix E – Preliminary Site Investigation, Soil Contamination

23 October 2020

Mr Kelvin Back
Hughes Developments Ltd
8 Mill Lane
Merivale
Christchurch 8014

Dear Kelvin

RE: Summary of Environmental Investigations - Faringdon Far West, Rolleston, Canterbury (Our Reference: 12903.000.000_104)

1 Introduction

ENGEO Ltd was requested by Hughes Developments Ltd to provide a summary of environmental investigations for the properties at Faringdon Far West, Rolleston, Canterbury. The purpose of the letter is to summarise several environmental preliminary site investigation (PSI) and detailed site investigation (DSI) reports previously completed by ENGEO. This document should be considered supplementary to the reports outlined below and the full reports should be consulted for further detail.

2 Site Description

We understand that the Faringdon Far West development is the area bordered by Dunns Crossing Road, Goulds Road and East Maddisons Road to the west of the existing Faringdon Development. The approximate site location is shown in Appendix 1 of this report. ENGEO has previously completed the following environmental reports within this site:

- 3/144 Dunns Crossing Road, Rolleston dated 14 August 2020.
- 108 Dunns Crossing Road, Rolleston dated 8 November 2019.
- 92 Dunns Crossing Road, Rolleston dated 17 December 2020.
- 597 East Maddisons Road, Rolleston dated 3 September 2020.

3 Environmental Investigation Summary

A summary of the environmental works undertaken to date are included in Table 1 below.

Table 1: Summary of Environmental Works

Address	Phase	Work required
3/144 Dunns Crossing Road	DSI completed – one minor exceedance against NES residential criteria.	Remediation not considered to be required. Topsoil from the site is proposed to be stripped, stockpiled and redistributed across the site which will cause mixing. Targeted remediation not required. Site management plan required. NES consent likely to be required. Asbestos demolition survey for buildings required as constructed pre-2000.
108 Dunns Crossing Road	DSI completed – two areas of concern and samples are below NES residential criteria.	Asbestos demolition survey for hay / implement shed is required as constructed pre-2000.
92 Dunns Crossing Road	DSI completed – three areas identified that require remediation. One additional area potentially present below large radio tower.	Remediation is required prior to development of sheep dip area, waste pit and above ground storage tank. Site management plan required. Unlikely that radio tower or mobile phone tower will be removed during development works therefore potential waste pit under this area is likely to remain *in situ* and not be investigated. Asbestos demolition survey for buildings required as constructed pre-2000.
597 East Maddisons Road	DSI completed – two areas identified that require remediation.	Remediation of burn pile and lead in soils are required prior to development. Site management plan required. Asbestos demolition survey for buildings required as constructed pre-2000.

4 Environmental Recommendations

Going forward, it is required that remediation occurs at 92 Dunns Crossing Road and 597 East Maddisons Road. Remedial action plans will be required to be written to outline the requirements for remediation, disposal options and validation requirements. A site management plan should also be outlined for 3/144 Dunns Crossing Road due to the presence of heavy metals above the site specific background levels across the site.

It is recommended due to the age of the buildings present that asbestos demolition surveys are undertaken at 3/144 Dunns Crossing Road, 108 Dunns Crossing Road, 92 Dunns Crossing Road and 597 East Maddisons Road. The Health and Safety at Work (Asbestos) Regulations 2016 state if a building constructed or installed prior to January 2000 requires demolition or refurbishment, a full asbestos survey must be undertaken by a competent person.

5 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the Client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ / ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by



Natalie Flatman

Environmental Scientist

Report reviewed by



Dave Robotham, CEnvP SC

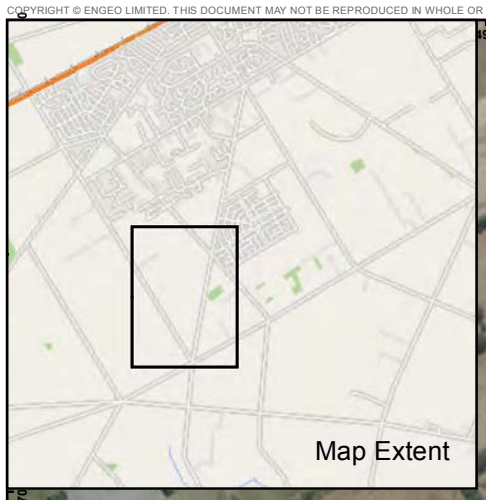
Principal Environmental Consultant

Attachments:

Figure of Sites

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DATE PLOTTED: 23 October 2020 9:22:49 am BY: NFlatman



3/144
Dunns Crossing Road

597
East Maddisons Road

108
Dunns Crossing Road

92
Dunns Crossing Road

N

Legend

Site boundary

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

0 50 100
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

PATH: Z:\Projects\12901 to 13000\12903 - Faringdon South Subdivision\102_Far West\01_GIS\Fig01.mxd

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ENGEO

Celebrating 10 YEARS IN NZ

Detailed Environmental Site Investigation

3/144 Dunns Crossing

Rolleston

Canterbury

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1 Introduction

ENGEO Ltd was requested by Hughes Development Ltd to undertake a combined preliminary and detailed environmental site investigation (PSI/DSI) of the property at 3/144 Dunns Crossing, Rolleston, Canterbury (herein referred to as 'the site'). Figure 1 attached indicated the location of the property. The purpose of the assessment was to assess the property's suitability for a change of land use consent and subdivision under the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES) and to satisfy the requirements of Selwyn District Council (SDC).

This DSI was undertaken in general accordance with the MfE 2011, *Contaminated Land Management Guidelines (CLMG) No.5: Guidelines for Site Investigation and Site Analysis of Soil* and reported in general accordance with the MfE 2011 *CLMG No.1: Reporting on Contaminated Sites in New Zealand*.

1.1 Objectives of the Assessment

The objective of this DSI was to assess conditions indicative of releases and threatened releases of hazardous substances on, at, in or to the subject property and report on the potential risk posed to future site users.

1.2 Approach

To satisfy the objectives, ENGEO sought to gather information regarding the following:

- Current and past property uses and occupancies;
- Current and past uses of hazardous substances;
- Waste management and disposal activities that could have caused a release or threatened release of hazardous substances;
- Current and past corrective actions and response activities to address past and on-going releases of hazardous substances at the subject property; and
- Properties adjoining or located near the subject property that have environmental conditions that could have resulted in conditions indicative of releases or threatened releases of hazardous substances to the subject property.

1.2.1 Review of Site Information

During this assessment, a number of sources of information were contacted for information relating to the site regarding its past and present uses. This included contacting Canterbury Regional Council (CRC) to determine if there were records on the Listed Land Use Register (LLUR), reviewing records held by Selwyn District Council (SDC) including the property file, and obtaining the certificate of titles for the property from Land Information New Zealand (LINZ). A review of a number of historical and current aerial photographs was also undertaken using images from Canterbury Maps and Google Earth.

1.2.2 Site Inspection

A site walkover was undertaken on 6 August 2020 by ENGEO.

2 Site Description and Setting

Site information is summarised in Table 1.

Table 1: Site Information

Item	Description
Location	3/144 Dunns Crossing Road, Rolleston
Legal Description	LOT 3 DP 70352 BLK III LEESTON SD-INT IN R/W EASEMENT DP 72978 OVER LOT 4 DP 7 0352
Site Area	Approximately 4.00 ha
Property Owner	Property is under contract to Hughes Developments Limited
Current Land Use	Residential and Horticultural - Walnut Orchard
Proposed Land Use	Standard residential subdivision, for single dwelling sites with gardens, including home-grown produce consumption (10%)
Building Construction	Main Dwelling: Concrete foundation, brick cladding, concrete tile roof. Garage: Concrete foundation, metal, cement board and timber cladding, metal roof. Shed: Open earth ground, timber pole, metal cladding and roof.
Territorial Authority	Selwyn District Council
Zoning	Inner Plains / Living Z

The site setting is summarised in Table 2.

Table 2: Site Setting

Item	Description
Topography	The site is predominately flat.
Local Setting	The surrounding area is a mix of agricultural and residential.
Nearest Surface Water & Use	An un-named stream runs along the eastern boundary of the site from the south-eastern corner and is diverted at a right angle into the neighbouring paddock to the northeast. The stream is presumed to be used for stormwater runoff.
Geology (GNS Science)	Late Quaternary unconsolidated to poorly consolidated mud, sand, gravel and peat of alluvial and colluvial origin.
Hydrogeology (ECan GIS)	The site is located over an unconfined / semiconfined gravel aquifer. The well on-site logged initial water depth at 6.8 m below ground level. Groundwater is presumed to flow from the northwest to the southeast towards Lake Ellesmere.
Groundwater Abstractions (ECan GIS)	There is one groundwater abstraction located on the site and three within 250 m of the site: M36/5041: Kajens Trading Development Ltd, active well (32.0 m) for domestic supply onsite. M36/5042: Kajens Trading Development Ltd, active well (32.10 m) for domestic supply to the northwest of the site. M36/4450: LK & JC Blackmore, active well (25.2 m) for irrigation to the south of the site. M36/5043: Kajens Trading Development Ltd, active well (35.2 m) for domestic supply to the west of the site.
Discharge Consents (ECan GIS)	There are no active discharge consents located on the site, and one active consent within 250 m of the site: CRC053035: Ogon & Magnum Properties Ltd, active discharge consent for human effluent discharge into land and water to the north of the site.

3 Site History

A number of sources were used to investigate the past uses of the site. The findings of these information searches have been summarised in this section.

3.1 Discussions with Site Owners

A discussion was held between ENGEO and the current site owner on 3 August 2020The owner has owned the site within a family trust for the past eight years. The owner stated that the walnut tree orchard was present when they purchased the property, and that the previous owners had harvested approximately 500 kg of walnuts annually for sale.

The current owners mentioned that the previous owners who planted the orchard were described as “Greenies” but didn’t have explicit information that sprays had or hadn’t been used on the trees. The current owner hasn’t sprayed any of the trees in the last eight years and have removed some of the blocks of trees.

The greenwaste from the trees were burnt off on-site with no additional rubbish, fence posts or other inorganic materials being burnt.

During their occupancy at the site no offal pits were dug on the land, and they cannot recall any pits or areas of land disturbance when they purchased the site.

3.2 Selwyn District Council Property File

The property file for the site, held by Selwyn District Council, was reviewed on 12 August 2020 as part of the DSI. :

- 20 February 1997 – Building consent for a garage
- 8 August 1997 – Building consent for a farm shed
- 8 August 1997 - Building consent for a dwelling
- 18 January 2000 – Building consent for a lean-to garage addition

The property file information did not pertain to any asbestos containing materials being used in the construction of the buildings. Because of the age of the buildings (constructed pre-2000) a full asbestos demolition survey is required; this is to ensure that any asbestos materials are identified prior to demolition works so that they can be removed in a safe manner.

3.3 Certificate of Title

A review of the certificate of title was completed with no information related to potential contaminating activities identified. The Certificates of Title are attached in Appendix 2.

3.4 Listed Land Use Register (LLUR)

Potentially hazardous activities are defined on the Ministry for the Environmental (MfE) Hazardous Activities and Industries List (HAIL). Canterbury Regional Council (CRC) maintains a Listed Land Use Register (LLUR) of past and current land uses within the Canterbury region which have potentially had an activity included on the HAIL undertaken on them. Under the NES, the listing of the property on the LLUR triggers the requirement for a contaminated land assessment prior to development.

The CRC LLUR property statement was requested by ENGEO on 30 July 2020 for the site and is presented in Appendix 3.

Table 3: LLUR Summary

Period From	Period To	HAIL Activity(s)	LLUR Category
2000	Present	A10: Persistent pesticide bulk storage or use	Not Investigated
Additional Information		Area defined on aerial photographs from 2000 to present. Horticultural activities (persistent pesticides) were noted in aerial photographs reviewed.	

3.5 Historical Aerial Photograph Review

Aerial photographs dating from 1940 to 2016 have been reviewed. The relevant visible features are summarised in Table 4.

Table 4: Aerial Photographs

Date	Source	Description
1940-1944	Canterbury Maps	The site is a part of a larger block of land which appears to be grassed and may be used for grazing. A fence line is present running along the current fence line in the north. No buildings are visible on the site. The surrounding area appears to also be undeveloped and used for grazing or cropping. A large forest block is present to the west of Dunns Crossing Road.
1960-1964	Canterbury Maps	The site has no significant changes from the previous photograph. The surrounding area remains mainly unchanged from the previous photograph. Some small land disturbance (stockpiles and cleared areas) is observed in the paddocks to the northwest and west but it is unclear what the stockpiles or cleared areas would have been used for.
1970-1974	Canterbury Maps	The site is mainly unchanged from the previous aerial photograph. The area is still grassed and is used for grazing. The surrounding area is mainly unchanged from the previous photograph.
1980-1984	Canterbury Maps	There is a small area of ponding observed along the eastern boundary line of the site with obvious ponding observed in neighbouring paddocks as well. The site is still grassed and undeveloped. The surrounding area is mainly unchanged from the previous photograph.
1990-1994	Canterbury Maps	The site is undeveloped with apparent channels running across the site from the northwest to the southeast. A tree line is visible along the northern boundary line. The surrounding area is still undeveloped and appears to be used for crop growing and grazing.
2000-2004	Canterbury Maps	The site has been developed into a residential site with a dwelling and shed visible in the western corner and an orchard area covering the remainder of the site. Three lines are visible running northwest to southeast and trees have been divided into smaller square blocks. Many of the surrounding sites have been redeveloped with residential dwellings present on properties to the northwest and west of the site. A horse track is present at 108 Dunns Crossing Road to the south of the site.
2010-2015	Canterbury Maps	The residential dwelling is still present on the site, and small buildings (possible barns) have been constructed to the southwest of the dwelling. The area around the dwelling is planted with a driveway coming into the site from the western corner. A small potential burn off area is apparent to the south of the dwelling. Eight areas are visible that are planted in trees which are bordered with a different tree specimen. There is a block of planting in the southern corner of the site. The site to the north at 4/144 Dunns Crossing Road has planting around the dwelling. The remainder of the surrounding area is mainly unchanged.

2017	Canterbury Maps	Three blocks of trees to the south of the site have been cleared. A ring structure which is presumed to be a horse corral is visible in the southern corner of the site. The remainder of the site appears unchanged since the previous photograph. The surrounding area remains mainly unchanged.

Table 5 below describes the site conditions during the site walkover on 6 August 2020. Photographs taken during the site walkover are included in Appendix 1.

Table 5: Current Site Conditions

Site Conditions	Comments
Visible signs of contamination	Four areas of orchard were observed in the north-eastern section of the site. The walnut trees were planted in rows with eucalyptus trees planted between each area. Three burn piles were observed in the cleared paddocks on the site. The material appeared to be free from any building materials or domestic rubbish. The site owner indicated that the burn piles were used for burning green waste only with no domestic rubbish or treated timber being burnt. The horse corral which was observed in the aerial photograph review was no longer present on site however obvious markings were in the ground from the previous corral ring.
Surface water appearance	No visual indication of potential contamination such as suspended sediment or sheen was observed in the stream running along the north-eastern boundary. The stream was flowing during the visit.
Currently surrounding land use	The properties around the site are all mixed residential and grazing sites.
Local sensitive environments	The stream running along the north-eastern boundary.
Visible signs of plant stress	No visible signs of plant stress were noted on-site.
Additional observations	A well, pump shed and water tank were observed to the south of the dwelling. A previous chicken coup area which was constructed from timber fence poles and metal wire was observed to the south of the dwelling. A glasshouse (domestic scale) was observed near the chicken coup along with several plastic bread trays which were used for drying the walnuts. A few empty 100 L plastic drums were observed on the site which were being used for horse jumps. It was confirmed with the site owners that they were brought onto site as empty containers. A wrecked car was observed near the barn along the south-western boundary line. No staining was observed in surface soils below the car.

4 Potential HAIL Activities

Activities included on the Hazardous Activities and Industries List (HAIL) trigger the requirement for a contaminated land investigation prior to redevelopment. Following the site walkover and review of the desktop information, it is considered that the following HAIL activities are or have been present at the site.

Table 6: Potential HAIL Activities

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES
Orchard – walnut trees	Heavy metals Organochlorine pesticides (OCPs)	The entire site	A10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds

5 Intrusive Investigation

Potential contamination on-site as a result of historical pesticide application is likely limited to shallow soils. An intrusive investigation was developed to investigate the upper 0.3 meters below ground level (m bgl).

The soils were sampled to assess the suitability of the land (from a contamination / human health perspective) for residential use, and to assess the human health risks posed to site works under the commercial / outdoor worker scenario. The results can also be used to indicate whether there is a likely impact to the surrounding environment.

5.1 Methodology

The following was undertaken during the soil sampling works:

- Collection for 40 discrete soil samples from 0.0-0.3 m depth from across the site. The samples were grouped into 10 separate areas defined by areas of trees. The soil samples were composited in the laboratory into ten, four-point composite soil samples.
- Each composite sample was scheduled for analysis for heavy metals and OCPs;
- Each sample was inspected for visual and olfactory indicators of contamination;
- All soil samples collected were placed in jars, which were then sealed, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to RJ Hill Laboratories (Hills) under the standard ENGEO chain of custody documentation provided in Appendix 4;
- To reduce the potential for cross contamination, each sample was collected using disposable nitrile gloves that were discarded following the collection of each sample;

- After collection of each sample, the sampling equipment was decontaminated by scrubbing with a solution of Decon90 and rinsing with tap water followed by deionised water;
- The intrusive sampling was completed in accordance with ENGEO standard operating procedures;
- All fieldwork and sampling was undertaken in general accordance with the procedures for the appropriate handling of potentially contaminated soils as described in the MfE Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils;
- Following receipt of the samples by Hill Laboratories, the soil samples were scheduled for a selection of contaminants of concern including heavy metals (arsenic, cadmium, chromium, copper, mercury, lead, nickel and zinc) and organochlorine pesticides (OCPs); and
- On receipt of the analytical results, an assessment of the soil concentrations for contaminants of concern with applicable standards and soil acceptance criteria for the protection of human health and the environment was undertaken.

Quality Assurance and Quality Control

The quality assurance / quality control (QA / QC) procedures employed during the works included:

- Standard sample registers and chain of custody records have been kept for all samples;
- The use of Hill Laboratories, ISO/IEC 17025 and IANZ accredited laboratory, to conduct all laboratory analysis. To maintain their International Accreditation, Hill Laboratories undertakes rigorous cross checking and routine duplicate sampling testing to ensure the accuracy of their results;
- Prior to sampling the equipment (hand auger) was decontaminated using a triple wash procedure with potable water, Decon 90 solution and deionised water; and
- During the site investigation every attempt was made to ensure that cross contamination did not occur through the use of the procedures outlined within this document.

6 Regulatory Framework and Assessment Criteria

The regulatory frameworks and rules relating to the management and control of contaminated sites in the Canterbury Region are specified in two documents: the NES and the ECan Regional Plan. A summary of each and its implications for the site is provided in Sections 6.1-6.2.

6.1 NES

The NES came into effect on 1 January 2012 (MfE, 2011f).

The NES introduced soil contaminant standards (SCSs) for 12 priority contaminants for the protection of human health under a variety of land use scenarios.

The NES requires the *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values* be used where a NES SCS is not available. The NES does not consider environmental receptors; accordingly, the application of guidelines relevant to

environmental receptors shall be implemented according to the MfE CLMG No. 2 and any relevant rules in the Regional Plan.

In addition, local background levels in soil have been referenced to establish consenting implications under the NES and disposal requirements. Background levels for metals in soils in the area were obtained from ECan's online GIS – Trace Level 2 concentrations.

6.2 Disposal Criteria

An assessment of potential off-site disposal options for excess soil generated during site development works has been conducted. Dependent on the condition of the spoil, off-site disposal options range from disposal to "cleanfill" sites to managed fill sites. As outlined in the publication Waste Management Institute of New Zealand Technical Guidelines for Disposal to Land (August 2018) definition of cleanfill which states:

"Virgin excavated natural materials (VENM) such as clay, soil and rock that are free of:

- Combustible, putrescible, degradable or leachable components;
- Hazardous substances or material (such as municipal solid waste) likely to create leachate by means of biological breakdown;
- Products or materials derived from hazardous waste treatment, stabilisation or disposal practices;
- Materials such as medical and veterinary waste, asbestos or radioactive substances that may present a risk to human health if excavated;
- Contaminated soil and other contaminated materials; and
- Liquid waste."

6.3 Assessment Criteria

Contaminant concentrations in soil were compared to human health criteria based on the following land use:

- Residential land use (10% produce); and
- Commercial / industrial land use (based on an outdoor worker scenario) (for redevelopment workers).

The land use scenarios are relevant to the likely future use of the site and are being used as a surrogate to assess short term risks to redevelopment earth workers on-site during the development activities.

The NES methodology document notes that the exposure parameters assumed for the maintenance / excavation scenario in other New Zealand guidelines are unrealistic (perhaps by a factor of 10 or more). The technical committee preparing the NES decided that a maintenance / excavation worker scenario should not be included in the NES as sites would not be cleaned up to this standard; it was considered more appropriate that exposures to these workers be limited through the use of site-specific controls that are required under health and safety legislation. However, this report uses

commercial / industrial outdoor worker criteria to get a general sense of potential risks to excavation workers during the redevelopment. Note that commercial / industrial outdoor worker criteria are based on personnel carrying out maintenance activities involving soil exposure to surface soil during landscaping activities, and occasional shallow excavation for routine underground service maintenance. Exposure to soil is less intensive than would occur during construction works but occurs over a longer period. For a construction worker developing the site, the soil exposure is limited when compared to a large earthworks project (e.g. for a residential subdivision or industrial development). As such, the commercial / industrial outdoor worker criteria are considered suitable for obtaining a high-level understanding of potential risks to excavation workers during site redevelopment and confirming the need for site controls.

Where appropriate, the standard NES criteria were adjusted according to the requirements for composite samples specified in the MfE (2011) Contaminated Land Management Guidelines No.5 – Site Investigation and Analysis of Soils. As the composite sample consisted of four sub-samples, the guideline criteria were divided by four to result in the adjusted criteria for the composite sample used in this investigation.

The soil analysis results have also been compared to Regional Background concentrations for heavy metals and OCPs. These provide information into the possible disposal options at a clean-fill facility. These criteria have not been adjusted as the composite sample results provide an indication of the average contaminant concentrations. These provide information into the possible disposal options at a cleanfill facility.

7 Results

7.1 Soil Encountered

Please refer to Table 7 from the summary of subsurface soil encountered within the near surface soils in the shallow soils. Please refer to the ENGEO Geotechnical Report (ENGEO, 2020) for deeper soil profiles.

Table 7: Summary of Subsurface Soils

Depth	Soil Description
0.0-0.3	Sandy SILT with trace rootlets and gravel; brown. [TOPSOIL].
0.3-0.4	Sandy fine to coarse GRAVEL with minor cobbles; brownish grey.

7.2 Analytical Results

The analytical results from the ENGEO investigation can be summarised as follows:

- One composite sample (Composite 5) reported arsenic above the adjusted NES criteria for residential land use. The reported concentration of arsenic was 6 mg/kg, where the adjusted NES residential value is 5 mg/kg;
- One composite sample (Composite 5) reported cadmium and lead above the site specific regional background levels;

- Upon request, Hills Laboratory supplied the file for the uncertainty of measure for the laboratory report for the samples (Appendix 4) which reports that the arsenic reported in Composite 5 has an uncertainty measure of 5.7 mg/kg +/- 1.6 mg/kg;
- Organochlorine pesticides (OCPs) were reported as above the laboratory limit of detection; 4,4'-DDE in all samples, and 4,4' DDT for Composite 3 and 4, however all OCP samples are below the NES criteria and the regional background guidelines; and
- All other samples analysed for heavy metals are below the applicable NES criteria and regional background levels.

Please refer to Appendix 4 for the full laboratory certificate and results. Only detectable concentrations of analytes are shown in Table 7 below

Table 8: Analysis Results

Analyte	Units	Composite 1	Composite 2	Composite 3	Composite 4	Composite 5	Composite 6	Composite 7	Composite 8	Composite 9	Composite 10	Assessment Criteria				
												Background (bl) - Canterbury Regional	Residential - 10% produce (unadjusted)	Recreational Land Use (unadjusted)	Commercial/ Industrial Outdoor Worker (unadjusted)	Residential (composite samples adjusted) made up from 4 subsamples
No. of sub samples in composite		4	4	4	4	4	4	4	4	4	4					
Subsample Numbers		1, 2, 3, 4	5, 6, 7, 8	9, 10, 11, 12	13, 14, 15, 16	17, 18, 19, 20	21, 22, 23, 24	25, 26, 27, 28	29, 30, 31, 32	33, 34, 35, 36	37, 38, 39 40					
Soil Depth		0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3					
Heavy Metals																
Arsenic	mg/kg	2	3	3	3	6	3	3	3	3	3	6.35	20 (A)	80 (A)	70 (A)	5 (A)
Cadmium	mg/kg	0.1	< 0.1	0.1	0.14	**0.27**	< 0.1	0.11	< 0.1	< 0.1	< 0.1	0.14	3 (A)	400 (A)	1300 (A)	0.75 (A)
Chromium (total)	mg/kg	11	10	11	12	12	11	10	11	11	11	19.89	460 (A)	2700 (A)	6300 (A)	115 (A)
Copper	mg/kg	4	4	6	5	8	5	5	5	4	5	11.68	10000 (A)	10000 (A)	10000 (A)	2500 (A)
Lead	mg/kg	13.1	13.3	13.6	13.8	**27**	13.4	13.4	13.8	13.6	14	19.75	210 (A)	880 (A)	3300 (A)	52.5 (A)
Mercury (inorganic)	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.07	310 (A)	1800 (A)	4200 (A)	77.5 (A)
Nickel	mg/kg	8	8	8	10	8	9	8	9	9	8	13.91	400 (B)	1200 (B)	6000 (B)	100 (B)
Zinc	mg/kg	47	47	52	47	58	49	48	51	46	48	59.58	7400 (B)	30000 (B)	400000 (B)	1850 (B)
4,4'-DDD	mg/kg	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	-	1.9 (C)	-	9.6 (C)	0.475 (C)
4,4'-DDE	mg/kg	0.106	0.071	0.09	0.121	0.07	0.045	0.026	0.069	0.07	0.079	-	2 (C)	-	9.3 (C)	0.5 (C)
4,4'-DDT	mg/kg	< 0.013	< 0.013	0.012	0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	-	1.9 (C)	-	8.5 (C)	0.475 (C)
DDT Isomers	mg/kg	0.11	< 0.08	0.1	0.13	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	0.08	-	70 (A)	400 (A)	1000 (A)	17.5 (A)

General Notes:
Cells highlighted red exceed one or more assessment criteria, highlighted yellow exceed the lab detection limit.
Adjusted assessment criteria are developed from the number of subsamples to form an adjusted guideline value
*** represents that the composite's guideline is excluded from dividing by the subsamples.**
This table does not represent the full analytical results, please refer to the laboratory results for full details.
Values in bold exceed the adopted background concentrations.
bl - denotes background samples compared to Canterbury Regional -> Yellow brown stony.
Assumes soil pH of 5.
Criteria for Chromium VI were conservatively selected.

Guideline Notes:
A - Methodology for Deriving Soil Guideline Values Protective of Human Health (NES, 2011), B - National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 2013), C - Regional Screening Levels Targeted Hazard Quotient 1.0 (US EPA, 2020), D - Identifying, Investigating and Managing Risks Associated with Former Sheep-dip Sites (MfE, 2006)

8 Conceptual Site Model

A conceptual site model consists of four primary components. For contaminants to present a risk to human health or an environmental receptor, all four components are required to be present and connected. The four components of a conceptual site model are:

- Source of contamination;
- Pathway(s) in which contamination could potentially mobilise along (e.g. vapour or groundwater migration);
- Sensitive receptor(s) which may be exposed to the contaminants; and
- An exposure route, where the sensitive receptor and contaminants come into contact (e.g. ingestion, inhalation, dermal contact).

The potential source, pathway, receptor linkages at this subject site are provided in Table 9.

Table 9: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Orchard	Heavy metals and OCPs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers.	**Yes,** one composite sample was reported above the adjusted residential guideline criteria, however the exceedance is considered marginal.

9 Conclusions and Recommendations

ENGEO Ltd were engaged by Hughes Developments Limited to undertake an environmental assessment of a site situated at 3/144 Dunns Crossing Road in Rolleston for change in land use, subdivision and soil disturbance consent. Information was gathered and reviewed regarding the potential releases of hazardous substances to the subject property.

A review of information identified that the site had been used for grazing since circa 1940 and residential land use with an associated walnut orchard since 1997.

The site is listed on the Canterbury Regional Council's Listed Land Use Register as A10: Persistent pesticide bulk storage or use, with the walnut orchard being identified in a historical aerial review by Selwyn District Council. The property file was obtained from Selwyn District Council and Certificate of Titles obtained by Land Information New Zealand and these files contained no information related to potentially hazardous activities having occurred at the site.

Based on the information gathered during the desk based study, it was considered that site soils may have been impacted by the past and previous uses of the site as an orchard. A total of 40 soil samples were collected from areas across the site and composited into 10 soil samples for analysis of

heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) and organochlorine pesticides (OCPs).

One composite sample (Composite 5), made up of four subsamples, returned concentrations of arsenic above the adjusted NES residential 10% land use criteria. The arsenic concentration reported by the laboratory is 6 mg/kg with the adjusted criteria at 5 mg/kg. The same composite sample also reported concentrations of cadmium and lead above the site specific background levels. Although the arsenic exceedances is considered marginal, it is recommended that analysis of the four subsamples comprising Composite 5 is completed to determine the risk to human health and determine potential remediation and disposal options (if required).

Due to the presence of arsenic concentrations above the adopted human health criterion in an isolated area of the site, additional analysis is recommended to determine whether remediation of soils is required for the site to be suitable for the proposed redevelopment.

If a volume of soil exceeding 25 m^3 per 500 m^2 of development area is proposed to be disturbed, or if a volume of soil exceeding 5 m^3 per 500 m^2 per development area per year is proposed to be disposed of off-site, a consent should be obtained according to the requirements of the NES. Due to the concentrations of the contaminants of concern at the site, a resource consent for land disturbance and removal may be required during the site works.

A stormwater discharge consent is not likely to be required from Canterbury Regional Council for the duration of the redevelopment works on site due to the low concentrations of heavy metal contamination at the site.

Council will likely require preparation of a Site Management Plan (SMP) as part of the resource consent application. The SMP will outline monitoring and management procedures for the earthworks due to the detection of contaminants above background levels and potential for encountering unidentified contamination. If additional sample analysis indicates that remediation of soil is required, provision of a remedial action plan for the disturbance and disposal of these soils will also need to be prepared.

If the groundwater well is to be removed from site during the development works, the well should be appropriately abandoned/disestablished by a suitably qualified professional.

If the buildings on-site are to be refurbished or demolished, the presence of asbestos in these buildings should be identified by undertaking full asbestos demolition surveys. If identified on the outside of the buildings in a deteriorated state, the soils surrounding the buildings should also be tested.

10 References

ECan (2007a). Background Concentrations of Selected Trace Elements in Canterbury Soils. Addendum 1: Additional Samples and Timaru Specific Background Levels. Report prepared for Environment Canterbury by Tonkin & Taylor Limited, Christchurch, New Zealand. Report Number R07/1/2. Tonkin & Taylor Reference: 50875.003.

MfE (2011a). *Ministry for the Environment Hazardous Activities and Industries List.*

MfE (2011b). *Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites*.

MfE (2011c). *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values.*

MfE (2011d). *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils*.

MfE (2011f). *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.*

MfE (2012). *Users' guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.*

11 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Development Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by



Natalie Flatman

Environmental Scientist

Report reviewed by



Hazel Atkins, CEnvP

Senior Engineering / Environmental Geologist



Claire Davies, CEnvP

Senior Environmental Consultant

FIGURES

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DATE PLOTTED: 13 August 2020 7:46:28 pm BY: NFlatman

PATH: Z:\Projects\12901 to 13000\12903 - Farrington South Subdivision\057_3-144 Dunns Crossing Road\04_GIS\Fig01.mxd



ENGEO
Tauranga Office
1/314 Maunganui Road
Mount Maunganui, Tauranga 3116
Tel: 07 777 0209, www.engeo.co.nz

Title:

Site Location Plan

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Client: Hughes Developments Ltd		Figure No: 1
Project: 3/144 Dunns Crossing Road Rolleston	Designed: NF Drawn: NF Checked: DRAFT Date: Aug 20	Size: A4
Proj No: 12903.000.003	Scale: 1:3,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

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DATE PLOTTED: 14 August 2020 12:50:51 pm BY: NFlatman

PATH: \\nzfile\nz\Projects\12901 to 13000\12903 - Farrington South Subdivision\07_3-144 Dunns Crossing Road\04_GIS\Fig01.mxd



ENGEO
Tauranga Office
1/314 Maunganui Road
Mount Maunganui, Tauranga 3116
Tel: 07 777 0209, www.engeo.co.nz

Title:

Sample Locaiton Plan

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Client: Hughes Developments Ltd		Figure No: 2
Project: 3/144 Dunns Crossing Road Rolleston	Designed: NF Drawn: NF Checked: DRAFT Date: Aug 20	Size: A4
Proj No: 12903.000.003	Scale: 1:2,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 1:

Site Photographs



Photo 1: Dwelling



Photo 2: Garage and lean-to



Photo 3: Water tank, well and pumpshed



Photo 4: 4. Shed along south-western boundary line



Photo 5: 5. Burnpile 1



Photo 6: 6. Burnpile 2

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments Ltd**		
Taken by	NF	**Project**	**3/144 Dunns Crossing Road**		
Approved by	HA/CD	**Description**	**Site Photographs**		
Photo No.	1 to 6	**ENGEO Ref:**	12903	**Appendix No.**	1a



Photo 7: Burn pile 3



Photo 8: Orchard area



Photo 9: Orchard area



Photo 10: Stream along north-eastern boundary line



Photo 11: Cleared paddock in south-western section of the site



Photo 12: Horse corral in south-western section of the site

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments Ltd**		
Taken by	NF	**Project**	**3/144 Dunns Crossing Road**		
Approved by	HA/CD	**Description**	**Site Photographs**		
Photo No.	7 to 12	**ENGEO Ref.**	12903	**Appendix No.**	1b

APPENDIX 2:

Certificate of Titles

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Historical Record

R.W. Muir
Registrar-General
of Land

Constituted as a Record of Title pursuant to Sections 7 and 12 of the Land Transfer Act 2017 - 12 November 2018

Identifier **CB40D/788**
Land Registration District **Canterbury**
Date Issued 14 November 1995

Prior References
CB39A/686

Estate	Fee Simple
Area	4.0000 hectares more or less
Legal Description	Lot 3 Deposited Plan 70352

Original Registered Owners
Stuart Robert Pluck and Glenys Joy Pluck

Interests

Subject to Part IV A Conservation Act 1987

A204853.21 Easement Certificate specifying the following easements - 14.11.1995 at 12.12 pm

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way, right to drain sewage, convey water, electric power and telephonic communications	Lot 4 Deposited Plan 70352 - CT CB40D/789	A DP 70352	Lot 3 Deposited Plan 70352 - herein	

The easements specified in Easement Certificate A204853.21 when created will be subject to Section 243(a) Resource Management Act 1991

Fencing Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

Land Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

A290610.4 Mortgage to Bank of New Zealand - 7.4.1997 at 2.25 pm

9224154.1 Discharge of Mortgage A290610.4 - 5.11.2012 at 12:41 pm

9224154.2 Transfer to Robert John Mackie, Elizabeth Gaynor Mackie and Mackie Family Trustees Limited - 5.11.2012 at 12:41 pm

9224154.3 Mortgage to ANZ Bank New Zealand Limited - 5.11.2012 at 12:41 pm

11211027.1 Court Order Varying Land Covenant in Transfer A204853.22 - 24.8.2018 at 7:00 am

References
Prior C/T 39A/686

Transfer No.
N/C. Order No. A204853/4-19

Land and Deeds 69

REGISTER

No. 40D/788

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 14th day of November one thousand nine hundred and ninety-five under the seal of the District Land Registrar of the Land Registration District of CANTERBURY

WITNESSETH that KAJENS TRADING & DEVELOPMENT LIMITED at Christchurch ---

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 4.0000 hectares or thereabouts being Lot 3 Deposited Plan 70352 ---

DISTRICT LAND REGISTRAR

ASSISTANT LAND REGISTRAR

Subject to:

Part IVA Conservation Act 1987

Mortgage A141598/3 to Bank of New Zealand - 27.10.1994 at 11.16am

No. A204853/2 Bond pursuant to Section 222 Resource Management Act 1991 to The Selwyn District Council - 14.11.1995 at 12.12pm

A.L.R.

No. A204853/21 Easement Certificate specifying intended easements on DP 70352

Nature	Servient Tenement		Dominant Tenement
Right of way, right to drain sewage, convey water, electric power and telephonic communications	4 (40D/789)	A	3 (herein)

- 14.11.1995 at 12.12pm

A.L.R.

Measurements are Metric

The easements specified in Easement Certificate A204853/21 when created will be subject to Section 243(a) Resource Management Act 1991

A.L.R.

Transfer A204853/22 to Kajens Trading & Development Limited at Christchurch - 14.11.1995 at 12.12pm (Fencing and Land Covenants)

A.L.R.

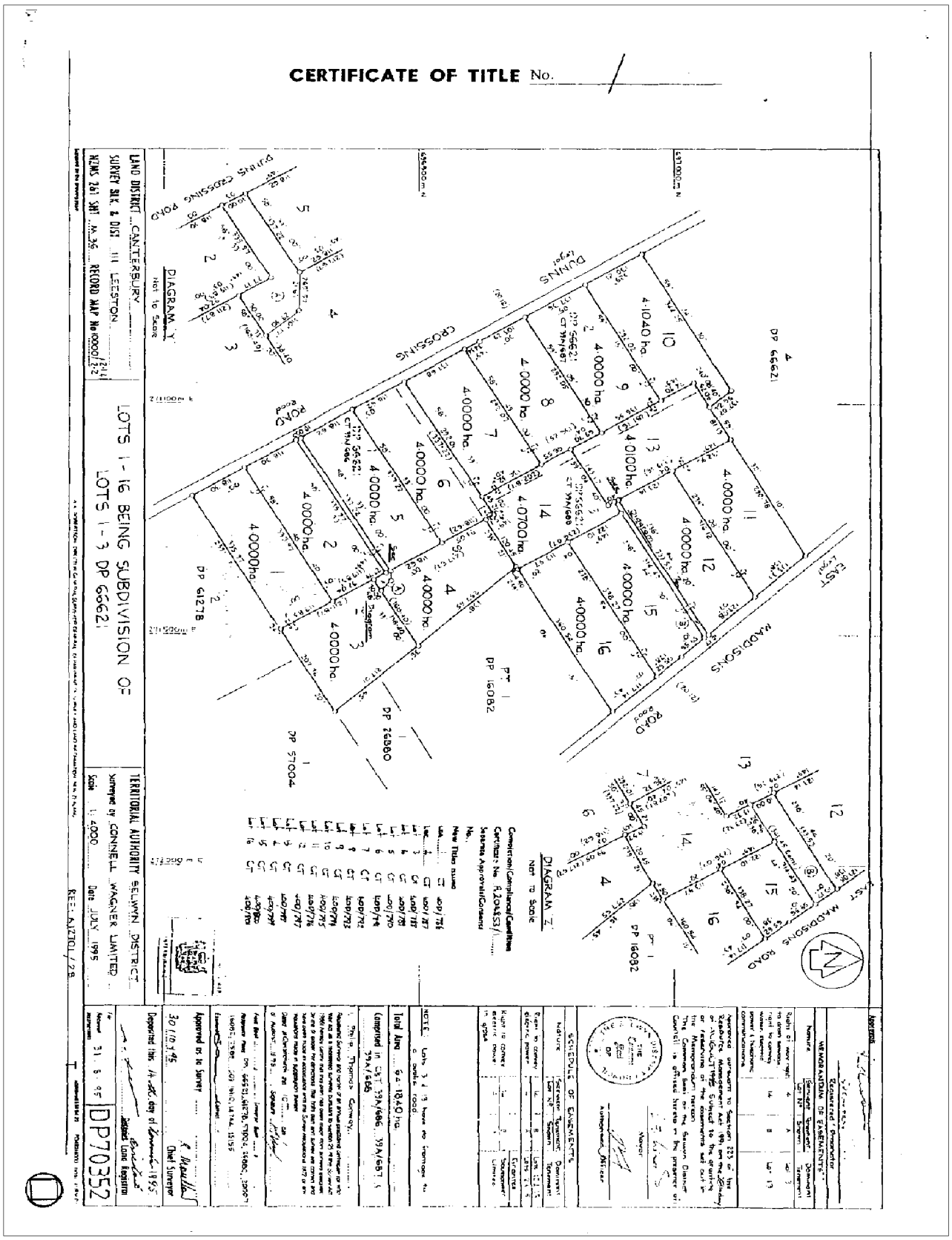
Transfer A290610/3 to Stuart Robert Pluck, Technical Sales Manager and Glenys Joy Pluck, Bank Officer, both of Christchurch - 7.4.1997 at 2.25pm

Mortgage A290610/4 to Bank of New Zealand - 7.4.1997 at 2.25pm

for A.L.R.

No. 40D/788

Identifier **CB40D/788**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

R.W. Muir
Registrar-General
of Land

Identifier **CB40D/788**
Land Registration District **Canterbury**
Date Issued 14 November 1995

Prior References
CB39A/686

Estate	Fee Simple
Area	4.0000 hectares more or less
Legal Description	Lot 3 Deposited Plan 70352

Registered Owners
Robert John Mackie, Elizabeth Gaynor Mackie and Mackie Family Trustees Limited

Interests

Subject to Part IV A Conservation Act 1987

A204853.21 Easement Certificate specifying the following easements - 14.11.1995 at 12.12 pm

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way, right to drain sewage, convey water, electric power and telephonic communications	Lot 4 Deposited Plan 70352 - CT CB40D/789	A DP 70352	Lot 3 Deposited Plan 70352 - herein	

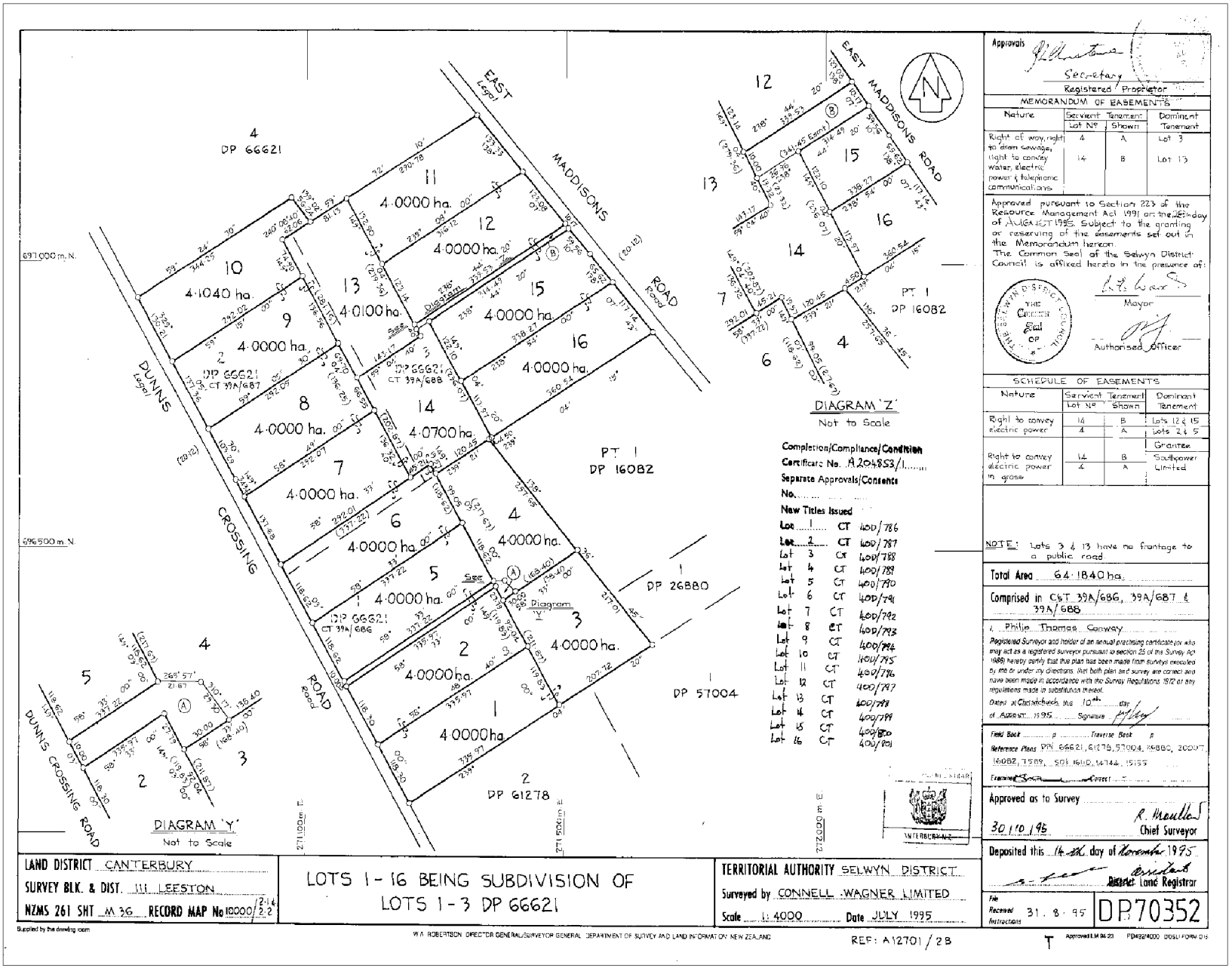
The easements specified in Easement Certificate A204853.21 when created will be subject to Section 243(a) Resource Management Act 1991

Fencing Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

Land Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

9224154.3 Mortgage to ANZ Bank New Zealand Limited - 5.11.2012 at 12:41 pm

11211027.1 Court Order Varying Land Covenant in Transfer A204853.22 - 24.8.2018 at 7:00 am



Approvals

Secretary

Registered Proprietor

MEMORANDUM OF EASEMENTS

Nature	Servient Tenement Lot Nº	Shown	Dominant Tenement
Right of way, right to drain sewage, right to convey water, electric power & telephonic communications	4	A	Lot 3
	14	B	Lot 13

Approved pursuant to Section 223 of the Resource Management Act 1991 on the 22nd day of AUGUST 1995. Subject to the granting or reserving of the easements set out in the Memorandum hereon.
The Common Seal of the Selwyn District Council is affixed hereto in the presence of:

Mayor

Authorised Officer

SCHEDULE OF EASEMENTS

Nature	Servient Tenement Lot Nº	Shown	Dominant Tenement
Right to convey electric power	14	B	Lots 12 & 15
	4	A	Lots 2 & 5
			Grantee
Right to convey electric power in gross	14	B	Southpower Limited
	4	A	

NOTE: Lots 3 & 13 have no frontage to a public road.

Total Area 64·1840 ha.

Comprised in CST 39A/686, 39A/687 & 39A/688

I, Philip Thomas Conway

Registered Surveyor and holder of an annual practising certificate (or who may act as a registered surveyor pursuant to section 23 of the Survey Act 1986) hereby certify that this plan has been made from surveys executed by me or under my directions, that both plan and survey are correct and have been made in accordance with the Survey Regulations 1972 or any regulations made in substitution thereof.

Dated at Christchurch, this 10th day of August 1995 Signature

Field Book p Traverse Book p

Reference Plans PTN 66621, 61278, 57004, 26880, 20007, 16082, 7589, SO 16110, 14744, 15155

Examined Correct

Approved as to Survey

30/10/95 Chief Surveyor

Deposited this 14th day of November 1995

District Land Registrar

File Received Instructions 31.8.95

DP 70352

Completion/Compliance/Condition

Certificate No. A204853/1

Separate Approvals/Consents No.

New Titles Issued

Lot 1	CT	400/786
Lot 2	CT	400/787
Lot 3	CT	400/788
Lot 4	CT	400/789
Lot 5	CT	400/790
Lot 6	CT	400/791
Lot 7	CT	400/792
Lot 8	CT	400/793
Lot 9	CT	400/794
Lot 10	CT	400/795
Lot 11	CT	400/796
Lot 12	CT	400/797
Lot 13	CT	400/798
Lot 14	CT	400/799
Lot 15	CT	400/800
Lot 16	CT	400/801

LAND DISTRICT CANTERBURY

SURVEY BLK. & DIST. III LEESTON

NZMS 261 SHT M 36 RECORD MAP No 10000/2·1 & 2·2

LOTS 1-16 BEING SUBDIVISION OF LOTS 1-3 DP 66621

TERRITORIAL AUTHORITY SELWYN DISTRICT

Surveyed by CONNELL WAGNER LIMITED

Scale 1:4000 Date JULY 1995

Supplied by the drawing room

W.A. ROBERTSON, DIRECTOR GENERAL/SURVEYOR GENERAL, DEPARTMENT OF SURVEY AND LAND INFORMATION, NEW ZEALAND

REF: A12701/2B

Approved LM 94.23 PD492/4000 DOSLI FORM D15

APPENDIX 3:

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:	30 July 2020
Land Parcels:	Lot 3 DP 70352 Valuation No(s): 2405537600;2405537700



The information presented in this map is specific to the property you have selected. Information on nearby properties 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
120683	3/144 Dunns Crossing Road, Rolleston	3/144 Dunns Crossing Road, Rolleston	A10 - Persistent pesticide bulk storage or use;	Not Investigated

Please note that the above table represents a summary of sites and HAILs intersecting the area of enquiry only.

Information held about the sites on the Listed Land Use Register

Site 120683: 3/144 Dunns Crossing Road, Rolleston (Intersects enquiry area.)

Site Address:	3/144 Dunns Crossing Road, Rolleston
Legal Description(s):	Lot 3 DP 70352

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

Land Uses (from HAIL):

Period From	Period To	HAIL land use
2000	Present	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

Notes:

8 Jan 2016 This record was created as part of the Selwyn District Council 2015 HAIL identification project.

8 Jan 2016 Area defined from 2000 to Present aerial photographs. Horticultural activities (persistent pesticides) were 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

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ260363.

Disclaimer: ***The enclosed information is derived from Environment Canterbury's Listed Land Use Register and is made available to you under the Local Government Official Information and Meetings Act 1987 and Environment Canterbury's Contaminated Land Information Management Strategy (ECan 2009).***

The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness of this information. It is released only as a copy of Environment Canterbury's records and is not intended to provide a full, complete or totally accurate assessment of the site. It is provided on the basis that Environment Canterbury makes no warranty or representation regarding the reliability, accuracy or completeness of the information provided or the level of contamination (if any) at the relevant site or that the site is suitable or otherwise for any particular purpose. Environment Canterbury accepts no responsibility for any loss, cost, damage or expense any person may incur as a result of the use, reference to or reliance on the information contained in this report.

Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

APPENDIX 4:

Laboratory Reports

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2415802	SPv1
Contact:	Natalie Flatman	**Date Received:**	10-Aug-2020	
	C/- Engeo Limited	**Date Reported:**	13-Aug-2020	
	PO Box 373	**Quote No:**	82742	
	Christchurch 8140	**Order No:**		
		Client Reference:	12903.003.000	
		Submitted By:	Natalie Flatman	

Sample Type: Soil

Sample Name:		Composite of S1, S2, S3 & S4	Composite of S5, S6, S7 & S8	Composite of S9, S10, S11 & S12	Composite of S13, S14, S15 & S16	Composite of S17, S18, S19 & S20
Lab Number:		2415802.41	2415802.42	2415802.43	2415802.44	2415802.45
Individual Tests						
Dry Matter	g/100g as rcvd	77	80	78	78	76
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	2	3	3	3	6
Total Recoverable Cadmium	mg/kg dry wt	0.10	< 0.10	0.10	0.14	0.27
Total Recoverable Chromium	mg/kg dry wt	11	10	11	12	12
Total Recoverable Copper	mg/kg dry wt	4	4	6	5	8
Total Recoverable Lead	mg/kg dry wt	13.1	13.3	13.6	13.8	27
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	8	8	8	10	8
Total Recoverable Zinc	mg/kg dry wt	47	47	52	47	58
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
alpha-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
beta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
delta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
cis-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
trans-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDE	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDE	mg/kg dry wt	0.106	0.071	0.090	0.121	0.070
2,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	0.012	0.013	< 0.013
Total DDT Isomers	mg/kg dry wt	0.11	< 0.08	0.10	0.13	< 0.08
Dieldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan I	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan II	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan sulphate	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin aldehyde	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin ketone	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor epoxide	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Hexachlorobenzene	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Methoxychlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Soil						
Sample Name:		Composite of S21, S22, S23 & S24	Composite of S25, S26, S27 & S28	Composite of S29, S30, S31 & S32	Composite of S33, S34, S35 & S36	Composite of S37, S38, S39 & S40
Lab Number:		2415802.46	2415802.47	2415802.48	2415802.49	2415802.50
Individual Tests						
Dry Matter	g/100g as rcvd	80	77	80	78	80
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.11	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	10	11	11	11
Total Recoverable Copper	mg/kg dry wt	5	5	5	4	5
Total Recoverable Lead	mg/kg dry wt	13.4	13.4	13.8	13.6	14.0
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	9	8	9	9	8
Total Recoverable Zinc	mg/kg dry wt	49	48	51	46	48
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
alpha-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
beta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
delta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
cis-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
trans-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDE	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDE	mg/kg dry wt	0.045	0.026	0.069	0.070	0.079
2,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Total DDT Isomers	mg/kg dry wt	< 0.08	< 0.08	< 0.08	< 0.08	0.08
Dieldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan I	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan II	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan sulphate	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin aldehyde	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin ketone	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor epoxide	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Hexachlorobenzene	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Methoxychlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	41-50
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	41-50
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD or GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8081 or 8270.	0.010 - 0.06 mg/kg dry wt	41-50
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	41-50

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-40

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 11-Aug-2020 and 12-Aug-2020. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Martin Cowell - BSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2415802	SUPv1
Contact:	Natalie Flatman	**Date Received:**	10-Aug-2020	
	C/- Engeo Limited	**Date Reported:**	13-Aug-2020	
	PO Box 373	**Quote No:**	82742	
	Christchurch 8140	**Order No:**		
		Client Reference:	12903.003.000	
		Submitted By:	Natalie Flatman	

Sample Type: Soil

Sample Name:		Composite of S1, S2, S3 & S4	Composite of S5, S6, S7 & S8	Composite of S9, S10, S11 & S12	Composite of S13, S14, S15 & S16
Lab Number:		2415802.41	2415802.42	2415802.43	2415802.44
Individual Tests					
Dry Matter	g/100g as rcvd	77.1 ± 5.0	79.6 ± 5.0	77.6 ± 5.0	78.2 ± 5.0
Heavy Metals with Mercury, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt	2.4 ± 1.4	2.6 ± 1.4	3.0 ± 1.4	3.3 ± 1.4
Total Recoverable Cadmium	mg/kg dry wt	0.101 ± 0.067	< 0.10 ± 0.067	0.102 ± 0.067	0.138 ± 0.068
Total Recoverable Chromium	mg/kg dry wt	11.4 ± 2.2	10.1 ± 2.1	11.1 ± 2.2	12.2 ± 2.3
Total Recoverable Copper	mg/kg dry wt	4.0 ± 1.5	4.1 ± 1.5	6.4 ± 1.6	5.3 ± 1.5
Total Recoverable Lead	mg/kg dry wt	13.1 ± 2.0	13.3 ± 2.1	13.6 ± 2.1	13.8 ± 2.1
Total Recoverable Mercury	mg/kg dry wt	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067
Total Recoverable Nickel	mg/kg dry wt	8.1 ± 1.7	8.3 ± 1.7	8.2 ± 1.7	9.6 ± 1.8
Total Recoverable Zinc	mg/kg dry wt	47.2 ± 4.3	46.5 ± 4.3	52.5 ± 4.6	47.3 ± 4.3
Organochlorine Pesticides Screening in Soil					
Aldrin	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0047	< 0.013 ± 0.0048	< 0.013 ± 0.0048
alpha-BHC	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0047	< 0.013 ± 0.0048	< 0.013 ± 0.0048
beta-BHC	mg/kg dry wt	< 0.013 ± 0.0055	< 0.013 ± 0.0054	< 0.013 ± 0.0055	< 0.013 ± 0.0055
delta-BHC	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0051	< 0.013 ± 0.0051
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0046	< 0.013 ± 0.0047
cis-Chlordane	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
trans-Chlordane	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0047	< 0.013 ± 0.0048	< 0.013 ± 0.0048
2,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0053	< 0.013 ± 0.0052	< 0.013 ± 0.0053	< 0.013 ± 0.0053
4,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0064
2,4'-DDE	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
4,4'-DDE	mg/kg dry wt	0.106 ± 0.053	0.071 ± 0.036	0.090 ± 0.045	0.121 ± 0.061
2,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0068	< 0.013 ± 0.0067	< 0.013 ± 0.0068	< 0.013 ± 0.0068
4,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0075	< 0.013 ± 0.0072	0.0124 ± 0.0074	0.0125 ± 0.0075
Total DDT Isomers	mg/kg dry wt	0.106 ± 0.055	< 0.08 ± 0.039	0.102 ± 0.047	0.134 ± 0.063
Dieldrin	mg/kg dry wt	< 0.013 ± 0.0061	< 0.013 ± 0.0059	< 0.013 ± 0.0060	< 0.013 ± 0.0061
Endosulfan I	mg/kg dry wt	< 0.013 ± 0.0053	< 0.013 ± 0.0052	< 0.013 ± 0.0053	< 0.013 ± 0.0053
Endosulfan II	mg/kg dry wt	< 0.013 ± 0.0061	< 0.013 ± 0.0059	< 0.013 ± 0.0060	< 0.013 ± 0.0061
Endosulfan sulphate	mg/kg dry wt	< 0.013 ± 0.0079	< 0.013 ± 0.0076	< 0.013 ± 0.0078	< 0.013 ± 0.0078
Endrin	mg/kg dry wt	< 0.013 ± 0.0083	< 0.013 ± 0.0080	< 0.013 ± 0.0082	< 0.013 ± 0.0082
Endrin aldehyde	mg/kg dry wt	< 0.013 ± 0.0072	< 0.013 ± 0.0071	< 0.013 ± 0.0072	< 0.013 ± 0.0072
Endrin ketone	mg/kg dry wt	< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0064
Heptachlor	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0051	< 0.013 ± 0.0051
Heptachlor epoxide	mg/kg dry wt	< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0046	< 0.013 ± 0.0047
Hexachlorobenzene	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0051	< 0.013 ± 0.0051
Methoxychlor	mg/kg dry wt	< 0.013 ± 0.0083	< 0.013 ± 0.0080	< 0.013 ± 0.0082	< 0.013 ± 0.0082

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Soil					
Sample Name:		Composite of S17, S18, S19 & S20	Composite of S21, S22, S23 & S24	Composite of S25, S26, S27 & S28	Composite of S29, S30, S31 & S32
Lab Number:		2415802.45	2415802.46	2415802.47	2415802.48
Individual Tests					
Dry Matter	g/100g as rcvd	75.9 ± 5.0	79.8 ± 5.0	77.5 ± 5.0	79.6 ± 5.0
Heavy Metals with Mercury, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt	5.7 ± 1.6	2.9 ± 1.4	3.1 ± 1.4	2.6 ± 1.4
Total Recoverable Cadmium	mg/kg dry wt	0.270 ± 0.076	< 0.10 ± 0.067	0.107 ± 0.067	< 0.10 ± 0.067
Total Recoverable Chromium	mg/kg dry wt	12.4 ± 2.4	11.2 ± 2.2	10.2 ± 2.1	11.5 ± 2.2
Total Recoverable Copper	mg/kg dry wt	8.2 ± 1.8	4.7 ± 1.5	4.5 ± 1.5	4.9 ± 1.5
Total Recoverable Lead	mg/kg dry wt	26.5 ± 4.0	13.4 ± 2.1	13.4 ± 2.1	13.8 ± 2.1
Total Recoverable Mercury	mg/kg dry wt	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067
Total Recoverable Nickel	mg/kg dry wt	7.9 ± 1.7	8.6 ± 1.8	8.3 ± 1.7	9.2 ± 1.8
Total Recoverable Zinc	mg/kg dry wt	57.6 ± 4.9	48.9 ± 4.4	48.2 ± 4.4	50.7 ± 4.5
Organochlorine Pesticides Screening in Soil					
Aldrin	mg/kg dry wt	< 0.013 ± 0.0049	< 0.013 ± 0.0048	< 0.013 ± 0.0048	< 0.013 ± 0.0048
alpha-BHC	mg/kg dry wt	< 0.013 ± 0.0049	< 0.013 ± 0.0048	< 0.013 ± 0.0048	< 0.013 ± 0.0048
beta-BHC	mg/kg dry wt	< 0.013 ± 0.0056	< 0.013 ± 0.0054	< 0.013 ± 0.0055	< 0.013 ± 0.0055
delta-BHC	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0052	< 0.013 ± 0.0052
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0047	< 0.013 ± 0.0047
cis-Chlordane	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
trans-Chlordane	mg/kg dry wt	< 0.013 ± 0.0049	< 0.013 ± 0.0048	< 0.013 ± 0.0048	< 0.013 ± 0.0048
2,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0054	< 0.013 ± 0.0053	< 0.013 ± 0.0053	< 0.013 ± 0.0053
4,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0065
2,4'-DDE	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
4,4'-DDE	mg/kg dry wt	0.070 ± 0.035	0.045 ± 0.023	0.026 ± 0.014	0.069 ± 0.035
2,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0069	< 0.013 ± 0.0067	< 0.013 ± 0.0068	< 0.013 ± 0.0069
4,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0075	< 0.013 ± 0.0073	< 0.013 ± 0.0074	< 0.013 ± 0.0075
Total DDT Isomers	mg/kg dry wt	< 0.08 ± 0.038	< 0.08 ± 0.027	< 0.08 ± 0.020	< 0.08 ± 0.038
Dieldrin	mg/kg dry wt	< 0.013 ± 0.0061	< 0.013 ± 0.0060	< 0.013 ± 0.0061	< 0.013 ± 0.0061
Endosulfan I	mg/kg dry wt	< 0.013 ± 0.0054	< 0.013 ± 0.0053	< 0.013 ± 0.0053	< 0.013 ± 0.0053
Endosulfan II	mg/kg dry wt	< 0.013 ± 0.0061	< 0.013 ± 0.0060	< 0.013 ± 0.0061	< 0.013 ± 0.0061
Endosulfan sulphate	mg/kg dry wt	< 0.013 ± 0.0080	< 0.013 ± 0.0077	< 0.013 ± 0.0078	< 0.013 ± 0.0079
Endrin	mg/kg dry wt	< 0.013 ± 0.0084	< 0.013 ± 0.0081	< 0.013 ± 0.0083	< 0.013 ± 0.0083
Endrin aldehyde	mg/kg dry wt	< 0.013 ± 0.0073	< 0.013 ± 0.0071	< 0.013 ± 0.0072	< 0.013 ± 0.0073
Endrin ketone	mg/kg dry wt	< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0065
Heptachlor	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0052	< 0.013 ± 0.0052
Heptachlor epoxide	mg/kg dry wt	< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0047	< 0.013 ± 0.0047
Hexachlorobenzene	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0052	< 0.013 ± 0.0052
Methoxychlor	mg/kg dry wt	< 0.013 ± 0.0084	< 0.013 ± 0.0081	< 0.013 ± 0.0083	< 0.013 ± 0.0083

Sample Name:		Composite of S33, S34, S35 & S36	Composite of S37, S38, S39 & S40		
Lab Number:		2415802.49	2415802.50		
Individual Tests					
Dry Matter	g/100g as rcvd	78.1 ± 5.0	79.8 ± 5.0	-	-
Heavy Metals with Mercury, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt	2.7 ± 1.4	2.9 ± 1.4	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10 ± 0.067	< 0.10 ± 0.067	-	-
Total Recoverable Chromium	mg/kg dry wt	11.0 ± 2.2	11.0 ± 2.2	-	-
Total Recoverable Copper	mg/kg dry wt	4.2 ± 1.5	4.5 ± 1.5	-	-
Total Recoverable Lead	mg/kg dry wt	13.6 ± 2.1	14.0 ± 2.2	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10 ± 0.067	< 0.10 ± 0.067	-	-
Total Recoverable Nickel	mg/kg dry wt	8.5 ± 1.8	8.1 ± 1.7	-	-
Total Recoverable Zinc	mg/kg dry wt	46.1 ± 4.2	47.8 ± 4.3	-	-
Organochlorine Pesticides Screening in Soil					
Aldrin	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0048	-	-
alpha-BHC	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0048	-	-
beta-BHC	mg/kg dry wt	< 0.013 ± 0.0055	< 0.013 ± 0.0054	-	-

Sample Type: Soil					
Sample Name:		Composite of S33, S34, S35 & S36	Composite of S37, S38, S39 & S40		
Lab Number:		2415802.49	2415802.50		
Organochlorine Pesticides Screening in Soil					
delta-BHC	mg/kg dry wt	< 0.013 ± 0.0051	< 0.013 ± 0.0051	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013 ± 0.0046	< 0.013 ± 0.0046	-	-
cis-Chlordane	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	-	-
trans-Chlordane	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0048	-	-
2,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0053	< 0.013 ± 0.0052	-	-
4,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0064	< 0.013 ± 0.0063	-	-
2,4'-DDE	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	-	-
4,4'-DDE	mg/kg dry wt	0.070 ± 0.035	0.079 ± 0.040	-	-
2,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0068	< 0.013 ± 0.0067	-	-
4,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0074	< 0.013 ± 0.0073	-	-
Total DDT Isomers	mg/kg dry wt	< 0.08 ± 0.038	0.079 ± 0.042	-	-
Dieldrin	mg/kg dry wt	< 0.013 ± 0.0060	< 0.013 ± 0.0060	-	-
Endosulfan I	mg/kg dry wt	< 0.013 ± 0.0053	< 0.013 ± 0.0052	-	-
Endosulfan II	mg/kg dry wt	< 0.013 ± 0.0060	< 0.013 ± 0.0060	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.013 ± 0.0078	< 0.013 ± 0.0077	-	-
Endrin	mg/kg dry wt	< 0.013 ± 0.0082	< 0.013 ± 0.0081	-	-
Endrin aldehyde	mg/kg dry wt	< 0.013 ± 0.0072	< 0.013 ± 0.0071	-	-
Endrin ketone	mg/kg dry wt	< 0.013 ± 0.0064	< 0.013 ± 0.0063	-	-
Heptachlor	mg/kg dry wt	< 0.013 ± 0.0051	< 0.013 ± 0.0051	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.013 ± 0.0046	< 0.013 ± 0.0046	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.013 ± 0.0051	< 0.013 ± 0.0051	-	-
Methoxychlor	mg/kg dry wt	< 0.013 ± 0.0082	< 0.013 ± 0.0081	-	-

The reported uncertainty is an expanded uncertainty with a level of confidence of approximately 95 percent (i.e. two standard deviations, calculated using a coverage factor of 2). Reported uncertainties are calculated from the performance of typical matrices, and do not include variation due to sampling.

For further information on uncertainty of measurement at Hill Laboratories, refer to the technical note on our website: www.hill-laboratories.com/files/Intro_To_UOM.pdf, or contact the laboratory.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	41-50
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	41-50
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD or GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8081 or 8270.	0.010 - 0.06 mg/kg dry wt	41-50
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	41-50
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-40

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 11-Aug-2020 and 12-Aug-2020. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Kim Harrison MSc
Client Services Manager - Environmental



ENGEO

Expect Excellence

Combined Preliminary and Detailed Site Investigation

108 Dunns Crossing Road

Springston

Canterbury

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1 Introduction

ENGEO Ltd was requested by Hughes Developments Limited to undertake a combined preliminary and detailed site investigation of the property at 108 Dunns Crossing Road in Springston, Canterbury.

The site location and investigation areas are shown in Figure 1. ENGEO understands that the site is to be redeveloped into a residential subdivision. The environmental assessment was performed as part of an investigation into the potential contaminants at the site and the suitability of the site for residential land use.

This combined PSI / DSI was completed in order to satisfy Selwyn District Council (SDC) resource consent requirements in accordance with the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES).

This DSI was performed in general accordance with the MfE's *Contaminated Land Management Guidelines (CLMG) No.5: Site Investigation and Analysis of Soils* and reported in general accordance with the MfE's *CLMG No.1: Reporting on Contaminated Sites in New Zealand*.

1.1 Objectives of the Assessment

The objectives of this assessment were to:

- Evaluate and identify conditions indicative of releases and threatened releases of hazardous substances on, at, in or to the subject property;
- Evaluate the presence of and extent of identified contaminants of concern (COC) at the site; and
- Assess whether the COCs pose an unacceptable risk to human health or the environment during and post site redevelopment.

1.2 Approach

To satisfy the objectives, ENGEO sought to gather information regarding the following:

- Current and past property uses and occupancies;
- Current and past uses of hazardous substances;
- Waste management and disposal activities that could have caused a release or threatened release of hazardous substances;
- Current and past corrective actions and response activities to address past and on-going releases of hazardous substances at the subject property;
- Properties adjoining or located near the subject property that have environmental conditions that could have resulted in conditions indicative of releases or threatened releases of hazardous substances to the subject property; and
- Following the desktop review, ENGEO collected representative soil samples for laboratory analysis from shallow soil sampling completed across the site.

2 Site Description and Setting

The total site area is 101,150 m^2 and has the legal description of LOT 2 DP 61278. We understand that the property at 108 Dunns Crossing Road is to be subdivided into residential lots. The site location is displayed in Figure 1.

Site information is summarised in Table 1 with photographs of the site taken during the site sampling works provided in Appendix 1.

Table 1: Site Information

Item	Description
Location	108 Dunns Crossing Road, Springston, Canterbury
Legal Description	Lot 2 DP 61278
Site Area	10.1 ha
Property Owner	Under contract to Hughes Developments Limited
Current Land Use	Mixed residential and agricultural
Proposed Land Use	Residential
Territorial Authority	Selwyn District Council

The site setting is summarised in Table 2.

Table 2: Site Setting

Item	Description
Topography	The site is generally flat.
Local Setting	The surrounding area is mixed agricultural and residential lifestyle blocks. The remnants of an orchard are visible at 3/144 Dunns Crossing Road.
Nearest Surface Water & Use	There is an unnamed stream/drain approximately 420 m to the northeast of the site, running northwest to northeast.

2.1 Geology and Hydrogeology

The documented geology and hydrogeology of the site and surrounding area is summarised in Table 3.

Table 3: Geology and Hydrogeology

Item	Description
Geology	Unconsolidated to poorly consolidated mud, sand, gravel and peat of alluvial and colluvial origin.
Groundwater Abstractions	There is one groundwater abstraction located on the site and six active abstractions within 250 m of the site: M36/4450: LK & JC Blackmore, active well (25.2 m) for irrigation use on the site. M36/5041: Kajens Trading Development Ltd, active well (32.0 m) for domestic supply to the north of the site. M36/4449: GJ & FR Tyack, active well (24.2 m) for irrigation use of the south of the site. M36/4451: GJ & FR Tyack active well (no depth) for domestic supply to the south of the site. M36/8130: DB Irvine, active well (97.11 m) for irrigation use to the west of the site. M36/5038: Kajens Trading Developments Ltd, active well (32.1 m) for domestic supply to the northwest of the site. M36/5040: Kajens Trading Developments Ltd, active well (34.5 m) for irrigation use to the northwest of the site.
Discharge Consents	There are no discharge consents located on or within 250 m of the site.

2.2 Groundwater and Surface Water Sensitivity

Groundwater is not considered to be shallow with a groundwater bore search indicating that there are no groundwater abstractions located within 100 m of the site.

An assessment to establish whether the groundwater aquifer below the site is a ‘sensitive aquifer, as defined by the Ministry for the Environment (MfE) Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand – Module 5 – Tier 1 Groundwater Acceptance Criteria (2011), has been undertaken (refer to Table 4). It is noted that an aquifer is sensitive when either all of the first three criteria set out below are met or the fourth criterion is met in accordance with Modules 5.2.3 of the MfE Guidelines.

Table 4: Groundwater Sensitivity

Criteria	Assessment
The aquifer is not artesian or confined.	**No**. The site is overlying an unconfined or semi-confined aquifer.
The aquifer is expected to be less than 10 m below the potential suspected source of impact.	**No**. The aquifer is expected to be greater than 10 m below the site.
The aquifer is of a quality appropriate for use, can yield water at a useful rate and is in an area where abstraction and use of groundwater may be reasonably foreseen.	**Yes**. There is a groundwater abstraction on-site for irrigation supply.
The source is less than 100 m from a sensitive surface water body (i.e. a surface water body where limited dilution is available to mitigate the impact of contaminated groundwater discharging into the surface water body).	**No**. The nearest surface water is approximately 420 m to the east of the site.
Sensitivity Assessment	The aquifer is considered **NOT SENSITIVE**

Groundwater is considered to be NOT SENSITIVE in relation to the MfE sensitive aquifer assessment.

The Canterbury Land and Water Regional Plan (LWRP) Rule 5.187, states that the passive discharge of contaminants from contaminated land onto or into in circumstance where those contaminants may enter water is a permitted activity, provided the following conditions are met:

1. There has been a site investigation report provided to the CRC in accordance with Rule 5.185.
2. Either the site investigation report or water quality sampling demonstrates that the discharge does not result in the concentration of contaminants in groundwater:
    a. At the property boundary.
    b. At any existing groundwater bore (excluding any monitoring bore located on the property).
    c. Within a Community Drinking-Water Protection Zone.
    d. Exceeding the limits applicable to groundwater set out in Schedule 8.
3. Either the site investigation report or water quality sampling demonstrates that the discharge does not result in the concentration of contaminants in groundwater at any point where groundwater exits to surface water, exceeding the receiving water quality standards in Schedule 5 for 90% of species.
4. At any point where the groundwater exits to surface water the discharge does not produce any:
    a. Conspicuous oil or grease films, scums of foam, or floatable or suspended materials.

b. Conspicuous change in the colour or visual clarity.

3 Site History

A number of sources were used to investigate the past uses of the site. The findings of these information searches have been summarised in this section.

3.1 Conversations with Site Owner/Occupier

A conversation with Lindsay Blackmore was held regarding the site and its current and past uses. Lindsay bought the property in 1992 and the site was undeveloped at the time of purchase. Lindsay stated that he had never used any chemical sprays on plants and only used snail bait and small amounts of fertilisers on the vegetable garden to the north of the dwelling. The horse track had been constructed by stripping back the topsoil from the ground and then placing a small amount of imported gravel to form the track. A small amount of left-over soil and gravel is observed to the west of the track. He stated that the top north-western corner of the site was planted with gum trees (*Eucalyptus*) and he was not aware if the neighbour from 3/144 had used pesticides on the trees prior to selling the property to the new owners. He stated that he had never buried any offal or rubbish on the property but had burnt small piles of green waste historically in different sections of the site.

3.2 Listed Land Use Register (LLUR)

Canterbury Regional Council (CRC) maintains a Listed Land Use Register (LLUR) of past and current land uses within the Canterbury Region. The LLUR documents properties on which potentially hazardous activities have been undertaken. The potentially hazardous activities are defined on the MfE HAIL. Identifying a HAIL activity on the site triggers the requirement for a contaminated land assessment prior to development.

The CRC LLUR property statement was requested by ENGEO on 24 October 2019 for the site and is presented in Appendix 2. No areas of concern were identified on the CRC LLUR for the sites.

3.3 Selwyn District Council Property File

The property file for the site, held by Selwyn District Council, was reviewed on 5 November 2019 as a part of the PSI / DSI. The information below was gathered from the property file:

- 12 October 1995: Resource consent to erect 3 poultry sheds and establish a factory farming operation – retracted.
- 30 May 1997: Building consent for a hay/implement shed.
- 19 March 2003: Building consent for a 5 bay farm building – 120 m^2.
- 3 June 2003: Building consent for a 3 bedroom domestic dwelling with attached garage.

3.4 Certificate of Title

A review of the certificate of title was completed with no information related to the potential contaminating activities listed. The Certificates of Titles are attached in Appendix 3.

3.5 Historical Aerial Photograph Review

Aerial photographs obtained from Canterbury Maps and Google Earth from 1940 to 2017 have been reviewed. The relevant visible features are summarised in Table 5.

Table 5: Historical Aerial Photograph Review

Date	Source	Description
1940-1944	Canterbury Maps	The site appears to be a part of two relatively large paddocks which appear to have been ploughed or are bare (non-vegetated). Visible paleo channels are visible across the site running from the northwest boundary to the southeast boundary. The surrounding sites to the north, east and south are undeveloped and appear to be used for grazing. A small shed is visible along the south-western boundary at 92 Dunns Crossing Road. The sites to the west across Dunns Crossing Road is planted in forest.
1960-1964	Canterbury Maps	The site appears to be unchanged. The north-eastern section of the paddocks appears to be planted in crops in visible large sections. Sheep are visible in the south-western section of the site. The surrounding area remains mainly unchanged. One additional structure has been constructed along the south-western boundary line at 92 Dunns Crossing Road. This structure may be a sheep dip.
1970-1974	Canterbury Maps	The site no longer appears to have any crops growing on it and appears to be used for grazing. The potential sheep dip structure at 92 Dunns Crossing Road is still present. Additional trees have been planted along the roadside across Dunns Crossing Road in the forest area.
1980-1984	Canterbury Maps	The site appears to still be used for grazing. A large area of ponding is visible from the top north corner of the site to the south-eastern boundary line. It is presumed this area is ponding of water as there are other areas of ponding visible in paddocks to the northeast of the site. The surrounding areas remain mainly unchanged. The sheep dip structure appears to still be in place at 92 Dunns Crossing Road, however the photograph is low quality so it may be disused. Some of the forest block across Dunns Crossing Road appears to have been cleared.
1990-1994	Canterbury Maps	The site appears to still be used for grazing. Three paddocks are now visible with a new hedge/vegetation line running northwest to southeast across the top third of the site. The sites to the north and east of the site remain unchanged. The site at 92 Dunns Crossing Road appears to have been developed with a residential dwelling and associated sheds present in the western section of the site. A horse track is visible which covers most of the east section of the site. The sites across Dunns Crossing Road appear to have been replanted in trees.

Date	Source	Description
2000-2004	Canterbury Maps	The site has been developed. A horse track is visible which covers most of the north-western part of the site. The top north-western corner of the site appears to be vegetated. A shed or barn has been constructed in the south-eastern corner of the site with a driveway running to the barn from Dunns Crossing Road. Vegetation is visible planted in a rectangular shape (around current dwelling) to the north of the driveway. An area of land disturbance is visible on the western corner of the race track. Residential development has occurred to the sites to the northwest of the site. The remainder of the surrounding area remains mainly unchanged.
2010-2015	Canterbury Maps	A residential dwelling has been constructed to the north of the driveway coming off Dunns Crossing Road. Trees and other vegetation has been planted around the dwelling. A small vegetable garden and small sheds are visible on the north-eastern side of the dwelling. The shed/barn to the south of the driveway appears to have been added onto or another barn has been constructed next to the original. The horse track is still visible. The trees in the north-western corner of the site have matured. A small burn pit is visible in the middle of the horse track area. An orchard is visible at 3/144 Dunns Crossing Road directly northwest of the site. There is an area of land disturbance or ponding at 597 East Maddisons Road just beyond the north-eastern boundary of the site. The forestry block across Dunns Crossing Road has been cleared and is undeveloped. A small residential dwelling and shed has been constructed at 130 Dunns Crossing Road to the northwest of the site.
2018	Canterbury Maps	The site remains unchanged from the previous photograph. Some of the orchard at 3/144 Dunns Crossing Road has been cleared. The remainder of the surrounding area is unchanged from the previous photograph.

4 Current Site Conditions

A site walkover was completed by an ENGEO representative on 4 November 2019. A summary of the walkover is provided in Table 6 below.

Table 6: Current Site Conditions

Site Conditions	Comments
Visible signs of contamination	No visible signs of contamination were observed on either site.
Surface water appearance	There was no surface water identified on the site.

Site Conditions	Comments
Currently surrounding land use	The sites to the north, east, south and west are all mixed use – residential and agricultural.
Local sensitive environments	No sensitive environments were observed on-site.
Visible signs of plant stress	No visible signs of plant stress were observed on the site.
Additional observations	Small stockpile of gravel was observed to the west of the horse track. Small piles of greenwaste were observed in the north-west corner of the site below the gum trees. One 10L drum and one 100L drum were observed near the sheds. These drums were empty and no soil staining was visible on the ground.

5 Summary of Preliminary Site Investigation

Potential sources of contamination at the site were assessed. The information is summarised in Table 7 below.

Table 7: Potential Contaminants at the Site

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES (Soil)	Potential to be a risk on-site?
Horse track	Heavy metals PAHs	Area of horse track	I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.	**Unknown**. Analysis of soils from track required.

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES (Soil)	Potential to be a risk on-site?
Spray Drift from Neighbouring Orchard.	Heavy metals. Organochlorine pesticides.	North-western section of the site.	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. A10: Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds.	**Unknown.** Analysis of soil in north-western section of the site is required.

6 Intrusive Investigation

An intrusive investigation was developed to investigate if the soils have been impacted to 0.3 meters below ground level (m bgl). The soils were sampled to assess the suitability of the land (from a contamination / human health perspective) for residential use, and to assess the human health risks posed to site works under the commercial / outdoor worker scenario.

6.1 Methodology

The following was undertaken during the soil sampling works:

- Collection of four soil samples using a hand trowel from across the horse track area from the imported fill (0.0-0.3 m);
- Collection of six soil samples using a hand trowel from across the north-western section of the site close to the neighbouring orchard (0.0-0.3 m);
- Each sample was inspected for visual and olfactory indicators of contamination;
- All soil samples collected were placed in jars, which were then sealed, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to Hill Laboratories under the standard chain of custody documentation provided in Appendix 4;
- To reduce the potential for cross contamination, each sample was collected using disposable nitrile gloves that were discarded following the collection of each sample;
- After collection of each sample, the sampling equipment was decontaminated by scrubbing with a solution of Decon90 and rinsing with tap water followed by deionised water;

- The intrusive sampling was completed in accordance with ENGEO standard operating procedures while geological logging was completed in general accordance with the New Zealand Geotechnical Society Inc. '*Guideline for the Field Classification of Soil and Rock for Engineering Purposes' December 2005*;
- All fieldwork and sampling was undertaken in general accordance with the procedures for the appropriate handling of potentially contaminated soils as described in the MfE Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils;
- Following receipt of the samples by Hill Laboratories, the soil samples were scheduled for a selection of contaminants of concern including heavy metals, polycyclic aromatic hydrocarbons (PAHs) and organochlorine pesticides (OCPs); and
- On receipt of the analytical results, an assessment of the soil concentrations for contaminants of concern with applicable standards and soil acceptance criteria for the protection of human health and the environment was undertaken.

Quality Assurance and Quality Control

The quality assurance / quality control (QA / QC) procedures employed during the works included:

- Standard sample registers and chain of custody records have been kept for all samples;
- The use of Hill Laboratories, ISO/IEC 17025 and IANZ accredited laboratory, to conduct all laboratory analysis. To maintain their International Accreditation, Hill Laboratories undertakes rigorous cross checking and routine duplicate sampling testing to ensure the accuracy of their results;
- Prior to sampling the equipment (hand auger) was decontaminated using a triple wash procedure with potable water, Decon 90 solution and deionised water; and
- During the site investigation every attempt was made to ensure that cross contamination did not occur through the use of the procedures outlined within this document.

7 Regulatory Framework and Assessment Criteria

The regulatory frameworks and rules relating to the management and control of contaminated sites in the Canterbury Region are specified in two documents: the NES and the ECan Regional Plan. A summary of each and its implications for the site is provided in Sections 6.1-6.2.

7.1 NES

The NES came into effect on 1 January 2012 (MfE, 2011f).

The NES introduced soil contaminant standards (SCSs) for 12 priority contaminants for the protection of human health under a variety of land use scenarios.

The NES requires the *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values* be used where a NES SCS is not available. The NES does not consider environmental receptors; accordingly, the application of guidelines relevant to environmental receptors shall be implemented according to the MfE CLMG No. 2 and any relevant rules in the Regional Plan.

In addition, local background levels in soil have been referenced to establish consenting implications under the NES and disposal requirements. Background levels for metals in soils in the area were obtained from ECan's online GIS – Trace Level 2 concentrations.

7.2 Disposal Criteria

An assessment of potential off-site disposal options for any excess spoil generated during site development works has been conducted. Dependent on the contamination conditions of the spoil, off-site disposal options range from disposal to "cleanfill" sites to management fill sites. As outlined in the publication "A Guide to the Management of Clean Fills" (MfE, 2002), cleanfill is defined as:

"Material that when buried will have no adverse effect on people or the environment. Cleanfill material includes virgin natural materials such as clay, soil and rock, and other inert materials such as concrete or brick that are free of:

- Combustible, putrescible, degradable or leachable components;
- Hazardous substances;
- Products or materials derived from hazardous waste treatment, hazardous waste stabilization or hazardous waste disposal practices;
- Material that may present a risk to human health such as medical and veterinary waste, asbestos or radioactive substances; and
- Liquid waste."

7.3 Assessment Criteria

Contaminant concentrations in soil were compared to human health criteria based on the following land use:

- Residential land use; and
- Commercial / industrial land use (based on an outdoor worker scenario) (for redevelopment workers).

The land use scenarios are relevant to the likely future use of the site and are being used as a surrogate to assess short term risks to redevelopment earth workers on-site during the development activities.

The NES methodology document notes that the exposure parameters assumed for the maintenance / excavation scenario in other New Zealand guidelines are unrealistic (perhaps by a factor of 10 or more). The technical committee preparing the NES decided that a maintenance / excavation worker scenario should not be included in the NES as sites would not be cleaned up to this standard; it was considered more appropriate that exposures to these workers be limited through the use of site-specific controls that are required under health and safety legislation.

However, this report uses commercial / industrial outdoor worker criteria to get a general sense of potential risks to excavation workers during the redevelopment. Note that commercial / industrial outdoor worker criteria are based on personnel carrying out maintenance activities involving soil exposure to surface soil during landscaping activities, and occasional shallow exposure to surface or near surface soil during landscaping activities, and occasional shallow excavation for routine underground service maintenance. Exposure to soil is less intensive than would occur during construction works but occurs over a longer period. For a construction worker developing the site, the soil exposure is limited when compared to a large earthworks project (e.g. for a residential subdivision or industrial development). As such, the commercial / industrial outdoor worker criteria are considered suitable for obtaining a high-level understanding of potential risks to excavation workers during site redevelopment and confirming the need for site controls.

The soil analysis results have also been compared to Regional Background levels for heavy metals (arsenic, copper, cadmium, mercury, nickel, zinc) and organochlorine pesticides (OCPs). These provide information into the possible disposal options at a cleanfill facility.

8 Results

8.1 Soil Encountered

Please refer to Table 8 from the summary of subsurface soil encountered within the near surface soils in the burn pit area. Please refer to ENGEO's Geotechnical Report (ENGEO, 2019) for the site for additional soil profiles.

No potential asbestos containing material was visually identified in the fill material on the race track; therefore soil analysis for asbestos was not undertaken.

Table 8: Summary of Subsurface Soils

	Depth	Soil Description
Orchard	0.0-0.1	SILT with some sand, trace gravel and rootlets.
	0.1-0.3	SILT with some sand, trace gravel.
Horse Track	0.0-0.15	Silty GRAVEL with some sand.
	0.15-0.3	SILT with some sand, trace gravel.

8.2 Analytical Results

Six samples were collected from around the north-western section of the site closest to the neighbouring orchard in the surface soils (0.1 m bgl). All samples returned concentrations of heavy metals and OCPs below the applicable NES criteria and below the site specific background levels. Samples O-3, O-4, O-5 and O-6 reported very low concentrations of 4,4'-DDT, however these concentrations are only marginally above the laboratory detection of limit.

The horse rack samples (T-1, T-2, T-3, T-4) analysed for heavy metals and PAHs were reported below the applicable NES criteria and below the site specific background levels. All PAH analytes were reported below the laboratory detection of limit.

Table 9: Sample Analysis Results

Sample Name	T-1	T-2	T-3	T-4	O-1	O-2	O-3	O-4	O-5	O-6	Human health criteria – Residential Land Use	Human health criteria - Commercial / industrial outdoor worker (unpaved)[a]	Regional background - Trace Elements (Level 2)[b]
Soil Type	GRAVEL	GRAVEL	GRAVEL	GRAVEL	SILT	SILT	SILT	SILT	SILT	SILT			
Sample Depth, m	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.1-0.3	0.1-0.3	0.1-0.3	0.1-0.3	0.1-0.3	0.1-0.3			
Heavy Metals in soil, mg/kg													
Arsenic	3	3	3	3	3	3	3	3	3	3	20	70	6.35
Cadmium[c]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	0.10	3	1,300	0.14
Chromium[d]	12	11	11	12	13	12	13	11	13	12	460	6,300	19.89
Copper	4	5	5	4	3	5	4	4	4	4	>10,000	>10,000	11.68
Lead	16.7	11.3	12.4	13.7	16.7	13.7	14.8	11.6	13.7	12.5	210	3,300	19.75
Mercury	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	310	4,200	0.07
Nickel	8	8	8	8	8	7	8	7	8	7	400[c]	6,000[c]	13.91
Zinc	51	41	42	44	50	46	49	42	46	43	7,400[c]	400,000[c]	69.58
Organochlorine Pesticides in soil, mg/kg													
∑DDT	-	-	-	-	<0.07	<0.07	0.07	0.12	0.14	0.12	23.33	333.33	0.431
Dieldrin	-	-	-	-	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	0.86	53.33	-
Polycyclic aromatic hydrocarbons in soil, mg/kg													
BaP eq.	<0.03	<0.03	<0.03	0.03	-	-	-	-	-	-			0.922

[a] Human health criteria from the NES except where noted.

Bold text indicates that the concentration exceeds the Residential land use criterion.

Italics indicates that the concentration exceeds the Commercial/industrial land user criterion.

[b] ECan (2007) Background Concentrations of Selected Trace Elements in Canterbury Soils. Exceedances are underlined.

[c] Assumes soil pH of 5.

[d] Criteria for Chromium VI were conservatively selected.

9 Conceptual Site Model

A conceptual site model consists of four primary components. For contaminants to present a risk to human health or an environmental receptor, all four components are required to be present and connected. The four components of a conceptual site model are:

- Source of contamination;
- Pathway(s) in which contamination could potentially mobilise along (e.g. vapour or groundwater migration);
- Sensitive receptor(s) which may be exposed to the contaminants; and
- An exposure route, where the sensitive receptor and contaminants come into contact (e.g. ingestion, inhalation, dermal contact).

The potential source, pathway, receptor linkages at this subject site are provided in Table 10.

Table 10: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Horse Track	Heavy metals and PAHs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers.	**Yes.** All samples were below the applicable NES criteria.
Orchard	Heavy metals and OCPs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers.	**Yes.** All samples were below the applicable NES criteria.

10 Conclusions and Recommendations

ENGEO Ltd was engaged by Hughes Developments Ltd to undertake a Preliminary and Detailed Site Investigation at a 10.1 ha site, situated at 108 Dunns Crossing Road, Rolleston, for a change in land use, subdivision and soil disturbance consent. Information was gathered and reviewed regarding the current and past uses of the site that could have resulted in releases or potential releases of hazardous substances to the subject property.

The review of information identified that the site has been used for agricultural grazing from circa 1940, and residential land use including a horse trotting track and various shed since 1990's/2000's.

No activities were identified on Canterbury Regional Council's Listed Land Use Register (CRC LLUR). The property file for the site was viewed at Selwyn District Council, and contained no information related to potential hazardous activities having occurred at the site.

During the site walkover the horse track was sampled for impacted imported fill material. It was noted that the imported fill consisted of gravel and shells. The laboratory analysis of four samples from around the trotting track area were submitted for analysis for heavy metals and PAHs. Six samples were also collected from the north-western corner of the site for heavy metals and OCPs due to the neighbouring site being a historic orchard. All ten samples returned concentrations below the site specific regional background criteria and the applicable NES human health criteria.

Based on the information gathered, we consider that it is highly unlikely for the soils to have been impacted from past and current uses of the site. As per regulation 7 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011, it is highly unlikely that an activity included on the HAIL has or is being carried out on the site therefore this piece of land is not covered by this piece of legislation.

11 References

ECan (2007a). *Background Concentrations of Selected Trace Elements in Canterbury Soils. Addendum 1: Additional Samples and Timaru Specific Background Levels. Report prepared for Environment Canterbury by Tonkin & Taylor Limited, Christchurch, New Zealand.* Report Number R07/1/2. Tonkin & Taylor Reference: 50875.003.

Forsyth, P.J.; Barrell, D.J.A; Jongens, R. (2008). *Sheet 16 - Geology of the Christchurch Area 1:250,000. Institute of Geological and Nuclear Sciences, Lower Hutt.*

MfE (2011a). *Ministry for the Environment Hazardous Activities and Industries List.*

MfE (2011b). *Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites*.

MfE (2011c). *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values.*

MfE (2011d). *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils*.

MfE (2011f). *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.*

MfE (2012). *Users' guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.*

12 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments Limited, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

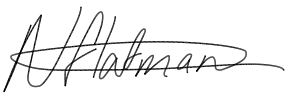
iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

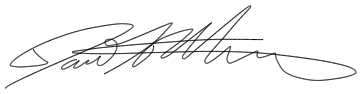
Report prepared by



Natalie Flatman

Environmental Scientist

Report reviewed by



Dave Robotham, CEnvP SC

Principal Environmental Consultant

FIGURES

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DATE PLOTTED: 07 November 2019 11:42:15 am BY: NFlatman





Legend

Site boundary

Sample locations

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

ENGEO

Christchurch Office
124 Montreal Street, Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title: Site Location Plan

Client: Hughes Developments Ltd		Figure No: 1
Project: 108 Dunns Crossing Road Rolleston	Designed: NF Drawn: NF Checked: XX Date: Nov 19	Size: A3
Proj No: 12903.001.000	Scale: 1:2,000	Revision: A

PATH: \\nzfile\nz\Projects\12901 to 13000\12903 - Farrington South Subdivision\052_108 Dunns Crossing Road - Enviro\05_CAD-GIS & Figures\Fig_01 landscape.mxd

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 1:

Site Photographs



Photo 1: Dwelling at 108 Dunns Crossing Road



Photo 2: Shed on site

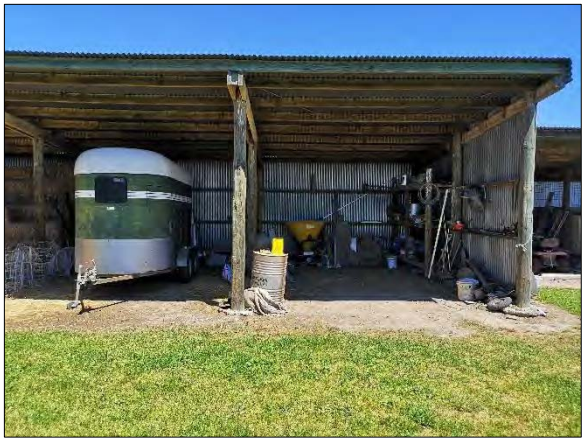


Photo 3: Shed on site



Photo 4: Small sheds to the north of the dwelling



Photo 5: Residential vegetable garden to the north of the dwelling



Photo 6: Horse track

ENGEO
Expect Excellence

Date taken	Nov 19	**Client**	**Hughes Developments**		
Taken by	JH	**Project**	**108 Dunns Crossing Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	1 to 6	**ENGEO Ref.**	12903	**Appendix No.**	1a



Photo 7: Middle of horse track looking north



Photo 8: Middle of horse track area



Photo 9: Southern Gravel Stockpile (old oval track material)



Photo 10: Typical strata of horse track material



Photo 11: Green waste pile in gum trees northwest corner of the site



Photo 12: Empty storage containers near sheds

ENGEO
Expect Excellence

Date taken	Nov 19	**Client**	**Hughes Developments**		
Taken by	JH	**Project**	**108 Dunns Crossing Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	7 to 12	**ENGEO Ref**	12903	**Appendix No**	1b

APPENDIX 2:

CRC LLUR

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

Dear Sir/Madam

Thank you for submitting your property enquiry in regards to our Listed Land Use Register (LLUR) which holds information about sites that have been used, or are currently used for activities which have the potential to have caused contamination.

The LLUR statement provided indicates the location of the land parcel(s) you enquired about and provides information regarding any LLUR sites within a radius specified in the statement of this land.

Please note that if a property is not currently entered on the LLUR, it does not mean that an activity with the potential to cause contamination has never occurred, or is not currently occurring there. The LLUR is not complete, and new sites are regularly being added as we receive information and conduct our own investigations into current and historic land uses.

The LLUR only contains information held by Environment Canterbury in relation to contaminated or potentially contaminated land; other information relevant to potential contamination may be held in other files (for example consent and enforcement files).

If your enquiry relates to a farm property, please note that many current and past activities undertaken on farms may not be listed on the LLUR. Activities such as the storage, formulation and disposal of pesticides, offal pits, foot rot troughs, animal dips and underground or above ground fuel tanks have the potential to cause contamination.

Please contact and Environment Canterbury Contaminated Sites Officer if you wish to discuss the contents of the LLUR statement, or if you require additional information.
For any other information regarding this land please contact Environment Canterbury Customer Services.

Yours sincerely

Contaminated Sites Team

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:	24 October 2019	
Land Parcels:	Lot 2 DP 61278	Valuation No(s): 2405538000



The information presented in this map is specific to the property you have selected. Information on nearby properties may not be shown on this map, even if the property is visible.

Summary of sites:

There are no sites associated with the area of enquiry.

Information held about the sites on the Listed Land Use Register

There are no sites associated with the area of enquiry.

Information held about other investigations on the Listed Land Use Register

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ244766.

Disclaimer:

The enclosed information is derived from Environment Canterbury's Listed Land Use Register and is made available to you under the Local Government Official Information and Meetings Act 1987 and Environment Canterbury's Contaminated Land Information Management Strategy (ECan 2009).

The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness of this information. It is released only as a copy of Environment Canterbury's records and is not intended to provide a full, complete or totally accurate assessment of the site. It is provided on the basis that Environment Canterbury makes no warranty or representation regarding the reliability, accuracy or completeness of the information provided or the level of contamination (if any) at the relevant site or that the site is suitable or otherwise for any particular purpose. Environment Canterbury accepts no responsibility for any loss, cost, damage or expense any person may incur as a result of the use, reference to or reliance on the information contained in this report.

Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know



Everything is connected

What is the Listed Land Use Register (LLUR)?

The LLUR is a database that Environment Canterbury uses to manage information about land that is, or has been, associated with the use, storage or disposal of hazardous substances.

Why do we need the LLUR?

Some activities and industries are hazardous and can potentially contaminate land or water. We need the LLUR to help us manage information about land which could pose a risk to your health and the environment because of its current or former land use.

Section 30 of the Resource Management Act (RMA, 1991) requires Environment Canterbury to investigate, identify and monitor contaminated land. To do this we follow national guidelines and use the LLUR to help us manage the information.

The information we collect also helps your local district or city council to fulfil its functions under the RMA. One of these is implementing the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil, which came into effect on 1 January 2012.

For information on the NES, contact your city or district council.

How does Environment Canterbury identify sites to be included on the LLUR?

We identify sites to be included on the LLUR based on a list of land uses produced by the Ministry for the Environment (MfE). This is called the Hazardous Activities and Industries List (HAIL)[1]. The HAIL has 53 different activities, and includes land uses such as fuel storage sites, orchards, timber treatment yards, landfills, sheep dips and any other activities where hazardous substances could cause land and water contamination.

We have two main ways of identifying HAIL sites:

- We are actively identifying sites in each district using historic records and aerial photographs. This project started in 2008 and is ongoing.
- We also receive information from other sources, such as environmental site investigation reports submitted to us as a requirement of the Regional Plan, and in resource consent applications.

[1] The Hazardous Activities and Industries List (HAIL) can be downloaded from MfE's website www.mfe.govt.nz, keyword search HAIL

How does Environment Canterbury classify sites on the LLUR?

Where we have identified a HAIL land use, we review all the available information, which may include investigation reports if we have them. We then assign the site a category on the LLUR. The category is intended to best describe what we know about the land use and potential contamination at the site and is signed off by a senior staff member.

Please refer to the Site Categories and Definitions factsheet for further information.

What does Environment Canterbury do with the information on the LLUR?

The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list of any investigation reports.

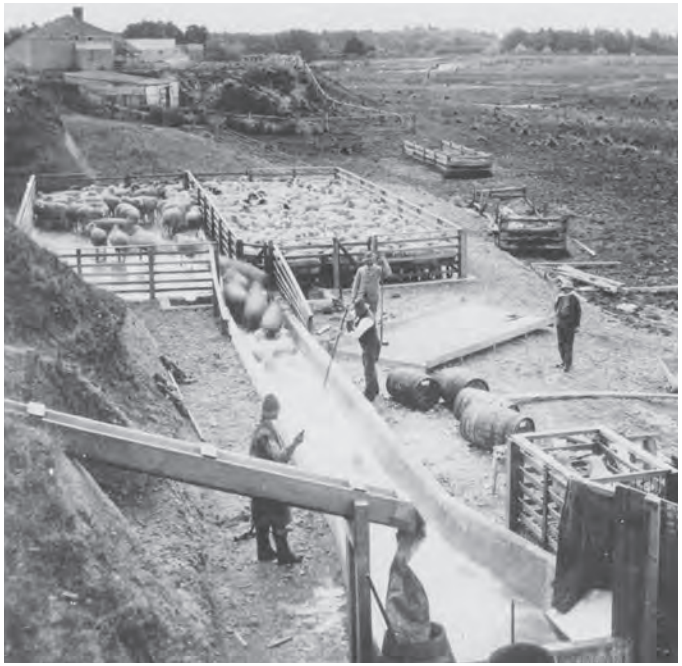
We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

If you are conducting an environmental investigation or removing an underground storage tank at your property, you will need to comply with the rules in the Regional Plan and send us a copy of the report. This means we can keep our records accurate and up-to-date, and we can assign your property an appropriate category on the LLUR. To find out more, visit www.ecan.govt.nz/HAIL.



IMPORTANT!

The LLUR is an online database which we are continually updating. A property may not currently be registered on the LLUR, but this does not necessarily mean that it hasn't had a HAIL use in the past.



Sheep dipping (ABOVE) and gas works (TOP) are among the former land uses that have been identified as potentially hazardous. (Photo above by Wheeler & Son in 1987, courtesy of Canterbury Museum.)

My land is on the LLUR – what should I do now?

IMPORTANT! Just because your property has a land use that is deemed hazardous or is on the LLUR, it doesn't necessarily mean it's contaminated. The only way to know if land is contaminated is by carrying out a detailed site investigation, which involves collecting and testing soil samples.

You do not need to do anything if your land is on the LLUR and you have no plans to alter it in any way. It is important that you let a tenant or buyer know your land is on the Listed Land Use Register if you intend to rent or sell your property. If you are not sure what you need to tell the other party, you should seek legal advice.

You may choose to have your property further investigated for your own peace of mind, or because you want to do one of the activities covered by the National Environmental Standard for Assessing and Managing Contaminants in Soil. Your district or city council will provide further information.



If you wish to engage a suitably qualified experienced practitioner to undertake a detailed site investigation, there are criteria for choosing a practitioner on www.ecan.govt.nz/HAIL.

I think my site category is incorrect – how can I change it?

If you have an environmental investigation undertaken at your site, you must send us the report and we will review the LLUR category based on the information you provide. Similarly, if you have information that clearly shows your site has not been associated with HAIL activities (eg. a preliminary site investigation), or if other HAIL activities have occurred which we have not listed, we need to know about it so that our records are accurate.

If we have incorrectly identified that a HAIL activity has occurred at a site, it will be not be removed from the LLUR but categorised as Verified Non-HAIL. This helps us to ensure that the same site is not re-identified in the future.

Contact us

Property owners have the right to look at all the information Environment Canterbury holds about their properties.

It is free to check the information on the LLUR, online at www.llur.ecan.govt.nz.

If you don't have access to the internet, you can enquire about a specific site by phoning us on (03) 353 9007 or toll free on 0800 EC INFO (32 4636) during business hours.

Contact Environment Canterbury:

Email: ecinfo@ecan.govt.nz

Phone:
Calling from Christchurch: (03) 353 9007
Calling from any other area: 0800 EC INFO (32 4636)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

Listed Land Use Register

Site categories and definitions

When Environment Canterbury identifies a Hazardous Activities and Industries List (HAIL) land use, we review the available information and assign the site a category on the Listed Land Use Register. The category is intended to best describe what we know about the land use.

If a site is categorised as **Unverified** it means it has been reported or identified as one that appears on the HAIL, but the land use has not been confirmed with the property owner.

If the land use has been confirmed but analytical information from the collection of samples is not available, and the presence or absence of contamination has therefore not been determined, the site is registered as:

Not investigated:

- A site whose past or present use has been reported and verified as one that appears on the HAIL.
- The site has not been investigated, which might typically include sampling and analysis of site soil, water and/or ambient air, and assessment of the associated analytical data.
- There is insufficient information to characterise any risks to human health or the environment from those activities undertaken on the site. Contamination may have occurred, but should not be assumed to have occurred.

If analytical information from the collection of samples is available, the site can be registered in one of six ways:

At or below background concentrations:

The site has been investigated or remediated. The investigation or post remediation validation results confirm there are no hazardous substances above local background concentrations other than those that occur naturally in the area. The investigation or validation sampling has been sufficiently detailed to characterise the site.

Below guideline values for:

The site has been investigated. Results show that there are hazardous substances present at the site but indicate that any adverse effects or risks to people and/or the environment are considered to be so low as to be acceptable. The site may have been remediated to reduce contamination to this level, and samples taken after remediation confirm this.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Managed for:

The site has been investigated. Results show that there are hazardous substances present at the site in concentrations that have the potential to cause adverse effects or risks to people and/or the environment. However, those risks are considered managed because:

- the nature of the use of the site prevents human and/or ecological exposure to the risks; and/or
- the land has been altered in some way and/or restrictions have been placed on the way it is used which prevent human and/or ecological exposure to the risks.

Partially investigated:

The site has been partially investigated. Results:

- demonstrate there are hazardous substances present at the site; however, there is insufficient information to quantify any adverse effects or risks to people or the environment; or
- do not adequately verify the presence or absence of contamination associated with all HAIL activities that are and/or have been undertaken on the site.

Significant adverse environmental effects:

The site has been investigated. Results show that sediment, groundwater or surface water contains hazardous substances that:

- have significant adverse effects on the environment; or
- are reasonably likely to have significant adverse effects on the environment.

Contaminated:

The site has been investigated. Results show that the land has a hazardous substance in or on it that:

- has significant adverse effects on human health and/or the environment; and/or
- is reasonably likely to have significant adverse effects on human health and/or the environment.

If a site has been included incorrectly on the Listed Land Use Register as having a HAIL, it will not be removed but will be registered as:

Verified non-HAIL:

Information shows that this site has never been associated with any of the specific activities or industries on the HAIL.

Please contact Environment Canterbury for further information:

(03) 353 9007 or toll free
on 0800 EC INFO (32 4636)
email ecinfo@ecan.govt.nz

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

E13/102

APPENDIX 3:

Certificate of Titles

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB36C/248**
Land Registration District	**Canterbury**
Date Issued	29 October 1992

Prior References
CB33K/66

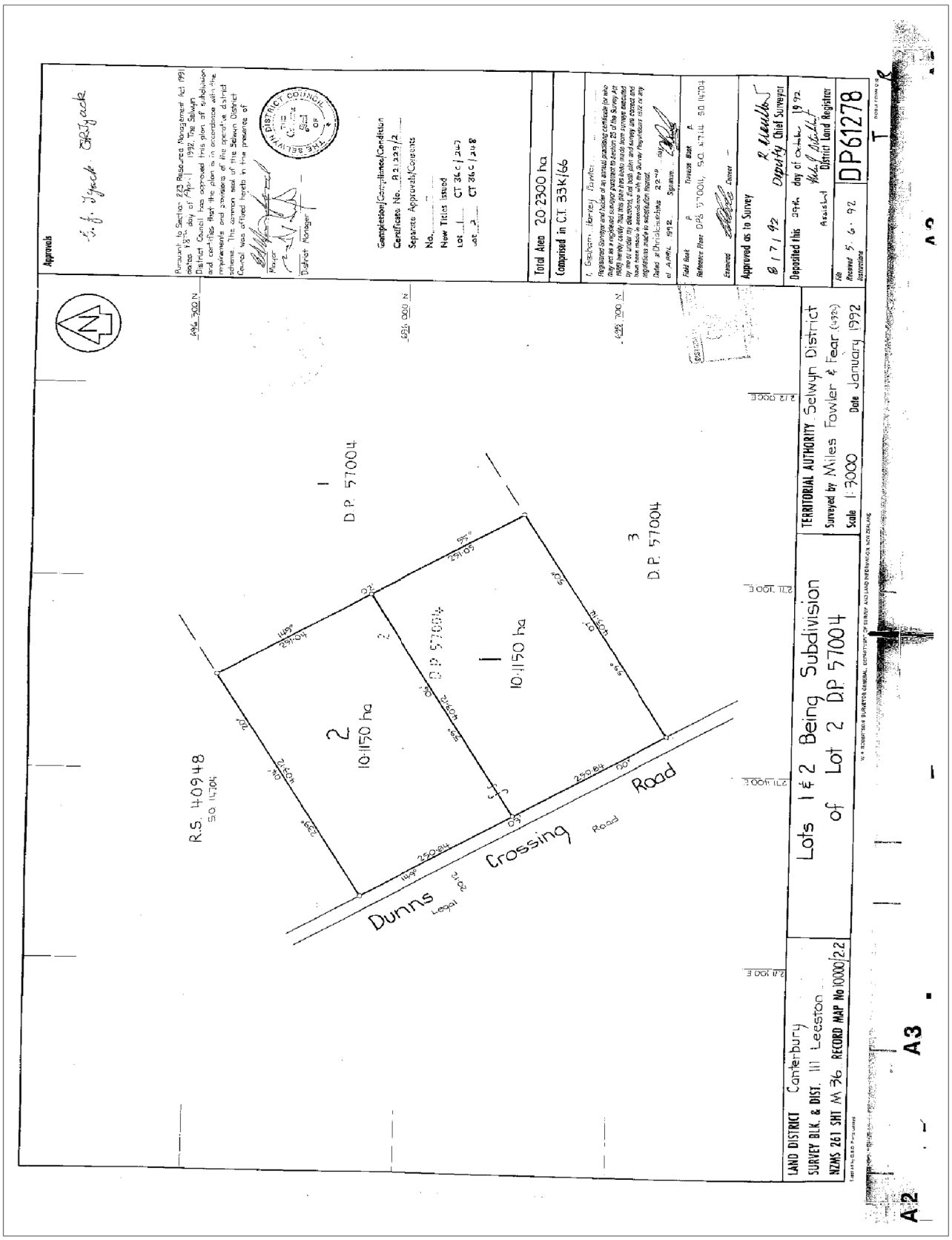
Estate	Fee Simple
Area	10.1150 hectares more or less
Legal Description	Lot 2 Deposited Plan 61278

Registered Owners
Lindsay Kenneth Blackmore as to a 1/2 share
Judith Christina Blackmore as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

Identifier **CB36C/248**



APPENDIX 4:

Laboratory Certificates

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2269325 SPv2
Contact:	Natalie Flatman	**Date Received:**	05-Nov-2019
	C/- Engeo Limited	**Date Reported:**	07-Nov-2019
	PO Box 373	**Quote No:**	82742
	Christchurch 8140	**Order No:**	
		Client Reference:	12903.000.000-108DC
		Submitted By:	Natalie Flatman

Sample Type: Soil

Sample Name:		T-1 @ 0.0-0.1 04-Nov-2019	T-2 @ 0.0-0.1 04-Nov-2019	T-3 @ 0.0-0.1 04-Nov-2019	T-4 @ 0.0-0.1 04-Nov-2019	0-1 @ 0.1-0.3 04-Nov-2019
Lab Number:		2269325.1	2269325.2	2269325.3	2269325.4	2269325.5
Individual Tests						
Dry Matter	g/100g as rcvd	87	97	96	92	84
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	3	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	12	11	11	12	-
Total Recoverable Copper	mg/kg dry wt	4	5	5	4	-
Total Recoverable Lead	mg/kg dry wt	16.7	11.3	12.4	13.7	-
Total Recoverable Nickel	mg/kg dry wt	8	8	8	8	-
Total Recoverable Zinc	mg/kg dry wt	51	41	42	44	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	-	-	-	3
Total Recoverable Cadmium	mg/kg dry wt	-	-	-	-	< 0.10
Total Recoverable Chromium	mg/kg dry wt	-	-	-	-	13
Total Recoverable Copper	mg/kg dry wt	-	-	-	-	3
Total Recoverable Lead	mg/kg dry wt	-	-	-	-	16.7
Total Recoverable Mercury	mg/kg dry wt	-	-	-	-	< 0.10
Total Recoverable Nickel	mg/kg dry wt	-	-	-	-	8
Total Recoverable Zinc	mg/kg dry wt	-	-	-	-	50
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	-	-	-	< 0.012
alpha-BHC	mg/kg dry wt	-	-	-	-	< 0.012
beta-BHC	mg/kg dry wt	-	-	-	-	< 0.012
delta-BHC	mg/kg dry wt	-	-	-	-	< 0.012
gamma-BHC (Lindane)	mg/kg dry wt	-	-	-	-	< 0.012
cis-Chlordane	mg/kg dry wt	-	-	-	-	< 0.012
trans-Chlordane	mg/kg dry wt	-	-	-	-	< 0.012
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	-	-	-	< 0.04
2,4'-DDD	mg/kg dry wt	-	-	-	-	< 0.012
4,4'-DDD	mg/kg dry wt	-	-	-	-	< 0.012
2,4'-DDE	mg/kg dry wt	-	-	-	-	< 0.012
4,4'-DDE	mg/kg dry wt	-	-	-	-	< 0.012
2,4'-DDT	mg/kg dry wt	-	-	-	-	< 0.012
4,4'-DDT	mg/kg dry wt	-	-	-	-	< 0.012
Total DDT Isomers	mg/kg dry wt	-	-	-	-	< 0.08
Dieldrin	mg/kg dry wt	-	-	-	-	< 0.012
Endosulfan I	mg/kg dry wt	-	-	-	-	< 0.012
Endosulfan II	mg/kg dry wt	-	-	-	-	< 0.012

ilac-MRA IANZ ACCREDITED LABORATORY

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		T-1 @ 0.0-0.1 04-Nov-2019	T-2 @ 0.0-0.1 04-Nov-2019	T-3 @ 0.0-0.1 04-Nov-2019	T-4 @ 0.0-0.1 04-Nov-2019	0-1 @ 0.1-0.3 04-Nov-2019
Lab Number:		2269325.1	2269325.2	2269325.3	2269325.4	2269325.5
Organochlorine Pesticides Screening in Soil						
Endosulfan sulphate	mg/kg dry wt	-	-	-	-	< 0.012
Endrin	mg/kg dry wt	-	-	-	-	< 0.012
Endrin aldehyde	mg/kg dry wt	-	-	-	-	< 0.012
Endrin ketone	mg/kg dry wt	-	-	-	-	< 0.012
Heptachlor	mg/kg dry wt	-	-	-	-	< 0.012
Heptachlor epoxide	mg/kg dry wt	-	-	-	-	< 0.012
Hexachlorobenzene	mg/kg dry wt	-	-	-	-	< 0.012
Methoxychlor	mg/kg dry wt	-	-	-	-	< 0.012
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	-
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Acenaphthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[a]anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[e]pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Chrysene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	0.012	-
Fluorene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	-
Perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Phenanthrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-

Sample Name:		0-2 @ 0.1-0.3 04-Nov-2019	0-3 @ 0.1-0.3 04-Nov-2019	0-4 @ 0.1-0.3 04-Nov-2019	0-5 @ 0.1-0.3 04-Nov-2019	0-6 @ 0.1-0.3 04-Nov-2019
Lab Number:		2269325.6	2269325.7	2269325.8	2269325.9	2269325.10
Individual Tests						
Dry Matter	g/100g as rcvd	83	83	91	83	90
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.10	0.10
Total Recoverable Chromium	mg/kg dry wt	12	13	11	13	12
Total Recoverable Copper	mg/kg dry wt	5	4	4	4	4
Total Recoverable Lead	mg/kg dry wt	13.7	14.8	11.6	13.7	12.5
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	7	8	7	8	7
Total Recoverable Zinc	mg/kg dry wt	46	49	42	46	43
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
alpha-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
beta-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
delta-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
gamma-BHC (Lindane)	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011

Sample Type: Soil						
Sample Name:		0-2 @ 0.1-0.3 04-Nov-2019	0-3 @ 0.1-0.3 04-Nov-2019	0-4 @ 0.1-0.3 04-Nov-2019	0-5 @ 0.1-0.3 04-Nov-2019	0-6 @ 0.1-0.3 04-Nov-2019
Lab Number:		2269325.6	2269325.7	2269325.8	2269325.9	2269325.10
Organochlorine Pesticides Screening in Soil						
cis-Chlordane	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
trans-Chlordane	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
4,4'-DDD	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
2,4'-DDE	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
4,4'-DDE	mg/kg dry wt	< 0.012	0.013	0.064	0.078	0.060
2,4'-DDT	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
4,4'-DDT	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Total DDT Isomers	mg/kg dry wt	< 0.07	< 0.07	< 0.07	0.08	< 0.07
Dieldrin	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endosulfan I	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endosulfan II	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endosulfan sulphate	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endrin	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endrin aldehyde	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endrin ketone	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Heptachlor	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Heptachlor epoxide	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Hexachlorobenzene	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Methoxychlor	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011

Analyst's Comments

Appendix No.1 - Chain of Custody

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-10
Total of Reported PAHs in Soil	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg dry wt	1-4
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-4
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	5-10
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082). Tested on as recieved sample	0.010 - 0.06 mg/kg dry wt	5-10
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.3 mg/kg dry wt	1-4
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-10
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-4

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Benzo[a]pyrene Toxic Equivalence (TEF)	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Martin Cowell - BSc
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

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Job No: **226 9325**

Date Recv: 05-Nov-19 05:49

Received by: Nathaniel Sue

3122693254

Quote No

Primary Contact Natalie Flatman

Submitted By Natalie Flatman

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Charge To ENGEO Ltd

Client Reference 12903.000.000_108DC

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☑ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

ADDITIONAL INFORMATION

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories

Date & Time: 4/11/19 4:00

Name: N Flatman

☑ *Tick if you require COC to be emailed back*

Signature:

Received at Hill Laboratories

Date & Time:

Name:

Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen

Temp: >3

☐ *Sample and Analysis details checked*

Signature:

Priority ☐ Low ☐ Normal ☑ High

☐ **Urgent** (ASAP, extra charge applies, please contact lab first)

Requested Reporting Date:

No.	Sample Name	Sample Date	Sample Time	Sample Type	Tests Required (if not as per Quote)
1	T-1 @0.0-0.1	4/11/19		ES	Heavy metals & PAHs
2	T-2 @0.0-0.1				" "
3	T-3 @0.0-0.1				" "
4	T-4 @0.0-0.1				" "
5	0-1 @0.1-0.3				Heavy metals incl Mercury & OCPs
6	0-2 @0.1-0.3				" "
7	0-3 @0.1-0.3				" "
8	0-4 @0.1-0.3				" "
9	0-5 @0.1-0.3				" "
10	0-6 @0.1-0.3				" "
11					
12					

Continued on next page



ENGEO

Expect Excellence

Detailed Environmental Site Investigation

92 Dunns Crossing Road

Rolleston

Canterbury

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Table 13: Conceptual Site Model

Table 14: Comparison of Proposed Earthwork Volumes to NES

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Figure 1a: 1940 Histrocial Aerial Photograph

Figure 1b: 1960 Histrocial Aerial Photograph

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Figure 1h: Current Site Photograph

Figure 2: Sampling Location Plan

Figure 3: Sampling Location Plan

Appendices

Appendix 1: Certificates of Titles

Appendix 2: CRC LLUR Statement

Appendix 3: Site Photographs

Appendix 4: Laboratory Analysis

ENGEO Document Control:

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1 Introduction

ENGEO Ltd was requested by Hughes Developments Limited to undertake a combined Preliminary and Detailed Site Investigation (PSI / DSI) of neighbouring properties at 92 Dunns Crossing Road and Goulds Road (Lot 3 DP 54007) (herein referred to as 'the sites'). The purpose of the assessment was to assess the property's suitability for a change of land use consent, subdivision and soil disturbance under the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES) to satisfy the requirements of Selwyn District Council (SDC).

Figure 1h attached indicates the location of the property. This PSI / DSI was undertaken in accordance with the Ministry for the Environment (MfE) 2001, *Guidelines for Reporting on Contaminated Sites*.

1.1 Objectives of the Assessment

The objective of this PSI / DSI was to evaluate and identify conditions indicative of releases and threatened releases of hazardous substances on, at, in or to the subject property and report on the potential risk posed to future site users.

1.2 Approach

To satisfy the objectives, ENGEO sought to gather information regarding the following:

- Current and past property uses and occupancies;
- Current and past uses of hazardous substances;
- Waste management and disposal activities that could have caused a release or threatened release of hazardous substances;
- Current and past corrective actions and response activities to address past and ongoing releases of hazardous substances at the subject property; and
- Properties adjoining or located near the subject property that have environmental conditions that could have resulted in conditions indicative of releases or threatened releases of hazardous substances to the subject property.

1.2.1 Review of Site Information

During this assessment, a number of sources of information were contacted for information relating to the sites regarding their past and present uses. This included contacting Canterbury Regional Council (CRC) to determine if there were records on the Listed Land Use Register (LLUR) and reviewing records held by Selwyn District Council (SDC) including the property file and dangerous goods file (if available). A review of a number of historical and current aerial photographs was also undertaken using images from Canterbury Maps and Google Earth.

1.2.2 Site Inspection

A site walkover was undertaken on 22 November 2019 by Natalie Flatman of ENGEO.

2 Site Description and Setting

Site information is summarised in Table 1.

Table 1: Site Information

Item	Description	
Location	92 Dunns Crossing Road	Goulds Road
Legal Description	Lot 1 DP 61278	Lot 3 DP 57004
Site Area	10.1 ha	20.7 ha
Property Owner	Property is under contract to Hughes Developments Limited.	
Current Land Use	Residential and Agricultural	
Proposed Land Use	Residential	
Building Construction	Dwelling – Concrete ring foundation, brick cladding, cement soffits, metal roof. Garage – concrete foundation, metal cladding and roof. Barns – timber frame with metal cladding and roof.	Not applicable
Territorial Authority	Selwyn District Council	

The site setting is summarised in Table 2.

Table 2: Site Setting

Item	Description
Topography	The sites are predominately flat.
Local Setting	The surrounding area is a mix of agricultural and residential.
Nearest Surface Water & Use	An un-named drain runs northeast to southwest along the southern side of Goulds Road.
Geology	Late Quaternary unconsolidated to poorly consolidated mud, sand, gravel and peat of alluvial and colluvial origin.
Hydrogeology	The sites are located over an unconfined / semiconfined gravel aquifer.
Groundwater Abstractions	There are two groundwater abstractions located on the sites and three within 250 m of the sites: M36/4451: GJ & FR Tyack, active well (no depth recorded) on-site for domestic supply. M36/4387: G & DC Robertson, active well (35.6 m) on-site for domestic supply. M36/20535: S & M Baxter, active well (30.0 m) to the east of the site for domestic and stockwater use. BX23/0895: M & T Croucher, active well (53.5m) to the south of the site for domestic and stormwater supply. M36/4450: LK & JC Blackmore, active well (25.2 m) to the northwest of the sites of irrigation use.
Discharge Consents	There is no active discharge consent located on the sites and one active consent within 250 m of the sites: CRC110335: S Baxter, active discharge consent for the discharge of contaminant into land and water.

3 Site History

A number of sources were used to investigate the past uses of the sites. The findings of these information searches have been summarised in this section.

3.1 Discussions with Site Owners

Ivan Robertson has been the owner of the sites at 92 Dunns Crossing Road and Gould Road for approximately 15 years. ENGEO spoke with Mr Robertson in regards to the past and current uses of the sites. Mr Robertson stated that he used the paddocks for grazing and growing hay. Mr Robertson stated that that no pesticides or chemicals had been stored on site. He mentioned a waste pit, which is roughly located along the trees on the eastern boundary directly across from the dwelling.

Mr Robertson did not place anything in the pit but remembers it being there when they purchased the property.

Mr Robertson also stated that he used to drive past the sites every day prior to owning the sites and does not recall the area identified as a sheep dip being a sheep dip – he thought it was more of a holding pen. He also mentioned that the only storage tank for fuel is the above ground storage tank located east of the largest barn.

3.2 Selwyn District Council Property File

The property file for the sites, held by Selwyn District Council, was reviewed on 12 September 2018 as part of the PSI. The details below were identified in the property file search:

92 Dunns Crossing Road

- 1990 Relocation of a house onto the site
- 1990 Extension of a stable building 67 m^2
- 1990 Extension of a shed 100 m^2
- 1990 Building Consent for a Versatile garage 36 m^2
- 2001 Building consent for an extension of the dwelling to include a porch area 24 m^2
- 2002 Building Consent for a 3 bay implement shed

Lot 3 DP 57004

- 1992 Building Consent for a small Pump shed

3.3 Certificate of Title

A review of the certificate of title was completed with no information related to potential contaminating activities identified. The Certificates of Title are attached in Appendix 1.

3.4 Listed Land Use Register (LLUR)

Potentially hazardous activities are defined on the Hazardous Activities and Industries List (HAIL). Canterbury Regional Council (CRC) maintains a Listed Land Use Register (LLUR) of past and current land uses within the Canterbury region which have potentially had an activity included on the HAIL undertaken on them. Under the NES, the listing of the property on the LLUR triggers the requirement for a contaminated land assessment prior to development.

The CRC LLUR property statement was requested by ENGEO on 8 November 2019 for the sites and is presented in Appendix 2.

Table 2: LLUR Summary

Period From	Period To	HAIL Activity(s)	LLUR Category
Pre 1941	Pre 1984	A8: Livestock dip or spray race operations	Not Investigated
Additional Information		Area defined from aerial photographs. Defined from 1961-1974 aerials.	

3.5 Historical Aerial Photograph Review

Aerial photographs dating from 1940 to 2017 have been reviewed. The relevant visible features are summarised in Table 4. Please refer to the figures for each aerial photograph.

Table 3: Aerial Photographs

Date	Figure	Source	Description
1940-1944	1a	Canterbury Maps	The sites are undeveloped and appear to be grassed and presumably used for grazing. A small shed is observed in the western corner of 92 Dunns Crossing Road. Alluvial flow paths are visible across the sites running northwest to southeast. The surrounding areas are also undeveloped to the north, east and south. The land to the west across Dunns Crossing Road is a part of a large forestry block.
1960-1964	1b	Canterbury Maps	A pen or sheep dip is observed just north of the shed in the western corner of 92 Dunns Crossing Road. There is a visible fence line around the shed, which can be seen to feed into the paddock with the pen / sheep dip in it. A large area of the Gould Road site has been planted with crops. A line of vegetation is visible between the Gould Road site and 92 Dunns Crossing Road. The surrounding area remains mainly unchanged. The forestry block across Dunns Crossing Road appears to have been thinned or felled.
1970-1974	1c	Canterbury Maps	The shed and pen / sheep dip area is still visible in the western corner of the Dunns Crossing Road site. Another small structure is visible to the east of the shed. The remainder of this site appears unchanged from the previous photograph. The surrounding areas to the north, east and south are unchanged and the forestry block to the west of Dunns Crossing Road is maturing again.
1980-1984	1d	Canterbury Maps	The shed near the sheep dip / pen area is not visible. A small area of ponding is visible to the northeast of the sheep dip area. There is a small area of land disturbance / un-vegetated ground on the north-eastern corner of the Goulds Road site. The surrounding areas from the sites remain unchanged.

Date	Figure	Source	Description
1990-1994	1e	Canterbury Maps	A dwelling and shed / garage have been constructed at 92 Dunns Crossing Road near the west of the site. A horse track is visible which spans across the southern part of 92 Dunns Crossing Road – east of the dwelling. The sheep dip area is no longer present on the site. A small shed has been constructed in the Goulds Road site to the west towards Dunns Crossing Road. The surrounding areas from the sites remain mainly unchanged.
2000-2004	1f	Canterbury Maps	A large shed has been constructed to the northwest of the dwelling. A small shed is visible in the northern section of 92 Dunns Crossing Road. The horse track is no longer visible at the site. The site at Goulds Road is mainly unchanged. A shed and horse track have been constructed at 108 Dunns Crossing Road to the north of the site. The remainder of the surrounding area is mainly unchanged.
2010-2015	1g	Canterbury Maps	Another shed has been constructed to the east of the newly constructed shed observed in the 2000-2004 photograph. A small glasshouse is observed near a vegetable garage to the east of the dwelling. The surrounding areas from the sites remain mainly unchanged.
2017	1h	Canterbury Maps	The sites and surrounding area remains mainly unchanged from the previous aerial photograph.

Table 5 below describes the site conditions during the site walkover on 19 September 2019. Photographs taken during the site walkover are included in Appendix 3.

Table 4: Current Site Conditions

Site Conditions	Comments
Visible signs of contamination	A small area of soil staining was present below a 1000 L above ground storage tank (diesel).
Surface water appearance	There was no surface water identified on the sites.
Currently surrounding land use	The sites to the north, east, south and west are all mixed use – residential and agricultural.
Local sensitive environments	No sensitive environments were observed.
Visible signs of plant stress	No visible signs of plant stress were observed on the sites.

Site Conditions	Comments
Additional observations	A 1000 L above ground storage tank was observed to the north of the large barn near the dwelling. A 100 L metal drum was observed to the south of the dwelling. The drum contained cardboard waste and there was visible ashy material spilling from the bottom of the drum. A large (10 m long, 3 m wide and 1.5 m deep) waste pit was observed along the eastern boundary line at 92 Dunns Crossing Road. Please refer to Section 7.1 for additional information for the waste pit. A large radio tower was observed in the eastern corner of the Goulds Road property.

4 Potential HAIL Activities

Activities included on the Hazardous Activities and Industries List (HAIL) trigger the requirement for a contaminated land investigation prior to redevelopment.

Table 5: Potential HAIL Activities

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES
Sheep dip	Heavy metals OCPs ONPs	Area in the north-western paddock at 92 Dunns Crossing Rd	A8. Livestock dip or spray race operations
Area of land disturbance – potential waste or offal pit	Unknown – dependent on type of waste (if any)	Area along eastern boundary line at 92 Dunns Crossing Rd	G5. Waste disposal to land
Storage tank AST	Heavy metals TPH	Underlying soils around AST	A17: Storage tanks or drums for fuels chemicals or liquid waste
Area of land disturbance – potential waste or offal pit	Unknown – dependent on type of waste (if any)	Area in eastern corner of the Goulds Road site.	G5. Waste disposal to land

No other activities included on the HAIL were identified on the remaining areas of the sites inspected.

5 Intrusive Investigation

An intrusive investigation was developed to investigate if the soils have been impacted to 0.3 metres below ground level (m bgl). The soils were sampled to assess the suitability of the land (from a contamination / human health perspective) for residential use, and to assess the human health risks posed to site works under the commercial / outdoor worker scenario.

5.1 Methodology

The following was undertaken during the soil sampling works:

- Collection of eight soil samples using a hand trowel from the surface soils (0.0-0.2 m bgl) from across the former sheep dip area. Samples were also collected from depth (0.4-0.5 m bgl) using a hand auger. Samples were collected on 22 November 2019.
- Collection of one soil sample from the visual staining below the AST using a hand trowel. Samples were collected on 22 November 2019.
- Collection of one soil sample from the material from the burn drum using a hand trowel. Samples were collected on 22 November 2019.
- Collection of three samples from the waste pit material. Samples were collected on 5 December 2019.
- Each sample was inspected for visual and olfactory indicators of contamination.
- All soil samples collected were placed in jars, which were then sealed, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to Hill Laboratories and Terra Scientific under the standard chain of custody documentation provided in Appendix 4.
- To reduce the potential for cross contamination, each sample was collected using disposable nitrile gloves that were discarded following the collection of each sample.
- After collection of each sample, the sampling equipment was decontaminated by scrubbing with a solution of Decon90 and rinsing with tap water followed by deionised water.
- The intrusive sampling was completed in accordance with ENGEO standard operating procedures while geological logging was completed in general accordance with the New Zealand Geotechnical Society Inc. '*Guideline for the Field Classification of Soil and Rock for Engineering Purposes' December 2005*.
- Fieldwork and sampling was undertaken in general accordance with the procedures for the appropriate handling of potentially contaminated soils as described in the MfE Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils.
- Following receipt of the samples by Hill Laboratories, the soil samples were scheduled for a selection of contaminants of concern including heavy metals and organochlorine pesticides.
- On receipt of the analytical results, an assessment of the soil concentrations for contaminants of concern with applicable standards and soil acceptance criteria for the protection of human health and the environment was undertaken.

Quality Assurance and Quality Control

The quality assurance / quality control (QA / QC) procedures employed during the works included:

- Standard sample registers and chain of custody records have been kept for all samples.
- The use of Hill Laboratories, ISO/IEC 17025 and IANZ accredited laboratory, to conduct all laboratory analysis. To maintain their International Accreditation, Hill Laboratories undertake rigorous cross checking and routine duplicate sampling testing to ensure the accuracy of their results.
- Prior to sampling, the equipment (hand auger) was decontaminated using a triple wash procedure with potable water, Decon 90 solution and deionised water.
- During the site investigation, every attempt was made to ensure that cross contamination did not occur through the use of the procedures outlined within this document.

6 Regulatory Framework and Assessment Criteria

The regulatory frameworks and rules relating to the management and control of contaminated sites in the Canterbury Region are specified in two documents: the NES and the ECan Regional Plan. A summary of each and its implications for the site is provided in Sections 6.1-6.2.

6.1 NES

The NES came into effect on 1 January 2012 (MfE, 2011f).

The NES introduced soil contaminant standards (SCSs) for 12 priority contaminants for the protection of human health under a variety of land use scenarios.

The NES requires the *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values* be used where a NES SCS is not available. The NES does not consider environmental receptors; accordingly, the application of guidelines relevant to environmental receptors shall be implemented according to the MfE CLMG No. 2 and any relevant rules in the Regional Plan.

In addition, local background levels in soil have been referenced to establish consenting implications under the NES and disposal requirements. Background levels for metals in soils in the area were obtained from ECan's online GIS – Trace Level 2 concentrations.

6.2 Disposal Criteria

An assessment of potential off-site disposal options for any excess soil generated during site development works has been conducted. Dependent on the contamination conditions of the spoil, off-site disposal options range from disposal to "cleanfill" sites to managed waste sites. As outlined in the publication Waste Management Institute of New Zealand Technical Guidelines for Disposal to Land (August 2018) definition of cleanfill, which states:

"Virgin excavated natural materials (VENM) such as clay, soil and rock that are free of:

- Combustible, putrescible, degradable or leachable components;
- Hazardous substances or material (such as municipal solid waste) likely to create leachate by means of biological breakdown;
- Products or materials derived from hazardous waste treatment, stabilisation or disposal practices;
- Materials such as medical and veterinary waste, asbestos or radioactive substances that may present a risk to human health if excavated;
- Contaminated soil and other contaminated materials; and
- Liquid waste."

6.3 Asbestos Criteria

The field work and reporting for these sites have been done in accordance with the New Zealand Guidelines for Assessing and Managing Asbestos in Soil released on 6 November 2017. The BRANZ Asbestos (2017) Guidelines have been developed based on the WA DOH Guidelines but with the New Zealand regulatory environment in mind.

The BRANZ guideline criteria have been adopted as investigation criteria for this assessment and are presented in Table 7.

Table 6: Adopted Asbestos Investigation Criteria

Form of asbestos		Soil guideline values for asbestos (w/w)			
		Residential[1]	High-density residential[2]	Recreational[3]	Commercial and Industrial[4]
ACM (bonded)		0.01%	0.04%	0.02%	0.05%
FA and/or AF[5]		0.001%			
All forms of asbestos – surface		No visible asbestos on surface soil[6]			
Capping requirements for residual contamination above selected soil guideline value					
Depth[7]	Hard cap	No depth limitation, no controls – except for long-term management			
	Soft cap	≥0.5 m			≥0.2 m

Table 7 Notes:

ACM: Asbestos-containing material i.e. asbestos bound in a matrix; material that cannot pass through a 7 mm x 7 mm sieve.

FA: Fibrous asbestos. Encompasses friable asbestos material, such as severely weathered ACM, and asbestos in the form of loose fibrous material such as insulation products. Friable asbestos is defined here as asbestos material that is in a degraded condition, such that it can be broken or crumbled by hand pressure.

AF: Asbestos fines. It includes free fibres of asbestos, small fibre bundles and also ACM fragments that pass through a 7 mm x 7 mm sieve.

Residential: Single dwelling site with garden and / or accessible soil. Also includes daycare centres, preschools, primary and secondary schools and rural residential.

High-density residential: Urban residential site with limited exposed soil/soil contact, including small gardens. Applicable to urban townhouses, flats and ground-floor apartments with small ornamental gardens but not high-rise apartments (with very low opportunity for soil contact).

Recreational: Public and private green areas and sports and recreation reserves. Includes playing fields, suburban reserves where children play frequently and school playing fields.

Commercial and industrial: Includes accessible soils within retail, office, factory and industrial sites. Many commercial and industrial properties are well paved with concrete pavement and buildings that will adequately cover / cap any contaminated soils.

FA and / or AF: Where free fibre is present at concentrations at or below 0.001% w/w, a proportion of these samples should be analysed using the laboratory analysis method described in section 5.4.4 of the BRANZ Guideline (≥10% of samples). This is due to limitations in the AS 4964-2004 and WA Guidelines 500 ml sample method for free fibre (see section 5.4 of the BRANZ guideline for more information).

Surface: Effective options include raking / tilling the top 100 mm of asbestos-contaminated soil (or to clean soil / fill if shallower to avoid contaminating clean material at depth) and hand picking to remove visible asbestos and ACM fragments or covering with a soft cap of virgin natural material (VNM) 100 mm thick delineated by a permeable geotextile marker layer or hard cap. Near-surface fragments of ACM can become exposed in soft soils such as sandy pumiceous soils after periods of rain.

Depth: Capping is used where contamination levels exceed soil guideline values. Considerations of depth need to incorporate the type and likelihood of future disturbance activities at the site and site capping requirements (see section 6.1 of the BRANZ guideline). Ideally, any capping layer should be delineated by a permeable geotextile marker layer between the cap and underlying asbestos / contaminated material. Institutional controls must be used to manage long-term risks, particularly where the cap may be disturbed (see section 7 of the BRANZ guideline). Two forms of capping are typically used:

a. Hard cap comprises surfaces that are difficult to penetrate and isolate the asbestos contamination, such as tar seal or concrete driveway cover. This would typically not include pavers or decking due to maintenance and coverage factors. b. Soft cap consists of a layer(s) of material, which either comprise virgin natural material or soils that meet the asbestos residential soil guideline value from an on-site source. Use of on-site soils may require resource consent.

6.4 Assessment Criteria

Contaminant concentrations in soil were compared to human health criteria based on the following land use:

- Residential land use; and
- Commercial / Industrial land use (based on an outdoor worker scenario) (for redevelopment workers).

The land use scenarios are relevant to the likely future use of the sites and are being used as a surrogate to assess short-term risks to redevelopment earth workers on site during the development activities.

The NES methodology document notes that the exposure parameters assumed for the maintenance / excavation scenario in other New Zealand guidelines are unrealistic (perhaps by a factor of ten or more). The technical committee preparing the NES decided that a maintenance / excavation worker scenario should not be included in the NES as sites would not be cleaned up to this standard; it was considered more appropriate that exposures to these workers be limited through the use of site-specific controls that are required under health and safety legislation. However, this report uses commercial / industrial outdoor worker criteria to get a general sense of potential risks to excavation workers during the redevelopment. Note that commercial / industrial outdoor worker criteria are based on personnel carrying out maintenance activities involving soil exposure to surface soil during landscaping activities, and occasional shallow exposure to surface or near surface soil during landscaping activities, and occasional shallow excavation for routine underground service maintenance. Exposure to soil is less intensive than would occur during construction works but occurs over a longer period. For a construction worker developing the sites, the soil exposure is limited when compared to a large earthworks project (e.g. for a residential subdivision or industrial development). As such, the commercial / industrial outdoor worker criteria are considered suitable for obtaining a high-level understanding of potential risks to excavation workers during site redevelopment and confirming the need for site controls.

The soil analysis results have also been compared to Regional Background levels for heavy metals (arsenic, copper, cadmium, mercury, nickel, zinc) and organochlorine pesticides (OCPs). These provide information into the possible disposal options at a cleanfill facility.

7 Results

7.1 Soil Encountered

Please refer to Table 8 for the summary of the general subsurface soil encountered within the near surface soils in the burn pit area. Please refer to ENGEO's Geotechnical Report (ENGEO, 2019) for the sites for additional soil profiles.

Ash and charcoal material was observed in the sample collected from the burn drum. The soil collected from beneath the AST was visually stained a black colour and smelt of diesel.

The waste pit material consisted of silt, gravel, metals (wire fencing), plastics (bags, bottles and food wrappers), cans, glass bottles, bones, material, potential asbestos containing material and timber.

Table 7: Summary of Subsurface Soils

Depth	Soil Description
0.0-0.1	Sandy SILT with trace rootlets; brown.
0.1-0.5	Sandy SILT with trace gravel; greyish brown.

7.2 Analytical Results

Eight samples were collected from around the former sheep dip area and storage shed from the surface soils (0.0-0.2 m below ground level). One sample (HA08) returned concentrations of lead above the NES residential land use criteria. Several other samples analysed from the sheep dip area returned concentrations of heavy metals above the site-specific regional background criteria. DDT was detected in HA05 and HA06 but was still below the NES human health residential criteria. Additional samples (HA09-HA16) have been collected from around HA08 to assess the extent of the lead impact; all of these samples were below the NES human health criteria for residential land use. These locations are included on Figure 2.

One soil sample (SS01) was collected from stained material below the AST. The total petroleum hydrocarbon results for C10-C14 were reported above the NES human health criteria for residential land use in silty sand soil types. The sample SS01 also reported elevated heavy metal concentrations against the regional background levels.

One sample (SS02) was collected from the burn pile to the east of the house. The analysis reports that arsenic, cadmium and chromium are above the NES human health residential criteria and arsenic is also above the NES commercial / industrial outdoor worker human health criteria. All heavy metals were reported as being above the site-specific background criteria.

Samples have been collected from the waste pit along the eastern boundary line at 92 Dunns Crossing Road. Three samples have been submitted for heavy metals, PAHs and asbestos semi-quantitative analysis. Asbestos results collected from the waste pit reported that the PACM cement board was positive for chrysotile and amosite asbestos. One of the three soil samples collected returned concentrations of asbestos fines and fibres above the BRANZ guidelines. The other two samples were reported as not asbestos containing. The soil samples were also analysed for heavy metals and polycyclic aromatic hydrocarbons. A number of heavy metals from the samples WP01, WP02 and WP03 were reported above the background levels with no exceedances against the NES human health criteria. All PAH results were below the laboratory detection limits.

Table 8: Analytical Results – Heavy Metals and OCPs

Sample ID	HA01	HA02	HA03	HA04	HA05	HA06	HA07	HA08	SS01	SS02	WP01	WP02	WP03	Background (bl)	Assessment Criteria	
Soil Depth	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	-	-	-	Canterbury Regional	Residential - 10% produce	Industrial
Sample Date	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	5-12-2019	5-12-2019	5-12-2019			
Arsenic	3	3	**7**	6	3	3	3	**9**	**10**	**1,470**	5	**13**	**19**	6.35	20 (A)	70 (A)
Cadmium	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	**0.73**	**0.15**	**5.2**	**0.35**	**0.68**	**1.32**	0.14	3 (A)	1300 (A)
Chromium (total)	11	11	14	13	10	10	10	13	**22**	**480**	14	18	**24**	19.89	460 (A)	6300 (A)
Copper	7	5	**13**	8	4	4	4	**35**	**68**	**1,630**	10	**340**	**640**	11.68	NL (A)	NL (A)
Lead	**19.8**	16.6	**20**	18.3	12.9	13	19.4	**290**	**159**	**149**	**27**	**115**	**61**	19.75	210 (A)	3300 (A)
Nickel	7	7	8	7	6	7	6	10	8	**22**	9	11	**340**	13.91	400 (B)	6000 (B)
Zinc	56	51	**117**	**62**	42	45	46	**1,530**	**220**	**370**	**113**	**320**	**580**	59.58	7400 (B)	350000 (C)
DDE	< 0.012	< 0.012	< 0.013	< 0.012	0.012	0.1	< 0.013	0.023	-	-	-	-	-	-	2 (C)	9.3 (C)
2,4'-DDT	< 0.012	< 0.012	< 0.013	< 0.012	< 0.012	0.015	< 0.013	< 0.013	-	-	-	-	-	-	-	-
DDT	0.012	0.012	0.013	0.012	0.02	0.046	< 0.013	0.019	-	-	-	-	-	-	1.9 (C)	8.5 (C)
DDT Isomers	< 0.07	< 0.07	< 0.08	< 0.08	< 0.08	0.16	< 0.08	< 0.08	-	-	-	-	-	-	70 (A)	1000 (A)
Fluoranthene	-	-	-	-	-	-	-	-	-	0.018	-	-	-	-	650 (D)	2400 (C)
Phenanthrene	-	-	-	-	-	-	-	-	-	0.016	-	-	-	-	180 (D)	-
Pyrene	-	-	-	-	-	-	-	-	-	0.015	-	-	-	1600	NA	NA

General Notes:
Values highlighted red exceed one or more assessment criteria, highlighted yellow exceed the lab detection limit.
All data by default is in mg/kg.
Adjusted assessment criteria are developed from the number of subsamples to form an adjusted guideline value.
Values in bold exceed the adopted background concentrations.
bl - denotes background samples compared to Canterbury Regional -> Yellow brown stony.
Guideline Notes: A - Methodology for Deriving Soil Guideline Values Protective of Human Health (MfE, 2011), B - National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 2013), C - Environmental Protection Agency – Regional Screening Levels (May 2019), D - Users' Guide to the Guidelines for Assessing and Managing Contaminated Gasworks Sites in New Zealand (MfE, 1997).

Table 9: TPH Analysis Results

Sample ID	SS01	Residential
		Sandy Silt
Soil Depth	**surface - 0.2 m**	< 1 m (A)
Sample Date	**22-11-2019**	
Sample Soil Type	**Sandy Silt**	
Guideline Soil Depth	**< 1 m**	
C7-C9	91	1,600
C10-C14	10,200	2,400
C15-C36	85,000	NA

General Notes:
Values highlighted red exceed one or more assessment criteria, highlighted yellow exceed the lab detection limit.
All data by default is in mg/kg.
Adjusted assessment criteria are developed from the number of subsamples to form an adjusted guideline value.
Values in bold exceed the adopted background concentrations.
bl - denotes background samples compared to Canterbury Regional -> Yellow brown stony.
Guideline Notes: A - Users' Guide to the Guidelines for Assessing and Managing Contaminated Gasworks Sites in New Zealand (MfE, 1997).

Table 10: Asbestos Semi-quantitative Analysis Results

Sample Name	Asbestos Type	AF and FA as % w/w of total sample
PACM 1 Waste Pit	Chrysotile and Amosite	NA
Waste Pit 01	No asbestos detected	-
Waste Pit 02	No asbestos detected	-
Waste Pit 03	Chrysotile and Amosite	**0.02035**

Table 11: Lead Delineation Analysis Results

Sample Name	Lead (mg/kg)
HA09	85
HA10	79
HA11	57
HA12	42
HA13	67
HA14	43
HA15	39
HA16	54
HA17	51
Background Criteria	19.75
Residential - 10% produce	210

Notes: b ECan (2007) Background Concentrations of Selected Trace Elements in Canterbury Soils Exceedances are shaded.

8 Conceptual Site Model

A conceptual site model consists of four primary components. For contaminants to present a risk to human health or an environmental receptor, all four components are required to be present and connected. The four components of a conceptual site model are:

- Source of contamination;
- Pathway(s) in which contamination could potentially mobilise along (e.g. vapour or groundwater migration);
- Sensitive receptor(s) which may be exposed to the contaminants; and
- An exposure route, where the sensitive receptor and contaminants come into contact (e.g. ingestion, inhalation, dermal contact).

The potential source, pathway and receptor linkages at the subject sites are provided in Table 13.

Table 12: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Former sheep dip	Heavy metals, ONPs and OCPs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On site redevelopment workers Future subsurface maintenance workers Future land users – residents	No. one exceedance (HA08) was reported above the applicable NES residential land use guidelines.
Area of land disturbance (potential waste pit or offal pit)	Heavy metal, PAHs and asbestos containing material	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On site redevelopment workers Future subsurface maintenance workers Future land users – residents	No. Asbestos samples returned results above the BRANZ guidelines.
Above ground storage tank	TPH and heavy metals	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On site redevelopment workers Future subsurface maintenance workers Future land users – residents	No. An exceedance of TPH was reported above the applicable NES residential land use guidelines.
Area of land disturbance (potential waste pit or offal pit)	Unknown - Dependent on waste	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers Future subsurface maintenance workers Future land users – residents	Unknown. The area of concern was unable to be assessed as a large radio tower is directly on the area where land disturbance was observed. An investigation should occur if the area is to be redeveloped or disturbed.

9 Conclusions and Recommendations

ENGEO Ltd was engaged by Hughes Development Ltd to undertake an environmental assessment of two sites totalling 30.8 ha at 92 Dunns Crossing Road and Goulds Road (Lot 3 DP 54007) for change in land use, subdivision and soil disturbance land consent. Information was gathered and reviewed regarding the past and potential releases of hazardous substances to the subject property.

The review of information identified that the sites have been used for grazing since circa 1940 and residential land use since 1990 when a dwelling was relocated onto the sites.

The Canterbury Regional Council's Listed Land Use Register identified HAIL activity *A8. Livestock dip or spray race operations* as being on the sites. The sheep dip area was identified during a Selwyn District Council historical aerial photograph review. The property file for the sites was viewed at Selwyn District Council, and contained no information related to potentially hazardous activities having occurred at the sites.

The current owner of the sites was interviewed as a part of the investigation. Mr Robertson stated that when he purchased the property a waste pit was visible along the eastern boundary line of 92 Dunns Crossing Road. He also stated that the only storage tank was the above ground storage tank (AGST) near the large barn at 92 Dunns Crossing Road. During the site walkover, a small burn drum was observed to the south of the dwelling which had ashy material spilling from the drum onto the underlying soils.

During the review of the SDC property file, the main dwelling was relocated onto the site at 92 Dunns Crossing in 1990. The Health and Safety at Work (Asbestos) Regulations 2016 states if a building constructed or installed prior to 1 January 2000 requires demolition or refurbishment, a full asbestos survey must be undertaken by a competent person.

Based on the information gathered, soil samples were collected from around the former sheep dip area, below the AGST, burn drum and waste pit.

One sample from the sheep dip area (HA08), one sample from the AGST (SS01) and one sample from the burn drum material (SS02) reported exceedances for lead, TPH and arsenic, cadmium and chromium, respectively, against the NES human health residential land use criteria. Samples collected from the waste pit are still being analysed at the laboratory. The sheep dip (HA08) area, AGST soils and burn drum soils all therefore require remediation prior to the sites' proposed redevelopment for residential land use.

Asbestos results collected from the waste pit reported that the PACM cement board was positive for chrysotile and amosite asbestos. One of the three soil samples collected returned concentrations of asbestos fines and fibres above the BRANZ guidelines. The other two samples were reported as not asbestos containing. Heavy metals were reported at concentrations above the site specific guideline values. No exceedances of heavy metals or PAHs were reported against the NES human health criteria.

Based on the current results, remediation of the soils in the areas of the burn drum, former sheep dip, waste pit and AGST should be undertaken. Works should be detailed in a Remedial Action Plan (RAP) which will also include the procedures for the handling, management and disposal of contaminated soils. Following remediation, a validation report will be required to indicate the sites are suitable for their intended end use.

Soils from the burn drum, sheep dip and AGST areas should be removed and properly disposed of prior to the redevelopment of the sites and remaining soils validated. The removal of these areas would be considered a permitted activity under Regulation 8(3) of Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulation 2011 due to the small volume to be removed.

A summary of the soil disturbance volumes anticipated for the earthworks is provided in Table 14. ENGEO does not know the full extent of soils to be remediated as a part of the site works.

Table 13: Comparison of Proposed Earthwork Volumes to NES

NES Regulation			Site Area	Permitted Site Disturbance / Removal Volumes	Proposed Earthwork Volumes
Clause	Description	Permitted Volume			
8.3c	Soil disturbance	25 m^3 per 500 m^2	308,360 m^2	15,418 m^2	50 m^3
8.3d	Soil removal	5 m^3 per 500 m^2 (per year)	308,360 m^2	3,083.6 m^3	50 m^3

The soils from the waste pit are suitable for disposal at Kate Valley Landfill as asbestos contaminated waste. The soils from the above ground storage tank and burn drum should be checked with Kate Valley to assess whether they will accept these soils. Additional TCLP analysis may be required to be undertaken.

If the buildings on site are to be refurbished or demolished, the presence of asbestos in these buildings should be identified by undertaking full asbestos demolition surveys. If identified on the outside of the buildings in a deteriorated state, the soils surrounding the buildings should also be tested.

10 References

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National Environmental Protection Council (1999). *National Environment Protection Measure Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater*.

11 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ / ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by



Natalie Flatman, BSc, IP402
Environmental Scientist

Report reviewed by



Dave Robotham, SC, CEnvP
Principal Environmental Scientist

FIGURES

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DATE PLOTTED: 04 December 2019 8:38:24 am BY: NFlatman

1550000

N

Legend

Site boundary

0 10,000 20,000
Meters

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ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title:

Historical Aerial Photograph - 1940-1944

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project:
92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: **1a**

Size: A3

Revision: A

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1550000

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Legend

Site boundary

0 10,000 20,000

Meters

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Title:

Historical Aerial Photograph - 1960-1964

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project: 92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: **1b**

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1550000

N

Legend

Site boundary

0 10,000 20,000

Meters

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ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title:

Historical Aerial Photograph - 1970-1974

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project:
92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: **1c**

Size: A3

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

PATH: \\nz\file\nz\Projects\12901 to 13000\12903 - Farrington South Subdivision\054_92 Dunns Crossing Road - Enviro\06_CAD-GIS & Figures\Fig01.mxd

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DATE PLOTTED: 04 December 2019 8:41:24 am BY: NFlahman



PATH: \\nzfile\ez\Projects\12901 to 13000\12903 - Farrington South Subdivision\054_92 Dunns Crossing Road - Enviro\06_CAD-GIS & Figures\Fig01.mxd

ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title:

Historical Aerial Photograph - 1980-1984

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator



Client: Hughes Developments Ltd

Project:
92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: 1d

Size: A3

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

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DATE PLOTTED: 04 December 2019 8:42:04 am BY: NFlatman



PATH: \\nzfile\ezi\Projects\12901 to 13000\12903 - Farrington South Subdivision\054_92 Dunns Crossing Road - Envivo\06_CAD-GIS & Figures\Fig01.mxd

ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title:

Historical Aerial Photograph - 1990-1994

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator



Client: Hughes Developments Ltd

Project:
92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: **1e**

Size: A3

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

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DATE PLOTTED: 04 December 2019 8:44:00 am BY: NFlatman



PATH: \\nzfile\ez\Projects\12901 to 13000\12903 - Farrington South Subdivision\054_92 Dunns Crossing Road - Envio\06_CAD-GIS & Figures\Fig01.mxd

ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title:

Historical Aerial Photograph - 2000-2004

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator



Client: Hughes Developments Ltd

Project:
92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: 1f

Size: A3

Revision: A

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DATE PLOTTED: 04 December 2019 8:44:40 am BY: NFlatman

1550000

N

Legend

Site boundary

0 10,000 20,000

Meters

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ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title:

Historical Aerial Photograph - 2010-2015

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project: 92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: **1g**

Size: A3

Revision: A

PATH: \\nzfile\nz\Projects\12901 to 13000\12903 - Farrington South Subdivision\054 92 Dunns Crossing Road - Enviro\06_CAD-GIS & Figures\Fig01.mxd

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DATE PLOTTED: 04 December 2019 8:45:39 am BY: NFlatman

PATH: \\nzfile\nz\Projects\12901 to 13000\12903 - Fairington South Subdivision\054_92 Dunns Crossing Road - Enviro\06_CAD-GIS & Figures\Fig01.mxd

1550000

N

Legend

Site boundary

0 10,000 20,000
Meters

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ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title:

Current Aerial Photograph

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project:
92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: 1h

Size: A3

Revision: A

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DATE PLOTTED: 16 December 2019 3:57:48 pm BY: NFlatman



ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title:

Sample location plan

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project:
92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:400

Figure No: 2

Size: A3

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

PATH: \\nzcfile\nz\Projects\12901 to 13000\12903 - Farrington South Subdivision\054_92 Dunns Crossing Road - Enviro\08_CAD-GIS & Figures\Fig01.mxd

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DATE PLOTTED: 06 December 2019 8:52:25 am BY: NFlatman



ENGEO
Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title: Sampling locations

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project: 92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:641

Figure No: 3

Size: A3

Revision: A

PATH: \\nzfile\ez\Projects\12901 to 13000\12903 - Farrington South Subdivision\054 92 Dunns Crossing Road - Enviro\06_CAD-GIS & Figures\Fig01.mxd

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 1:

Certificates of Titles

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB33K/67**
Land Registration District	**Canterbury**
Date Issued	18 October 1990

Prior References
CB33F/774

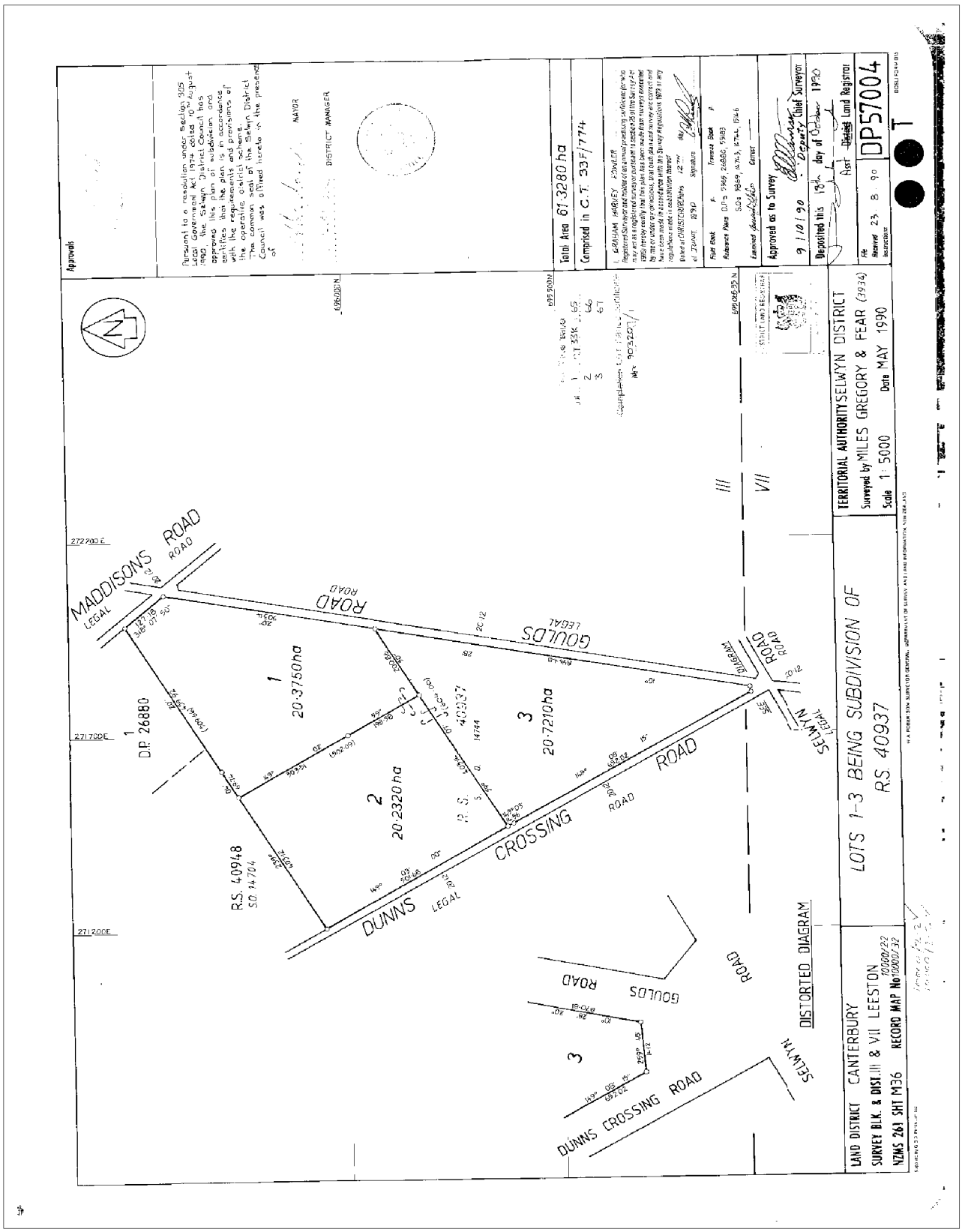
Estate	Fee Simple
Area	20.7210 hectares more or less
Legal Description	Lot 3 Deposited Plan 57004

Registered Owners
Ivan George Robertson as to a 1/2 share
Dorothy Caroline Robertson as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

Identifier **CB33K/67**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Historical Search Copy

R.W. Muir
Registrar-General
of Land

Constituted as a Record of Title pursuant to Sections 7 and 12 of the Land Transfer Act 2017 - 12 November 2018

Identifier **CB33K/67**
Land Registration District **Canterbury**
Date Issued 18 October 1990

Prior References
CB33F/774

Estate	Fee Simple
Area	20.7210 hectares more or less
Legal Description	Lot 3 Deposited Plan 57004

Original Registered Owners
Ivan George Robertson as to a 1/2 share
Dorothy Caroline Robertson as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

Identifier **CB33K/67**

References
Prior C/T 33F/774

Transfer No.
N/C. Order No. 903207/4

Land and Deeds 69

REGISTER

No. 33K/67

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 19th day of October one thousand nine hundred and ninety under the seal of the District Land Registrar of the Land Registration District of CANTERBURY

WITNESSETH that KELVIN ROYCE TAYLOR, Farmer and GILLIAN DOROTHY TAYLOR, Married Woman, both of Springston, Christchurch as tenants in common in equal shares are ---

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 20.7210 hectares or thereabouts being Lot 3 Deposited Plan 57004 ---

DISTRICT LAND REGISTRAR
CANTERBURY N.Z.
ASSISTANT LAND REGISTRAR

Subject to:

Part IVA Conservation Act 1987

A.L.R.

Transfer 912688/1 to Ivan George Robertson, Farmer and Dorothy Caroline Robertson, Housewife, both of Springston - 14.12.1990 at 11.35am

for A.L.R.

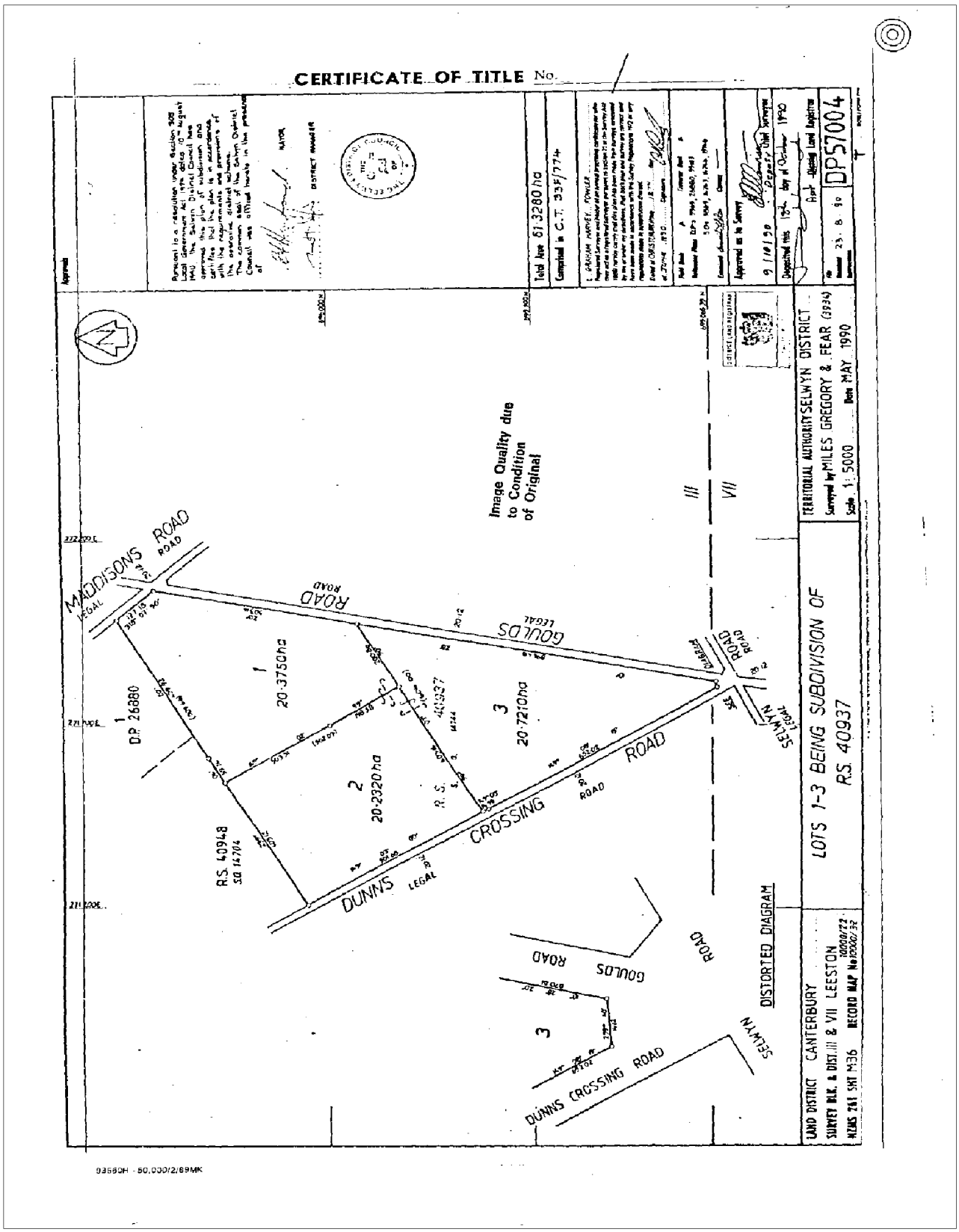
A466952.1 Transfer to Ivan George Robertson and Dorothy Caroline Robertson in equal shares - 19.7.2000 at 2.42

for RGL

No. 33K/67

Measurements are Metric

Identifier **CB33K/67**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB36C/247**
Land Registration District	**Canterbury**
Date Issued	29 October 1992

Prior References
CB33K/66

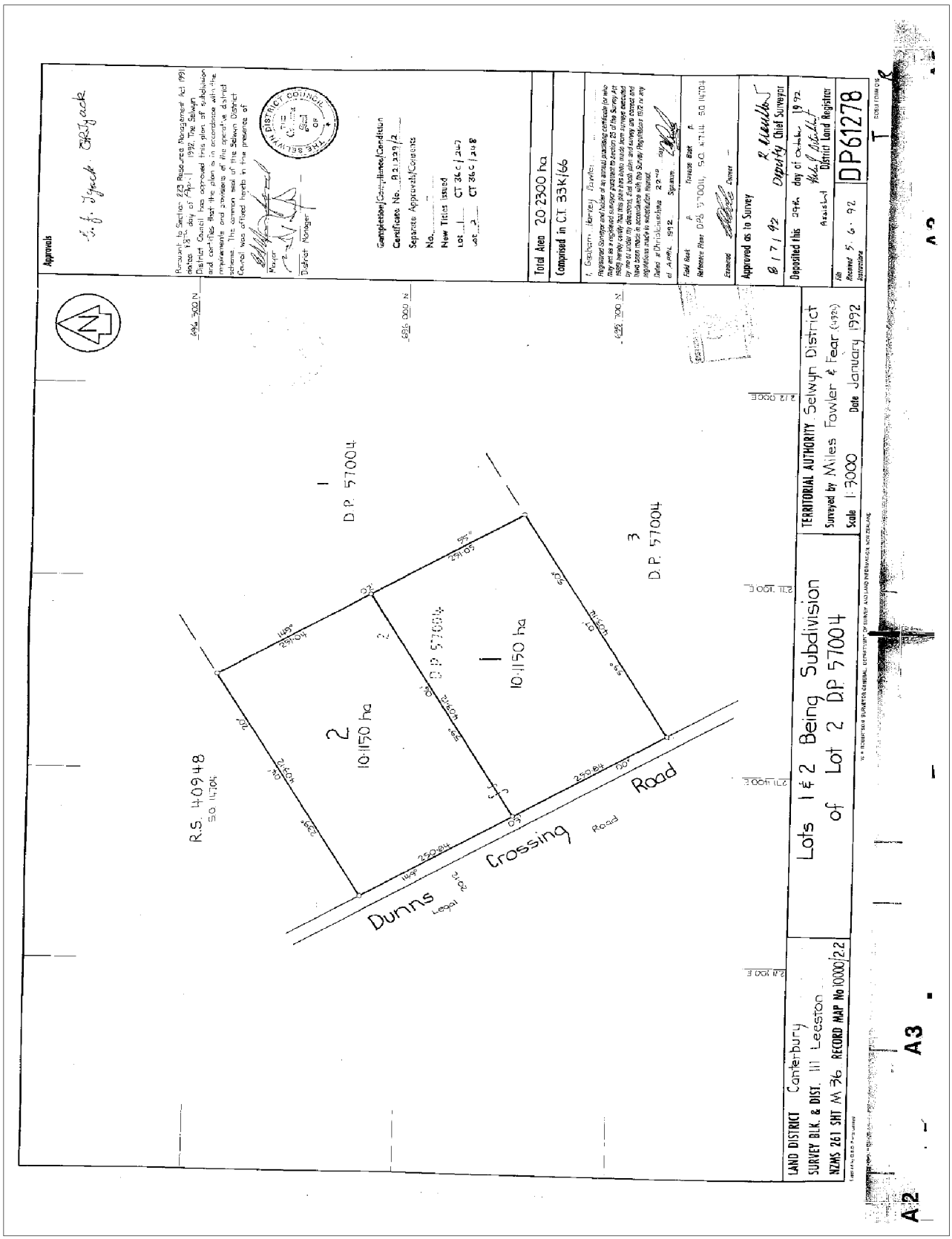
Estate	Fee Simple
Area	10.1150 hectares more or less
Legal Description	Lot 1 Deposited Plan 61278

Registered Owners
Ivan George Robertson as to a 1/2 share
Dorothy Caroline Robertson as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

Identifier **CB36C/247**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Historical Search Copy

R.W. Muir
Registrar-General
of Land

Constituted as a Record of Title pursuant to Sections 7 and 12 of the Land Transfer Act 2017 - 12 November 2018

Identifier **CB36C/247**
Land Registration District **Canterbury**
Date Issued 29 October 1992

Prior References
CB33K/66

Estate	Fee Simple
Area	10.1150 hectares more or less
Legal Description	Lot 1 Deposited Plan 61278

Original Registered Owners
Ivan George Robertson as to a 1/2 share
Dorothy Caroline Robertson as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

Land and Deeds 69

References
Prior C/T 33K/66

Transfer No.
N/C. Order No. A21229/3

REGISTER

36C/247

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 29th day of October one thousand nine hundred and ninety-two under the seal of the District Land Registrar of the Land Registration District of CANTERBURY

WITNESSETH that GREGORY JOSEPH TYACK, Extruder Operator and FLORENCE RUBY TYACK, Prison Officer both of Christchurch are ---

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 10.1150 hectares or thereabouts being Lot 1 Deposited Plan 61278 ---

DISTRICT LAND REGISTRAR
ASSISTANT LAND REGISTRAR
CANTERBURY N.Z.

Subject to:

Part IVA Conservation Act 1987

Mortgage 912417/2 to Post Office Bank Limited - 13.12.1990 at 11.21am DISCHARGED

Mortgage A4582/2 to Charles Kerei Lane - 15.7.1992 at 3.46am DISCHARGED A333SS

Mortgage A21229/1 to Bank of New Zealand - 29.10.1992 at 11.40am DISCHARGED 22 FEB

A.L.R.

Transfer A221487/2 to Ivan George Robertson, Farmer and Dorothy Caroline Robertson, Housewife, both of Springston - 22.2.1996 at 11.23am

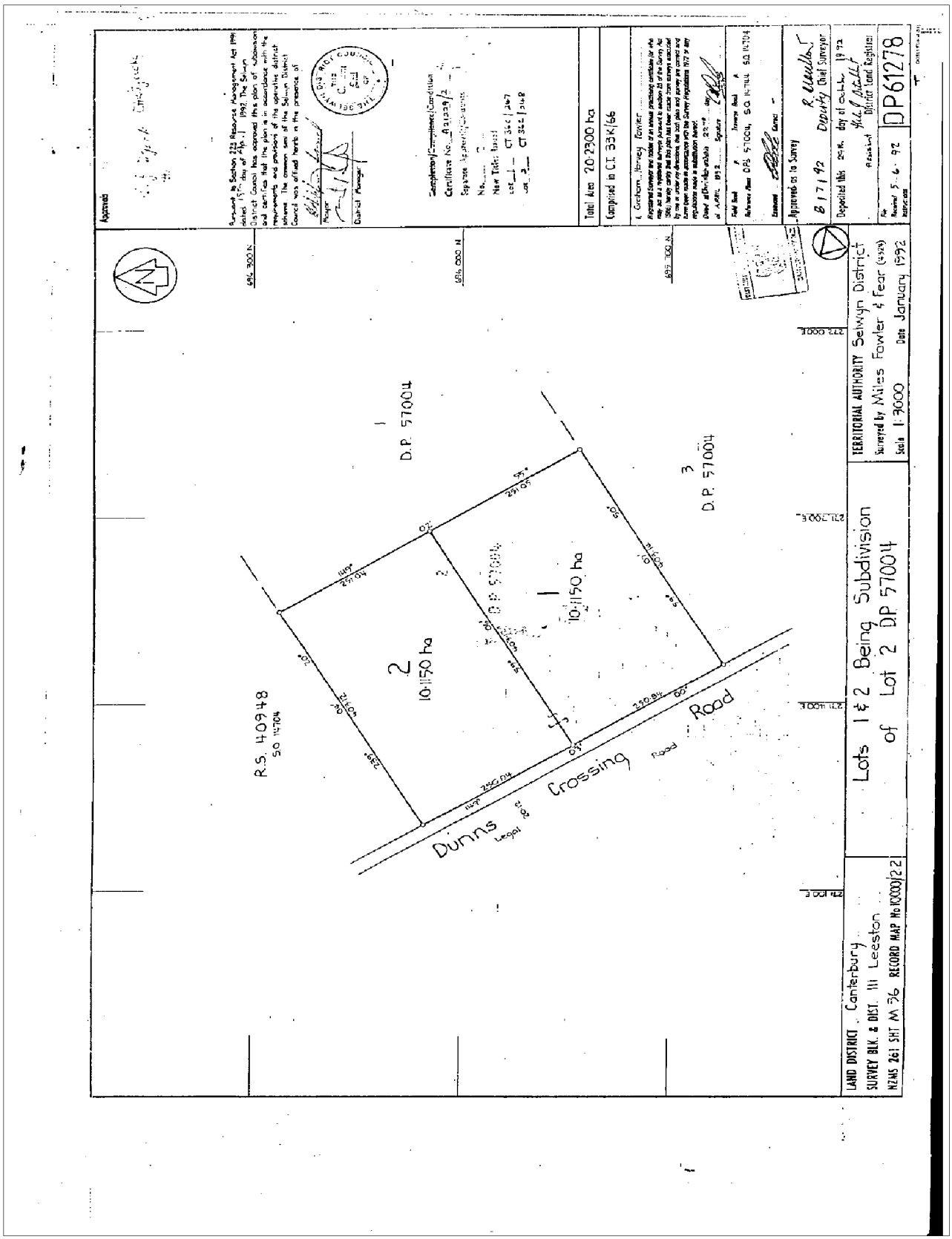
for A.L.R.

A466952.1 Transfer to Ivan George Robertson and Dorothy Caroline Robertson in equal shares - 19.7.2000 at 2.42

for RGL

No. 36C/247

Identifier **CB36C/247**



APPENDIX 2:

CRC LLUR Statement

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

Dear Sir/Madam

Thank you for submitting your property enquiry in regards to our Listed Land Use Register (LLUR) which holds information about sites that have been used, or are currently used for activities which have the potential to have caused contamination.

The LLUR statement provided indicates the location of the land parcel(s) you enquired about and provides information regarding any LLUR sites within a radius specified in the statement of this land.

Please note that if a property is not currently entered on the LLUR, it does not mean that an activity with the potential to cause contamination has never occurred, or is not currently occurring there. The LLUR is not complete, and new sites are regularly being added as we receive information and conduct our own investigations into current and historic land uses.

The LLUR only contains information held by Environment Canterbury in relation to contaminated or potentially contaminated land; other information relevant to potential contamination may be held in other files (for example consent and enforcement files).

If your enquiry relates to a farm property, please note that many current and past activities undertaken on farms may not be listed on the LLUR. Activities such as the storage, formulation and disposal of pesticides, offal pits, foot rot troughs, animal dips and underground or above ground fuel tanks have the potential to cause contamination.

Please contact and Environment Canterbury Contaminated Sites Officer if you wish to discuss the contents of the LLUR statement, or if you require additional information.
For any other information regarding this land please contact Environment Canterbury Customer Services.

Yours sincerely

Contaminated Sites Team

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

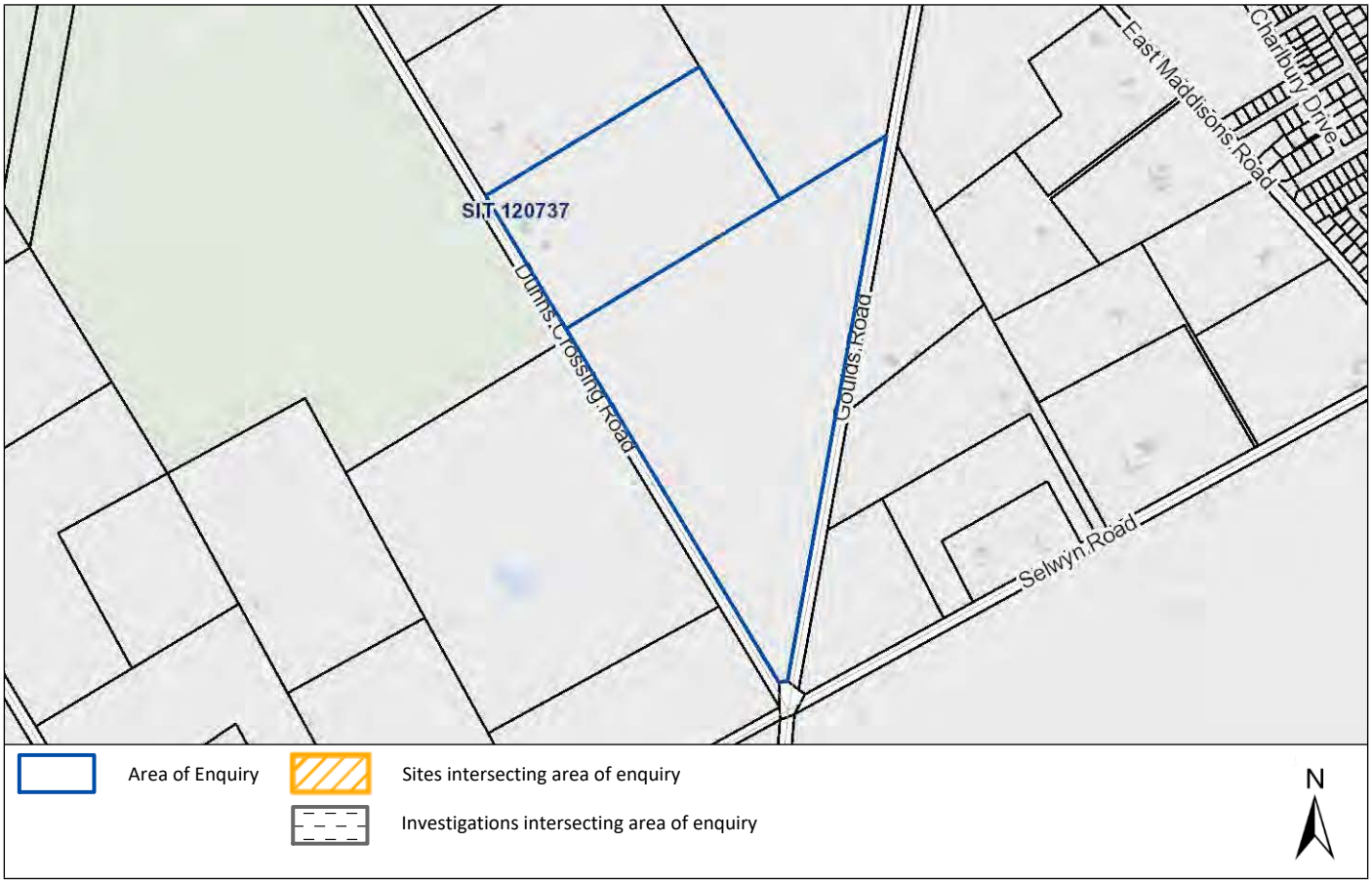
Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

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

www.ecan.govt.nz

Date:	08 November 2019	
Land Parcels:	Lot 3 DP 57004	Valuation No(s): 2405534300
	Lot 1 DP 61278	Valuation No(s): 2405538300



The information presented in this map is specific to the property you have selected. Information on nearby properties 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
120737	92 Dunns Crossing Road, Rolleston	92 Dunns Crossing Road, Rolleston	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 only.

Information held about the sites on the Listed Land Use Register

Site 120737: 92 Dunns Crossing Road, Rolleston (Intersects enquiry area.)

Site Address:	92 Dunns Crossing Road, Rolleston
Legal Description(s):	Lot 1 DP 61278

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

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1961	1974	Livestock dip or spray race operations

Notes:

11 Jan 2016	This record was created as part of the Selwyn District Council 2015 HAIL identification project.
11 Jan 2016	Area defined from 1961 to 1974 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

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ247142.

Disclaimer: ***The enclosed information is derived from Environment Canterbury's Listed Land Use Register and is made available to you under the Local Government Official Information and Meetings Act 1987 and Environment Canterbury's Contaminated Land Information Management Strategy (ECan 2009).***

The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness of this information. It is released only as a copy of Environment Canterbury's records and is not intended to provide a full, complete or totally accurate assessment of the site. It is provided on the basis that Environment Canterbury makes no warranty or representation regarding the reliability, accuracy or completeness of the information provided or the level of contamination (if any) at the relevant site or that the site is suitable or otherwise for any particular purpose. Environment Canterbury accepts no responsibility for any loss, cost, damage or expense any person may incur as a result of the use, reference to or reliance on the information contained in this report.

Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know



Everything is connected

What is the Listed Land Use Register (LLUR)?

The LLUR is a database that Environment Canterbury uses to manage information about land that is, or has been, associated with the use, storage or disposal of hazardous substances.

Why do we need the LLUR?

Some activities and industries are hazardous and can potentially contaminate land or water. We need the LLUR to help us manage information about land which could pose a risk to your health and the environment because of its current or former land use.

Section 30 of the Resource Management Act (RMA, 1991) requires Environment Canterbury to investigate, identify and monitor contaminated land. To do this we follow national guidelines and use the LLUR to help us manage the information.

The information we collect also helps your local district or city council to fulfil its functions under the RMA. One of these is implementing the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil, which came into effect on 1 January 2012.

For information on the NES, contact your city or district council.

How does Environment Canterbury identify sites to be included on the LLUR?

We identify sites to be included on the LLUR based on a list of land uses produced by the Ministry for the Environment (MfE). This is called the Hazardous Activities and Industries List (HAIL)[1]. The HAIL has 53 different activities, and includes land uses such as fuel storage sites, orchards, timber treatment yards, landfills, sheep dips and any other activities where hazardous substances could cause land and water contamination.

We have two main ways of identifying HAIL sites:

- We are actively identifying sites in each district using historic records and aerial photographs. This project started in 2008 and is ongoing.
- We also receive information from other sources, such as environmental site investigation reports submitted to us as a requirement of the Regional Plan, and in resource consent applications.

[1] The Hazardous Activities and Industries List (HAIL) can be downloaded from MfE's website www.mfe.govt.nz, keyword search HAIL

How does Environment Canterbury classify sites on the LLUR?

Where we have identified a HAIL land use, we review all the available information, which may include investigation reports if we have them. We then assign the site a category on the LLUR. The category is intended to best describe what we know about the land use and potential contamination at the site and is signed off by a senior staff member.

Please refer to the Site Categories and Definitions factsheet for further information.

What does Environment Canterbury do with the information on the LLUR?

The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list of any investigation reports.

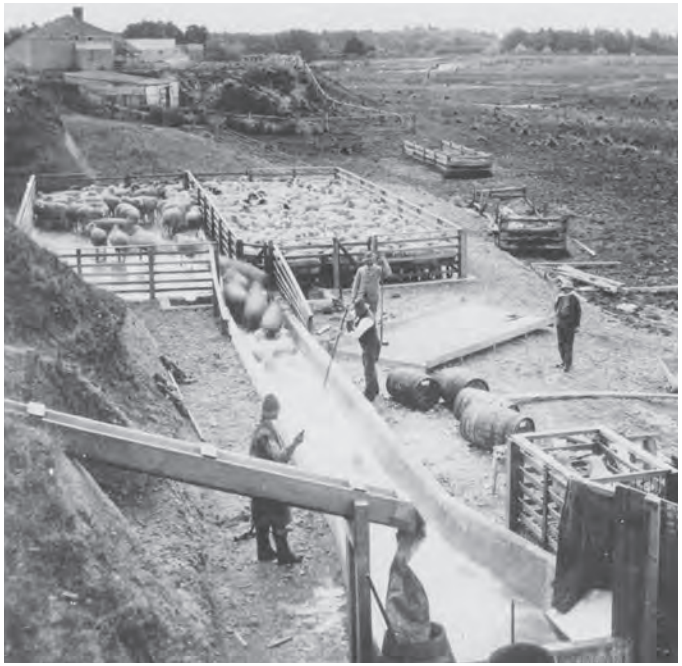
We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

If you are conducting an environmental investigation or removing an underground storage tank at your property, you will need to comply with the rules in the Regional Plan and send us a copy of the report. This means we can keep our records accurate and up-to-date, and we can assign your property an appropriate category on the LLUR. To find out more, visit www.ecan.govt.nz/HAIL.



IMPORTANT!

The LLUR is an online database which we are continually updating. A property may not currently be registered on the LLUR, but this does not necessarily mean that it hasn't had a HAIL use in the past.



Sheep dipping (ABOVE) and gas works (TOP) are among the former land uses that have been identified as potentially hazardous. (Photo above by Wheeler & Son in 1987, courtesy of Canterbury Museum.)

My land is on the LLUR – what should I do now?

IMPORTANT! Just because your property has a land use that is deemed hazardous or is on the LLUR, it doesn't necessarily mean it's contaminated. The only way to know if land is contaminated is by carrying out a detailed site investigation, which involves collecting and testing soil samples.

You do not need to do anything if your land is on the LLUR and you have no plans to alter it in any way. It is important that you let a tenant or buyer know your land is on the Listed Land Use Register if you intend to rent or sell your property. If you are not sure what you need to tell the other party, you should seek legal advice.

You may choose to have your property further investigated for your own peace of mind, or because you want to do one of the activities covered by the National Environmental Standard for Assessing and Managing Contaminants in Soil. Your district or city council will provide further information.



If you wish to engage a suitably qualified experienced practitioner to undertake a detailed site investigation, there are criteria for choosing a practitioner on www.ecan.govt.nz/HAIL.

I think my site category is incorrect – how can I change it?

If you have an environmental investigation undertaken at your site, you must send us the report and we will review the LLUR category based on the information you provide. Similarly, if you have information that clearly shows your site has not been associated with HAIL activities (eg. a preliminary site investigation), or if other HAIL activities have occurred which we have not listed, we need to know about it so that our records are accurate.

If we have incorrectly identified that a HAIL activity has occurred at a site, it will be not be removed from the LLUR but categorised as Verified Non-HAIL. This helps us to ensure that the same site is not re-identified in the future.

Contact us

Property owners have the right to look at all the information Environment Canterbury holds about their properties.

It is free to check the information on the LLUR, online at www.llur.ecan.govt.nz.

If you don't have access to the internet, you can enquire about a specific site by phoning us on (03) 353 9007 or toll free on 0800 EC INFO (32 4636) during business hours.

Contact Environment Canterbury:

Email: ecinfo@ecan.govt.nz

Phone:
Calling from Christchurch: (03) 353 9007
Calling from any other area: 0800 EC INFO (32 4636)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

Listed Land Use Register

Site categories and definitions

When Environment Canterbury identifies a Hazardous Activities and Industries List (HAIL) land use, we review the available information and assign the site a category on the Listed Land Use Register. The category is intended to best describe what we know about the land use.

If a site is categorised as **Unverified** it means it has been reported or identified as one that appears on the HAIL, but the land use has not been confirmed with the property owner.

If the land use has been confirmed but analytical information from the collection of samples is not available, and the presence or absence of contamination has therefore not been determined, the site is registered as:

Not investigated:

- A site whose past or present use has been reported and verified as one that appears on the HAIL.
- The site has not been investigated, which might typically include sampling and analysis of site soil, water and/or ambient air, and assessment of the associated analytical data.
- There is insufficient information to characterise any risks to human health or the environment from those activities undertaken on the site. Contamination may have occurred, but should not be assumed to have occurred.

If analytical information from the collection of samples is available, the site can be registered in one of six ways:

At or below background concentrations:

The site has been investigated or remediated. The investigation or post remediation validation results confirm there are no hazardous substances above local background concentrations other than those that occur naturally in the area. The investigation or validation sampling has been sufficiently detailed to characterise the site.

Below guideline values for:

The site has been investigated. Results show that there are hazardous substances present at the site but indicate that any adverse effects or risks to people and/or the environment are considered to be so low as to be acceptable. The site may have been remediated to reduce contamination to this level, and samples taken after remediation confirm this.

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Managed for:

The site has been investigated. Results show that there are hazardous substances present at the site in concentrations that have the potential to cause adverse effects or risks to people and/or the environment. However, those risks are considered managed because:

- the nature of the use of the site prevents human and/or ecological exposure to the risks; and/or
- the land has been altered in some way and/or restrictions have been placed on the way it is used which prevent human and/or ecological exposure to the risks.

Partially investigated:

The site has been partially investigated. Results:

- demonstrate there are hazardous substances present at the site; however, there is insufficient information to quantify any adverse effects or risks to people or the environment; or
- do not adequately verify the presence or absence of contamination associated with all HAIL activities that are and/or have been undertaken on the site.

Significant adverse environmental effects:

The site has been investigated. Results show that sediment, groundwater or surface water contains hazardous substances that:

- have significant adverse effects on the environment; or
- are reasonably likely to have significant adverse effects on the environment.

Contaminated:

The site has been investigated. Results show that the land has a hazardous substance in or on it that:

- has significant adverse effects on human health and/or the environment; and/or
- is reasonably likely to have significant adverse effects on human health and/or the environment.

If a site has been included incorrectly on the Listed Land Use Register as having a HAIL, it will not be removed but will be registered as:

Verified non-HAIL:

Information shows that this site has never been associated with any of the specific activities or industries on the HAIL.

Please contact Environment Canterbury for further information:

(03) 353 9007 or toll free
on 0800 EC INFO (32 4636)
email ecinfo@ecan.govt.nz

Environment Canterbury Regional Council
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E13/102

APPENDIX 3:

Site Photographs



Photo 1: Area of former sheep dip



Photo 2: Stock loading - holding pen



Photo 3: 1000 L above ground storage tank near large barn



Photo 4: Staining below above ground storage tank



Photo 5: Storage of metal, wood and old appliances



Photo 6: Dwelling

ENGEO
Expect Excellence

Date taken	Dec 19	**Client**	**Hughes Developments**		
Taken by	NF	**Project**	**92 Dunns Crossing Road**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	1 to 6	**ENGEO Ref.**	12903	**Appendix No.**	3a



Photo 7: Barn towards the north of the sheep dip area



Photo 8: Drum with burnt material to the east of the dwelling



Photo 9:Contents of burn drum



Photo 10: Paddocks to the east of the dwelling looking east



Photo 11: Paddocks to the north of the dwelling looking northeast



Photo 12: Paddocks to the north of the dwelling looking north

ENGEO
Expect Excellence

Date taken	Dec 19	**Client**	**Hughes Developments**		
Taken by		**Project**	**92 Dunns Crossing Road**		
Approved by		**Description**	**Site Photographs**		
Photo No.	7 to 12	**ENGEO Ref.**	12903	**Appendix No.**	3b



Photo 13: Waste pit along eastern boundary at 92 Dunns Crossing Road



Photo 14: General waste pit material



Photo 15: Waste pit soil material



Photo 16: Extent of waste pit looking north



Photo 17: Paddocks to the north of the dwelling looking northeast



Photo 18: Radio tower in eastern paddock at Goulds Road Site

ENGEO
Expect Excellence

Date taken	Dec 19	**Client**	**Hughes Developments**		
Taken by	NF	**Project**	**92 Dunns Crossing Road**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	13 to 18	**ENGEO Ref.**	12903	**Appendix No.**	3c

APPENDIX 4:

Laboratory Analysis

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2282039 SPv1
Contact:	Natalie Flatman C/- Engeo Limited PO Box 373 Christchurch 8140	**Date Received:**	27-Nov-2019
		Date Reported:	29-Nov-2019
		Quote No:	102457
		Order No:	
		Client Reference:	12903.001.000_92D
		Submitted By:	Natalie Flatman

Sample Type: Soil

Sample Name:		HA01 @ 0.0-0.2 22-Nov-2019	HA02 @ 0.0-0.2 22-Nov-2019	HA03 @ 0.0-0.2 22-Nov-2019	HA04 @ 0.0-0.2 22-Nov-2019	HA05 @ 0.0-0.2 22-Nov-2019
Lab Number:		2282039.1	2282039.2	2282039.3	2282039.4	2282039.5
Individual Tests						
Dry Matter	g/100g as rcvd	86	81	89	77	84
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	7	6
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	10	11	14	13
Total Recoverable Copper	mg/kg dry wt	7	4	5	13	8
Total Recoverable Lead	mg/kg dry wt	19.8	19.4	16.6	20	18.3
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	7	6	7	8	7
Total Recoverable Zinc	mg/kg dry wt	56	46	51	117	62
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
alpha-BHC	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
beta-BHC	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
delta-BHC	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
gamma-BHC (Lindane)	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
cis-Chlordane	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
trans-Chlordane	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
4,4'-DDD	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
2,4'-DDE	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
4,4'-DDE	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
2,4'-DDT	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
4,4'-DDT	mg/kg dry wt	0.012	< 0.013	0.012	0.013	0.012
Total DDT Isomers	mg/kg dry wt	< 0.07	< 0.08	< 0.07	< 0.08	< 0.08
Dieldrin	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endosulfan I	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endosulfan II	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endosulfan sulphate	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endrin	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endrin aldehyde	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endrin ketone	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Heptachlor	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Heptachlor epoxide	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Hexachlorobenzene	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Methoxychlor	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012

ilac-MRA IANZ ACCREDITED LABORATORY

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		HA01 @ 0.0-0.2 22-Nov-2019	HA02 @ 0.0-0.2 22-Nov-2019	HA03 @ 0.0-0.2 22-Nov-2019	HA04 @ 0.0-0.2 22-Nov-2019	HA05 @ 0.0-0.2 22-Nov-2019
Lab Number:		2282039.1	2282039.2	2282039.3	2282039.4	2282039.5
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Acetochlor	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Alachlor	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Atrazine	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Atrazine-desethyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Atrazine-desisopropyl	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Azaconazole	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Azinphos-methyl	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Benalaxyl	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Bitertanol	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Bromacil	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Bromopropylate	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Butachlor	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Captan	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Carbaryl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Carbofuran	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Chlorfluazuron	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Chlorothalonil	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Chlorpyrifos	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Chlorpyrifos-methyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Chlortoluron	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Cyanazine	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Cyfluthrin	mg/kg	< 0.07	< 0.08	< 0.07	< 0.08	< 0.07
Cyhalothrin	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Cypermethrin	mg/kg	< 0.14	< 0.15	< 0.13	< 0.16	< 0.14
Deltamethrin (including Tralomethrin)	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Diazinon	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Dichlofluanid	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Dichloran	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Dichlorvos	mg/kg	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Difenoconazole	mg/kg	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Dimethoate	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Diphenylamine	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Diuron	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Fenpropimorph	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Fluazifop-butyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Fluometuron	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Flusilazole	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Fluvalinate	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Furalaxyl	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Haloxyfop-methyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Hexaconazole	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Hexazinone	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Kresoxim-methyl	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Linuron	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Malathion	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Metalaxyl (Mefenoxam)	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Methamidophos	mg/kg	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Metolachlor	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Metribuzin	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Molinate	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Myclobutanil	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Naled	mg/kg	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Norflurazon	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12

Sample Type: Soil						
Sample Name:		HA01 @ 0.0-0.2 22-Nov-2019	HA02 @ 0.0-0.2 22-Nov-2019	HA03 @ 0.0-0.2 22-Nov-2019	HA04 @ 0.0-0.2 22-Nov-2019	HA05 @ 0.0-0.2 22-Nov-2019
Lab Number:		2282039.1	2282039.2	2282039.3	2282039.4	2282039.5
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Oxadiazon	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Oxyfluorfen	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Paclobutrazol	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Parathion-ethyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Parathion-methyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Pendimethalin	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Permethrin	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pirimicarb	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Pirimiphos-methyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Prochloraz	mg/kg	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Procymidone	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Prometryn	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Propachlor	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Propanil	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Propazine	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Propiconazole	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyriproxyfen	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Quizalofop-ethyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Simazine	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Simetryn	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Sulfentrazone	mg/kg	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
TCMTB [2-(thiocyanomethylthio) benzothiazole,Busan]	mg/kg dry wt	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Tebuconazole	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Terbacil	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Terbufos	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Terbumeton	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Terbuthylazine	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Terbuthylazine-desethyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Terbutryn	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Thiabendazole	mg/kg	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Thiobencarb	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Tolylfluanid	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Triazophos	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Trifluralin	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Vinclozolin	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06

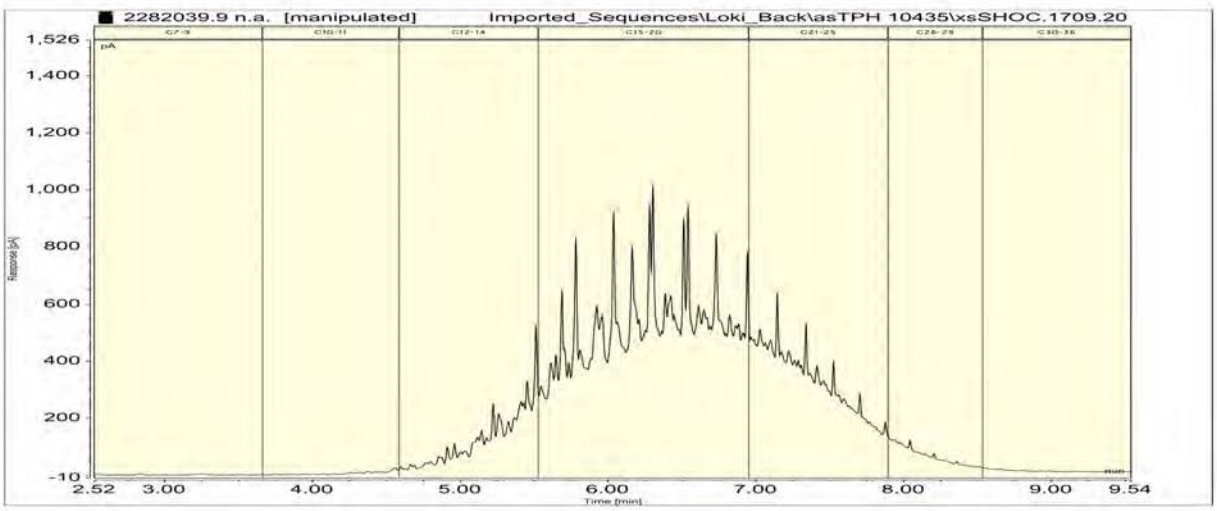
Sample Name:		HA06 @ 0.0-0.2 22-Nov-2019	HA07 @ 0.0-0.2 22-Nov-2019	HA08 @ 0.0-0.2 22-Nov-2019	SS01 @ 0.0 22-Nov-2019	SS02 @ 0.0 22-Nov-2019
Lab Number:		2282039.6	2282039.7	2282039.8	2282039.9	2282039.10
Individual Tests						
Dry Matter	g/100g as rcvd	80	84	78	75	77
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	-	-	10	1,470
Total Recoverable Cadmium	mg/kg dry wt	-	-	-	0.15	5.2
Total Recoverable Chromium	mg/kg dry wt	-	-	-	22	480
Total Recoverable Copper	mg/kg dry wt	-	-	-	68	1,630
Total Recoverable Lead	mg/kg dry wt	-	-	-	159	149
Total Recoverable Nickel	mg/kg dry wt	-	-	-	8	22
Total Recoverable Zinc	mg/kg dry wt	-	-	-	220	370
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	9	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	0.73	-	-
Total Recoverable Chromium	mg/kg dry wt	10	10	13	-	-
Total Recoverable Copper	mg/kg dry wt	4	4	35	-	-
Total Recoverable Lead	mg/kg dry wt	12.9	13.0	290	-	-

Sample Type: Soil						
Sample Name:		HA06 @ 0.0-0.2 22-Nov-2019	HA07 @ 0.0-0.2 22-Nov-2019	HA08 @ 0.0-0.2 22-Nov-2019	SS01 @ 0.0 22-Nov-2019	SS02 @ 0.0 22-Nov-2019
Lab Number:		2282039.6	2282039.7	2282039.8	2282039.9	2282039.10
Heavy Metals with Mercury, Screen Level						
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Nickel	mg/kg dry wt	6	7	10	-	-
Total Recoverable Zinc	mg/kg dry wt	42	45	1,530	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
alpha-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
beta-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
delta-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
cis-Chlordane	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
trans-Chlordane	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	-	-
2,4'-DDD	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
4,4'-DDD	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
2,4'-DDE	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
4,4'-DDE	mg/kg dry wt	0.012	0.100	0.023	-	-
2,4'-DDT	mg/kg dry wt	< 0.012	0.015	< 0.013	-	-
4,4'-DDT	mg/kg dry wt	0.020	0.046	0.019	-	-
Total DDT Isomers	mg/kg dry wt	< 0.08	0.16	< 0.08	-	-
Dieldrin	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endosulfan I	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endosulfan II	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endrin	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endrin aldehyde	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endrin ketone	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Heptachlor	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Methoxychlor	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Acetochlor	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Alachlor	mg/kg	< 0.05	< 0.05	< 0.05	-	-
Atrazine	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Atrazine-desethyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Atrazine-desisopropyl	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Azaconazole	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Azinphos-methyl	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Benalaxyl	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Bitertanol	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Bromacil	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Bromopropylate	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Butachlor	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Captan	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Carbaryl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Carbofuran	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Chlorfluazuron	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Chlorothalonil	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Chlorpyrifos	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Chlorpyrifos-methyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Chlortoluron	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Cyanazine	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Cyfluthrin	mg/kg	< 0.08	< 0.07	< 0.08	-	-
Cyhalothrin	mg/kg	< 0.06	< 0.06	< 0.06	-	-

Sample Type: Soil						
Sample Name:		HA06 @ 0.0-0.2 22-Nov-2019	HA07 @ 0.0-0.2 22-Nov-2019	HA08 @ 0.0-0.2 22-Nov-2019	SS01 @ 0.0 22-Nov-2019	SS02 @ 0.0 22-Nov-2019
Lab Number:		2282039.6	2282039.7	2282039.8	2282039.9	2282039.10
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Cypermethrin	mg/kg	< 0.15	< 0.14	< 0.15	-	-
Deltamethrin (including Tralomethrin)	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Diazinon	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Dichlofluanid	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Dichloran	mg/kg	< 0.2	< 0.2	< 0.2	-	-
Dichlorvos	mg/kg	< 0.09	< 0.09	< 0.09	-	-
Difenoconazole	mg/kg	< 0.09	< 0.09	< 0.09	-	-
Dimethoate	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Diphenylamine	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Diuron	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Fenpropimorph	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Fluazifop-butyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Fluometuron	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Flusilazole	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Fluvalinate	mg/kg	< 0.05	< 0.05	< 0.05	-	-
Furalaxyl	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Haloxyfop-methyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Hexaconazole	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Hexazinone	mg/kg	< 0.03	< 0.03	< 0.03	-	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Kresoxim-methyl	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Linuron	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Malathion	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Metalaxyl (Mefenoxam)	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Methamidophos	mg/kg	< 0.3	< 0.3	< 0.3	-	-
Metolachlor	mg/kg	< 0.05	< 0.05	< 0.05	-	-
Metribuzin	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Molinate	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Myclobutanil	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Naled	mg/kg	< 0.3	< 0.3	< 0.3	-	-
Norflurazon	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Oxadiazon	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Oxyfluorfen	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Paclobutrazol	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Parathion-ethyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Parathion-methyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Pendimethalin	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Permethrin	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Pirimicarb	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Pirimiphos-methyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Prochloraz	mg/kg	< 0.3	< 0.3	< 0.3	-	-
Procymidone	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Prometryn	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Propachlor	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Propanil	mg/kg	< 0.2	< 0.2	< 0.2	-	-
Propazine	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Propiconazole	mg/kg	< 0.05	< 0.05	< 0.05	-	-
Pyriproxyfen	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Quizalofop-ethyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Simazine	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Simetryn	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Sulfentrazone	mg/kg	< 0.3	< 0.3	< 0.3	-	-
TCMTB [2-(thiocyanomethylthio) benzothiazole,Busan]	mg/kg dry wt	< 0.12	< 0.12	< 0.12	-	-
Tebuconazole	mg/kg	< 0.06	< 0.06	< 0.06	-	-

Sample Type: Soil						
Sample Name:		HA06 @ 0.0-0.2 22-Nov-2019	HA07 @ 0.0-0.2 22-Nov-2019	HA08 @ 0.0-0.2 22-Nov-2019	SS01 @ 0.0 22-Nov-2019	SS02 @ 0.0 22-Nov-2019
Lab Number:		2282039.6	2282039.7	2282039.8	2282039.9	2282039.10
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Terbacil	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Terbufos	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Terbumeton	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Terbuthylazine	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Terbuthylazine-desethyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Terbutryn	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Thiabendazole	mg/kg	< 0.3	< 0.3	< 0.3	-	-
Thiobencarb	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Tolylfluanid	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Triazophos	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Trifluralin	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Vinclozolin	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	-	-	-	-	< 0.3
1-Methylnaphthalene	mg/kg dry wt	-	-	-	-	< 0.013
2-Methylnaphthalene	mg/kg dry wt	-	-	-	-	< 0.013
Acenaphthylene	mg/kg dry wt	-	-	-	-	< 0.013
Acenaphthene	mg/kg dry wt	-	-	-	-	< 0.013
Anthracene	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[a]anthracene	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	-	-	-	-	< 0.04
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	-	-	-	-	< 0.04
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[e]pyrene	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	-	< 0.013
Chrysene	mg/kg dry wt	-	-	-	-	< 0.013
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	-	< 0.013
Fluoranthene	mg/kg dry wt	-	-	-	-	0.018
Fluorene	mg/kg dry wt	-	-	-	-	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	-	< 0.013
Naphthalene	mg/kg dry wt	-	-	-	-	< 0.07
Perylene	mg/kg dry wt	-	-	-	-	< 0.013
Phenanthrene	mg/kg dry wt	-	-	-	-	0.016
Pyrene	mg/kg dry wt	-	-	-	-	0.015
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	-	-	91	-
C10 - C14	mg/kg dry wt	-	-	-	10,200	-
C15 - C36	mg/kg dry wt	-	-	-	85,000	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	-	95,000	-

2282039.9
SS01 @ 0.0 22-Nov-2019
Client Chromatogram for TPH by FID



Analyst's Comments

Appendix No.1 - Chain of Custody

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-10
Total of Reported PAHs in Soil	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg dry wt	10
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	9-10
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-8
Organochlorine/nitro&phosphorus Pest.s Screen in Soils, GCMS	Sonication extraction, Dilution cleanup, GC-MS analysis. Tested on as received sample	-	1-8
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.3 mg/kg dry wt	10
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	9
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-10
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	10
Benzo[a]pyrene Toxic Equivalence (TEF)	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	10

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
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ANALYSIS REQUEST

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Private Bag 3205
Hamilton 3240, New Zealand

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Job No: **228 2039**

Date Recv: 27-Nov-19 05:55

Received by: Alpha Tan

3122820394

Quote No 102457
Primary Contact N Flatman
Submitted By N Flatman
Client Name ENGEO Ltd
Address 124 Montreal St
Christchurch *Postcode* 8014
Phone 03 3289012 *Mobile*
Email nflatman@engeo.co.nz
Charge To ENGEO
Client Reference 12903.001.000 - 92D
Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☑ Email Primary Contact ☐ Email Submitter ☐ Email Client
☐ Email Other
☐ Other

ADDITIONAL INFORMATION

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories *Date & Time:* 25/11/19 3:00
Name: N Flatman
☐ *Tick if you require COC to be emailed back* *Signature:*

Received at Hill Laboratories *Date & Time:*
Name:
Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen *Temp:* 9.0

☐ Sample and Analysis details checked
Signature:

Priority ☐ Low ☑ Normal ☐ High
☐ Urgent (ASAP, extra charge applies, please contact lab first)

Requested Reporting Date:

No.	Sample Name	Sample Date	Sample Time	Sample Type	Tests Required (if not as per Quote)
1	HA01 @ 0.0-0.2	22/11/19		ES	Heavy metals incl Hg, OCPs & ONPs
2	HA02 @ 0.0-0.2				" "
3	HA03 @ 0.0-0.2				" "
4	HA04 @ 0.0-0.2				" "
5	HA05 @ 0.0-0.2				" "
6	HA06 @ 0.0-0.2				" "
7	HA07 @ 0.0-0.2				" "
8	HA08 @ 0.0-0.2				" "
9	SS01 @ 0.0				Heavy metals & TPH
10	SS02 @ 0.0				Heavy metals & PAHs
11	HA01 @ 0.4-0.5				COLD HOLD
12	HA02 @ 0.4-0.5				COLD HOLD

Continued on next page

No.	Sample Name	Sample Date	Sample Time	Sample Type	Tests Required (if not as per Quote)
13	HA03 @0.4-0.5	22/11/19		ES	HOLD COLD
14	HA04 @0.4-0.5	↓		↓	↓
15	HA05 @0.4 -0.5				
16	HA06 @0.4 -0.5				
17	HA07 @0.4 -0.5				
18					
19					
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40					

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Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2288278 SPv1
Contact:	Natalie Flatman C/- Engeo Limited PO Box 373 Christchurch 8140	**Date Received:**	06-Dec-2019
		Date Reported:	10-Dec-2019
		Quote No:	82742
		Order No:	
		Client Reference:	12903.000.000_92 DC
		Submitted By:	Natalie Flatman

Sample Type: Soil

Sample Name:		WP01 05-Dec-2019 9:10 am	WP02 05-Dec-2019 9:12 am	WP03 05-Dec-2019 9:15 am	HA09 05-Dec-2019 10:00 am	HA10 05-Dec-2019 10:05 am
Lab Number:		2288278.1	2288278.2	2288278.3	2288278.4	2288278.5
Individual Tests						
Dry Matter	g/100g as rcvd	94	95	95	-	-
Total Recoverable Lead	mg/kg dry wt	-	-	-	85	79
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	13	19	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.35	0.68	1.32	-	-
Total Recoverable Chromium	mg/kg dry wt	14	18	24	-	-
Total Recoverable Copper	mg/kg dry wt	10	340	640	-	-
Total Recoverable Lead	mg/kg dry wt	27	115	61	-	-
Total Recoverable Nickel	mg/kg dry wt	9	11	340	-	-
Total Recoverable Zinc	mg/kg dry wt	113	320	580	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Acenaphthene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Anthracene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Benzo[a]anthracene	mg/kg dry wt	0.011	< 0.011	< 0.011	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.015	< 0.011	< 0.011	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.03	< 0.03	< 0.03	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.03	< 0.03	< 0.03	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.014	< 0.011	< 0.011	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.012	< 0.011	< 0.011	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Chrysene	mg/kg dry wt	0.012	< 0.011	< 0.011	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Fluoranthene	mg/kg dry wt	0.019	< 0.011	< 0.011	-	-
Fluorene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.012	< 0.011	< 0.011	-	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	-	-
Perylene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Phenanthrene	mg/kg dry wt	0.012	< 0.011	< 0.011	-	-
Pyrene	mg/kg dry wt	0.017	< 0.011	< 0.011	-	-

ilac-MRA IANZ ACCREDITED LABORATORY

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		HA11 05-Dec-2019 10:10 am	HA12 05-Dec-2019 10:15 am	HA13 05-Dec-2019 10:20 am	HA14 05-Dec-2019 10:25 am	HA15 05-Dec-2019 10:30 am
Lab Number:		2288278.6	2288278.7	2288278.8	2288278.9	2288278.10
Individual Tests						
Total Recoverable Lead	mg/kg dry wt	57	42	67	43	39

Sample Name:		HA16 05-Dec-2019 10:35 am	HA17 05-Dec-2019 10:40 am			
Lab Number:		2288278.11	2288278.12			
Individual Tests						
Total Recoverable Lead	mg/kg dry wt	54	51	-	-	-

Analyst's Comments

Appendix No.1 - Chain of Custody

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-12
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	4-12
Total of Reported PAHs in Soil	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg dry wt	1-3
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-3
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.3 mg/kg dry wt	1-3
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-3
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	4-12
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	4-12
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-3
Benzo[a]pyrene Toxic Equivalence (TEF)	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

R J Hill Laboratories Limited
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Private Bag 3205
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Job No: **228 8278**
Date Recv: 06-Dec-19 05:50
Received by: Alpha Tan
3122882786

Quote No
Primary Contact N Flatman
Submitted By N Flatman
Client Name ENGEO Ltd
Address 124 Montreal St
Christchurch *Postcode* 8023
Phone 027 3350114 *Mobile*
Email nflatman@engeo.co.nz
Charge To ENGEO
Client Reference 12903.000.000 - 92 DC
Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☑ Email Primary Contact ☐ Email Submitter ☐ Email Client
☐ Email Other
☐ Other

ADDITIONAL INFORMATION

WP01, WP02 & WP03 may contain asbestos

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories
Date & Time: 5/12/19 3:30
Name: N Flatman
☐ *Tick if you require COC to be emailed back*
Signature:

Received at Hill Laboratories
Date & Time:
Name:
Signature:

Condition Temp: 8.1
☐ Room Temp ☐ Chilled ☐ Frozen
☐ Sample and Analysis details checked
Signature:

Priority ☐ Low ☑ Normal ☐ High
☐ **Urgent** (ASAP, extra charge applies, please contact lab first)

Requested Reporting Date:

No.	Sample Name	Sample Date	Sample Time	Sample Type	Tests Required (if not as per Quote)
1	WP01	5/12/19	9:10	ES	Heavy metals & PAHs
2	WP02	5/12/19	9:12		↓
3	WP03	5/12/19	9:15		↓
4	HA09	5/12/19	10:00		Lead
5	HA10	5/12/19	10:05		↓
6	HA11	5/12/19	10:10		↓
7	HA12	5/12/19	10:15		↓
8	HA13	5/12/19	10:20		↓
9	HA14	5/12/19	10:25		↓
10	HA15	5/12/19	10:30		↓
11	HA16	5/12/19	10:35		↓
12	HA17	5/12/19	10:40	↓	↓

Continued on next page

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IANZ ACCREDITED LABORATORY ACCREDITATION Nº: 1334

Version Number: 7	Date Issued: November 2019	Authorised By: TCH	Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T000897.2	**Total Samples Received:**	3
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference/Address:**	92 DC	**Date Received:**	5/12/2019
Client Reference:	12903.000.000			**Date Analysed:**	6/12/2019
Client Contact:	Natalie Flatman	**Key Technical Person:**	Marie Foxwell	**Date Reported:**	6/12/2019

ASBESTOS IN SOIL ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description	Received Weight (g)	Dry Weight (g)	Results	ACM Weight (g)	FA Weight (g)	AF Weight (g)	ACM w/w %	FA w/w %	AF w/w %	Combined AF/FA %	Comments
T000897.2.1	WP01	Waste pit 01 , Soil											
		Layer 1: >10 mm	1931.65	998.90	Synthetic Mineral Fibres Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected
		Layer 2: 10 - 2 mm		486.16	Synthetic Mineral Fibres Organic Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		498.73	Synthetic Mineral Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		51.61	Organic Fibres								
		Total sample weight:		1983.79	Total Combined:	0.00000	0.00000	0.00000					
T000897.2.2	WP02	Waste pit 02 , Soil											
		Layer 1: >10 mm	2037.33	767.18	Synthetic Mineral Fibres Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected
		Layer 2: 10 - 2 mm		493.67	Synthetic Mineral Fibres Organic Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		703.02	Synthetic Mineral Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		55.34	Organic Fibres								
		Total sample weight:		1963.87	Total Combined:	0.00000	0.00000	0.00000					

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Client Reference:	12903.000.000			**Date Analysed:**	6/12/2019
Client Contact:	Natalie Flatman	**Key Technical Person:**	Marie Foxwell	**Date Reported:**	6/12/2019

ASBESTOS IN SOIL ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description	Received Weight (g)	Dry Weight (g)	Results	ACM Weight (g)	FA Weight (g)	AF Weight (g)	ACM w/w %	FA w/w %	AF w/w %	Combined AF/FA %	Comments
T000897.2.3	WP03	Waste pit 03, Soil											
		Layer 1: >10 mm	1991.10	844.16	Synthetic Mineral Fibres Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.02035%	0.00000%	0.02035%	
		Layer 2: 10 - 2 mm		486.78	**Chrysotile (White Asbestos)** **Amosite (Brown Asbestos)** Organic Fibres Synthetic Mineral Fibres	N/A	0.39191	0.00000					
		Layer 3: <2 mm		594.88	Synthetic Mineral Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		52.18	Organic Fibres								
		Total sample weight:		1925.82	Total Combined:	0.00000	0.39191	0.00000					

Method References and Disclaimers

Samples were analysed in: AS4964-2004 Australian Standard - Method for Qualitative Identification of Asbestos in Bulk Samples
BRANZ - New Zealand Guidelines for Assessing and Managing Asbestos in Soil 2017

Disclaimers:
Samples are reported 'As Received'. Terra Scientific takes no responsibility for sampling processes, client sample descriptions and sample locations as these were provided by the client.
The results presented in this report relate specifically to the samples submitted for this job.
The detection limit is 0.1g/1kg (0.01% w/w) as stated in the AS4964-2004. Samples that contain asbestos less than this limit are outside the scope of accreditation.
Asbestos calculations are outside the scope of accreditation.
All opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced, except in full, without the written consent of the Key Technical Person assigned to this report.

Analysis Conducted By:

Marie Foxwell
Laboratory Manager

Reviewed By:

Jessica Campbell
Managing Director

For any queries regarding this report, please do not hesitate to contact the laboratory and speak with the Key Technical Personnel.

Marie Foxwell
Laboratory Manager
Key Technical Person

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IANZ ACCREDITED LABORATORY ACCREDITATION №: 1334

Client Name:	ENGEO Christchurch	**Job Number:**	T000897.1	**Total Samples Received:**	1
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference / Address:**	92 DC	**Date Received:**	5/12/2019
Client Reference:	12903.000.000			**Date Analysed:**	6/12/2019
Client Contact:	Natalie Flatman	**Key Technical Person:**	Marie Foxwell	**Date Reported:**	6/12/2019

ASBESTOS ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description		Results	Comments
T000897.1.1	PACM1	Waste pit, Cement board		**Chrysotile (White Asbestos)** **Amosite (Brown Asbestos)** Organic Fibres	
		White painted cement sheeting			
		Sample Weight:	33.70 g		

Method References and Disclaimers

Samples were analysed in accordance with: AS4964-2004 Australian Standard - Method for Qualitative Identification of Asbestos in Bulk Samples
Samples are reported 'As Received'. Terra Scientific takes no responsibility for sampling processes, client sample descriptions and sample locations as these were provided by the client.

Disclaimers:
The results presented in this report relate specifically to the samples submitted for this job.
The detection limit is 0.1g/1kg as stated in the AS4964-2004.
This report shall not be reproduced, except in full, without the written consent of the Key Technical Person assigned to this report.

Analysis Conducted By:

Sarah Giles
Laboratory Assistant

Reviewed By:

Marie Foxwell
Laboratory Manager

For any queries regarding this report, please do not hesitate to contact the laboratory and speak with the Key Technical Personnel.

Marie Foxwell
Laboratory Manager
Key Technical Person



ENGEO
Celebrating 10 YEARS IN NZ

Combined Preliminary and Detailed Site Investigation

597 Maddisons Road
Rolleston
Canterbury

Submitted to:

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03.09.2020
12903.000.005_96

ACENZ

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Figure 1: Site Location Plan

Figure 2: Waste Pit Sample Plan

Figure 3: Burn Pile Sample Plan

Appendices

Appendix 1: Site Photography

Appendix 2: Certificate of Title

Appendix 3: LLUR Statement

Appendix 4: Laboratory reports

ENGEO Document Control:

Report Title	Combined Preliminary and Detailed Site Investigation - 597 Maddisons Road, Rolleston			
Project No.	12903.003.000	Doc ID	05	
Client	Hughes Development Ltd	Client Contact	Kelvin Back	
Distribution (PDF)	Hughes Development Ltd			
Date	Revision Details/Status	WP	Author	Reviewer
03/09/2020	Issued to Client	DF	NF/SF	DR

1 Introduction

ENGEO Ltd was requested by Hughes Development Ltd to undertake a combined preliminary and detailed site investigation of the property at 597 Maddisons Road, Rolleston, Canterbury (herein referred to as 'the site'). Figure 1 attached indicates the location of the property. The purpose of the assessment was to assess the property's suitability for a change of land use consent and subdivision under the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES) and to satisfy the requirements of Selwyn District Council (SDC).

This investigation was undertaken in general accordance with the MfE 2011, *Contaminated Land Management Guidelines (CLMG) No.5: Guidelines for Site Investigation and Site Analysis of Soil* and reported in general accordance with the MfE 2011 *CLMG No.1: Reporting on Contaminated Sites in New Zealand*.

1.1 Objectives of the Assessment

The objective of this Combined PSI / DSI was to assess conditions indicative of releases and threatened releases of hazardous substances on, at, in or to the subject property and report on the potential risk posed to future site users.

1.2 Approach

To satisfy the objectives, ENGEO sought to gather information regarding the following:

- Current and past property uses and occupancies;
- Current and past uses of hazardous substances;
- Waste management and disposal activities that could have caused a release or threatened release of hazardous substances;
- Current and past corrective actions and response activities to address past and on-going releases of hazardous substances at the subject property; and
- Properties adjoining or located near the subject property that have environmental conditions that could have resulted in conditions indicative of releases or threatened releases of hazardous substances to the subject property.

1.2.1 Review of Site Information

During this assessment, a number of sources of information were contacted for information relating to the site regarding its past and present uses. This included contacting Canterbury Regional Council (CRC) to determine if there were records on the Listed Land Use Register (LLUR), reviewing records held by Selwyn District Council (SDC) including the property file, and obtaining the certificate of titles for the property from Land Information New Zealand (LINZ). A review of a number of historical and current aerial photographs was also undertaken using images from Canterbury Maps and Google Earth.

1.2.2 Site Inspection

A site walk over was undertaken on 28 august 2020 by ENGEO staff. Photographs collected from site have been included in Appendix 1.

2 Site Description and Setting

Site information is summarised in Table 1 below.

Table 1: Site Information

Name	Description
Location	597 East Maddisons Road, Rolleston
Legal Description	Lot 1 DP 57004
Site Area	Approximately 20.4 ha
Property Owner	Property is under contract to Hughes Developments Limited.
Current Land Use	Residential and Agricultural Land
Proposed Land Use	Standard residential subdivision, for single dwelling sites with gardens, including home-grown produce consumption (10%).
Building Construction	Dwelling – concrete foundation, brick cladding, metal roof. Various sheds – timber and metal cladding, metal roofs.
Territorial Authority	Selwyn District Council
Zoning	Inner Plains / Living Z / Rural

The site setting is summarised in Table 2 below.

Table 2: Site Setting

Item	Description
Topography	The site is predominantly flat
Local Setting	The surrounding area is a mix of agricultural and residential.
Nearest Surface Water & Use	Two marked drains (ECAN GIS) are present, one on the north eastern boundary of the site (Drain ID 20877) and one on the south eastern side of the property on the far side of Goulds Road (Drain ID 20881).

Item	Description
Geology (GNS Science)	Late Quaternary alluvium and colluvium. Unconsolidated to poorly consolidated mud, sand, gravel and peat of alluvial and colluvial origin
Hydrogeology (ECan GIS)	The site is located over an unconfined / semiconfined gravel aquifer. The on-site well does not record ground water level, however wells directly west (M36/5041) and directly east (M36/4891) record depth of groundwater at 6.8 and 7.38 meters below ground level respectively. Groundwater is presumed to flow from the northwest to the southeast towards Lake Ellesmere.
Groundwater Abstractions (ECan GIS)	There is one groundwater abstraction located on the site and eight within 250 m of the site: M36/4346: Main M. R, active well (26.8 m) for domestic supply onsite. M36/5041: Kajens Trading Development Ltd, active well (32.0 m) for domestic supply to the northwest of the site. M36/5268: Macdonald, K, active well (37.0 m) for domestic supply to the north of the site. M36/3041: Quinton, K. R, active well (24.0 m) for domestic supply to the north of the site. M36/3721: Wilson, N. L, active well (19.0 m) for domestic supply to the north of the site. M36/0038: M. W. B, active well (27.1 m) for domestic supply to the north of the site. M36/20602: Mr David Foskett, active well (36.7 m) for domestic and stockwater supply to the north of the site. M36/4891: Mr & Ms BN & JA Stevens & Gray, active well (25.25 m) for domestic and stockwater supply to the east of the site.
Discharge Consents (ECan GIS)	There are no active discharge consents located on the site, and three active consent within 250 m of the site: CRC052128: Mr & Ms KP & DM Graham, active discharge consent to discharge domestic sewage tank effluent into ground to the north of the site. CRC082098: Brian & Louise Smart & Wilkinson, active discharge consent to discharge domestic sewage effluent into land to the north of the site. CRC190197: BENZ 2007 Limited, active discharge consent to discharge stormwater to land to the north of the site.

3 Site History

A number of sources were used to investigate the past uses of the site. The findings of these information searches have been summarised in this section.

3.1 Discussions with Site Owners

Discussions were had with the current site owners in regards to the past and present uses of the site. The current owners have owned the property since the 1990's when the site was open grazing land. The owner mentioned the offal pit in the far south corner of the site and that is was used for disposing of offal and hardfill. The owner also mentioned the burn pile behind the house where domestic rubbish has been burnt. The remainder of the site has been used for grazing of horses and cattle since it was purchased. The owner cannot recall any other waste pits or burn piles when the land was transferred to them.

3.2 Selwyn District Council Property File

The property file for the site, held by Selwyn District Council, was reviewed on 28 August 2020 as part of the DSI

- 17 February 1994 – Building consent for residential dwelling
- 29 November 1994 – Building consent for garage
- 18 October 1995 – Building consent for implement shed
- 1 November 1999 – Building consent, new / relocated implement shed

The property file information did not indicate asbestos containing materials having being used in the construction of the buildings. Because of the age of the buildings (constructed pre-2000) a full asbestos demolition survey is required; this is to ensure that asbestos materials are identified prior to demolition works so that they can be removed in a safe manner.

3.3 Certificate of Title

A review of the certificate of title was completed with no information related to potential contaminating activities identified. The Certificates of Title are attached in Appendix 2.

3.4 Listed Land Use Register (LLUR)

Potentially hazardous activities are defined on the Ministry for the Environmental (MfE) Hazardous Activities and Industries List (HAIL). Canterbury Regional Council (CRC) maintains a Listed Land Use Register (LLUR) of past and current land uses within the Canterbury region which have potentially had an activity included on the HAIL undertaken on them. Under the NES, the listing of the property on the LLUR triggers the requirement for a contaminated land assessment prior to development.

The CRC LLUR property statement was requested by ENGEO on 28 August 2020 for the site and is presented in Appendix 3. The provided LLUR indicates no recorded information for potentially and / or contaminating activities associated with the site.

3.5 Historical Aerial Photography Review

Aerial photographs dating from 1940 to 2016 have been reviewed. The relevant visible features are summarised in Table 3.

Table 3: Aerial Photography

Date	Source	Site Description	Surrounding Area
1940-1944	Canterbury Maps	The site is a part of a larger block of land which appears to be grassed and likely used for grazing. A fence line is present running along the current fence line in the north west. No buildings are visible on the site.	The surrounding area appears to also be undeveloped and used for grazing or cropping. Forestry is observed to the southeast of the site.
1960-1964	Canterbury Maps	The site has no significant changes from the previous photograph.	The surrounding area remains mainly unchanged from the previous photograph. Some small land disturbance (earth clearance) is observed along the north western boundary of the site however it is unknown what this is associated with.
1970-1974	Canterbury Maps		The surrounding area is mainly unchanged from the previous photograph. New structures (likely residential dwellings and sheds) are observed to the north west and east of the site
1980-1984	Canterbury Maps	No significant changes observed on the site, boundary fences corresponding with the current property boundaries are now present along the south west and south east boarders of the site	The surrounding area is mainly unchanged from the previous photograph.
1990-1994	Canterbury Maps	Multiple small structures are now present on the northern section of the site (likely corresponding with development of a garage and dwelling). Otherwise no significant changes from the previous photograph.	A horse training/race track is observed directly south west of the site in addition to new structures to the south west and east of the site. The majority of the surrounding area still appears to be undeveloped and used for agricultural purposes

Date	Source	Site Description	Surrounding Area
2000-2004	Canterbury Maps	Multiple additional structures are now visible in the northern portion of the site (likely corresponding with development of additional garages and implement sheds). A large white spot is noted on the eastern boundary, cause unknown.	Further residential development is noted on all sides of the site. The former training/race track observed in the preceding photography has been removed and another has been constructed to the west of the site. The site located directly west has been split into grids and appears to have horticultural activities taking place.
2010-2015	Canterbury Maps	A small area of earth disturbance is noted on the western portion of the site (corresponding with a small soakage/wetland area), otherwise no significant changes from earlier photography noted.	Further residential development in the surrounding area, however no significant changes observed.
2017	Canterbury Maps	No significant changes observed on site	Further minor residential development observed to the south, west and north. Significant residential development has occurred to the east of the site.

Table 4 below describes the site conditions during the site walkover on 28 August 2020. Photographs taken during the site walk over have been included in Appendix 1.

Table 4: Current Site Conditions

Site Conditions	Comments
Visible signs of contamination	A burn pile is observed to the south of the dwelling and associated sheds. The material in the burn pile is described as ashy with metal, charcoal and potential asbestos containing material. The burn pile is approximately 5 m in diameter. An offal and waste pit is observed in the southern corner of the site. The pit was approximately 3 m depth. The material observed in the pit was offal, plastics and hardfill including bricks and breeze blocks.
Surface water appearance	The surface water in the stream that feeds into the wetland area and the wetland area was clear.
Current surrounding land use	The majority of the surrounding land is mixed use residential and agricultural.
Local sensitive environments	The wetland area on site and the stream along the western boundary line of the site.
Visible signs of plant stress	No signs of plant stressed observed on the site.

Site Conditions	Comments
Additional observations	A large amount of stored vehicles, machinery and 205 L drums containing domestic house hold rubbish were observed along the southern boundary line of the site. This storage of waste is unlikely to have impacted the underlying soils as it is contained in the drums. The machinery and vehicles have recently been relocated from another site and there was no visual impacts to suggest the underlying soils have been impacted from these stored goods. A few vehicles were stored in the paddock to the south of the dwelling. The soils below the vehicles were visually clear from staining. A large barn to the south of the dwelling had deteriorated paint on the exterior cladding.

4 Potential HAIL Activities

Activities included on the Hazardous Activities and Industries List (HAIL) trigger the requirement for a contaminated land investigation prior to redevelopment. Following the site walkover and review of the desktop information, it is considered that the following HAIL activities are or have been present at the site.

Table 5: Potential HAIL Activities

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES
Waste pit/offal pit	Heavy metals Polycyclic aromatic hydrocarbons	Soils within waste pit	G5: Waste disposal to land
Stockpiled soil near offal pit	Heavy metals Polycyclic aromatic hydrocarbons	Stockpiled soil only	G5: Waste disposal to land
Burn pile to south of the dwelling	Heavy metals Polycyclic aromatic hydrocarbons Asbestos	Burn pile and surrounding soils	G5: Waste disposal to land

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES
Lead based paint – shed to south of the dwelling	Lead	Soils around the shed	I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be risk to human health or the environment

Note: Due to the age of the site buildings (constructed in the late 1990's), there is potential for asbestos products to have been used in their construction. Based on experience, asbestos is often present beneath the subfloor of a building or in the upper soil horizon around the halo of a building as a result of cutting of asbestos-containing building material (e.g. for service installation) and weathering of exterior building material. No damaged potential asbestos containing materials were observed around the house during the walkover.

5 Intrusive Investigation

An intrusive investigation was developed to investigate the surface soils around the burn pile, the surface soils within the offal pit and the surface soils near the large shed to the south of the dwelling.

The soils were sampled to assess the suitability of the land (from a contamination / human health perspective) for residential use, and to assess the human health risks posed to site works under the commercial / outdoor worker scenario. The results can also be used to indicate whether there is a likely impact to the surrounding environment.

5.1 Methodology

The following was undertaken during the soil sampling works:

- Collection of three soil samples from the offal/waste pit area in the surface soils (S1-S3). These samples were analysed for heavy metals and polycyclic hydrocarbons (PAHs);
- Collection of three soil samples from the stockpiled topsoil near the waste pit (S4-S6). These samples were analysed for heavy metals and polycyclic hydrocarbons (PAHs);
- Collection of five soil samples (S7-S11) from around the burn pile to the south of the dwelling with analysis for heavy metals and PAHs (PAHs from middle sample only);
- Collection of one PACM cement board from the southern extent of the burn pile;
- Collection of five asbestos soil samples from around the cement board sample with analysis for asbestos semi-quantitative analysis. Additional samples are on hold at the laboratory and may be analysed for delineation purposes;
- Collection of one soil sample from adjacent to the large barn to the south of the dwelling with analysis for lead (S12);
- Each sample was inspected for visual and olfactory indicators of contamination;
- All soil samples collected were placed in jars, which were then sealed, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to RJ Hill Laboratories (Hills) and Terra Scientific (Terra) under the standard ENGEO chain of custody documentation provided in Appendix 4;
- To reduce the potential for cross contamination, each sample was collected using disposable nitrile gloves that were discarded following the collection of each sample;
- After collection of each sample, the sampling equipment was decontaminated by scrubbing with a solution of Decon90 and rinsing with tap water followed by deionised water;
- The intrusive sampling was completed in accordance with ENGEO standard operating procedures;
- All fieldwork and sampling was undertaken in general accordance with the procedures for the appropriate handling of potentially contaminated soils as described in the MfE Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils; and
- On receipt of the analytical results, an assessment of the soil concentrations for contaminants of concern with applicable standards and soil acceptance criteria for the protection of human health and the environment was undertaken.

Quality Assurance and Quality Control

The quality assurance / quality control (QA / QC) procedures employed during the works included:

- Standard sample registers and chain of custody records have been kept for all samples;

- The use of Hill Laboratories, ISO/IEC 17025 and IANZ accredited laboratory, to conduct all laboratory analysis. To maintain their International Accreditation, Hill Laboratories undertakes rigorous cross checking and routine duplicate sampling testing to ensure the accuracy of their results;
- Prior to sampling the equipment (hand auger) was decontaminated using a triple wash procedure with potable water, Decon 90 solution and deionised water; and
- During the site investigation every attempt was made to ensure that cross contamination did not occur through the use of the procedures outlined within this document.

6 Regulatory Framework and Assessment Criteria

The regulatory frameworks and rules relating to the management and control of contaminated sites in the Canterbury Region are specified in two documents: the NES and the ECan Regional Plan. A summary of each and its implications for the site is provided in Sections 6.1-6.2.

6.1 NES

The NES came into effect on 1 January 2012 (MfE, 2011f).

The NES introduced soil contaminant standards (SCSs) for 12 priority contaminants for the protection of human health under a variety of land use scenarios.

The NES requires the *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values* be used where a NES SCS is not available. The NES does not consider environmental receptors; accordingly, the application of guidelines relevant to environmental receptors shall be implemented according to the MfE CLMG No. 2 and any relevant rules in the Regional Plan.

In addition, local background levels in soil have been referenced to establish consenting implications under the NES and disposal requirements. Background levels for metals in soils in the area were obtained from ECan's online GIS – Trace Level 2 concentrations.

6.2 Disposal Criteria

An assessment of potential off-site disposal options for excess soil generated during site development works has been conducted. Dependent on the condition of the spoil, off-site disposal options range from disposal to "cleanfill" sites to managed fill sites. As outlined in the publication Waste Management Institute of New Zealand Technical Guidelines for Disposal to Land (August 2018) definition of cleanfill which states:

"Virgin excavated natural materials (VENM) such as clay, soil and rock that are free of:

- Combustible, putrescible, degradable or leachable components;
- Hazardous substances or material (such as municipal solid waste) likely to create leachate by means of biological breakdown;
- Products or materials derived from hazardous waste treatment, stabilisation or disposal practices;

- Materials such as medical and veterinary waste, asbestos or radioactive substances that may present a risk to human health if excavated;
- Contaminated soil and other contaminated materials; and
- Liquid waste."

6.3 Assessment Criteria

Contaminant concentrations in soil were compared to human health criteria based on the following land use:

- Residential land use (10% produce); and
- Commercial / industrial land use (based on an outdoor worker scenario) (for redevelopment workers).

The land use scenarios are relevant to the likely future use of the site and are being used as a surrogate to assess short term risks to redevelopment earth workers on-site during the development activities.

The NES methodology document notes that the exposure parameters assumed for the maintenance / excavation scenario in other New Zealand guidelines are unrealistic (perhaps by a factor of 10 or more). The technical committee preparing the NES decided that a maintenance / excavation worker scenario should not be included in the NES as sites would not be cleaned up to this standard; it was considered more appropriate that exposures to these workers be limited through the use of site-specific controls that are required under health and safety legislation. However, this report uses commercial / industrial outdoor worker criteria to get a general sense of potential risks to excavation workers during the redevelopment. Note that commercial / industrial outdoor worker criteria are based on personnel carrying out maintenance activities involving soil exposure to surface soil during landscaping activities, and occasional shallow excavation for routine underground service maintenance. Exposure to soil is less intensive than would occur during construction works but occurs over a longer period. For a construction worker developing the site, the soil exposure is limited when compared to a large earthworks project (e.g. for a residential subdivision or industrial development). As such, the commercial / industrial outdoor worker criteria are considered suitable for obtaining a high-level understanding of potential risks to excavation workers during site redevelopment and confirming the need for site controls.

The soil analysis results have also been compared to Regional Background concentrations for heavy metals and PAHs. These provide information into the possible disposal options at a cleanfill facility.

6.4 Asbestos Criteria

The field work and reporting for this site have been done in accordance with the New Zealand Guidelines for Assessing and Managing Asbestos in Soil released on 6 November 2017. The BRANZ Asbestos (2017) Guidelines have been developed based on the WA DOH Guidelines but with the New Zealand regulatory environment in mind.

The BRANZ guideline criteria have been adopted as investigation criteria for this assessment and are presented in Table 6 below.

Table 6: Adopted Asbestos Investigation Criteria

Form of asbestos		Soil guideline values for asbestos (w/w)			
		Residential[1]	High-density residential[2]	Recreational[3]	Commercial and Industrial[4]
ACM (bonded)		0.01%	0.04%	0.02%	0.05%
FA and/or AF[5]		0.001%			
All forms of asbestos – surface		No visible asbestos on surface soil[6]			
Capping requirements for residual contamination above selected soil guideline value					
Depth[7]	Hard cap	No depth limitation, no controls – except for long-term management			
	Soft cap	≥ 0.5 m			≥ 0.2 m

Table 8 Notes:

ACM: Asbestos-containing material i.e. asbestos bound in a matrix; material that cannot pass through a 7 mm x 7 mm sieve.

FA: Fibrous asbestos. Encompasses friable asbestos material, such as severely weathered ACM, and asbestos in the form of loose fibrous material such as insulation products. Friable asbestos is defined here as asbestos material that is in a degraded condition, such that it can be broken or crumbled by hand pressure.

AF: Asbestos fines. It includes free fibres of asbestos, small fibre bundles and also ACM fragments that pass through a 7 mm x 7 mm sieve.

Residential: Single dwelling site with garden and / or accessible soil. Also includes daycare centres, preschools, primary and secondary schools and rural residential.

High-density residential: Urban residential site with limited exposed soil / soil contact, including small gardens. Applicable to urban townhouses, flats and ground-floor apartments with small ornamental gardens but not high-rise apartments (with very low opportunity for soil contact).

Recreational: Public and private green areas and sports and recreation reserves. Includes playing fields, suburban reserves where children play frequently and school playing fields.

Commercial and industrial: Includes accessible soils within retail, office, factory and industrial sites. Many commercial and industrial properties are well paved with concrete pavement and buildings that will adequately cover / cap any contaminated soils.

FA and / or AF: Where free fibre is present at concentrations at or below 0.001% w/w, a proportion of these samples should be analysed using the laboratory analysis method described in section 5.4.4 of the BRANZ Guideline (≥10% of samples). This is due to limitations in the AS 4964-2004 and WA Guidelines 500 ml sample method for free fibre (see section 5.4 of the BRANZ guideline for more information).

Surface: Effective options include raking / tilling the top 100 mm of asbestos-contaminated soil (or to clean soil / fill if shallower to avoid contaminating clean material at depth) and hand picking to remove visible asbestos and ACM fragments or covering with a soft cap of virgin natural material (VNM) 100 mm thick delineated by a permeable geotextile marker layer or hard cap. Near-surface fragments of ACM can become exposed in soft soils such as sandy pumiceous soils after periods of rain.

Depth: Capping is used where contamination levels exceed soil guideline values. Considerations of depth need to incorporate the type and likelihood of future disturbance activities at the site and site capping requirements (see section 6.1 of the BRANZ guideline). Ideally, any capping layer should be delineated by a permeable geotextile marker layer between the cap and underlying asbestos / contaminated material. Institutional controls must be used to manage long-term risks, particularly where the cap may be disturbed (see section 7 of the BRANZ guideline). Two forms of capping are typically used:

a. Hard cap comprises surfaces that are difficult to penetrate and isolate the asbestos contamination, such as tar seal or concrete driveway cover. This would typically not include pavers or decking due to maintenance and coverage factors.
b. Soft cap consists of a layer(s) of material which either comprise virgin natural material or soils that meet the asbestos residential soil guideline value from an on-site source. Use of on-site soils may require resource consent.

7 Results

7.1 Soil Encountered

Please refer to Table 7 for a summary of subsurface soils encountered.

The burn pile material is described as ash with charcoal, metal, timber, plastic and PACM.

Table 7: Summary of Subsurface Soils

Depth	Soil Description
0.0-0.3	Fine to medium SAND with trace gravel and rootlets; brown.
0.3-0.5	Sand fine to coarse GRAVEL with minor cobbles.

7.2 Analytical Results

The analytical results from the ENGEO investigation can be summarised as follows:

- All samples collected from the waste pit have returned concentrations below the NES residential land use criteria. Sample S3 has reported concentrations of lead and cadmium slightly above the site specific regional background levels;
- All samples collected from the stockpiled soil have returned concentrations below the NES residential land use criteria and site specific regional background levels;
- Sample S7, S8, S9 and S10 have reported concentrations of heavy metals above the NES residential land use criteria. All samples from the burn pile are also reported above the site specific regional background levels. PAHs were reported as elevated in S7 but are below the NES residential standards and background levels;
- The cement board sample collected from the burn pile was reported positive for chrysotile, amosite and crocidolite asbestos;
- Asbestos soil sample 1 from the burn pile reported asbestos fines and fibres above the BRANZ guidelines. Asbestos soil sample 5 reported cement board in the soil sample above the BRANZ guidelines. Asbestos soil sample 7 reported asbestos fines and fibres below the BRANZ guidelines; and

Please refer to Appendix 4 for the full laboratory certificate and results. Only detectable concentrations of analytes are shown in Table 8 and 9 below.

Table 8: Asbestos Semi-quantitative Analysis Results

Sample Name	Sample Depth	Asbestos Type	ACM weight	AF and FA as % w/w of total sample
Sample 1	0.0	Chrysotile, Amosite and Crocidolite	-	**0.07805**
ASS04	0.0	No asbestos detected	-	-
ASS05	0.0	Chrysotile, Amosite and Crocidolite	**0.01884**	-
ASS06	0.0	No asbestos detected	-	-
ASS07	0.0	Chrysotile	-	0.00083

Table 9: Sample Analysis Results

Sample Name	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	Human health criteria – Residential Land Use	Human health criteria - Commercial / industrial outdoor worker (unpaved)[a]	Regional background - Trace Elements (Level 2)[b]
Soil Type	SILT	SILT	SILT	SILT	SILT	SILT	SILT	SILT	SILT	SILT	SILT	SILT			
Sample Depth, m	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1			
Heavy Metals in soil, mg/kg															
Arsenic	4	4	5	3	3	4	**790**	**149**	**77**	**37**	14	-	20	70	6.35
Cadmium[c]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	22	7.6	19.6	2.5	0.47	-	3	1,300	0.14
Chromium[d]	14	13	18	12	10	14	260	118	50	22	17	-	460	6,300	19.89
Copper	8	5	11	5	4	4	990	350	191	66	34	-	>10,000	>10,000	11.68
Lead	16.2	15	22	14.2	10.4	14.6	**340**	**550**	107	**1780**	47	**1620**	210	3,300	19.75
Nickel	12	10	14	8	8	10	36	18	13	89	8	-	400[c]	6,000[c]	13.91
Zinc	60	46	78	47	34	49	3,000	1,610	420	430	108	-	7,400[c]	400,000[c]	69.58
Polycyclic aromatic hydrocarbons in soil, mg/kg															
BaP eq.	0.03	0.03	0.03	0.03	0.03	0.03	0.36	-	-	-	-	-	10	35	0.922

[a] Human health criteria from the NES except where noted.
Bold text indicates that the concentration exceeds the Residential land use criterion.
Italics indicates that the concentration exceeds the Commercial/industrial land user criterion.
[b] ECan (2007) Background Concentrations of Selected Trace Elements in Canterbury Soils. Exceedances are underlined.
[c] Assumes soil pH of 5.
[d] Criteria for Chromium VI were conservatively selected.

8 Conceptual Site Model

A conceptual site model consists of four primary components. For contaminants to present a risk to human health or an environmental receptor, all four components are required to be present and connected. The four components of a conceptual site model are:

- Source of contamination;
- Pathway(s) in which contamination could potentially mobilise along (e.g. vapour or groundwater migration);
- Sensitive receptor(s) which may be exposed to the contaminants; and
- An exposure route, where the sensitive receptor and contaminants come into contact (e.g. ingestion, inhalation, dermal contact).

The potential source, pathway, receptor linkages at this subject site are provided in Table 10.

Table 10: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Waste pile/offal pit	Heavy metals PAHs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers. Future site users.	**Yes.** All samples collected are below the NES residential land use criteria.
Stockpiled soils near waste pit	Heavy metals PAHs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers. Future site users.	**Yes.** All samples collected are below the NES residential land use criteria.

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Burn pile	Heavy metals PAHs Asbestos	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers. Future site users.	**No.** Asbestos was detected above BRANZ guidelines and arsenic and lead are reported above the NES residential land use criteria.
Lead based paint on southern shed	Lead	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers. Future site users.	**No.** A sample collected from the soils around the shed are reported above the NES residential land use criteria.

9 Conclusions

ENGEO Ltd were engaged by Hughes Developments Limited to undertake an environmental assessment of a site situated at 597 East Maddisons Road in Rolleston for change in land use, subdivision and soil disturbance consent. Information was gathered and reviewed regarding the potential releases of hazardous substances to the subject property.

A review of information identified that the site had been used for grazing since circa 1940 and residential land use since 1994.

The site is not listed on the Canterbury Regional Council's Listed Land Use Register as being associated with a HAIL related activity. The property file was obtained from Selwyn District Council and Certificate of Titles obtained by Land Information New Zealand and these files contained no information related to potentially hazardous activities having occurred at the site.

During the site walkover, three areas of concern were observed on the site.

- An offal and waste pit was observed in the southern boundary of the site. Three soil samples were collected from the base of the pit and all samples returned concentrations below the NES residential and use criteria. One sample, S3, reported slightly elevated concentrations of zinc and lead which are considered likely due to natural variances in the site soils. An area of stockpiled soils were observed near the offal pit. No visual contamination was observed in the stockpiled soils. Three soil samples were collected from the stockpiled soils and all samples reported concentrations of heavy metals below the NES residential land use criteria and site specific background levels for heavy metals.

- A burn pile was identified towards the south of the dwelling. Four samples collected from the middle of the burn pile and surrounding area reported concentrations of heavy metals above the NES residential land use criteria. Asbestos cement board was also identified in the burn pile and reported positive for chrysotile, amosite and crocidolite. One soil sample (ASS01) collected for asbestos semi-quantitative analysis reported concentrations of fines and fibres above the BRANZ guidelines. Sample (ASS07) collected from the middle of the burn pile reported asbestos fines and fibres below the BRANZ guidelines.
- A large shed was identified to the south of the dwelling which had presumed lead paint in a deteriorated condition. One soil sample was collected in the surface soils from around the shed with concentrations of lead above the NES residential land use criteria.

The burn pile area and soils around the large shed to the south of the dwelling are required to be remediated prior to development of the site.

The remainder of the site is considered highly likely to be suitable for its intended residential end use.

As the redevelopment of the whole site involves a change of land use, subdivision and soil disturbance, it is possible that the identified impacted area can be removed as a permitted activity under Regulation 8(3) of Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulation 2011 due to the small volume in relation to the soil disturbance across the site.

Remediation works should be detailed in a Remedial Action Plan (RAP) which will also include the procedures for the handling, management and disposal of contaminated soils. Following remediation, a validation report will be required to indicate the site is suitable for its intended end use.

The soils from the burn pile are suitable for disposal at Kate Valley Landfill as asbestos contaminated waste. The soils from around the shed should be checked with Kate Valley to assess whether they will accept them. Additional TCLP analysis may be required to be undertaken.

If the buildings on site are to be refurbished or demolished, the presence of asbestos in these buildings should be identified by undertaking full asbestos surveys. If identified on the outside of the buildings in a deteriorated state, the soils surrounding the buildings should be tested.

10 References

ECan (2007a). Background Concentrations of Selected Trace Elements in Canterbury Soils. Addendum 1: Additional Samples and Timaru Specific Background Levels. Report prepared for Environment Canterbury by Tonkin & Taylor Limited, Christchurch, New Zealand. Report Number R07/1/2. Tonkin & Taylor Reference: 50875.003.

MfE (2011a). *Ministry for the Environment Hazardous Activities and Industries List.*

MfE (2011b). *Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites*.

MfE (2011c). *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values.*

MfE (2011d). *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils*.

MfE (2011f). *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.*

MfE (2012). *Users' guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.*

11 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Development Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by



Natalie Flatman

Environmental Scientist



Sean Freeman

Environmental Scientist

Report reviewed by



Dave Robotham, CEnvP SC

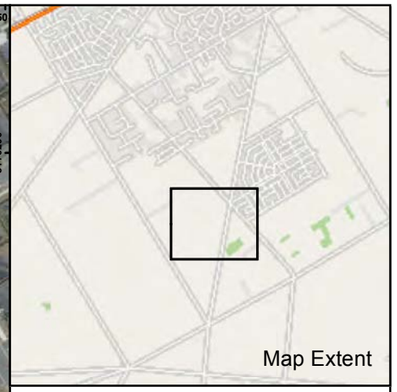
Principal Environmental Consultant

FIGURES

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DATE PLOTTED: 01 September 2020 4:59:49 pm BY: NFaitman





Legend

Site boundary

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

0 50 100
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

ENGEO

Christchurch Office
124 Montreal Street Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title:

Site Location Plan

Client: Hughes Developments		Figure No: 1
Project: 597 East Maddisons Road Rolleston	Designed: NF Drawn: NF Checked: DRAFT Date: Sep 20	Size: A3
Proj No: 12903.000.005	Scale: 1:3,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

PATH: Z:\Projects\12901 to 13000\12903 - Farrington South Subdivision\59_597 East Maddisons Road\05_GIS\Fig01.mxd

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DATE PLOTTED: 03 September 2020 2:08:16 pm BY: NFlatman

1549800





Legend

- Sample locations
- Approximate extent of waste pit
- Site boundary

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

ENGEO

Christchurch Office
124 Montreal Street Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title:

Waste pit locations

Client: Hughes Developments		Figure No: 2
Project: 597 East Maddisons Road Rolleston	Designed: NF Drawn: NF Checked: DRAFT Date: Sep 20	Size: A3
Proj No: 12903.000.005	Scale: 1:250	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

PATH: Z:\Projects\12901 to 13000\12903 - Farrington South Subdivision\59_597 East Maddisons Road\05_GIS\Fig01.mxd

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DATE PLOTTED: 03 September 2020 2:14:57 pm BY: NFlatman





Legend

- Sample locations
- Approximate extent of waste pit
- Site boundary

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

ENGEO

Christchurch Office
124 Montreal Street Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title:
Burn pile sample locations

Client: Hughes Developments		Figure No: 3
Project: 597 East Maddisons Road Rolleston	Designed: NF Drawn: NF Checked: DRAFT Date: Sep 20	Size: A3
Proj No: 12903.000.005	Scale: 1:80	Revision: A

PATH: Z:\Projects\12901 to 13000\12903 - Farrington South Subdivision\59_597 East Maddisons Road\05_GIS\Fig01.mxd

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 1:

Site Photography



Photo 1: Offal/waste pit in southern corner of the site



Photo 2: Mounded topsoil near offal pit in southern corner of the site



Photo 3: Stored machinery and vehicles along southern boundary



Photo 4: 205 L drums containing domestic rubbish



Photo 5: Southern paddocks



Photo 6: Northern paddocks

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments**		
Taken by	NF	**Project**	**597 East Maddisons Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	1 to 6	**ENGEO Ref.**	12903	**Appendix No.**	1a



Photo 7: Dwelling



Photo 8: Garages to south of dwelling



Photo 9: Barn to south of dwelling



Photo 10: Disused pool near dwelling



Photo 11: Burn pile in paddock south of dwelling



Photo 12: Asbestos cement board in burn pile material

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments**		
Taken by	NF	**Project**	**597 East Maddisons Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	7 to 12	**ENGEO Ref.**	12903	**Appendix No.**	1b



Photo 13: Stream towards western boundary line



Photo 14: Wetland area



Photo 15: Stream feeding into wetland area



Photo 16: Material stored in large barn in paddock south of dwelling



Photo 17: Stored vehicle in paddock south of dwelling



Photo 18: Sleepout near dwelling

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments**		
Taken by	NF	**Project**	**597 East Maddisons Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	13 to 18	**ENGEO Ref.**	12903	**Appendix No.**	1c

APPENDIX 2:

Certificate of Title

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Historical Search Copy

R.W. Muir
Registrar-General
of Land

Constituted as a Record of Title pursuant to Sections 7 and 12 of the Land Transfer Act 2017 - 12 November 2018

Identifier **CB33K/65**
Land Registration District **Canterbury**
Date Issued 18 October 1990

Prior References
CB33F/774

Estate	Fee Simple
Area	20.3750 hectares more or less
Legal Description	Lot 1 Deposited Plan 57004

Original Registered Owners
Malcolm Richard Main and Philippa Ruth Main

Interests

Subject to Part IV A Conservation Act 1987

A21096.5 Mortgage to Trust Bank Canterbury Limited - 28.10.1992 at 2.32 pm and varied 30.10.1996 at 9.36 am

5798897.2 Transfer to Malcolm Richard Main, Philippa Ruth Main and Graeme Charles Main - 13.11.2003 at 9:00 am

5798897.3 Variation of Mortgage A21096.5 - 13.11.2003 at 9:00 am

7095691.1 Application pursuant to Section 99A Land Transfer Act 1952 vesting Mortgage A21096.5 in Westpac New Zealand Limited - 2.11.2006 at 9:00 am

8556170.1 Transfer to Malcolm Richard Main and Philippa Ruth Main - 29.7.2010 at 3:14 pm

8577235.1 Variation of Mortgage A21096.5 - 25.8.2010 at 5:05 pm

Identifier **CB33K/65**

References
Prior C/T 33F/774

Transfer No.
N/C. Order No. 903207/2

Land and Deeds 69

REGISTER

No. 33K/65

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 18th day of October one thousand nine hundred and ninety under the seal of the District Land Registrar of the Land Registration District of CANTERBURY

WITNESSETH that KELVIN ROYCE TAYLOR, Farmer and GILLIAN DOROTHY TAYLOR, Married Woman, both of Springston, Christchurch as tenants in common in equal shares are ---

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 20.3750 hectares or thereabouts being Lot 1 Deposited Plan 57004 ---

ASSISTANT LAND REGISTRAR

Subject to:

Part IVA Conservation Act 1987

A.L.R.

Transfer A21096/4 to Malcolm Richard Main of Christchurch, Scientist and Philippa Ruth Main his wife - 28.10.1992 at 2.32pm

for A.L.R.

Mortgage A21096/5 to Trust Bank Canterbury Limited - 28.10.1992 at 2.32pm

for A.L.R.

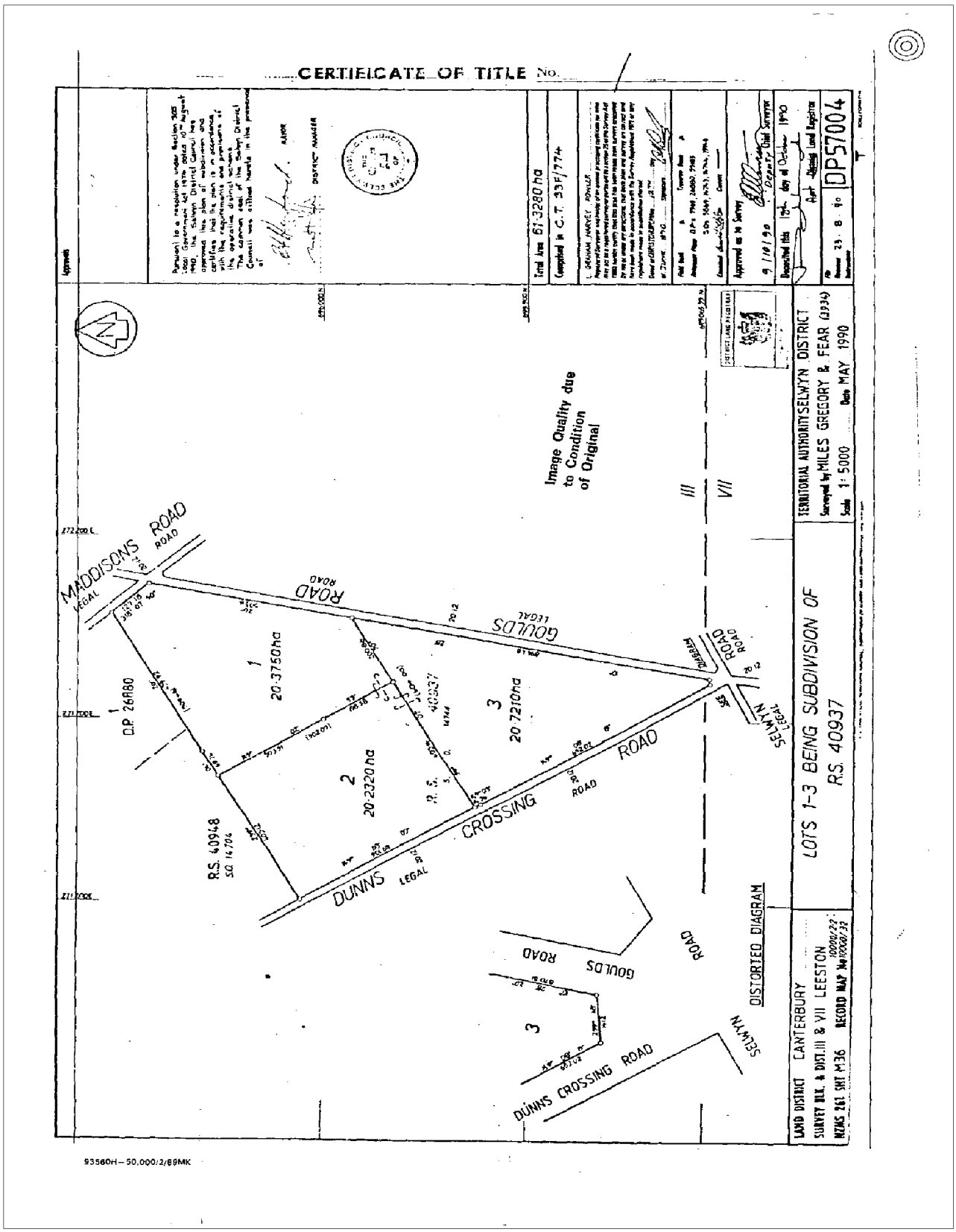
Variation of Mortgage A21096/5 - 30.10.1996 at 9.36am

for A.L.R.

No. 33K/65

Measurements are Metric

Identifier **CB33K/65**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB33K/65**
Land Registration District	**Canterbury**
Date Issued	18 October 1990

Prior References
CB33F/774

Estate	Fee Simple
Area	20.3750 hectares more or less
Legal Description	Lot 1 Deposited Plan 57004

Registered Owners
Malcolm Richard Main and Philippa Ruth Main

Interests

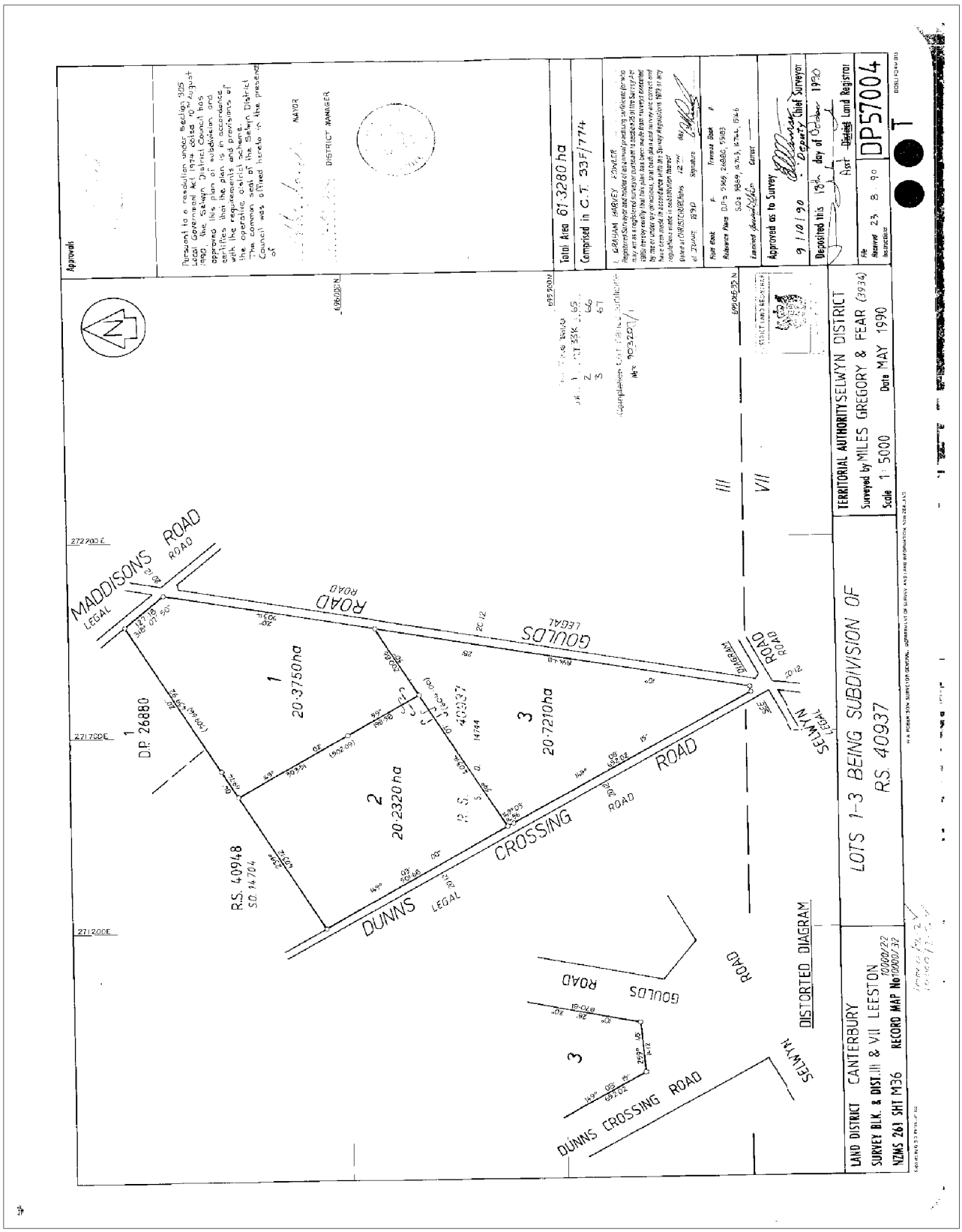
Subject to Part IV A Conservation Act 1987

A21096.5 Mortgage to (now) Westpac New Zealand Limited - 28.10.1992 at 2.32 pm and varied 30.10.1996 at 9.36 am

5798897.3 Variation of Mortgage A21096.5 - 13.11.2003 at 9:00 am

8577235.1 Variation of Mortgage A21096.5 - 25.8.2010 at 5:05 pm

Identifier **CB33K/65**



APPENDIX 3:

LLUR Statement

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

Dear Sir/Madam

Thank you for submitting your property enquiry in regards to our Listed Land Use Register (LLUR) which holds information about sites that have been used, or are currently used for activities which have the potential to have caused contamination.

The LLUR statement provided indicates the location of the land parcel(s) you enquired about and provides information regarding any LLUR sites within a radius specified in the statement of this land.

Please note that if a property is not currently entered on the LLUR, it does not mean that an activity with the potential to cause contamination has never occurred, or is not currently occurring there. The LLUR is not complete, and new sites are regularly being added as we receive information and conduct our own investigations into current and historic land uses.

The LLUR only contains information held by Environment Canterbury in relation to contaminated or potentially contaminated land; other information relevant to potential contamination may be held in other files (for example consent and enforcement files).

If your enquiry relates to a farm property, please note that many current and past activities undertaken on farms may not be listed on the LLUR. Activities such as the storage, formulation and disposal of pesticides, offal pits, foot rot troughs, animal dips and underground or above ground fuel tanks have the potential to cause contamination.

Please contact and Environment Canterbury Contaminated Sites Officer if you wish to discuss the contents of the LLUR statement, or if you require additional information.
For any other information regarding this land please contact Environment Canterbury Customer Services.

Yours sincerely

Contaminated Sites Team

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

www.ecan.govt.nz

Date:	28 August 2020	
Land Parcels:	Lot 1 DP 57004	Valuation No(s): 2405534400



The information presented in this map is specific to the property you have selected. Information on nearby properties may not be shown on this map, even if the property is visible.

Summary of sites:

There are no sites associated with the area of enquiry.

Information held about the sites on the Listed Land Use Register

There are no sites associated with the area of enquiry.

Information held about other investigations on the Listed Land Use Register

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ262291.

Disclaimer:

The enclosed information is derived from Environment Canterbury's Listed Land Use Register and is made available to you under the Local Government Official Information and Meetings Act 1987 and Environment Canterbury's Contaminated Land Information Management Strategy (ECan 2009).

The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness of this information. It is released only as a copy of Environment Canterbury's records and is not intended to provide a full, complete or totally accurate assessment of the site. It is provided on the basis that Environment Canterbury makes no warranty or representation regarding the reliability, accuracy or completeness of the information provided or the level of contamination (if any) at the relevant site or that the site is suitable or otherwise for any particular purpose. Environment Canterbury accepts no responsibility for any loss, cost, damage or expense any person may incur as a result of the use, reference to or reliance on the information contained in this report.

Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know



Everything is connected

What is the Listed Land Use Register (LLUR)?

The LLUR is a database that Environment Canterbury uses to manage information about land that is, or has been, associated with the use, storage or disposal of hazardous substances.

Why do we need the LLUR?

Some activities and industries are hazardous and can potentially contaminate land or water. We need the LLUR to help us manage information about land which could pose a risk to your health and the environment because of its current or former land use.

Section 30 of the Resource Management Act (RMA, 1991) requires Environment Canterbury to investigate, identify and monitor contaminated land. To do this we follow national guidelines and use the LLUR to help us manage the information.

The information we collect also helps your local district or city council to fulfil its functions under the RMA. One of these is implementing the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil, which came into effect on 1 January 2012.

For information on the NES, contact your city or district council.

How does Environment Canterbury identify sites to be included on the LLUR?

We identify sites to be included on the LLUR based on a list of land uses produced by the Ministry for the Environment (MfE). This is called the Hazardous Activities and Industries List (HAIL)[1]. The HAIL has 53 different activities, and includes land uses such as fuel storage sites, orchards, timber treatment yards, landfills, sheep dips and any other activities where hazardous substances could cause land and water contamination.

We have two main ways of identifying HAIL sites:

- We are actively identifying sites in each district using historic records and aerial photographs. This project started in 2008 and is ongoing.
- We also receive information from other sources, such as environmental site investigation reports submitted to us as a requirement of the Regional Plan, and in resource consent applications.

[1] The Hazardous Activities and Industries List (HAIL) can be downloaded from MfE's website www.mfe.govt.nz, keyword search HAIL

How does Environment Canterbury classify sites on the LLUR?

Where we have identified a HAIL land use, we review all the available information, which may include investigation reports if we have them. We then assign the site a category on the LLUR. The category is intended to best describe what we know about the land use and potential contamination at the site and is signed off by a senior staff member.

Please refer to the Site Categories and Definitions factsheet for further information.

What does Environment Canterbury do with the information on the LLUR?

The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list of any investigation reports.

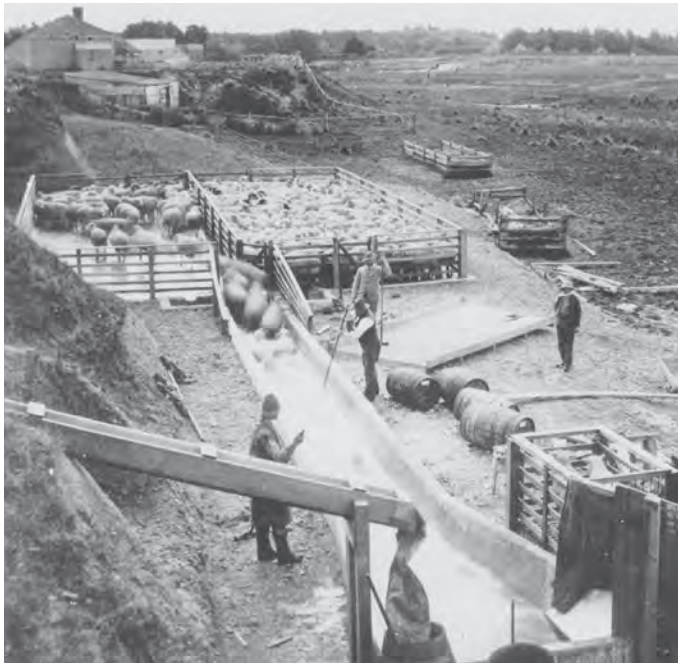
We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

If you are conducting an environmental investigation or removing an underground storage tank at your property, you will need to comply with the rules in the Regional Plan and send us a copy of the report. This means we can keep our records accurate and up-to-date, and we can assign your property an appropriate category on the LLUR. To find out more, visit www.ecan.govt.nz/HAIL.



IMPORTANT!

The LLUR is an online database which we are continually updating. A property may not currently be registered on the LLUR, but this does not necessarily mean that it hasn't had a HAIL use in the past.



Sheep dipping (ABOVE) and gas works (TOP) are among the former land uses that have been identified as potentially hazardous. (Photo above by Wheeler & Son in 1987, courtesy of Canterbury Museum.)

My land is on the LLUR – what should I do now?

IMPORTANT! Just because your property has a land use that is deemed hazardous or is on the LLUR, it doesn't necessarily mean it's contaminated. The only way to know if land is contaminated is by carrying out a detailed site investigation, which involves collecting and testing soil samples.

You do not need to do anything if your land is on the LLUR and you have no plans to alter it in any way. It is important that you let a tenant or buyer know your land is on the Listed Land Use Register if you intend to rent or sell your property. If you are not sure what you need to tell the other party, you should seek legal advice.

You may choose to have your property further investigated for your own peace of mind, or because you want to do one of the activities covered by the National Environmental Standard for Assessing and Managing Contaminants in Soil. Your district or city council will provide further information.



If you wish to engage a suitably qualified experienced practitioner to undertake a detailed site investigation, there are criteria for choosing a practitioner on www.ecan.govt.nz/HAIL.

I think my site category is incorrect – how can I change it?

If you have an environmental investigation undertaken at your site, you must send us the report and we will review the LLUR category based on the information you provide. Similarly, if you have information that clearly shows your site has not been associated with HAIL activities (eg. a preliminary site investigation), or if other HAIL activities have occurred which we have not listed, we need to know about it so that our records are accurate.

If we have incorrectly identified that a HAIL activity has occurred at a site, it will be not be removed from the LLUR but categorised as Verified Non-HAIL. This helps us to ensure that the same site is not re-identified in the future.

Contact us

Property owners have the right to look at all the information Environment Canterbury holds about their properties.

It is free to check the information on the LLUR, online at www.llur.ecan.govt.nz.

If you don't have access to the internet, you can enquire about a specific site by phoning us on (03) 353 9007 or toll free on 0800 EC INFO (32 4636) during business hours.

Contact Environment Canterbury:

Email: ecinfo@ecan.govt.nz

Phone:
Calling from Christchurch: (03) 353 9007
Calling from any other area: 0800 EC INFO (32 4636)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

Listed Land Use Register

Site categories and definitions

When Environment Canterbury identifies a Hazardous Activities and Industries List (HAIL) land use, we review the available information and assign the site a category on the Listed Land Use Register. The category is intended to best describe what we know about the land use.

If a site is categorised as **Unverified** it means it has been reported or identified as one that appears on the HAIL, but the land use has not been confirmed with the property owner.

If the land use has been confirmed but analytical information from the collection of samples is not available, and the presence or absence of contamination has therefore not been determined, the site is registered as:

Not investigated:

- A site whose past or present use has been reported and verified as one that appears on the HAIL.
- The site has not been investigated, which might typically include sampling and analysis of site soil, water and/or ambient air, and assessment of the associated analytical data.
- There is insufficient information to characterise any risks to human health or the environment from those activities undertaken on the site. Contamination may have occurred, but should not be assumed to have occurred.

If analytical information from the collection of samples is available, the site can be registered in one of six ways:

At or below background concentrations:

The site has been investigated or remediated. The investigation or post remediation validation results confirm there are no hazardous substances above local background concentrations other than those that occur naturally in the area. The investigation or validation sampling has been sufficiently detailed to characterise the site.

Below guideline values for:

The site has been investigated. Results show that there are hazardous substances present at the site but indicate that any adverse effects or risks to people and/or the environment are considered to be so low as to be acceptable. The site may have been remediated to reduce contamination to this level, and samples taken after remediation confirm this.

Environment Canterbury Regional Council
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Managed for:

The site has been investigated. Results show that there are hazardous substances present at the site in concentrations that have the potential to cause adverse effects or risks to people and/or the environment. However, those risks are considered managed because:

- the nature of the use of the site prevents human and/or ecological exposure to the risks; and/or
- the land has been altered in some way and/or restrictions have been placed on the way it is used which prevent human and/or ecological exposure to the risks.

Partially investigated:

The site has been partially investigated. Results:

- demonstrate there are hazardous substances present at the site; however, there is insufficient information to quantify any adverse effects or risks to people or the environment; or
- do not adequately verify the presence or absence of contamination associated with all HAIL activities that are and/or have been undertaken on the site.

Significant adverse environmental effects:

The site has been investigated. Results show that sediment, groundwater or surface water contains hazardous substances that:

- have significant adverse effects on the environment; or
- are reasonably likely to have significant adverse effects on the environment.

Contaminated:

The site has been investigated. Results show that the land has a hazardous substance in or on it that:

- has significant adverse effects on human health and/or the environment; and/or
- is reasonably likely to have significant adverse effects on human health and/or the environment.

If a site has been included incorrectly on the Listed Land Use Register as having a HAIL, it will not be removed but will be registered as:

Verified non-HAIL:

Information shows that this site has never been associated with any of the specific activities or industries on the HAIL.

Please contact Environment Canterbury for further information:

(03) 353 9007 or toll free
on 0800 EC INFO (32 4636)
email ecinfo@ecan.govt.nz

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

E13/102

APPENDIX 4:

Laboratory reports

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2428499 SPv2
Contact:	Natalie Flatman	**Date Received:**	01-Sep-2020
	C/- Engeo Limited	**Date Reported:**	03-Sep-2020
	PO Box 373	**Quote No:**	82742
	Christchurch 8140	**Order No:**	
		Client Reference:	12903.000.005
		Submitted By:	Natalie Flatman

Sample Type: Soil

Sample Name:		597_S1 28-Aug-2020	597_S2 28-Aug-2020	597_S3 28-Aug-2020	597_S4 28-Aug-2020	597_S5 28-Aug-2020
Lab Number:		2428499.1	2428499.2	2428499.3	2428499.4	2428499.5
Individual Tests						
Dry Matter	g/100g as rcvd	84	97	86	84	90
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	4	5	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	14	13	18	12	10
Total Recoverable Copper	mg/kg dry wt	8	5	11	5	4
Total Recoverable Lead	mg/kg dry wt	16.2	15.0	22	14.2	10.4
Total Recoverable Nickel	mg/kg dry wt	12	10	14	8	8
Total Recoverable Zinc	mg/kg dry wt	60	46	78	47	34
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Acenaphthene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Benzo[a]anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	< 0.011	0.014	< 0.012	< 0.011
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Benzo[e]pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Chrysene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Fluoranthene	mg/kg dry wt	< 0.012	< 0.011	0.019	< 0.012	< 0.011
Fluorene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Phenanthrene	mg/kg dry wt	< 0.012	< 0.011	0.014	< 0.012	< 0.011
Pyrene	mg/kg dry wt	< 0.012	< 0.011	0.021	< 0.012	< 0.011

ilac-MRA IANZ ACCREDITED LABORATORY

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Soil						
Sample Name:		597_S6 28-Aug-2020	597_S7 28-Aug-2020	597_S8 28-Aug-2020	597_S9 28-Aug-2020	597_S10 28-Aug-2020
Lab Number:		2428499.6	2428499.7	2428499.8	2428499.9	2428499.10
Individual Tests						
Dry Matter	g/100g as rcvd	88	68	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	790	149	77	37
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	22	7.6	19.6	2.5 #1
Total Recoverable Chromium	mg/kg dry wt	14	260	118	50	22
Total Recoverable Copper	mg/kg dry wt	4	990	350	191	66
Total Recoverable Lead	mg/kg dry wt	14.6	340	500	107	1,780
Total Recoverable Nickel	mg/kg dry wt	10	36	18	13	89 #2
Total Recoverable Zinc	mg/kg dry wt	49	3,000	1,610	420	430 #3
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	3.9	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.012	0.076	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.012	0.080	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.012	0.074	-	-	-
Acenaphthene	mg/kg dry wt	< 0.012	< 0.015	-	-	-
Anthracene	mg/kg dry wt	< 0.012	0.063	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.012	0.27	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	0.24	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	0.36	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	0.36	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.012	0.60	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.012	0.36	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	0.112	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	0.171	-	-	-
Chrysene	mg/kg dry wt	< 0.012	0.22	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.015	-	-	-
Fluoranthene	mg/kg dry wt	< 0.012	0.28	-	-	-
Fluorene	mg/kg dry wt	< 0.012	0.101	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	0.126	-	-	-
Naphthalene	mg/kg dry wt	< 0.06	0.42	-	-	-
Perylene	mg/kg dry wt	< 0.012	0.051	-	-	-
Phenanthrene	mg/kg dry wt	< 0.012	0.38	-	-	-
Pyrene	mg/kg dry wt	< 0.012	0.31	-	-	-

Sample Name:		597_S11 28-Aug-2020	597_S12 28-Aug-2020			
Lab Number:		2428499.11	2428499.12			
Individual Tests						
Total Recoverable Lead	mg/kg dry wt	-	1,620	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	14	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.47	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	17	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	34	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	47	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	8	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	108	-	-	-	-

Analyst's Comments

#1 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. Rep 1 = 2.5 mg/Kg Rep 2 = 1.7 mg/Kg

#2 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. Rep 1 = 89 mg/Kg Rep 2 = 9.6 mg/Kg

#3 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. Rep 1 = 430 mg/Kg, Rep 2 = 259 mg/Kg

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-12
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	12
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-7
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-11
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.002 - 0.05 mg/kg dry wt	1-7
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-7
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	12
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	12
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-7
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-7

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 02-Sep-2020 and 03-Sep-2020. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Kim Harrison MSc
Client Services Manager - Environmental

TERRA SCIENTIFIC

Terra Scientific Ltd
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ACCREDITED IANZ TESTING LABORATORY Nº 1334

Version Number: 7 | Date Issued: August 2020 | Authorised By: JC | Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T002740.1	**Total Samples Received:**	1
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference / Address:**	EM - 12903.000.000	**Date Received:**	31/08/2020
Client Reference:	12903.000.000			**Date Analysed:**	31/08/2020
Client Contact:	Natalie Flatman	**Analyst:**	Lisa Bullock	**Date Reported:**	31/08/2020

ASBESTOS ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description		Results	Comments
T002740.1.1	1	Burn pile PACM 1, Cement board		**Chrysotile (White Asbestos)** **Amosite (Brown Asbestos)** **Crocidolite (Blue Asbestos)** Organic Fibres	
		Yellow painted cement			
		Sample Weight:	33.25 g		

Method References and Disclaimers

Samples were analysed in accordance with: AS4964-2004 Australian Standard - Method for Qualitative Identification of Asbestos in Bulk Samples

Disclaimers:
- Samples are reported 'As Received'. Terra Scientific takes no responsibility for sampling processes, client sample descriptions and sample locations as these were provided by the client.
- The results presented in this report relate specifically to the samples submitted for this job.
- The detection limit is 0.1g/1kg as stated in the AS4964-2004.
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ACCREDITED IANZ TESTING LABORATORY Nº 1334

Version Number: 10	Date Issued: August 2020	Authorised By: JC	Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T002740.2	**Total Samples Received:**	1
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference / Address:**	EM - 12903.000.000	**Date Received:**	31/08/2020
Client Reference:	12903.000.000			**Date Analysed:**	1/09/2020
Client Contact:	Natalie Flatman	**Analyst:**	Jessica Campbell	**Date Reported:**	1/09/2020

ASBESTOS IN SOIL ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description	Received Weight (g)	Dry Weight (g)	Results	ACM Weight (g)	FA Weight (g)	AF Weight (g)	ACM w/w %	FA w/w %	AF w/w %	Combined AF/FA %	Comments
T002740.2.1	1	Burn pile - sample 1, Soil											
		Layer 1: >10 mm	893.91	17.30	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.06923%	0.00882%	0.07805%	
		Layer 2: 10 - 2 mm		28.43	**Chrysotile (White Asbestos) Amosite (Brown Asbestos) Crocidolite (Blue Asbestos)** Organic Fibres	N/A	0.46908	0.00000					
		Layer 3: <2 mm		631.85	**Chrysotile (White Asbestos) Amosite (Brown Asbestos) Crocidolite (Blue Asbestos)** Organic Fibres	N/A	0.00000	0.05974					
		Layer 3 sub sampled weight:		50.24									
		Total sample weight:		677.58	Total Combined:	0.00000	0.46908	0.05974					

Method References and Disclaimers

Samples were analysed in accordance with:
AS4964-2004 Australian Standard - Method for Qualitative Identification of Asbestos in Bulk Samples
BRANZ - New Zealand Guidelines for Assessing and Managing Asbestos in Soil 2017

Disclaimers:
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Asbestos calculations are outside the scope of accreditation.
All opinions and interpretations are outside the scope of accreditation.
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ACCREDITED IANZ TESTING LABORATORY Nº 1334

Version Number: 10	Date Issued: August 2020	Authorised By: JC	Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T002772	**Total Samples Received:**	7
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference / Address:**	597 EM	**Date Received:**	2/09/2020
Client Reference:	12903.000.005			**Date Analysed:**	3/09/2020
Client Contact:	Natale Flatman	**Analyst:**	Lisa Bullock	**Date Reported:**	3/09/2020

ASBESTOS IN SOIL ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description	Received Weight (g)	Dry Weight (g)	Results	ACM Weight (g)	FA Weight (g)	AF Weight (g)	ACM w/w %	FA w/w %	AF w/w %	Combined AF/FA %	Comments
T002772.1	3	ASS04 @ 0.0, Soil											
		Layer 1: >10 mm	854.07	19.66	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected QA/QC Reviewed
		Layer 2: 10 - 2 mm		67.99	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		538.92	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		53.71	Synthetic Mineral Fibres								
		Total sample weight:		626.57	Total Combined:	0.00000	0.00000	0.00000					
T002772.2	4	ASS05 @ 0.0, Soil											
		Layer 1: >10 mm	1065.38	120.68	**Chrysotile (White Asbestos) Amosite (Brown Asbestos) Crocidolite (Blue Asbestos)** Organic Fibres	1.05348	0.00000	0.00000	0.01884%	0.00000%	0.00000%	0.00000%	
		Layer 2: 10 - 2 mm		23.31	Organic Fibres Synthetic Mineral Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		694.81	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		51.97	Synthetic Mineral Fibres								
		Total sample weight:		838.80	Total Combined:	1.05348	0.00000	0.00000					
T002772.3	5	ASS06 @ 0.0, Soil											
		Layer 1: >10 mm	1342.34	105.13	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected QA/QC Reviewed
		Layer 2: 10 - 2 mm		107.00		N/A	0.00000	0.00000					
		Layer 3: <2 mm		860.08		N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		50.08									
		Total sample weight:		1072.21	Total Combined:	0.00000	0.00000	0.00000					

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Version Number: 10 | Date Issued: August 2020 | Authorised By: JC | Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T002772	**Total Samples Received:**	7
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference / Address:**	597 EM	**Date Received:**	2/09/2020
Client Reference:	12903.000.005			**Date Analysed:**	3/09/2020
Client Contact:	Natale Flatman	**Analyst:**	Lisa Bullock	**Date Reported:**	3/09/2020

ASBESTOS IN SOIL ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description	Received Weight (g)	Dry Weight (g)	Results	ACM Weight (g)	FA Weight (g)	AF Weight (g)	ACM w/w %	FA w/w %	AF w/w %	Combined AF/FA %	Comments
T002772.4	6	ASS07 @ 0.0, Soil											
		Layer 1: >10 mm	741.38	54.82	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00083%	0.00000%	0.00083%	
		Layer 2: 10 - 2 mm		112.04	**Chrysotile (White Asbestos)** Organic Fibres Synthetic Mineral Fibres	N/A	0.00405	0.00000					
		Layer 3: <2 mm		321.09	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		54.29	Synthetic Mineral Fibres								
		Total sample weight:		487.95	Total Combined:	0.00000	0.00405	0.00000					

Method References and Disclaimers

Samples were analysed in accordance with:
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Sarah Giles
Laboratory Analyst
Key Technical Person

Private Plan Change Request – Hughes Developments Limited
Appendix F – Capacity Assessments

DAVIE LOVELL-SMITH
PLANNING SURVEYING ENGINEERING

Rolleston Residential Land Capacity Assessment

This report investigates remaining capacity for residential land development within specific Outline Development Plans (ODP) in Rolleston as well as the second Housing Accord area, Acland Park. Current development within Rolleston is largely confined to ODP Areas 9 - 13 and Acland Park. For this reason, the capacity of these 'active' ODP Areas forms the primary focus of this assessment.

The assessment is concentrated on the remaining capacity for undeveloped, residential zoned land as the findings of the assessment are to be used to inform a private plan change rezoning application. The emphasis on undeveloped land differs slightly from previous Council initiated capacity assessments which are 'housing-centric'.

The land-focussed approach is preferred in this instance for the following reasons:

1. The process is to inform rezoning of land and the subsequent development of land. The land component of residential development has first priority in the development process.
2. Using houses (measured via building consents and/or code of compliance) to determine 'capacity' ignores key factors around the timing lag it takes to develop land to a stage where it can accommodate a house (i.e. issue of title). When layering in timeframes stipulated within the National Policy Statement (short, medium & long term), an 18-month to 2 year land development process becomes an important consideration and that is before the house build process even commences.
3. Developed land is seen as an important indicator for capacity due to the fact that once a title is 'sold', it is no longer in the 'capacity pool'. Following the sale of a title, whether the building process commences immediately or not, the land is no longer available – therefore it should not be classified as 'capacity' irrespective of whether there is a house on it or not.

The methodology used to assess the current capacity of residential zoned land in Rolleston is predominantly based on Selwyn District Council monitoring data compiled in respect of resource consents approved, 224c certificates issued and building consents issued for all ODP and Special Housing Areas. These figures are compared to an allocated household yield calculated by Council for each ODP or Special Housing Area. The data used is based on monitoring figures obtained as at 16 October 2019.

The assessment extricates two primary datasets from the SDC monitoring data and seeks to refine this data to create an accurate 'snapshot' in respect of development capacity for the ODPs and Special Housing Area. Firstly, the allocated households for each ODP have been critically examined to determine whether allocated yields are feasible, based on specific characteristics within each ODP area. Secondly, the number of 224c certificates issued within each of the specified ODP Areas has been updated to include advanced stages of development including pending dealings registered with LINZ to provide an accurate snapshot of titles that will be due to issue in the immediate future.

ODP AREA 9

This area is located on Lowes Road and consists entirely of the Helpet Park residential area. The ODP has a total area of 25ha and has an allocated yield of 245 households. The area was originally developed as a very low density residential development with lots averaging between 1ha and 1.3ha. In recent times some of these lots have been developed to create smaller standalone residential lots and also a boutique lifestyle retirement village.

The size of the lots and the positioning of existing homes within each lot, makes intensification challenging. Homes within Helpet Park are large, which is understandable given the setting, and it is therefore likely to be uneconomic to demolish them to provide a constraint-free parcel of land for future development. What has started to occur within Helpet is that the main home is typically subdivided off from the underlying title to create a vacant balance parcel of land. Houses have tended to be left on lots with an average area of 3,500m^2, with a large curtilage being necessary to incorporate established gardens and existing improvements such as sheds, sleep-outs, fences etc.

A further challenge to future development is the fact that half of the households within Helpet Park take legal access from a shared Right of Way (ROW). Given the ROW has multiple interests, being able to establish a legal road to serve the rear portion of ODP 9 is complex, as all parties will need to surrender their ROW interest in order to legalise any future road. Additionally, the ROW is not of sufficient width in its current form to accommodate future development, therefore parties to the ROW will need to contribute land for widening purposes.

Given the access constraints alluded to above, it is not surprising that infill-development to date has occurred on lots that have direct legal access to Lowes Road.

Capacity Assessment

The main adjustment to capacity of ODP 9 has been to reduce the allocated households for the area to take account of the number of large existing houses remaining within the area. Excluding the existing residential development on the corner of Lowes Road and Springston Rolleston Road and the retirement village, a further 23 households have or are likely to be created on their own title in order to release the balance land to facilitate future development. This removes approximately 8.3ha from the 25ha ODP area. Using the ODP average density of 10hh/ha this equates to a reduction of 83 households from ODP 9 allocation.

There are no current developments underway within ODP 9 and no pending dealings have been lodged. Accordingly, Council's monitoring data can be adjusted as follows:

ODP	CURRENT YIELD	ADJUSTMENT	REVISED YIELD	CURRENT 224	PENDING 224	TOTAL 224
9	245	83	162	45	-	45

ODP AREA 10

ODP Area 10 is a triangular shaped-block bounded by Goulds Road and East Maddisons Road with a total area of 31ha. The area is characterised by a series of long narrow rectangular sites which are held in multiple ownership. Developers have slowly been able to aggregate parcels of land and the more sizeable and better-shaped parcels have been developed in recent times.

ODP 10 has been allocated 279 households by Council which equates to a net density of 9hh/ha. This slightly lower density is an obvious reflection of the difficulties posed by shape and size factors as well as the multiple ownership characteristics that prevail.

Capacity Assessment

Given the extent of ownership within the ODP there are numerous existing dwellings which under normal development conditions will be retained and kept on larger sites. The majority of existing dwellings are located in close proximity to either Goulds Road or East Maddisons Road and based on current trends seem likely to be retained on sites of approximately 2000m^2. Given the location of these dwellings coupled with the narrowness of sites, accessing the rear of these properties in isolation will be difficult.

Some non-residential activities also look likely to establish within this ODP. The Roman Catholic Church has acquired 1.7ha along East Maddisons Road and a large childcare and café development on 4000m^2 has been approved in the corner where both Goulds Rd and East Maddisons Road converge. Adjustments to allocated household yield have been made as follows:

Existing Dwellings (11 x 2000m^2)	2.2ha
Roman Catholic Church	1.7ha
Childcare / Café	0.4ha
Total	4.3ha
Adjusted yield @ 9hh/ha	39 lots

The more constrained sites in the ODP are located in the southern portion. This area is approximately 7.2ha and given shape, size and ownership factors it is prudent to reduce the expected net density to be achieved from this part of the ODP. When factors such as retention of existing houses, the location and width of internal roads are factored in alongside the area and dimensions of each site , using a net density of 7.0hh/ha instead of 9hh/ha appears more realistic. This results in a further adjustment as follows:

7.2ha @ 9hh/ha	65 lots
7.2ha @ 7.5hh/ha	50 lots
Adjusted yield	15 lots

The main concentration of development within ODP 10 is located in the northern areas where size and shape are more forgiving. Staged developments such as East Maddisons Estate and Goulds Estate are well progressed. Land within future stages of these developments is well-advanced with roads formed, berms and lots being earth worked and landscaping underway. Approximately 60 titles appear close to apply for 224c and titles issuing.

Based on yield adjustments and the advanced stage of further development, Council's monitoring data can be adjusted as follows:

ODP	CURRENT YIELD	ADJUSTMENT	REVISED YIELD	CURRENT 224	PENDING 224	TOTAL 224
9	245	83	162	45	-	45
10	279	54	225	119	60	179

ODP AREA 11

ODP Area 11 sits between Springston Rolleston Road and Lincoln Rolleston Road. It has an area of 151ha and has been allocated a yield of 1,510 households. Development within the area is well-advanced with several established subdivisions underway, including:

- Branthwaite Park
- Falcons Landing
- Urban Estates
- Eastonfields
- Faringdon Borough
- Faringdon Green

The ODP area also includes 12.9ha of Council-owned land for the Helpet Wastewater Treatment Plant and Water Supply Reservoir.

Capacity Assessment

The area was previously separated into a series of 4ha lifestyle blocks with some larger intervening rural land holdings included. During the aggregation of land as part of the development process throughout the ODP, existing households were separated off from the underlying title, with the residual land now being developed for residential purposes. The existing household blocks that have been created are significantly larger than what has typically been created in other ODP areas, predominantly because of the scale of the original landholding. Large curtilage areas have been required to encapsulate established gardens, driveways and improvements along with the existing houses.

Up to 11 sites have been created under the above circumstances, each ranging in size from between 3,500m^2 to 1.5ha. The 1.5ha landholding is of further significance given its central location within the ODP. The property is 'sandwiched' between the Faringdon Green and Falcon's Landing developments. Any future development of this property will require a considerable amount of roading to be incorporated to achieve the necessary ODP connection between the east and west. The requisite inclusion of this road and its location along the northern property boundary makes future development of this property an expensive undertaking. For this reason the 1.5ha has been excluded from calculations in its entirety.

Titles with existing houses and curtilage areas within ODP 11 total 9.5ha. Using a density of 10hh/ha this equates to 95 lots.

As mentioned above, the Helpet Wastewater Treatment Plant and Water Supply Reservoir is located on a 12.9ha parcel of land at the northern end of the ODP. The land has been designated for utility purposes, with the designation being updated in the last 3 years. The land designated in this most recent process is approximately 3.6ha, therefore it is safe to assume this land will not be available for residential development anytime soon.

Using a net density of 10hh/ha the 3.6ha designated area equates to 36 lots.

Given the extent of development underway within the ODP, several stages within the aforementioned developments are nearing completion. Accordingly a number of pending dealings have been registered or development has been advanced to such a stage whereby dealings and 224c appear imminent. These can be summarised in the table below:

DEVELOPMENT	NUMBER OF PENDING LOTS (TITLES)
Branthwaite	66
Falcons Landing	98
Urban Estates	50
Eastonfield	40
Faringdon Green	106
TOTAL	**340**

Based on yield adjustments and the advanced stage of further development, Council's monitoring data can be adjusted as follows:

ODP	CURRENT YIELD	ADJUSTMENT	REVISED YIELD	CURRENT 224	PENDING 224	TOTAL 224
9	245	83	162	45	-	45
10	279	54	225	119	60	179
11	1510	131	1379	690	340	1030

ODP AREA 12

ODP 12 is located to the southwest of Rolleston and is bounded by Dunns Crossing Rd, East Maddisons Road and Selwyn Rd. It has an area of 56ha. The area previously consisted almost entirely of 4ha rural lifestyle blocks. It has been extensively developed in recent times from the East Maddisons Rd frontage. Developments such as Riverstone and Olivefields have commenced from East Maddisons Road and are slowly developing their way westward.

Capacity Assessment

Given the rural lifestyle similarities with ODP 11, it is not unreasonable to expect a similar pattern to evolve around large sites being created to accommodate existing houses and improvements. Whilst houses on the East Maddisons frontage have been absorbed into development on lots ranging between 1,800m^2 and 2,200m^2, the nature of land use, house location and size and existing curtilage areas all suggest that houses on the western side of the ODP will be separated off from landholdings on 1ha or similar titles. One such title on Dunns Crossing Road has already been created. Based on this assumption, a total of 6 households are likely to be subdivided onto 1ha titles, freeing up the balance of land for development in the future. Using a net density of 10hh/ha this equates to an adjustment of 60 lots from the allocated household figure.

Looking at the progress of development and pending dealings it appears approximately 35 lots of staged development are nearing completion and the issue of 224c and titles is imminent.

Based on yield adjustments and the advanced stage of further development, Council's monitoring data can be adjusted as follows:

ODP	CURRENT YIELD	ADJUSTMENT	REVISED YIELD	CURRENT 224	PENDING 224	TOTAL 224
9	245	83	162	45	-	45
10	279	54	225	119	60	179
11	1510	131	1379	690	340	1030
12	560	60	500	160	35	195

ODP AREA 13

ODP Area 13 comprises 36ha and is located along Springston Rolleston Road. The area is characterised by an eclectic mix of landholdings ranging from typical 4ha lifestyle blocks to a series of long narrow rectangular blocks varying in size from 4000m^2 to 1.2ha. A range of non-residential activities are established within the ODP including a large pre-school, Rolleston Christian School and a parcel of land owned by the Presbyterian Church.

The allocated yield for ODP 13 is 450 households which surprisingly equates to a net density of 12.5hh/ha.

Capacity Assessment

As for other ODP areas, for land to be freed up for development, existing houses will be separated off from the main landholding. This has already occurred to some extent with houses being subdivided off and held in titles ranging from 4100m^2 to 8000m^2. Assessing additional landholdings as well as those already separated it is estimated approximately 4.3ha of land will be removed from the total developable land area to accommodate existing houses, curtilage areas and improvements.

Another factor that warrants further examination is the net density figure allocated to this ODP. The allocation of households for this ODP reflects a net density of 12.5hh/ha. What makes this all the more unusual is that there is not an overabundance of medium density area identified in the ODP to assist with achieving this density.

Given the multiple landownership and unusually shaped (and sized) lots within this ODP, coupled with existing houses and improvements and the extent of non-residential activity, achieving 10hh/ha would seem challenging enough, let alone 12.5hh/ha. Additionally, the two southern-most 4ha lifestyle blocks are required to accommodate the large CRETS east-west road that has been re-aligned as part of the Acland Park Special Housing Area. The requirement to accommodate this road (and its alignment) will require more land and development cost which will impact future yields. Accordingly, for the reasons identified above, the allocated households for ODP 13 should be adjusted to reflect a net density of 10hh/ha.

Given the factors discussed above, the revised yield of 10hh/ha has been applied as follows:

Current allocation	36ha x 12.5hh/ha =	450 lots
Revised allocation	36h x 10hh/ha =	360 lots
Difference		90 lots

Constrained land as referred to above includes the following:

Presbyterian Church	0.7ha		
Christian School	2.0ha		
Pre-School	0.3ha		
Existing Houses	4.3ha		
	7.3ha	(x 10hh/ha)	73 lots

Based on yield adjustments, Council's monitoring data for ODP Areas 9-13 can be adjusted as follows:

ODP	CURRENT YIELD	ADJUSTMENT	REVISED YIELD	CURRENT 224	PENDING 224	TOTAL 224
9	245	83	162	45	-	45
10	279	54	225	119	60	179
11	1510	131	1379	690	340	1030
12	560	60	500	160	35	195
13	450	163	287	61	-	61

Acland Park Special Housing Areas

Looking at the broader picture beyond the ODPs above, the other main residential area which contributes residential capacity within Rolleston is the Acland Park Special Housing Area.

Acland Park has recently increased their yield through resource consent to reduce the extent of stormwater reserve within the development and introduce 116 more residential lots. In addition, development of stages beyond Stage 1 has progressed to a point where a further 114 lots have 224c and/or titles pending. Adjustments have been made to reflect these updates:

CURRENT YIELD	ADJUSTMENT	REVISED YIELD	CURRENT 224	PENDING 224	TOTAL 224
900	+ 116	1016	105	114	219

Based on the Acland Park assessment, residential capacity within Rolleston ODP's is supplemented by a further **797** households (Revised yield **1016** less Developed Land **219**). Acland Park is a greenfield development that is not constrained by characteristics evident within other Rolleston ODPs.

CONCLUSION

Based on the land capacity assessment and the assumptions made in respect of ODPs 9-13 these areas have a capacity of **1043 households** (Revised Yield 2553 - Developed Land (224c issued or pending) 1510 = 1043).

ODP	CURRENT YIELD	ADJUSTMENT	REVISED YIELD	CURRENT 224	PENDING 224	TOTAL 224
9	245	83	162	45	-	45
10	279	54	225	119	60	179
11	1510	131	1379	690	340	1030
12	560	60	500	160	35	195
13	450	163	287	61	-	61
TOTAL	**3044**	**491**	**2553**	**1075**	**435**	**1510**

Council's overall capacity monitoring table which includes **all** Rolleston ODPs as well as the completed Faringdon South Special Housing Area has been updated to reflect the assessment undertaken in respect of ODPs 9 - 13 and Acland Park Special Housing Area. The updated table is included below and reflects a total overall capacity (revised yield less developed land) of **2059 households.**

ODP	CURRENT YIELD	ADJUSTMENT	REVISED YIELD	CURRENT 224	PENDING 224	TOTAL 224
1	**633**		**633**	**697**		**697**
2	**0**		**0**	**0**		**0**
3	**484**		**484**	**393**		**393**
4	**108**		**108**	**0**		**0**
5	**0**		**0**	**0**		**0**
6	**1100**	**99**	**1001**	**1001**		**1001**
7	**69**		**69**	**41**		**41**
8	**330**		**330**	**347**		**347**
9	**245**	**83**	**162**	**45**		**45**
10	**279**	**54**	**225**	**119**	**60**	**179**
11	**1510**	**131**	**1379**	**690**	**340**	**1030**
12	**560**	**60**	**500**	**160**	**35**	**195**
13	**450**	**163**	**287**	**61**		**61**
Sth Faringdon	**400**		**400**	**474**		**474**
Geddes	**900**	**116**	**1016**	**105**	**114**	**219**
***L 3 Holmes**	**96**		**96**	**0**		**0**
***L3 Skell**	**51**		**51**	**0**		**0**
L3 Coles	**36**		**36**	**36**		**36**
TOTALS	**7251**		**6777**	**4169**		**4718**

*147 L3 households are included as 'capacity'

When contemplating the revised capacity (1043 households) within 'active' ODP Areas 9-13 plus Acland Park, the likelihood of the estimated capacity with each ODP area being readily available for development also needs to be considered. Several ODP areas have characteristics which may preclude capacity from being fully realised. This is particularly relevant for ODP Areas 9, 10 and 12 for the reasons outlined below:

- ODP 9 has extensive issues in respect of achieving connectivity and legal road access, as well accumulating a critical mass to achieve favourable development conditions.
- The balance of land available for development in ODP 10 consists of irregular shaped and sized lots held in multiple-ownership. Aggregating this land to achieve a critical mass will be difficult and will take time. The feasibility of achieving this alongside ODP road connections and land preparation costs will be challenging.

- According to the Council's infrastructure masterplan, ODP 12 has wastewater constraints and the infrastructure investment required to service the western portion of the ODP is still some way off.

Once the above factors are taken into consideration, it becomes clear that immediate and feasible capacity is confined to ODP 11, ODP 13 and Acland Park. Therefore the overall capacity figure needs to be readjusted further to reflect what is immediately feasible. The adjusted capacity figure can therefore be calculated as being:

ODP 11:	Revised Yield **1379** less Developed Land **1030**	**349 households**
ODP 13:	Revised Yield **287** less Developed Land **61**	**226 households**
Acland Park	Revised Yield **1016** less Developed Land **219**	**797 households**
TOTAL		**1372 households**

Private Plan Change Request – Hughes Developments Limited
Appendix G – Certificates of Title

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **CB33K/65**
Land Registration District **Canterbury**
Date Issued 18 October 1990

Prior References
CB33F/774

Estate	Fee Simple
Area	20.3750 hectares more or less
Legal Description	Lot 1 Deposited Plan 57004

Registered Owners
Malcolm Richard Main and Philippa Ruth Main

Interests

Subject to Part IV A Conservation Act 1987

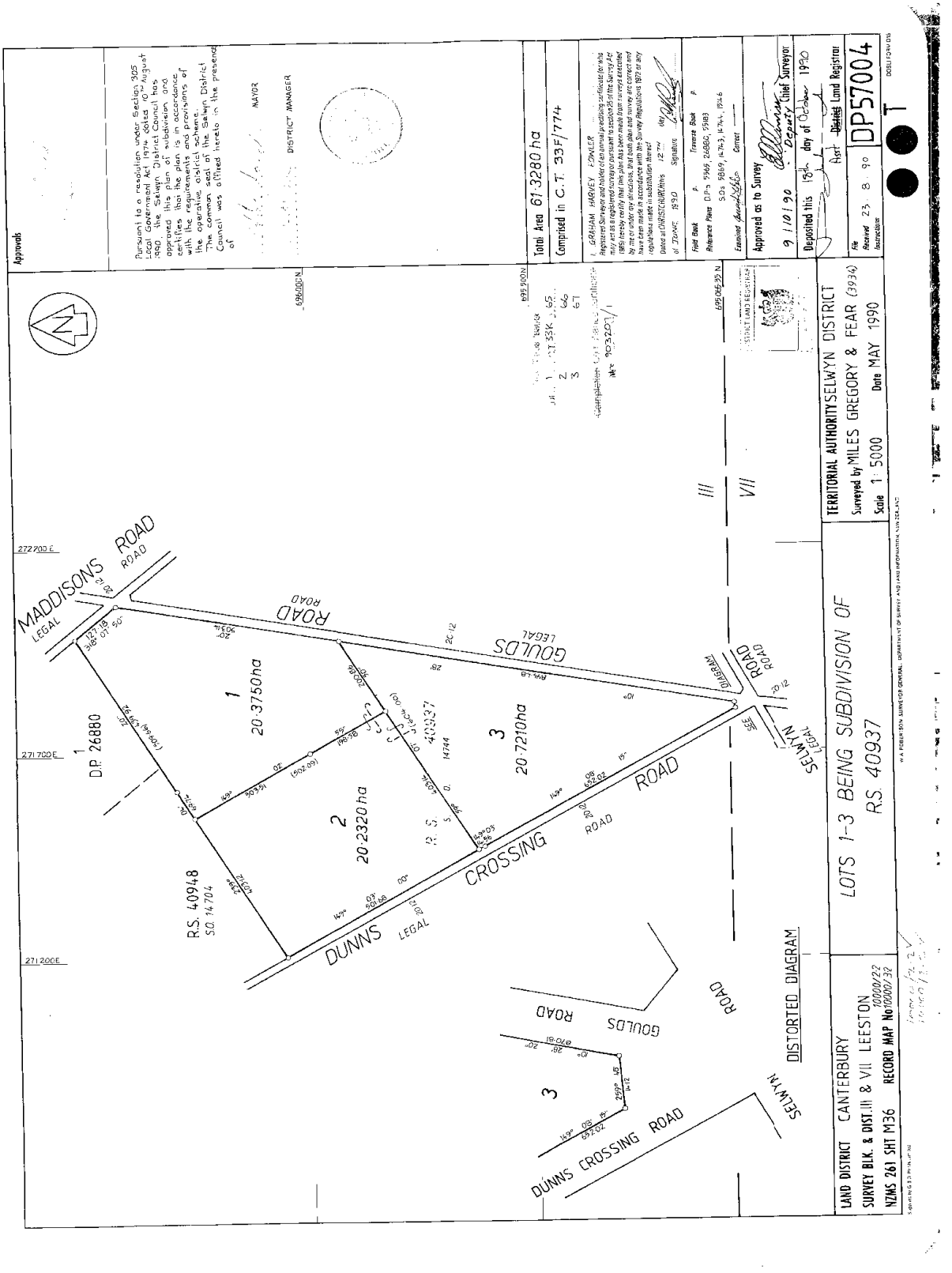
A21096.5 Mortgage to (now) Westpac New Zealand Limited - 28.10.1992 at 2.32 pm and varied 30.10.1996 at 9.36 am

5798897.3 Variation of Mortgage A21096.5 - 13.11.2003 at 9:00 am

8577235.1 Variation of Mortgage A21096.5 - 25.8.2010 at 5:05 pm

11864514.1 CAVEAT BY HUGHES DEVELOPMENTS LIMITED - 21.9.2020 at 9:14 am

Identifier **CB33K/65**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB33K/67**
Land Registration District	**Canterbury**
Date Issued	18 October 1990

Prior References
CB33F/774

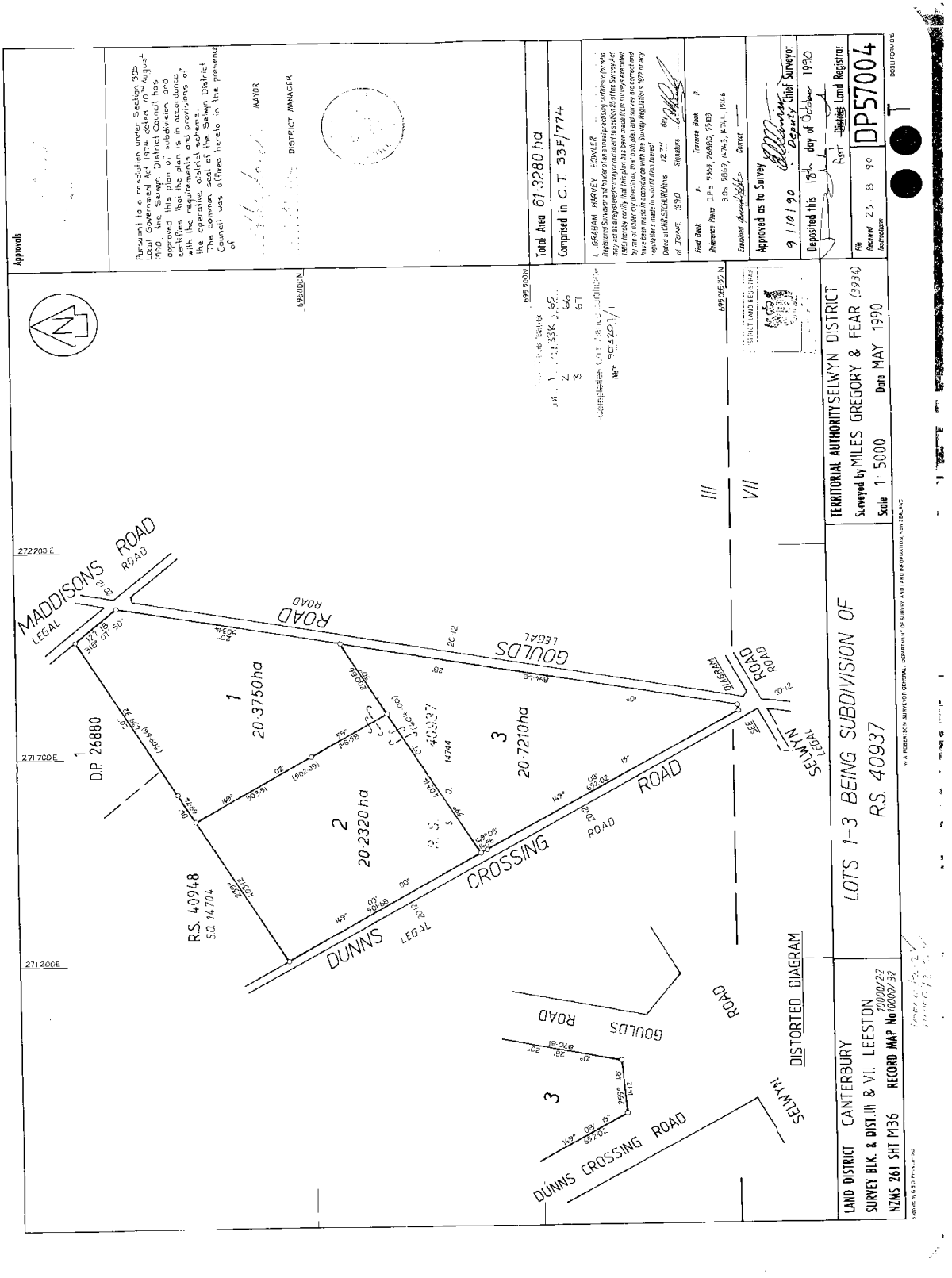
Estate	Fee Simple
Area	20.7210 hectares more or less
Legal Description	Lot 3 Deposited Plan 57004

Registered Owners
Ivan George Robertson as to a 1/2 share
Dorothy Caroline Robertson as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987
11668773.1 CAVEAT BY HUGHES DEVELOPMENTS LIMITED - 29.1.2020 at 2:12 pm

Identifier **CB33K/67**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **CB36C/247**
Land Registration District **Canterbury**
Date Issued 29 October 1992

Prior References
CB33K/66

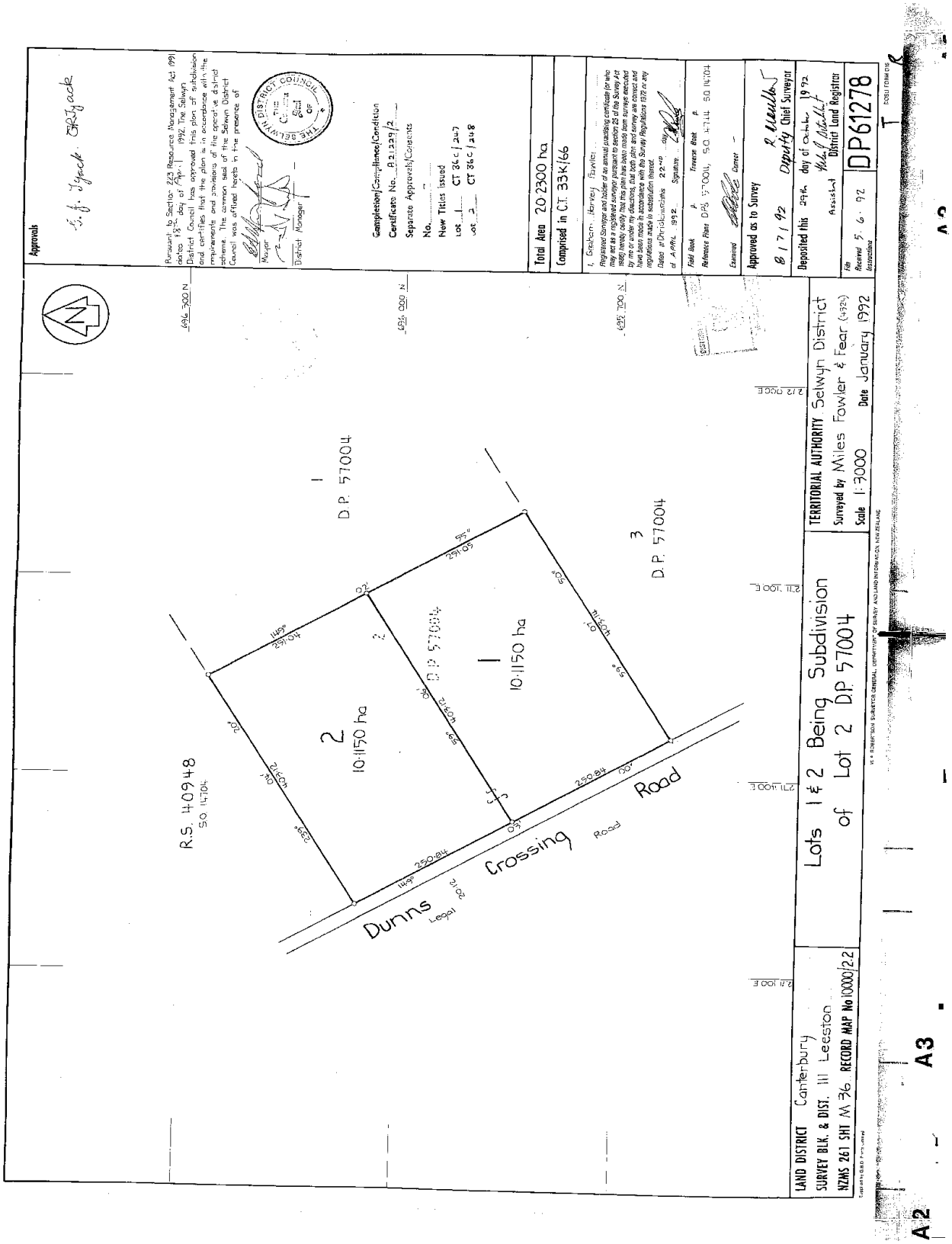
Estate	Fee Simple
Area	10.1150 hectares more or less
Legal Description	Lot 1 Deposited Plan 61278

Registered Owners
Ivan George Robertson as to a 1/2 share
Dorothy Caroline Robertson as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987
11668773.1 CAVEAT BY HUGHES DEVELOPMENTS LIMITED - 29.1.2020 at 2:12 pm

Identifier **CB36C/247**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB36C/248**
Land Registration District	**Canterbury**
Date Issued	29 October 1992

Prior References
CB33K/66

Estate	Fee Simple
Area	10.1150 hectares more or less
Legal Description	Lot 2 Deposited Plan 61278

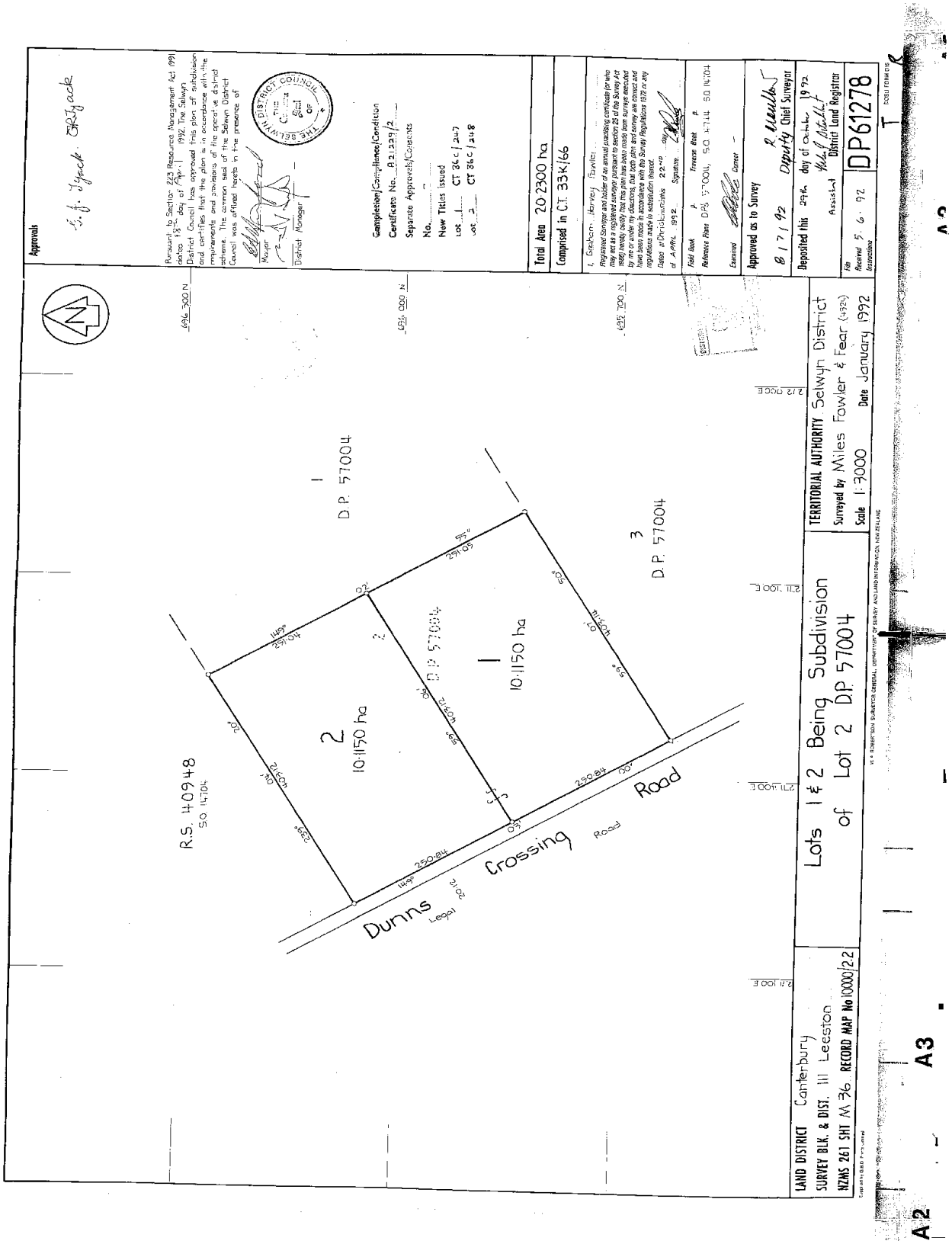
Registered Owners
Lindsay Kenneth Blackmore as to a 1/2 share
Judith Christina Blackmore as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

11639491.1 CAVEAT BY HUGHES DEVELOPMENTS LIMITED - 12.12.2019 at 12:33 pm

Identifier **CB36C/248**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **CB40D/788**
Land Registration District **Canterbury**
Date Issued 14 November 1995

Prior References
CB39A/686

Estate	Fee Simple
Area	4.0000 hectares more or less
Legal Description	Lot 3 Deposited Plan 70352

Registered Owners
Hughes Developments Limited

Interests

Subject to Part IV A Conservation Act 1987

A204853.21 Easement Certificate specifying the following easements - 14.11.1995 at 12.12 pm

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way, right to drain sewage, convey water, electric power and telephonic communications	Lot 4 Deposited Plan 70352 - CT CB40D/789	A DP 70352	Lot 3 Deposited Plan 70352 - herein	

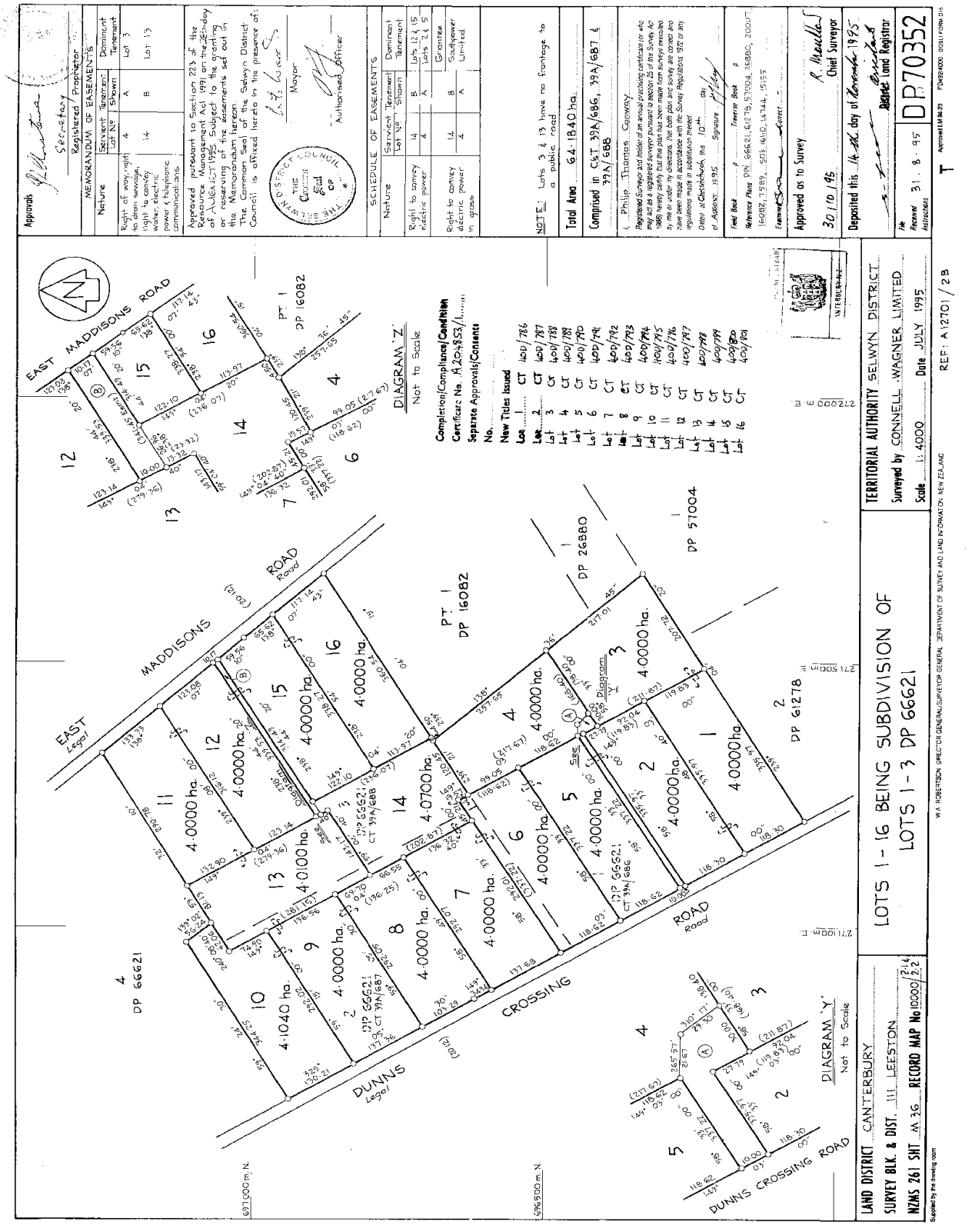
The easements specified in Easement Certificate A204853.21 when created will be subject to Section 243(a) Resource Management Act 1991

Fencing Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

Land Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

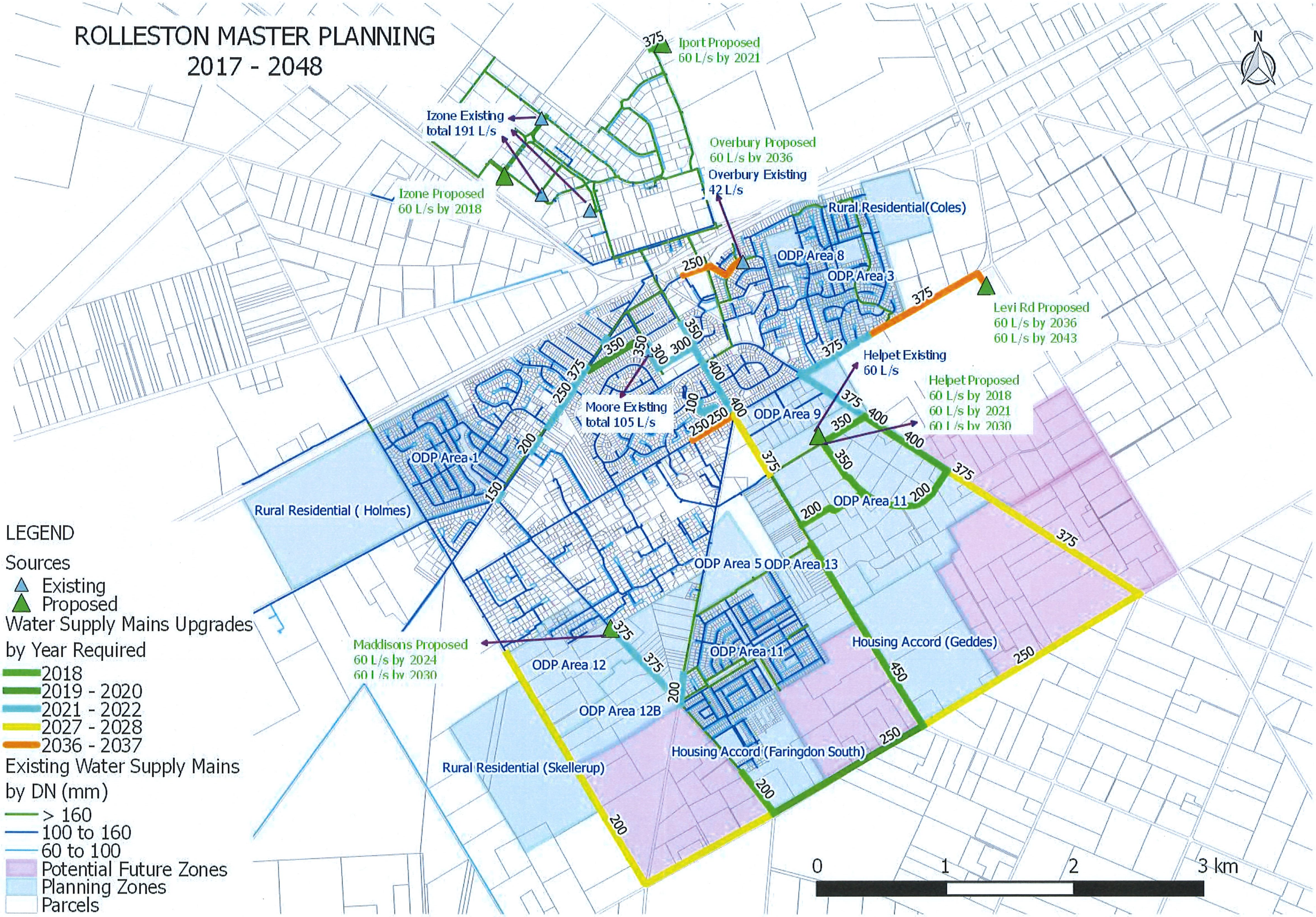
11211027.1 Court Order Varying Land Covenant in Transfer A204853.22 - 24.8.2018 at 7:00 am

Identifier **CB40D/788**



Private Plan Change Request – Hughes Developments Limited
Appendix H – Future Growth Staging

ROLLESTON MASTER PLANNING
2017 - 2048



LEGEND

Sources
- Existing
- Proposed

Water Supply Mains Upgrades by Year Required
- 2018
- 2019 - 2020
- 2021 - 2022
- 2027 - 2028
- 2036 - 2037

Existing Water Supply Mains by DN (mm)
- > 160
- 100 to 160
- 60 to 100

Potential Future Zones
Planning Zones
Parcels

Rolleston Potential Future Growth Staging

