ANNEXURE E (I):

DETAILED SITE INVESTIGATION REPORT

ENGEO

Expect Excellence

Detailed Environmental Site Investigation

711 Johns Road

Harewood

Christchurch

Submitted to:

McCracken and Associates Limited

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Appendices (at the rear of this report)

ENGEO Document Control:

Report Title	Detailed Environmental Site Investigation - 711 Johns Road, Harewood			
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Client	McCracken and Associates Limited	Client Contact	Kim McCracken	
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Date	Revision Details/Status	WP	Author	Reviewer
27/06/2017	Final	LL/BK	SF/CW	EM

1 Introduction

ENGEO Ltd was requested by McCracken and Associates Limited to undertake a Detailed Environmental Site Investigation (DSI) at 711 Johns Road Harewood, Christchurch (ref.13396.000.000) (herein referred to as 'the site'). ENGEO carried out a preliminary site investigation (PSI) of the site in October 2016. During the PSI, the site was identified as accommodating several activities on the Hazardous Activities and Industries List (HAIL; MfE, 2012). This DSI has been prepared to support the resource consent application for commercial / industrial redevelopment of the site

2 Objectives of the Assessment

The objectives of this environmental assessment are to:

- Assess concentrations of contaminants of concern (CoC) in soil to be disturbed and removed as part of the redevelopment;
- Compare CoC concentrations in soil to applicable disposal criteria and regulatory standards; and
- Provide recommendations for disposal of soil generated during the proposed redevelopment.

3 Site Information

The Christchurch City Council rates and valuation website describes the site as being 14.41 ha with the legal description of Sec 1 SO 455212. The site is located on predominantly flat land in the Harewood suburb of Christchurch. Information plans provided by the client indicate areas where some manmade earthen / waste piles existed or may still exist. There are no dwellings or structures present on the site.

Site information is summarised in Table 1 below.

Table 1: Site Information

Item	Description
Location	Johns Road, Harewood, Christchurch
Legal Description	Section 1 SO 455212
Current Land Use	The site is vacant
Proposed Land Use	Commercial / Industrial
Site Area	14.41 ha
Identified HAIL Activities (ENGEO, 2016)	EI: Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition. E2: Asphalt or bitumen manufacture or bulk storage (excluding single use sites used by a mobile asphalt plant). G3: Landfill sites.

4 Background

ENGEO carried out a preliminary site investigation (PSI) of the site in October 2016. The PSI concluded that the site has historically been used as a quarry, and was excavated to a depth of five metres below ground level. Consent was granted in 2009 to backfill the quarry with cleanfill and store stockpiled inert material, including mulch, asphalt millings, crushed concrete, and gravel, as well as to create earthen bunds along the site perimeter.

As the source and quality of the backfill was not documented nor has been investigated, ENGEO recommended carrying out a targeted intrusive environmental investigation to characterise the soil material underlying the site, specifically the potential presence of heavy metals, polycyclic aromatic hydrocarbons (PAHs) and asbestos where fill material has been placed (ENGEO, 2016).

5 Intrusive Investigation

Soils were sampled from 20 locations across the site. The HAIL associates each activity / industry with typical CoCs. Using this as a guide, soil samples were analysed for a suite of heavy metals (arsenic, cadmium, chromium, copper, lead, nickel and zinc), PAHs and, where evidence of potential asbestos containing material was observed, asbestos fibres.

Table 2 provides a summary of the areas investigated, sampling rationale and the type of analysis requested. The sample location map is included as Appendix 1.

Table 2: Investigation Summary

Area of Investigation	Sample Name	Depth of Sample Collected	Rationale for Sampling	Analysis Schedule
Southeast portion of the site	TP01	0.7 - 1.7 m bgl	Topsoil storage	Heavy metals and PAHs
	TP02	0.0 - 1.0 m bgl 1.0 - 2.5 m bgl		Heavy metals and PAHs
	TP03	0.0 – 0.5 m bgl 0.5 - 2.0 m bgl		Heavy metals and PAHs
South portion of the site	TP04	No Sample was taken as no fill was observed during the site works.		
South portion of the site	TP5	2.0 – 2.9 m bgl	Representative fill sample	Heavy metals and PAHs
Southwest portion of the site	TP6	2.0 - 2.7 m bgl	Representative fill sample	Heavy metals and PAHs
West portion of the site	TP7	1.5 – 2.0 m bgl 2.0 - 2.7 m bgl		Heavy metals and PAHs
Northeast portion of the site	TP8	0.0 - 0.2 m bgl 0.2 - 1.3 m bgl	Temporary asphalt milling storage	Heavy metals PAHs, and asbestos fibres
	TP09	0.0 - 0.3 m bgl 0.3 – 1.1 m bgl 1.1 - 2.6 m bgl		Heavy metals and PAHs
North portion of the site	TP10	0.0 - 0.3 m bgl 2.0 - 3.0 m bgl	Gravel storage	Heavy metals and PAHs
Middle portion of the site	TP11	0.2 - 0.6 m bgl	Representative fill sample	Heavy metals and PAHs
Northwest portion of the site	TP12	0.0 - 0.2 m bgl 0.2 - 1.1 m bgl 1.1 - 1.7 m bgl	Asphalt Millings	Heavy metals, PAHs and asbestos fibres
East portion of the site	TP13	0.3 – 0.5 m bgl	Stockpile	Heavy metals and PAHs

Area of Investigation	Sample Name	Depth of Sample Collected	Rationale for Sampling	Analysis Schedule
	TP14	0.3 – 0.5 m bgl		Heavy metals and PAHs
Centre portion of the site	TP15	1.0 - 2.5 m bgl	Representative fill sample	Heavy metals and PAHs
North portion of the site	TP16	0.3 - 0.4 m bgl		Heavy metals and PAHs
South portion of the site	TP17	0.3 - 0.4 m bgl		Heavy metals
South portion of the site	TP18	0.3 - 0.5 m bgl		PAHs
Centre portion of the site	TP19	0.3 - 0.5 m bgl		Heavy metals and PAHs
East portion of the site	TP20	0.3 - 0.5 m bgl	Representative fill sample - tar encountered at 0.5 m bgl.	PAHs and TPHs

5.1 Methodology

ENGEO collected soil samples at the site on 19 and 22 May 2017. The environmental investigation comprised the following:

- Collection of 31 soil samples from depths between 0.2 and 2.7 m below ground level (bgl).
- Submission of 29 soil samples to RJ Hill Laboratories (Hills) for chemical analysis.
- Submission of two soil samples and two potential asbestos containing material (PACM) to Environmental and Industrial Analysis Group (EIAG) for asbestos analysis.
- The soil samples submitted to Hills were analyzed for a suite of common heavy metals (As, Cd, Cu, Cr, Ni, Pb and Zin) and PAH). One soil sample, where tar was encountered during the field work, was analysed for total petroleum hydrocarbons (TPH). The soil samples and PACM were analysed for the presence of asbestos fibres.

All field work was carried out following ENGEO standard operating procedures for the appropriate field assessments and handling of potentially contaminated soils, including:

- Each soil sample was assessed for visual and olfactory indicators of contamination.
- The samples were collected by a trained and experienced technician.
- The soil was compressed directly into laboratory supplied containers by the field technician using a new pair of nitrile gloves for each sample.
- Following collection, all samples were placed directly into a chilly bin prior to transport, under standard ENGEO chain of custody procedures, to Hills and EIAG for analysis.

5.2 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 laboratories that have been accredited by the International Accreditation New Zealand (IANZ). To maintain their International Accreditation, Hills and EIAG Laboratories undertake rigorous cross checking and routine duplicate sample testing to ensure the accuracy of their results.
- During the site investigation the potential for cross contamination was minimised through the use of the procedures outlined within this document.

6 Adopted Investigation Criteria

6.1 Chemical Contamination

The investigation criteria referenced in this report have been selected in accordance with the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulation 2011 (the "NES") and the MfE's Contaminated Land Management Guidelines No.2 (MfE, 2011).

Contaminant concentrations in soil were compared to human health based on commercial / industrial land use (based on an outdoor worker scenario). This land use is relevant to the current and future use of the site, and it is being used as a surrogate to assess short term risks to redevelopment workers on site during the earthworks phase of the site redevelopment.

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 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 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 redeveloping 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.

To enable disposal of the soil at the Christchurch City Council (CCC) Burwood Landfill, contaminant concentrations must be below the NES recreational land use criteria. Additionally, the soil analysis results have been compared to regional background concentrations to provide information regarding possible disposal options at a cleanfill facility.

6.2 Asbestos

Currently, there are no national guidelines provided by the MfE on the acceptable concentration of asbestos in soil. However, the MfE does provide a framework in the Contaminated Land Management Guideline No.2 (MfE, 2011a) for adopting international guideline values where required. Our investigation therefore has been conducted in accordance with the Western Australia District of Health (WA DOH) Guidelines. These guidelines are recognised by WorkSafe and Environment Canterbury and are therefore suitable for the assessment of asbestos in soil materials (WA DOH, 2009).

The WA DOH Guidelines adopt a risk assessment approach for asbestos in soil that considers the form and quantity of asbestos present. The WA DOH soil guideline values are provided in Table 3 below.

Table 3: Adopted Asbestos Investigation Criteria

Soil Asbestos Investigation Criteria	Site End Use
0.001 % w / w asbestos for FA and AF	All site uses
NO ACM in surface soils (0 – 0.1 m)	All site uses
0.05 % w / w asbestos for ACM	Commercial / Industrial

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.

Both FA and AF have the potential to generate or be associated with free asbestos fibres, which can pose a considerable inhalation risk if made airborne.

7 Results

7.1 Laboratory Test Results

Error! Reference source not found. Table 4 summarises the results of soil contaminant concentrations in the samples tested compared to the adopted investigation criteria. Full analytical results are included in Appendix 2.

Table 4: Summary of Results

Area of Investigation	Sample Name	Depth of Sample Collected	Sample Analysis Result
Southeast portion of the site	TP01	0.7 - 1.7 m bgl	Arsenic, chromium, nickel and Benzo(a)Pyrene equivalent (BaP eq) above background criteria
	TP02	0.0 - 1.0 m bgl	Arsenic, chromium, ,nickel and BaP eq above background criteria
		1.0 - 2.5 m bgl	Arsenic, chromium, nickel and BaP eq above background criteria
	TP03	0.0 – 0.5 m bgl	Arsenic, cadmium, chromium, copper, lead, nickel and BaP eq above background criteria
		0.5 - 2.0 m bgl	Arsenic, cadmium, chromium, copper, lead, nickel, zinc and BaP eq above background criteria
South portion of the site	TP5	2.0 – 2.9 m bgl	Arsenic, cadmium, chromium, copper, nickel and BaP eq above background criteria
Southwest portion of the site	TP6	2.0 - 2.7 m bgl	Arsenic, chromium, nickel and BaP eq above background criteria
West portion of the site	TP7	1.5 – 2.0 m bgl	Arsenic, chromium, copper, lead and nickel above background criteria
		2.0 - 2.7 m bgl	Arsenic, chromium, copper, lead, nickel and BaP eq above background criteria
Northeast portion of the site	TP8	0.0 - 0.2 m bgl	Arsenic, chromium and nickel above background criteria

Area of Investigation	Sample Name	Depth of Sample Collected	Sample Analysis Result
		0.2 - 1.3 m bgl	Arsenic, chromium, nickel and BaP eq above background criteria Asbestos fibres in the soil above human health criteria Asbestos containing material positive for chrysotile (white asbestos), amosite (brown asbestos) and crocidolite (blue asbestos)
	TP09	0.0 - 0.3 m bgl	Arsenic, chromium, nickel and BaP eq above background criteria
		0.3 – 1.1 m bgl	Chromium, nickel and BaP eq above background criteria
		1.1 - 2.6 m bgl	Arsenic, chromium, nickel and BaP eq above background criteria
North portion of the site	TP10	0.0 - 0.3 m bgl	Arsenic, chromium, copper, lead, nickel and BaP eq above background criteria
		2.0 - 3.0 m bgl	Arsenic, chromium, nickel and BaP eq above background criteria
Middle portion of the site	TP11	0.2 - 0.6 m bgl	Arsenic, chromium, nickel and BaP eq above background criteria
Northwest portion of the site	TP12	0.0 - 0.2 m bgl	Arsenic, cadmium, chromium and nickel above background criteria
		0.2 - 1.1 m bgl	Arsenic, cadmium, chromium, copper, lead, nickel, zinc and BaP eq above background criteria

Area of Investigation	Sample Name	Depth of Sample Collected	Sample Analysis Result
		1.1 - 1.7 m bgl	Arsenic, cadmium, chromium, copper, lead, nickel, zinc and BaP eq above background criteria Asbestos fibres in the soil but below guideline criteria Asbestos containing material positive for chrysotile (white asbestos) and amosite (brown asbestos)
East portion of the site	TP13	0.3 – 0.5 m bgl	Arsenic, chromium, nickel and BaP eq above background criteria.
	TP14	0.3 – 0.5 m bgl	Arsenic, cadmium, chromium, copper, nickel and BaP eq above background criteria
		0.5 – 1.5 m bgl	Arsenic, chromium, nickel and BaP eq above background criteria
Centre portion of the site	TP15	1.0 - 2.5 m bgl	Arsenic, chromium, nickel and BaP eq above background criteria
North portion of the site	TP16	0.3 - 0.4 m bgl	Arsenic, chromium, copper, lead, nickel and BaP eq above background criteria
South portion of the site	TP17	0.3 - 0.4 m bgl	Arsenic, chromium and nickel above background criteria
South portion of the site	TP18	0.3 - 0.5 m bgl	BaP eq above background criteria
Centre portion of the site	TP19	0.3 - 0.5 m bgl	Chromium and nickel above background criteria

Area of Investigation	Sample Name	Depth of Sample Collected	Sample Analysis Result
East portion of the site	TP20	0.3 - 0.5 m bgl	BaP eq above background guideline criteria TPH concentrations in the carbon chain lengths C7-C9 and C10-C14 were below the laboratory detection limit. TPH C15-C36 was detected, but below adopted human health criteria.

7.2 Discussion

Table 4 shows that there were no exceedances of the commercial / industrial or recreational guideline criteria for heavy metals, PAHs and TPHs. The soil analysis results were also compared to regional background criteria, with all of the soils analysed exceeding background concentrations for several heavy metals and a subset of PAHs (represented as benzo (a) pyrene equivalents or “BaP eq”).

The soils analysis results show an exceedance of asbestos concentrations in the soils analysed from Test Pit 8 (TP08) at 1.3 m bgl, but no exceedance in the soils analysed from Test Pit 12 (TP12) at 1.7 m bgl. The two building materials analysed returned positive for asbestos fibres.

For the purpose of this investigation, ‘elevated concentrations’ are defined as above residential human health criteria. Although the end use is commercial / industrial, the site is near a drinking water protection zone, therefore a residential threshold was referenced to assess the potential risk associated with contaminants leaching to underlying groundwater. Elevated lead concentrations were detected at TP03 at 2.0 and TP12 at 1.1 and 1.7 m bgl. Elevated BaP eq concentrations were detected at TP05 at 2.0 m bgl, TP09 at 2.6 m bgl, and TP18 at 0.5 m bgl.

8 Conceptual Site Model

A conceptual site model consists of three primary components. For a contaminant to be considered a risk to human health or any environmental receptor, all three components are required to be present and connected. The three components of a conceptual site model are:

- Source of contamination;
- Receptors that may be exposed to the contamination; and
- An exposure route, where the receptor and contaminants come into contact (e.g. ingestion, inhalation, dermal contact).

The potential source, pathway, receptor linkages at this subject site during site works are provided in Table 5 below.

Table 5: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptor	Acceptable Risk?
Landfill materials	Heavy metals, PAHs and TPHs	Dermal contact with impacted soil Incidental ingestion Dust inhalation	On-site redevelopment construction workers Future subsurface maintenance workers and site Commercial / Industrial workers Surrounding environment	**Yes -** No exceedances of the adopted human health criteria identified.
Asbestos Containing Material	Asbestos fibres	Dust inhalation during and post-redevelopment earthworks	On-site redevelopment construction workers Future subsurface maintenance workers and site Commercial / Industrial workers	**No** - For soils excavated in the northeast where the asphalt milling storage occurred. **Yes** - For other parts of the site (refer to additional discussion in Section 0).
Asphalt millings storage	Petroleum hydrocarbon	Dermal contact with impacted soil, accidental ingestion and inhalation of dust during earthworks	On-site redevelopment construction workers Future subsurface maintenance workers and site Commercial / Industrial workers	**Yes -** The photo ionization detector (PID) did not show elevated readings, nor we did we observe any visual and / or olfactory indication of oils. In addition, the soil analysed from TPH in Test Pit 20 shows that none of the hydrocarbons chains are above the CoC guideline.

9 Conclusions and Recommendations

The results of this investigation show that chemical analytes were below the adopted human health soil contaminant standards for the site. However, asbestos at one location (Test Pit 8) exceeded the adopted human health criterion. Therefore, to make the site suitable for Commercial / Industrial use, soil in the northeast portion of the site, where the asphalt milling storage was identified, requires remediation. Material excavated from the balance of the site is suitable for re-use on the site as it meets Commercial / Industrial land use criteria.

The chemical soil results were also compared to regional background criteria, with heavy metals and BaP eq exceeding background criteria in all of the test pits. Therefore, material excavated from the site is not suitable for cleanfill disposal.

The majority of the soils across the site are considered suitable for disposal at Burwood Landfill as the soil contaminant concentrations were below the recreational land use criteria.

Acceptance of excavated material from the site should be confirmed with the landfill operator before any excavation is completed on-site. However, the soils excavated from the northeast, where the asphalt storage milling was identified, are not suitable for Burwood landfill due to the presence of asbestos. These soils must be disposed at a facility capable of accepting asbestos fibres above guideline criteria.

Although chemical contaminants were detected below the adopted human health criteria, elevated lead levels were found at TP03 at 2.0, TP12 at 1.1 and 1.7 m bgl. Additionally, elevated BaP eq levels were found at TP05 at 2.0 m bgl, TP09 at 2.6 m bgl, and TP18 at 0.5 m bgl. For both of these contaminants, “elevated” was defined as being above the residential human health criteria.

It is our understanding that the soils from the above locations/depths are to remain on-site. As the site is near a drinking water protection zone, we recommend a toxicity characteristic leaching procedure (TCLP) test is carried out on a subset of the samples mentioned above to assess the potential for contaminants to leach to underlying groundwater.

Given the presence of asbestos above the adopted human health criterion, land disturbance associated with site redevelopment is likely to be considered a restricted discretionary activity under Regulation 10 of the NES. During the detailed design phase of the redevelopment process, the volume of soil disturbance should be checked to confirm the NES is triggered.

The triggering of the NES may occur if:

- The volume of soil to be disturbed is greater than 25 m^3 per 500 m^2 ; or
- More than 5 m^3 per 500 m^2 per year is to be removed from the site.

Regardless of the volume to be disturbed, a Site Management Plan (SMP) should be prepared for the site works to help manage the risks to the site redevelopment workers and the surrounding environment. The SMP shall include procedures should additional contamination (e.g. asbestos) be encountered during the site works.

10 References

Canterbury Regional Council, 2007: Background Concentrations of Selected Trace Elements in Canterbury Soils. Addendum 1: Additional Samples and Timaru Specific Background Levels. Forsyth, P.J.; Barrell, D.J.A; Jongens, R. (Institute of Geological and Nuclear Sciences) 2008: Sheet 16 - Geology of the Christchurch Area 1:250,000.

ENGEO, 2016: Preliminary Environmental Site Investigation of 711 Johns Road, Belfast, Christchurch (our reference: 13396.000.000_02).

Ministry for the Environment, 2011. Contaminated Land Management Guidelines No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values.

Ministry for the Environment, 2012: User's Guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health, April 2012.

Western Australia Department of Health, 2009: Guideline for the Assessment, Remediation and Management of Asbestos – Contaminated Sites in Western Australia.

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, McCracken and Associates 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 IPENZ / ACENZ Standard Terms of Engagement.

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

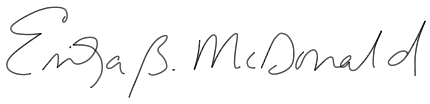
We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by

Carolina Winter

Environmental Scientist

Report reviewed by



Erika McDonald, MIPENZ

Associate Environmental Engineer

Sean Freeman

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APPENDIX 1:

Sample Location Map

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Date	June 2017	**Client**	**McCracken & Associates Ltd**		
Drawn by	CW	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	EM	**Description**	**Sample Location Map**		
Scale	NTS	**Figure Number**	1	**Project Number**	13396

APPENDIX 2:

Laboratory Results

Hill Laboratories
TRIED, TESTED AND TRUSTED

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ANALYSIS REPORT

Client:	Engeo Limited	**Lab No:**	1778727 SPv1
Contact:	Carolina Winter	**Date Received:**	19-May-2017
	C/- Engeo Limited	**Date Reported:**	06-Jun-2017
	PO Box 373	**Quote No:**	82742
	Christchurch 8140	**Order No:**	
		Client Reference:	711JR-19052017
		Submitted By:	Sean Freeman

Sample Type: Soil

Sample Name:		TP01@ 1.7 19-May-2017	TP02@ 1.0 19-May-2017	TP02@ 2.5 19-May-2017	TP03@ 0.5 19-May-2017	TP03@ 2.0 19-May-2017
Lab Number:		1778727.1	1778727.2	1778727.3	1778727.4	1778727.5
Individual Tests						
Dry Matter	g/100g as rcvd	93	94	90	89	89
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	5	4	7	6
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.15	0.33
Total Recoverable Chromium	mg/kg dry wt	15	16	15	18	16
Total Recoverable Copper	mg/kg dry wt	11	14	10	22	33
Total Recoverable Lead	mg/kg dry wt	37	41	21	133	260
Total Recoverable Nickel	mg/kg dry wt	13	17	15	16	14
Total Recoverable Zinc	mg/kg dry wt	83	58	48	132	270
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	0.04	0.13	0.13	< 0.03
Acenaphthylene	mg/kg dry wt	0.11	0.41	0.81	0.30	0.06
Anthracene	mg/kg dry wt	0.17	0.42	1.76	0.69	0.20
Benzo[a]anthracene	mg/kg dry wt	0.79	2.9	6.2	2.3	0.54
Benzo[a]pyrene (BAP)	mg/kg dry wt	1.11	4.0	6.3	3.0	1.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	1.22	4.4	7.0	3.4	1.00
Benzo[g,h,i]perylene	mg/kg dry wt	0.92	2.5	3.3	1.91	0.69
Benzo[k]fluoranthene	mg/kg dry wt	0.55	1.76	3.0	1.41	0.44
Chrysene	mg/kg dry wt	0.73	2.3	4.6	1.76	0.60
Dibenzo[a,h]anthracene	mg/kg dry wt	0.16	0.48	0.75	0.36	0.13
Fluoranthene	mg/kg dry wt	1.87	4.8	11.8	4.9	1.58
Fluorene	mg/kg dry wt	0.02	0.07	0.36	0.24	0.04
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.97	2.9	4.1	2.2	0.76
Naphthalene	mg/kg dry wt	< 0.12	< 0.12	< 0.13	< 0.13	< 0.13
Phenanthrene	mg/kg dry wt	0.92	1.20	7.3	2.8	0.60
Pyrene	mg/kg dry wt	1.89	5.2	11.0	4.6	1.81

Sample Name:		TP05@ 2.0 19-May-2017	TP06@ 2.7 19-May-2017	TP07@ 1.5 19-May-2017	TP07@ 2.7 19-May-2017	TP08@ 0.2 19-May-2017
Lab Number:		1778727.6	1778727.7	1778727.8	1778727.9	1778727.10
Individual Tests						
Dry Matter	g/100g as rcvd	91	87	89	94	95
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	7	4	6	8	5
Total Recoverable Cadmium	mg/kg dry wt	0.12	< 0.10	0.11	0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	17	16	18	18	15
Total Recoverable Copper	mg/kg dry wt	25	13	18	23	10
Total Recoverable Lead	mg/kg dry wt	59	29	38	75	31

Sample Type: Soil						
Sample Name:		TP05@ 2.0 19-May-2017	TP06@ 2.7 19-May-2017	TP07@ 1.5 19-May-2017	TP07@ 2.7 19-May-2017	TP08@ 0.2 19-May-2017
Lab Number:		1778727.6	1778727.7	1778727.8	1778727.9	1778727.10
Heavy Metals, Screen Level						
Total Recoverable Nickel	mg/kg dry wt	15	18	15	17	12
Total Recoverable Zinc	mg/kg dry wt	85	53	66	92	63
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	0.30	0.19	< 0.03	0.15	< 0.03
Acenaphthylene	mg/kg dry wt	0.7	0.44	< 0.03	0.33	0.04
Anthracene	mg/kg dry wt	2.5	1.36	0.07	1.04	0.12
Benzo[a]anthracene	mg/kg dry wt	7.9	3.5	0.28	5.2	0.33
Benzo[a]pyrene (BAP)	mg/kg dry wt	7.5	5.7	0.51	6.5	0.49
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	10.8	5.9	0.50	7.3	0.48
Benzo[g,h,i]perylene	mg/kg dry wt	4.1	3.8	0.39	4.1	0.29
Benzo[k]fluoranthene	mg/kg dry wt	3.7	2.5	0.23	3.1	0.22
Chrysene	mg/kg dry wt	6.6	3.3	0.27	4.5	0.30
Dibenzo[a,h]anthracene	mg/kg dry wt	0.95	0.76	0.06	0.76	0.06
Fluoranthene	mg/kg dry wt	25	7.7	0.74	9.3	0.79
Fluorene	mg/kg dry wt	0.74	0.42	< 0.03	0.39	0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	5.0	4.3	0.41	4.7	0.34
Naphthalene	mg/kg dry wt	0.18	0.25	< 0.13	0.25	< 0.12
Phenanthrene	mg/kg dry wt	12.0	4.8	0.29	3.2	0.38
Pyrene	mg/kg dry wt	20	6.9	0.71	8.9	0.72

Sample Name:		TP08@ 1.3 19-May-2017	TP09@ 0.3 19-May-2017	TP09@ 0.8 19-May-2017	TP09@ 2.6 19-May-2017	TP010@ 0.3 19-May-2017
Lab Number:		1778727.11	1778727.12	1778727.13	1778727.14	1778727.15
Individual Tests						
Dry Matter	g/100g as rcvd	90	95	93	93	91
Total Recoverable Cadmium	mg/kg dry wt	-	-	< 0.10	-	-
Total Recoverable Zinc	mg/kg dry wt	-	-	69	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	5	3	5	11
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	-	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	17	15	15	17	15
Total Recoverable Copper	mg/kg dry wt	13	13	13	13	15
Total Recoverable Lead	mg/kg dry wt	26	31	32	28	67
Total Recoverable Nickel	mg/kg dry wt	17	11	12	17	12
Total Recoverable Zinc	mg/kg dry wt	60	60	-	61	85
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	0.07	0.06	0.32	1.62	0.24
Acenaphthylene	mg/kg dry wt	0.20	0.07	0.7	0.7	0.55
Anthracene	mg/kg dry wt	0.47	0.31	2.2	3.2	1.55
Benzo[a]anthracene	mg/kg dry wt	2.1	0.92	5.2	5.9	3.9
Benzo[a]pyrene (BAP)	mg/kg dry wt	3.0	1.32	7.1	7.4	3.9
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	3.3	1.42	9.1	10.1	4.3
Benzo[g,h,i]perylene	mg/kg dry wt	1.98	0.87	4.6	4.7	2.0
Benzo[k]fluoranthene	mg/kg dry wt	1.44	0.65	3.6	3.7	2.0
Chrysene	mg/kg dry wt	1.83	0.77	5.1	5.4	3.2
Dibenzo[a,h]anthracene	mg/kg dry wt	0.34	0.15	0.92	1.02	0.53
Fluoranthene	mg/kg dry wt	4.5	2.0	14.5	18.0	8.4
Fluorene	mg/kg dry wt	0.19	0.09	0.76	2.8	0.71
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	2.3	0.95	5.3	5.5	2.4
Naphthalene	mg/kg dry wt	0.20	< 0.12	< 0.12	0.83	0.19
Phenanthrene	mg/kg dry wt	1.51	1.02	6.9	11.4	7.0
Pyrene	mg/kg dry wt	4.2	1.77	12.4	15.5	7.8

Sample Type: Soil						
Sample Name:		TP010@ 3.0 19-May-2017	TP011@ 0.6 19-May-2017	TP012@ 0.2 19-May-2017	TP012@ 1.1 19-May-2017	TP012@ 1.7 19-May-2017
Lab Number:		1778727.16	1778727.17	1778727.18	1778727.19	1778727.20
Individual Tests						
Dry Matter	g/100g as rcvd	85	93	91	87	82
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	7	6	8	10	12
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	0.13	0.46	0.77
Total Recoverable Chromium	mg/kg dry wt	15	16	16	18	21
Total Recoverable Copper	mg/kg dry wt	11	10	12	25	25
Total Recoverable Lead	mg/kg dry wt	31	33	44	390	230
Total Recoverable Nickel	mg/kg dry wt	12	13	12	15	16
Total Recoverable Zinc	mg/kg dry wt	56	54	78	410	600
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	0.16	0.08	< 0.03	0.11	0.05
Acenaphthylene	mg/kg dry wt	0.19	0.18	0.06	0.19	0.08
Anthracene	mg/kg dry wt	1.09	0.43	0.16	0.68	0.33
Benzo[a]anthracene	mg/kg dry wt	1.53	1.20	0.47	1.32	0.59
Benzo[a]pyrene (BAP)	mg/kg dry wt	1.51	1.81	0.59	1.72	0.77
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	1.60	1.91	0.65	1.75	0.72
Benzo[g,h,i]perylene	mg/kg dry wt	0.69	1.09	0.34	0.93	0.40
Benzo[k]fluoranthene	mg/kg dry wt	0.73	0.77	0.29	0.82	0.35
Chrysene	mg/kg dry wt	1.31	1.02	0.40	1.17	0.51
Dibenzo[a,h]anthracene	mg/kg dry wt	0.19	0.23	0.07	0.21	0.09
Fluoranthene	mg/kg dry wt	4.1	2.8	1.21	3.3	1.50
Fluorene	mg/kg dry wt	0.60	0.15	0.06	0.40	0.19
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.87	1.27	0.39	1.11	0.47
Naphthalene	mg/kg dry wt	0.18	< 0.12	< 0.12	0.14	< 0.13
Phenanthrene	mg/kg dry wt	4.7	1.35	0.71	2.6	1.21
Pyrene	mg/kg dry wt	3.3	2.5	1.01	2.8	1.34

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.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
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	1-20
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]	0.010 - 0.05 mg/kg dry wt	1-20
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	1-20
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	13
Total Recoverable Cadmium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, Interference removal by Kinetic Energy Discrimination, ICP-MS, screen level. US EPA 200.2.	0.10 mg/kg dry wt	13
Total Recoverable Zinc	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, Interference removal by Kinetic Energy Discrimination, ICP-MS, screen level. US EPA 200.2.	4 mg/kg dry wt	13

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 report must not be reproduced, except in full, without the written consent of the signatory.

Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental

Job No: 177 8727
Date Recv: 19-May-17 17:31
Received by: Cristina Prats Bellmun
3117787271

ENVIRONMENTAL Analysis Request Form

Hill Laboratories

R J Hill Laboratories Limited — accredited by International Accreditation NZ

1 Clyde Street, Private Bag 3205,
Telephone: +64 (7) 858-2000
Facsimile: +64 (7) 858-2001

Hill Laboratories

CLIENT

Name: ENGEO Ltd. [160117]
PO Box 373
Christchurch 8140

Phone: 03 328 9012 Fax:

Client Reference: 711JR-19052017 (Project Code)

Quote Number: Order No: (Cost Centre)

Hill Laboratories office use only:
Date In | Job # | No. of Samples

Submitted By S. Freeman

Charge To: ENGEO. [160117]

RESULTS TO ☐ Mail Client ☐ Mail Submitter
☐ Fax Results
X Email Results drobotham@engeo.co.nz

✠ C.O.C & coversheet to be scanned and emailed back

Additional Information

Chain of Custody Record

Delivered to Hill Laboratories (Depatched by)	Date & Time: Name: Signature:
Received at Hill Laboratories	Date & Time: Name: Signature:
Condition ☐ Ambient Temp ☑ Chilled 15.6 °C	

PRIORITY ☐ **Normal** (up to 10 days) ✠ **High** (approx 5 days) ☐ **Urgent** (MUST be pre-arranged)
Results required by: .....

Sample types

GW	Bore/well	**TW**	Trade waste	**S**	Saline water	**ES**	Soil/Solid	**Pl**	Plant
SW	Surface water	**E**	Effluent	**O**	Oil	**Sed**	Sediment	**BM**	Fish/shellfish/Biota
P	Potable/DI	**L**	Leachate	**Sl**	Sludge	**BS**	Biosolid	**M**	Misc (Specify)

Site ID	Sample type	Tests required	Comments
TP01@1.7	Soil	Heavy Metals, PAH's	Cold Hold
TP02@1.0			
" @2.5			
TP03@0.5			
" @2.0			
TP05@2.0			
TP06@2.7			
TP07@1.5			
" @2.7			
TP08@0.2			
" @1.3			
TP09@0.3			
" @0.8			
" @2.6			

ENVIRONMENTAL Analysis Request Form

CLIENT

Name ENGEO Ltd. [160117]

PO Box 373

Christchurch 8140

Phone: 03 328 9012 Fax:

Client Reference: 711JR-19052017 (Project Code)

Quote Number: Order No: (Cost Centre)

RESULTS TO

☐ Mail Client ☐ Mail Submitter

☐ Fax Results

X Email Results drobothan@engeo.co.nz

Additional Information

Hill Laboratories

R J Hill Laboratories Limited — accredited by International Accreditation NZ

1 Clyde Street, Telephone: +64 (7) 858-2000

Private Bag 3205, Facsimile: +64 (7) 858-2001

Hill Laboratories office use only:

Date In Job # No. of Samples

Submitted By S. Freeman

Charge To: ENGEO. [160117]

✠ C.O.C & coversheet to be scanned and emailed back

Chain of Custody Record

Delivered to Hill Laboratories (Depatched by)	Date & Time: Name: Signature:
Received at Hill Laboratories	Date & Time: Name: Signature:
Condition ☐ Ambient Temp ☐ Chilled ____ °C	

PRIORITY ☐ **Normal** (up to 10 days) ✠ **High** (approx 5 days) ☐ **Urgent** (MUST be pre-arranged)

Results required by: .....

Sample types

GW	Bore/well	**TW**	Trade waste	**S**	Saline water	**ES**	Soil/Solid	**Pl**	Plant
SW	Surface water	**E**	Effluent	**O**	Oil	**Sed**	Sediment	**BM**	Fish/shellfish/Biota
P	Potable/DI	**L**	Leachate	**Sl**	Sludge	**BS**	Biosolid	**M**	Misc (Specify)

Site ID	Sample type	Tests required	Comments
TP1@0.3	Soil	Heavy Metals, PAHs	Cold hold
" @ 3.0			
TP1@0.6			
TP2@0.2			
" @ 1.1			
" @ 1.7			

Page 2

KB Item: Version: 1

Hill Laboratories
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Hamilton 3240 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

ANALYSIS REPORT

Client:	Engeo Limited	**Lab No:**	1781183	SPv1
Contact:	Carolina Winter	**Date Received:**	25-May-2017	
	C/- Engeo Limited	**Date Reported:**	01-Jun-2017	
	PO Box 373	**Quote No:**	85411	
	Christchurch 8140	**Order No:**		
		Client Reference:	13396.000.000	
		Submitted By:	Carolina Winter	

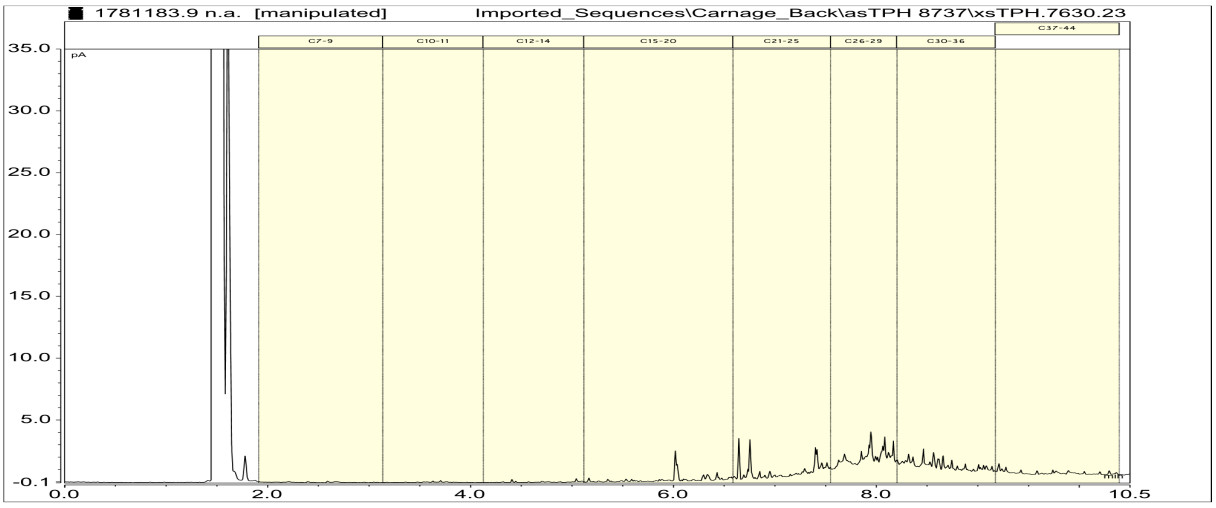
Sample Type: Soil

		Sample Name:	JR_TP13_0.5mbg | 22-May-2017	JR_TP14_0.3mbg | 22-May-2017	JR_TP14_1.5mbg | 22-May-2017	JR_TP15_2.5mbg | 22-May-2017	JR_TP16_0.4mbg | 22-May-2017
		Lab Number:	1781183.1	1781183.2	1781183.3	1781183.4	1781183.5
Individual Tests							
Dry Matter	g/100g as rcvd		91	88	85	87	90
Heavy Metals, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		4	4	6	17	9
Total Recoverable Cadmium	mg/kg dry wt		< 0.10	0.15	< 0.10	< 0.10	0.14
Total Recoverable Chromium	mg/kg dry wt		15	14	16	15	17
Total Recoverable Copper	mg/kg dry wt		13	16	14	10	15
Total Recoverable Lead	mg/kg dry wt		34	46	31	28	75
Total Recoverable Nickel	mg/kg dry wt		14	11	14	14	13
Total Recoverable Zinc	mg/kg dry wt		72	99	66	57	103
Polycyclic Aromatic Hydrocarbons Screening in Soil							
Acenaphthene	mg/kg dry wt		0.04	0.06	0.08	0.06	< 0.03
Acenaphthylene	mg/kg dry wt		0.25	0.47	0.18	0.25	0.19
Anthracene	mg/kg dry wt		0.36	0.44	0.41	0.39	0.30
Benzo[a]anthracene	mg/kg dry wt		1.67	2.8	1.44	1.64	1.36
Benzo[a]pyrene (BAP)	mg/kg dry wt		2.3	4.0	1.86	2.1	1.63
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt		2.7	4.9	2.2	2.5	2.0
Benzo[g,h,i]perylene	mg/kg dry wt		1.58	2.8	1.27	1.22	1.05
Benzo[k]fluoranthene	mg/kg dry wt		1.10	1.96	0.91	0.99	0.83
Chrysene	mg/kg dry wt		1.74	2.7	1.37	1.48	1.23
Dibenzo[a,h]anthracene	mg/kg dry wt		0.30	0.55	0.24	0.25	0.21
Fluoranthene	mg/kg dry wt		3.3	4.1	2.9	3.1	2.7
Fluorene	mg/kg dry wt		0.08	0.09	0.12	0.13	0.04
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt		1.77	3.1	1.37	1.41	1.16
Naphthalene	mg/kg dry wt		< 0.12	< 0.13	0.15	0.15	< 0.13
Phenanthrene	mg/kg dry wt		1.39	1.26	1.19	1.49	0.87
Pyrene	mg/kg dry wt		3.4	4.4	3.0	3.5	2.6

		Sample Name:	JR_TP17_0.4mbg | 22-May-2017	JR_TP18_0.5mbg | 22-May-2017	JR_TP19_0.5mbg | 22-May-2017	JR_TP20_0.5mbg | 22-May-2017	
		Lab Number:	1781183.6	1781183.7	1781183.8	1781183.9	
Individual Tests							
Dry Matter	g/100g as rcvd		-	86	-	90	-
Heavy Metals, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		7	-	3	-	-
Total Recoverable Cadmium	mg/kg dry wt		< 0.10	-	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt		14	-	14	-	-
Total Recoverable Copper	mg/kg dry wt		11	-	8	-	-
Total Recoverable Lead	mg/kg dry wt		28	-	34	-	-

Sample Type: Soil						
Sample Name:		JR_TP17_0.4mbg l 22-May-2017	JR_TP18_0.5mbg l 22-May-2017	JR_TP19_0.5mbg l 22-May-2017	JR_TP20_0.5mbg l 22-May-2017	
Lab Number:		1781183.6	1781183.7	1781183.8	1781183.9	
Heavy Metals, Screen Level						
Total Recoverable Nickel	mg/kg dry wt	11	-	11	-	-
Total Recoverable Zinc	mg/kg dry wt	52	-	44	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	-	2.3	-	0.05	-
Acenaphthylene	mg/kg dry wt	-	3.4	-	0.32	-
Anthracene	mg/kg dry wt	-	17.0	-	0.56	-
Benzo[a]anthracene	mg/kg dry wt	-	34	-	1.58	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	41	-	1.45	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	-	47	-	1.75	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	18.5	-	0.83	-
Benzo[k]fluoranthene	mg/kg dry wt	-	19.8	-	0.66	-
Chrysene	mg/kg dry wt	-	32	-	1.20	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	5.4	-	0.19	-
Fluoranthene	mg/kg dry wt	-	97	-	2.9	-
Fluorene	mg/kg dry wt	-	4.6	-	0.16	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	29	-	0.95	-
Naphthalene	mg/kg dry wt	-	1.11	-	< 0.12	-
Phenanthrene	mg/kg dry wt	-	74	-	2.2	-
Pyrene	mg/kg dry wt	-	73	-	2.5	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	-	-	< 8	-
C10 - C14	mg/kg dry wt	-	-	-	< 20	-
C15 - C36	mg/kg dry wt	-	-	-	210	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	-	210	-

1781183.9
JR_TP20_0.5mbgl 22-May-2017
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.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Client Chromatogram for TPH by FID*	.	-	9

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.010 - 60 mg/kg dry wt	9
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	1-6, 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]	0.010 - 0.05 mg/kg dry wt	1-5, 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	1-5, 7, 9

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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Job No: 178 1183 Date Recv: 25-May-17 06:06
Received by: Chloe Vedder
3117811830

Hill Laboratories
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ANALYSIS REQUEST

R J Hill Laboratories Limited
1 Clyde Street Hamilton 3216
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

Office use only (Job No)

Quote No 85411

Primary Contact Carolina Winter 201203

Submitted By Carolina Winter 201203

Client Name Engeo Limited 160117

Address PO Box 373, Christchurch 8140

Phone 03 328 9012 *Mobile*

Email

Charge To Engeo Limited 160117

Client Reference 13396.000.000

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:* 24/5/17
☐ *Tick if you require COC to be emailed back* *Name:* Carolina Winter
Signature: C. Winter

Received at Hill Laboratories *Date & Time:* 25/5/17 1138
Name: Jason M
Signature:

Condition *Temp:* 8.5
☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked
Signature:

Priority ☐ Low ☐ Normal ☑ High
☐ **Urgent** (ASAP, extra charge applies, please contact lab first)
NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 4 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types

Soil (Soil)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	JR_TP13_0.5mbgl	22/5/17	Soil	Heavy metals
2	"	"		PAHs
3	JR_TP14_0.3mbgl			Heavy metals
4	"			PAHs
5	JR_TP14_1.5mbgl			Heavy metals
6	"			PAHs
7	JR_TP15_2.5mbgl			Heavy metals
8	"			PAHs
9	JR_TP16_0.4mbgl			Heavy metals
10	"			PAHs

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

R J Hill Laboratories Limited
1 Clyde Street Hamilton 3216
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

Office use only (Job No)

Quote No 85411

Primary Contact Carolina Winter 201203

Submitted By Carolina Winter 201203

Client Name Engeo Limited 160117

Address PO Box 373, Christchurch 8140

Phone 03 328 9012 *Mobile*

Email

Charge To Engeo Limited 160117

Client Reference 13396.000.000

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

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories
☐ Tick if you require COC to be emailed back
Date & Time: Carolina Winter
Name: C. Winter
Signature: 24/5/17

Received at Hill Laboratories
Date & Time:
Name:
Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen
Temp:

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION

Priority ☐ Low ☐ Normal ☑ High
☐ **Urgent** (ASAP, extra charge applies, please contact lab first)

NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 4 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types

Soil (Soil)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	JR_TP17_0.4mbgl	22/5/17	soil	Heavy metals
2	JR_TP18_0.5mbgl			PAHs
3	JR_TP19_0.5mbgl			Heavy metals
4	JR_TP20_0.5mbgl			PAHs + TPH
5				
6				
7				
8				
9				
10				

Date: Monday 29th May 2017

Client Reference: N/A

ENGEO
124 Montreal Street
Sydenham
Christchurch, 8023

EIAG Reference No: E04605

For the Attention of: Sean Freeman

Dear Sean,

Re: 13396_711JR_19052017

Test Method – EIAG001: Polarised light microscopy including dispersion staining in accordance with the Australian Standard AS4964-2004 "Method for the qualitative identification of asbestos in bulk samples".

Where material weights passed through a 7mm and 2mm sieve and greater than 100g, representative sub samples of 50g were taken by cone and quartering using EIAG's in house method in accordance with the Australian Standard AS4964-2004. Subsamples were weighed.

Asbestos is reported as weight (g) found in each sample/sub sample. Where asbestos has been identified it has been broken down into three categories in accordance with "Guidelines for the Assessment Remediation and Management of Asbestos-Contaminated Sites in Western Australia May 2009".

Identified asbestos is reported as either
ACM- Asbestos Containing Material
FA- Fibrous Asbestos
AF- Asbestos Fines

The samples in this report are reported 'As Received'. The Environmental and Industrial Analysis Group does not take responsibility for the sampling procedure or accuracy of sample location description as these have been provided by the client.

Four samples were received on Wednesday 24th May 2017. The samples were taken from 13396_711JR_19052017.

The fibre identification analysis results are presented in the appended table.

Should you require further information please contact Belinda Hughes.

Yours sincerely

BHughes

……..
Belinda Hughes
Key Technical Person
ENVIRONMENTAL AND INDUSTRIAL ANALYSIS GROUP

IANZ ACCREDITED LABORATORY ACCREDITATION Nº: 1115

EIAG ENVIRONMENTAL & INDUSTRIAL ANALYSIS GROUP

ASBESTOS ANALYSIS REPORT

Monday 29th May 2017 **Reference No: E04605**

Laboratory Reference No.	Client Sample No.	Sampling Address/Sampling Location/Description/Dimensions	Fibre Identification Analysis Results
E04605.1	TP08 @ 1.3 - BM	13396_711JR_19052017 TP08@1.3 – BM, Cement White painted cement with brown particulate attached Sample weight: 47.12 g	**Chrysotile (White Asbestos)** **Amosite (Brown Asbestos)** **Crocidolite (Blue Asbestos)** Organic Fibres
E04605.2	TP08 @ 1.3 - Soil	13396_711JR_19052017 TP08 @ 1.3, Soil	
		>7 mm Sample weight: 472.65 g	**Chrysotile (White Asbestos)** **Amosite (Brown Asbestos)** **Crocidolite (Blue Asbestos)** Organic Fibres ACM cement weight: 6.6295 g AF weight: 0.0001 g
		7-2 mm (Sample weight: 152.81 g) Sub sample weight: 51.59 g	**Chrysotile (White Asbestos)** **Amosite (Brown Asbestos)** **Crocidolite (Blue Asbestos)** Organic Fibres ACM cement weight: 0.0029 g AF weight: 0.0001 g
		<2mm (Sample weight: 147.21 g) Sub sample weight: 49.85 g	**Chrysotile (White Asbestos)** **Amosite (Brown Asbestos)** **Crocidolite (Blue Asbestos)** Organic Fibres AF weight: 0.0003 g
		Total sample weight: 772.67 g	

IANZ ACCREDITED LABORATORY ACCREDITATION No: 1115

EIAG ENVIRONMENTAL & INDUSTRIAL ANALYSIS GROUP

ASBESTOS ANALYSIS REPORT

Monday 29th May 2017 **Reference No: E04605**

Laboratory Reference No.	Client Sample No.	Sampling Address/Sampling Location/Description/Dimensions	Fibre Identification Analysis Results
E04605.3	TP12 @ 1.7 - BM	13396_711JR_19052017 TP12@1.7 – BM, Cement White painted cement with brown particulate attached Sample weight: 31.69 g	**Chrysotile (White Asbestos)** **Amosite (Brown Asbestos)** Organic Fibres
E04605.4	TP12 @ 1.7 - Soil	13396_711JR_19052017 TP12 @ 1.7, Soil	
		>7 mm Sample weight: 452.47 g	**Chrysotile (White Asbestos)** Organic Fibres AF weight: 0.0002 g
		7-2 mm (Sample weight: 183.16 g) Sub sample weight: 51.72 g	Organic Fibres No Asbestos Detected
		<2mm (Sample weight: 96.16 g) Sub sample weight: 51.33 g	Organic Fibres No Asbestos Detected
		Total sample weight: 731.79 g	

Note: **The results contained in this report relate specifically to the samples submitted.**

Reporting limit is 0.1g/kg as per the AS4964-2004.

This report is consistent with the Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia – May 2009.

Reporting raw asbestos weights within soil samples is outside of EIAG's IANZ accreditation.

Identified By:

……
Belinda Hughes PgDip (Envr)
Laboratory Technician

Reviewed By:

……
Jessica Campbell BSc (Geol & Geog)
Laboratory/ Quality Manager

ANNEXURE E:

GROUND CONTAMINATION ASSESSMENT

10 February 2017

Kim McCracken
McCracken and Associates Ltd
PO Box 2551
Christchurch 8140

Dear Kim

RE: Preliminary Environmental Site Investigation of 711 Johns Road, Belfast, Christchurch (Our Reference: 13396.000.000_03)

1 Introduction

ENGEO Ltd was requested by McCracken and Associates Ltd to undertake a Preliminary Environmental Site Investigation of the property (herein referred to as 'the site') at 711 Johns Road, Belfast, Christchurch (ref. P2016.000.638). The purpose of the assessment was to perform a desktop study of the site in order to provide recommendations for future environmental site investigation activities. Our scope of works does not include a physical site inspection or sample collection and analysis.

1.1 Objectives of the Assessment

The objectives of this assessment 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 and identified environmental receptors

1.2 Approach

To satisfy the objectives, ENGEO gathered 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.

2 Site Description

The approximately 13.2 hectare site, with the legal identifier Section 1 SO 455212, is located in Belfast, Christchurch on relatively flat land with scattered stockpiled and bunded soil and debris. There is currently one structure on the site: a small shed on the eastern edge.

Site information is summarised in Table 1, and the site setting is summarised in Table 2.

Table 1: Site Information

Item	Description
Location	711 Johns Road, Belfast, Christchurch
Legal Description	Section 1 SO 455212
Property Owner	Kailua Limited
Current Land Use	Vacant
Proposed Land Use	Commercial
Site Area	13.2 ha
Zoning	Rural 5 (Airport Influences)

Table 2: Site Setting

Item	Description
Topography	The site is generally flat with an elevation of approximately 29 m above sea level. Sporadic stockpiles and depressions are located throughout the site.
Local Setting	In a mixed use area consisting of industrial (north), agricultural (east and west), and residential (south).
Nearest Surface Water & Use	Lake Roto Kohatu, used for recreation, is located 900 m northeast of the Property. The intermittent Styx River is located 900 m southeast of the Property.

2.1 Geology and Hydrogeology

The documented geology and hydrogeology of the site and surrounding area is summarised in Table 3 below.

Table 3: Geology and Hydrogeology

Item	Description
Geology[5]	Maps published by the Institute of Geological and Nuclear Sciences for the locality indicate that the site is underlain by alluvial gravel, sand and silt of historic river flood channels (Forsyth, 2008).
Hydrogeology[6]	The Christchurch groundwater system is a multi-layer, unconfined to confined aquifer system. The aquifers are composed of coarse sandy gravel sheets deposited during successive glacial and interglacial periods. Shallow groundwater in the unconfined alluvial aquifer of the Christchurch Formation is typically inferred towards the east to south east in the Christchurch region. The ECan GIS depicts the piezometric contours in the area of the site in an easterly direction. According to the ECan GIS Viewer, a nearby well (adjacent south east of the site) has reported depth to groundwater at approximately 4.7 metres below ground level (bgl).
Groundwater Abstractions[6]	The following supply wells are located within a 150 m radius of the site: M35/1718 Domestic Supply (30 m south) BX24/0011 Domestic Supply (15 m southeast) M35/2574 Domestic Supply (55 m southeast) M35/10911 Domestic Supply (70 m southeast) M35/2020 Domestic Supply (120 m south)
Discharge Consents[6]	There are no documented active discharge consents on or within 100 meters of the subject site.

2.2 Groundwater and Surface Water Sensitivity

An assessment to establish whether the shallow groundwater aquifer below the site is a ‘sensitive aquifer’ as defined by the Ministry for Environment (MfE) Guidelines, (2011) has been undertaken (Refer to Table 4 below). 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 Module 5.2.3 of the MfE Guidelines.

Table 4: Groundwater and Surface Water Sensitivity

Criteria	Assessment
The aquifer is not artesian or confined; and	**Yes**. The ECan GIS indicates the site is located upon an unconfined / semi-confined aquifer.
The aquifer is expected to be less than 10 m below the potential suspected source of impact; and	**Yes**. Groundwater in the area is anticipated to be between 4 m and 5 m below the ground surface.
The aquifer is of 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; or	**Yes.** Several wells in the immediate vicinity of the site are used for domestic 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.** No surface water receptors within 100 m of site**.**
Sensitivity Assessment	Based on the above, the shallow aquifer is considered to be **sensitive**.

Groundwater is considered to be sensitive in relation to the MfE sensitive aquifer assessment. Based on ENGEO's experience in the Canterbury Region, ECan has indicated that discharges to shallow groundwater above potable criteria are not a permitted activity according to Rule WQL47 of the NRRP. Section 15 of the Resource Management Act prohibits the discharge of contaminants to groundwater unless specifically allowed for in a regional plan rule.

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 CCC Property File Review

The property file for the site held by CCC was reviewed by ENGEO on 29 September 2016 as part of this Preliminary Site Investigation (PSI). A number of records documented the use of the site from the year 1995 onwards. The relevant and applicable findings in relation to our environmental assessment of this search have been summarised in Table 5.

Table 5: Review of CCC Property File

Date	Description
26 May 1995	Consent (CRC951068) to deposit inert fill. Conditions include installation and sampling of a down-gradient monitoring well, and mandatory record-keeping of all material deposited on site.
3 February 2005	Change in conditions to water permit to take and use water for domestic and industrial purposes (CO6C/12334).
15 May 2008	Proposed Site Plan (Golder Associates) showing locations of storage areas on site.
August 2008	Environmental Health Comments on Consent Application (RMA 92012448) No more than 2000 litres of diesel shall be stored at the site.
5 February 2009	Resource Consent Application (RMA 92012448). Application for consent to store materials, including screened soil, bark mulching, asphalt millings, crushed concrete, and gravel. Additionally, earthen bunds will be built along the edges of the property as visual and audible buffers. The application notes that the former quarry is currently being backfilled with allegedly clean fill, but no documentation of the fill is included.
25 February 2009	Retrospective Consent granted for Resource Consent Application RMA 92012448.
20 July 2009	Christchurch City Council Land Information Memorandum (LIM70108666). This memorandum “contains all the information known to the Christchurch City Council to be relevant to the land”. Information includes: 1) Council has issued a license to dispose of Clean Fill on this property. 2) The property is located in an area known to have been filled with undocumented material comprising Hardfill and Organic Material. 3) The property is not connected to a reticulated water supply.
20 December 2013	Johns Road, Harewood, Christchurch - Preliminary Site Investigation (Beca Ltd). Limited groundwater and stockpile samples at the site in 2013 demonstrated contaminant concentrations below thresholds of concern.
15 January 2014	Application for Resource Consent (Beca Ltd) Application for consent to widen Johns Road, adjacent north of the property. 1, 7, and 11 Nathan Place, adjacent north of the property, are identified as listed for HAIL activities including storage of fuel and chemicals, abrasive blasting, and landfill activities. 11 Nathan Place is also listed as a location for transport depots, concrete manufacture, and bulk storage. The site at 711 Johns Road is legally described as Pt RES 323. Groundwater at the site is approximately 4 m bgl, and the underlying aquifer has been determined to be sensitive due to both abstractions in the area and recharge to the nearby Waimakariri River.
24 February 2014	Health and Safety Management Plan (City Care) for Johns Road Project: removal of used construction materials from Waimak Pit to Burwood Landfill.
11 September 2014	Application for discretionary exemption for building consent (Orion NZ Ltd) Application to install toilet within proposed 66kV substation at 711 Johns Road.

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 Hazardous Activities and Industries List (HAIL)[2]. The listing of a property on the HAIL triggers the requirement for a contaminated land assessment prior to development.

The CRC LLUR property statement requested by ENGEO on 4 October 2016 for the site and neighbouring sites (within a 100 metre radius) is presented in Appendix A.

Table 6: Summary of Canterbury Regional Council Listed Land Use Register

Location	Period From	Period To	HAIL Activity (s)	LLUR Category
Off-Site				
12A McLeans Island Road, Harewood	1970 1997	1997 2004	A18 – Wood treatment or preservation and bulk storage of treated timber F8 – Transport depot	Review in Progress. Notes: Disposal of wastes from timber treatment processes and glue lamination, including phenols, formaldehyde, hydrocarbons and dioxins, has likely occurred on site and has not been investigated.
Sawyers Arms Road and Nathan Place, Papanui	1990 1962 Pre-1962 Pre-1962 Pre-1962	Present Present 1980s 1980s 1980s	F8 – Transport depot A17 – Storage tanks or drums for fuel, chemicals or liquid waste D1 – Abrasive blasting D3 – Metal treatment or coating G3 – Landfill sites	Closed Parent (encompasses several parcels: Lot 1 DP 55072, Lot 2 DP 55072, Lot 3 DP 55072, Lot 1 DP 70619, Lot 1 DP 45800).
108 Waimakariri Road, Harewood	Unknown	Present	A17 – Storage tanks or drums for fuel, chemicals or liquid waste	Not Investigated. Notes: 14 April 1999 The site holds a 1,750 L aboveground storage tank.
700 Johns Road and 16 McLeans Island Road, Harewood	1970 1997	1997 2004	A18 – Wood treatment or preservation and bulk storage of treated timber F8 – Transport depots	Closed Parent (encompasses several parcels: Lots 1-18 DP 375764, Lot 4 DP 36871).
11 Nathan Place, Harewood	1990 1962	Present Present	F8 – Transport depots A17 – Storage tanks or drums for fuel, chemical or liquid waste	Partially Investigated. Notes: A risk to site soils and groundwater exists from fill material and potential spills of waste

	Pre-1962 Pre-1962 Hydrocarbons Pre-1962	1980s 1980s 1980s	D1 – Abrasive blasting D3 – Metal treatment or coating G3 – Landfill sites	oil or other materials associated with sand blasting and metal spraying. Excavations at the site have revealed non-inert material, including plastic and metal objects. Surface soil samples collected from former soak pit locations in 2004 revealed elevated lead concentrations in soil. This extent of excavation of this contaminated soil was not documented, and site characterisation is incomplete.
700 Memorial Avenue, Christchurch Airport	1980	1983	G3 – Landfill sites	Review in Progress. Notes: A portion of the site has been used for fire fighting training, using hydrocarbons and fire fighting foam. The fire training pit on the south end of the site has historically received unregulated mixed waste. Approximately 208,000 m^3 of unregulated fill was deposited during the 1950s and 1960s. Currently jet fuel is used throughout the site.
Johns Road and Sawyers Arms Road, Harewood	Unknown	Unknown	G3 – Landfill sites	Not Categorised – In Progress
Waimakariri Road, Harewood	Pre-1941	Pre-1984	A10 – Persistent pesticide bulk storage or use	Not Investigated
Waimakariri Road, Harewood	Pre-1955	2011	A10 – Persistent pesticide bulk storage or use	Not Investigated

3.3 Historical Aerial Photograph Review

Aerial photographs obtained from the CRC online Geographical Information System (GIS) dating from 1941 to 2011 have been reviewed (refer to Figures 2 to 10 appended). The relevant visible features are summarised in Table 7.

Table 7: Historical Aerial Photograph Review

Date	Figure No.	Description
1941	3	The site appears to be used for agricultural purposes. Land to the west, south, and east of the site appears to be agricultural as well. Land to the north appears to be undeveloped. No structures are visible on the site. A roadway, in the approximate configuration of present-day Wairakei Road, is visible south of the site.
1946, 1955	4, 5	The site is heavily vegetated. Areas surrounding the site are relatively unchanged from the 1941 photograph.
1965	6	The eastern half of the site has been cleared of vegetation. Residential development has increased significantly to the southeast of the site. An industrial looking storage yard is visible on the parcel adjacent north of the site.
1973	7	Materials has been excavated and stockpiled on an eastern section of the site. A road following the alignment of the current Johns Road is visible along the northern boundary of the site.
1984	8	The excavation has expanded to include the majority of the site area, with the exception of the western portion. A structure in the location of the present-day shed is visible on the property. Increased industrial development is visible on the parcel to the north of the site.
1994	9	Excavation activities on the site appear to have ceased, but unpaved roads are still visible passing through the site.
2004	10	Vegetation appears to have grown over much of the excavated area.
2011	11	Much of the soil on the site has been exposed and stockpiled material is visible throughout the site.

4 Current Site Conditions

A site inspection was undertaken on 9 February 2017 by Jenna Lohmann of ENGEO. The information gathered is summarised inTable 8. Photographs taken during the site inspection are included in Appendix 1.

Table 8: Current Site Conditions

Site Conditions	Comments
Topography	The site is generally flat with a few medium-sized earthen mounds and a shallow ditch that runs east-west through the site. Earthen bunds were observed along the northern and southern site boundaries.
Visible signs of contamination	No visible signs of contamination were observed. Scattered pieces of miscellaneous concrete debris are present throughout the site.
Surface water appearance	No surface water was observed on the site.
Current surrounding land use	Rural residential.
Local sensitive environments	None identified within 100 m of the site.
Visible signs of plant stress	Abundant vegetation on site, including tall grasses, shrubs, and trees. No visible signs of plant stress.
Potential for on or off site migration of contaminants	No potential contaminant sources or potential discharges observed.
Additional observations (if any)	A chain link fence enclosure was observed along the southern site boundary.

5 Preliminary Conceptual Site Model

A conceptual site model consists of four primary components. For a contaminant 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).

Based on the information collected in this PSI, the primary source of potential contaminants is associated with undocumented fill material imported and placed at the site. Contaminants of potential concern associated with the fill material include asbestos, polycyclic aromatic hydrocarbons (PAHs) and heavy metals including arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.

Additional contamination may be present due to the materials stored on site. Although these materials have been described as inert, impacts to shallow soil may be present. Specifically petroleum hydrocarbons in soil at the location where asphalt millings have been historically stored.

From the distances to the sites identified on the LLUR database, the direction of groundwater flow (to the easterly direction), and / or the understanding that the abstraction and future use of groundwater from the shallow aquifer for potable use in the vicinity of the site is likely, the potential for the neighbouring properties to have impacted the subject site is possible.

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
Fill material	Heavy Metals	Dermal contact with impacted soil, accidental ingestion and inhalation of dust during earthworks.	On-site redevelopment construction workers.
	Polycyclic Aromatic Hydrocarbons	Dermal contact with impacted soil, incidental ingestions and inhalation of wind-blown dust.	Future Commercial land users. Surrounding environment.
	Asbestos	Inhalation of airborne fibres.	On-site workers, surrounding residents.
Asphalt millings storage	Petroleum Hydrocarbons	Dermal contact with impacted soil, accidental ingestion and inhalation of dust during earthworks.	On-site redevelopment construction workers. Future Commercial land users.
Timber treatment and glue lamination waste streams	Petroleum Hydrocarbons	Ingestion or use of down-gradient well water.	Down-gradient domestic well owners. On-site workers. Surrounding environment

6 Conclusions and Recommendations

McCracken and Associates Ltd commissioned ENGEO Limited to undertake an environmental site investigation at the 711 Johns Road, Belfast, Christchurch. A preliminary site investigation was undertaken to assess if the site had previously been used for activities included on the HAIL.

Review of historical records found that the site has historically been used as a quarry and was excavated to a depth of five meters below ground level. Consent was granted in 2009 to backfill the quarry with documented clean fill and store stockpiled inert material, including mulch, asphalt millings, crushed concrete, and gravel, as well as to create earthen bunds along the site perimeter.

The source and quality of the backfill was not documented and has not been investigated. Therefore, the potential for contaminants of concern, specifically, heavy metals, PAHs and asbestos to be present in the fill requires assessment.

Based on the results of this PSI, a targeted intrusive environmental investigation will be required to support the consent application for site redevelopment. The intent of this investigation is to characterise the soil material underlying the site, specifically the potential presence of heavy metals, PAHs and asbestos where fill material has been placed. The investigation should also target the location where asphalt millings were stored for the potential presence of petroleum hydrocarbons. Finally, groundwater along the north/north western boundary of the site should be assessed for potential hydrocarbon impacts from the adjacent site with potential contamination at 12A McLeans Island Road.

7 References

1. MfE, 2012. Users' Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.
2. MfE, 2011. Ministry for the Environment Hazardous Activities and Industries List.
3. MfE 2011: *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils*.
4. MfE, 2011. Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites in New Zealand.
5. Forsyth, P.J.; Barrell, D.J.A.; Jongens, R. Geology of the Christchurch Area 1:250,000 geological map 16. Institute of Geological & Nuclear Sciences. 2008.
6. ECan, 2014. Environment Canterbury on-line GIS Database. Viewed at: http://canterburymaps.co.nz/Portal
7. MfE 2011: *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values.*
8. ECan 2007: *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.
9. Australian National Environmental Protection Council 1999: *National Environment Protection Measure Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater*.
10. WA DOH. (2009). *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.*

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, McCracken and Associates 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 IPENZ / ACENZ Standard Terms of Engagement.

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

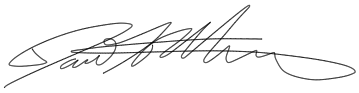
We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by

Jenna Lohmann

Environmental Engineer

Report reviewed by



David Robotham, CEnvP

Principal Environmental Consultant

Attachments:

- Figures 1-11

- ECan LLUR

- Site Photographs

FIGURES

ENGEO
Expect Excellence

Date	Sept 2016	**Client**	**McCracken & Associates Ltd**		
Drawn by	JL	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	DR	**Description**	**Site Location Plan**		
Scale	NTS	**Figure Number**	1	**Project Number**	13396

ENGEO
Expect Excellence

Date	Sept 2016	**Client**	**McCracken & Associates Ltd**		
Drawn by	JL	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	DR	**Description**	**Site Layout Plan**		
Scale	NTS	**Figure Number**	2	**Project Number**	13396

ENGEO
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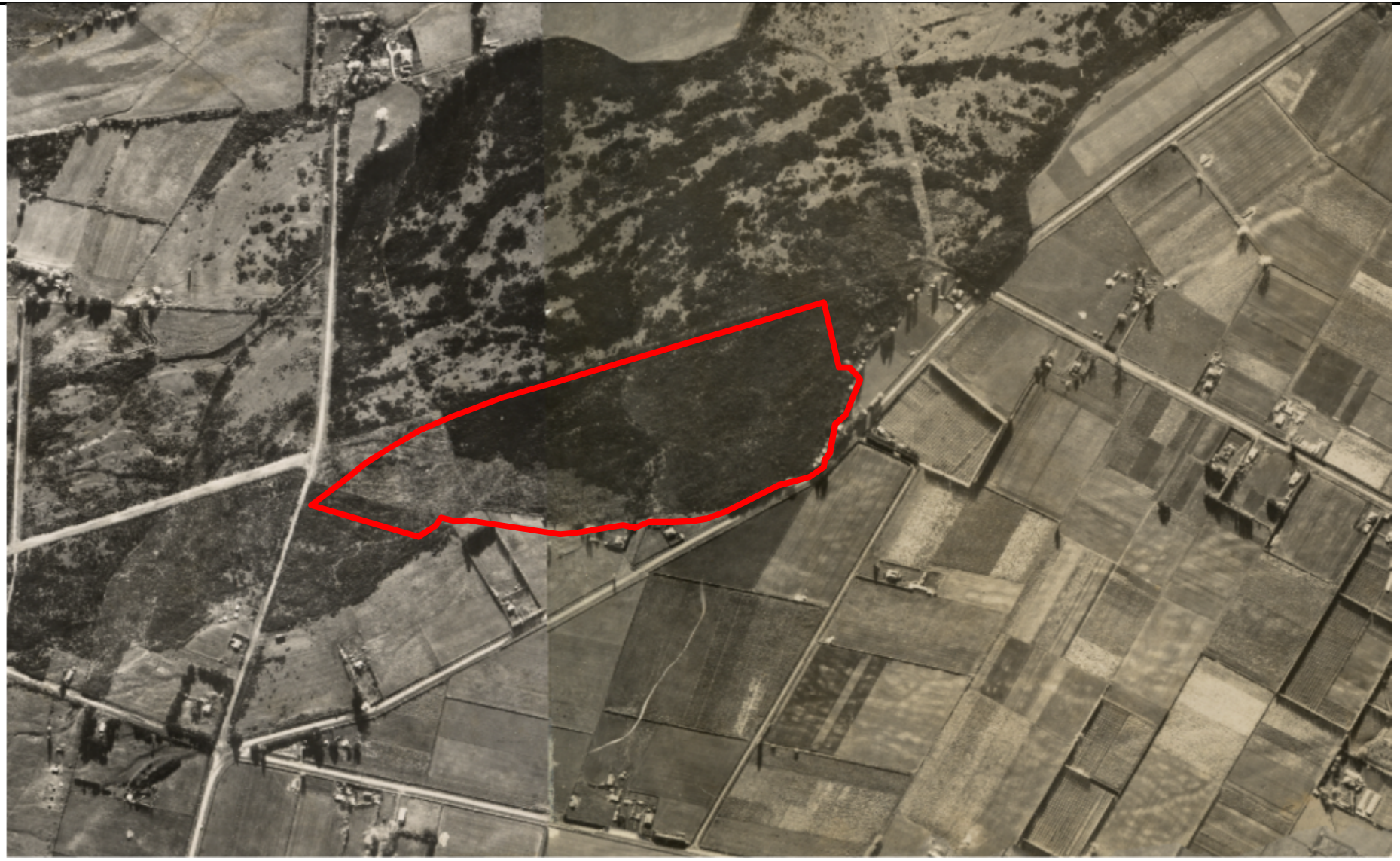
Date	Sept 2016	**Client**	**McCracken & Associates Ltd**		
Drawn by	JL	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	DR	**Description**	**Historical Aerial Photograph - 1941**		
Scale	NTS	**Figure Number**	3	**Project Number**	13396



ENGEO
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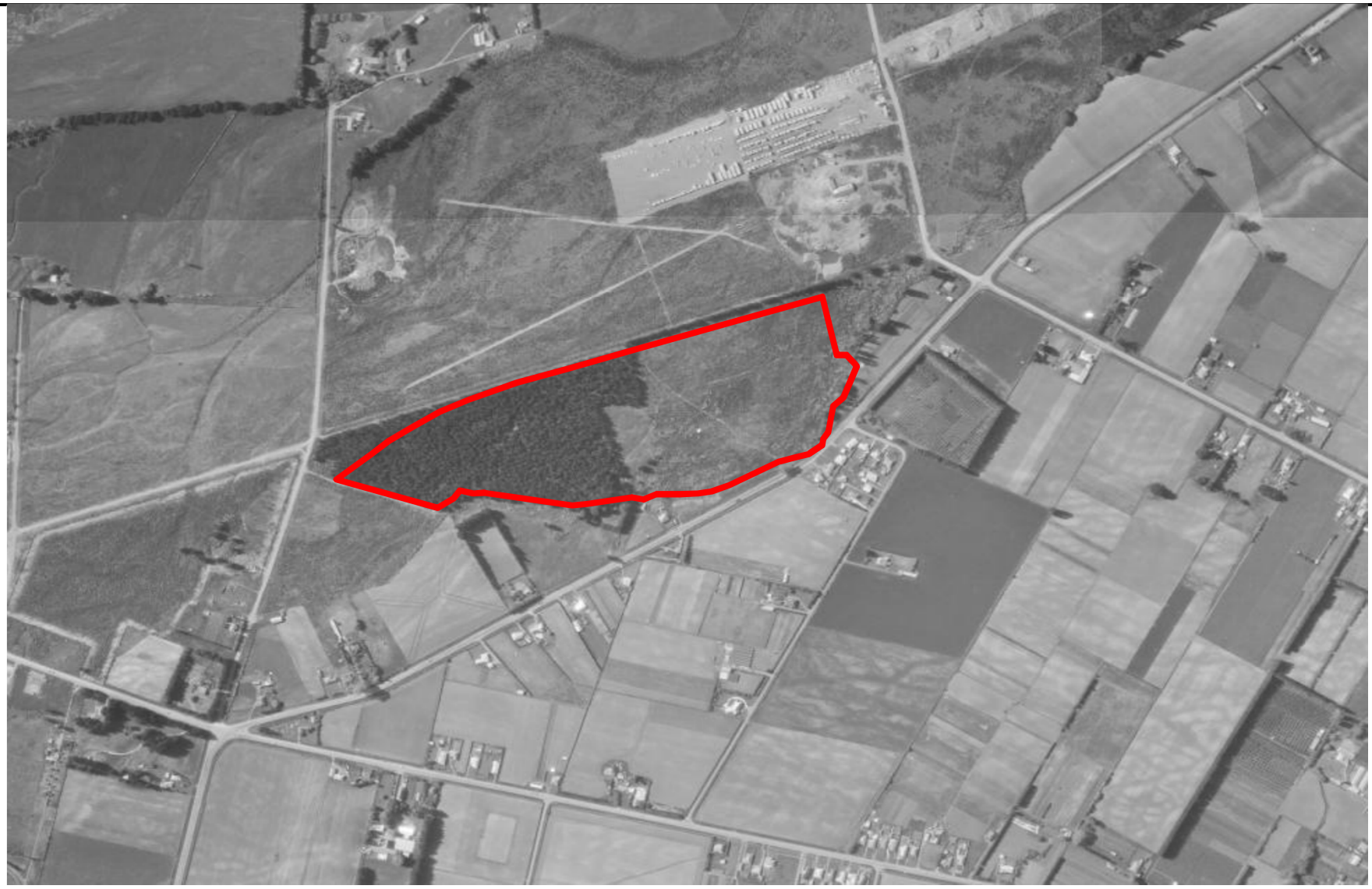
Date	Sept 2016	**Client**	**McCracken & Associates Ltd**		
Drawn by	JL	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	DR	**Description**	**Historical Aerial Photograph - 1946**		
Scale	NTS	**Figure Number**	4	**Project Number**	13396

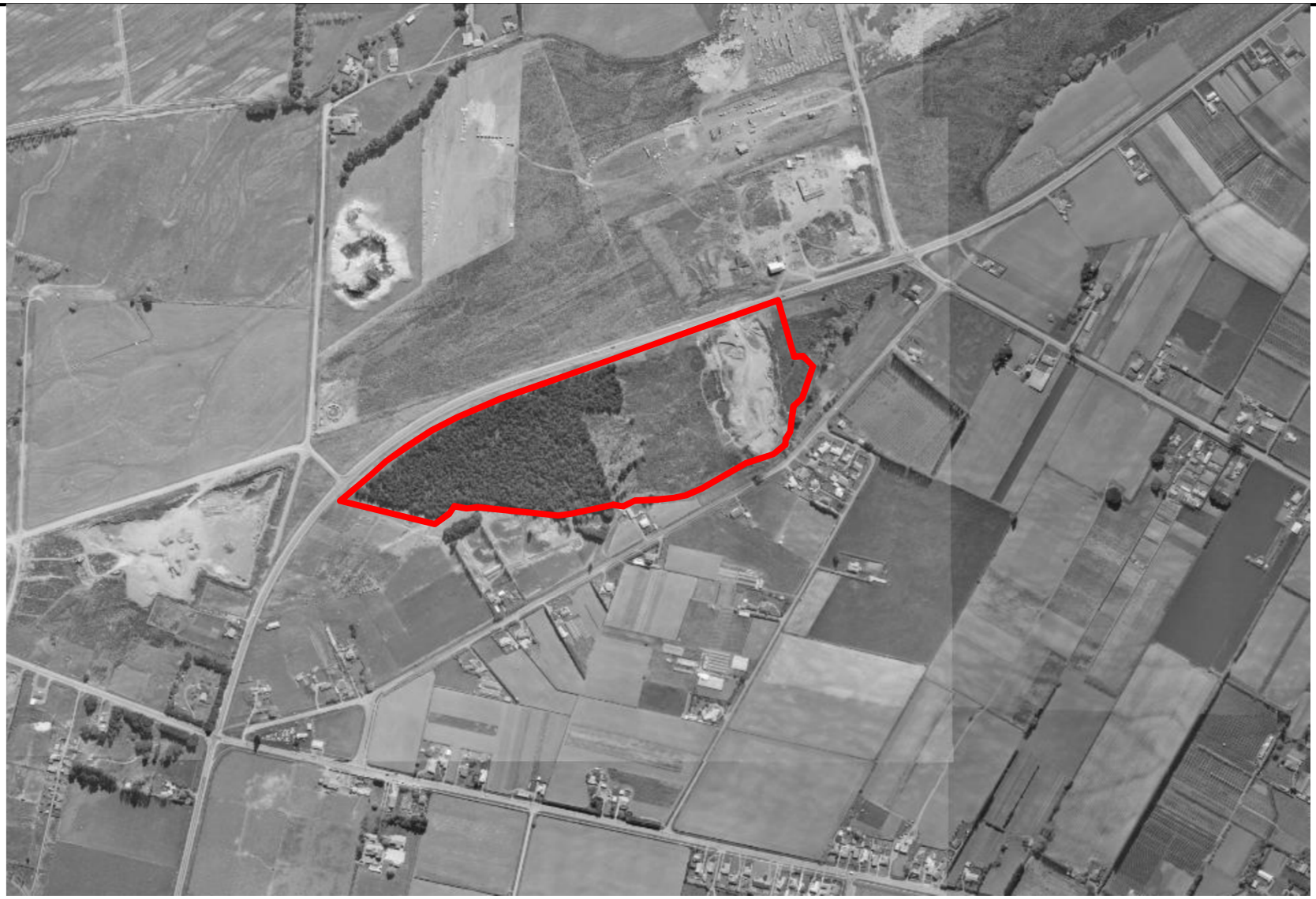
ENGEO
Expect Excellence

Date	Sept 2016	**Client**	**McCracken & Associates Ltd**		
Drawn by	JL	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	DR	**Description**	**Historical Aerial Photograph - 1955**		
Scale	NTS	**Figure Number**	5	**Project Number**	13396



ENGEO
Expect Excellence

Date	Sept 2016	**Client**	**McCracken & Associates Ltd**		
Drawn by	JL	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	DR	**Description**	**Historical Aerial Photograph - 1965**		
Scale	NTS	**Figure Number**	6	**Project Number**	13396



ENGEO
Expect Excellence

Date	Sept 2016	**Client**	**McCracken & Associates Ltd**		
Drawn by	JL	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	DR	**Description**	**Historical Aerial Photograph - 1973**		
Scale	NTS	**Figure Number**	7	**Project Number**	13396

ENGEO
Expect Excellence

Date	Sept 2016	**Client**	**McCracken & Associates Ltd**		
Drawn by	JL	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	DR	**Description**	**Historical Aerial Photograph - 1984**		
Scale	NTS	**Figure Number**	8	**Project Number**	13396

ENGEO
Expect Excellence

Date	Sept 2016	**Client**	**McCracken & Associates Ltd**		
Drawn by	JL	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	DR	**Description**	**Historical Aerial Photograph - 1994**		
Scale	NTS	**Figure Number**	9	**Project Number**	13396

ENGEO
Expect Excellence

Date	Sept 2016	**Client**	**McCracken & Associates Ltd**		
Drawn by	JL	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	DR	**Description**	**Historical Aerial Photograph - 2004**		
Scale	NTS	**Figure Number**	10	**Project Number**	13396

ENGEO
Expect Excellence

Date	Sept 2016	**Client**	**McCracken & Associates Ltd**		
Drawn by	JL	**Project**	**711 Johns Road, Belfast, Christchurch**		
Approved by	DR	**Description**	**Historical Aerial Photograph - 2011**		
Scale	NTS	**Figure Number**	11	**Project Number**	13396

APPENDIX A

ECan 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

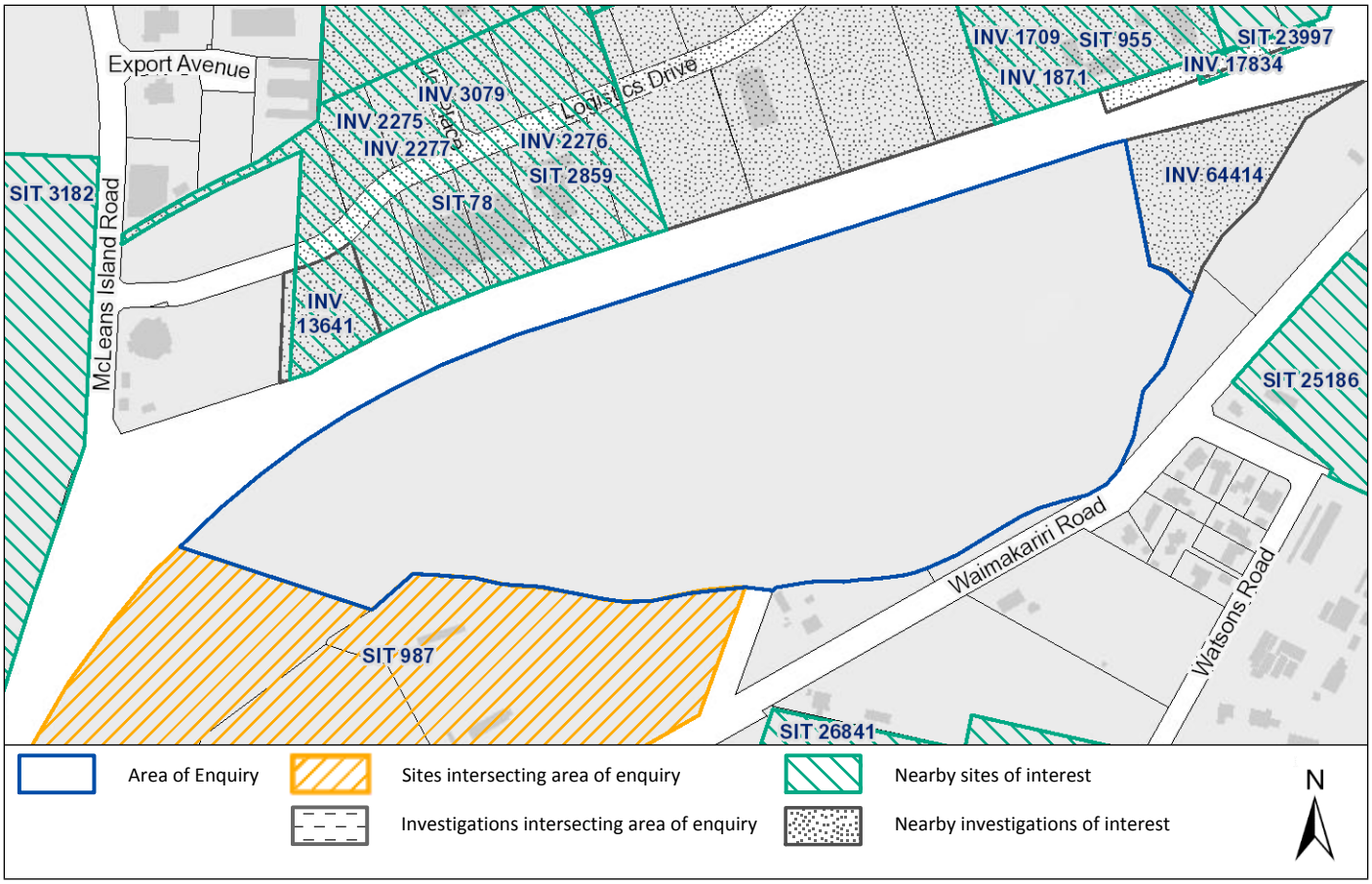
Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

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

www.ecan.govt.nz

Date:	04 October 2016	
Land Parcels:	Section 1 SO 455212	Valuation No(s): 2191608201



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

Summary of sites:

Site ID	Site Name	Location	HAIL Activity(s)	Category
78	Peter Stevens Ltd / Niagara Sawmilling Co Ltd / Inwood Cartage	12A McLeans Island Road, Harewood, Christchurch	A18 - Wood treatment or preservation and bulk storage of treated timber;F8 - Transport depots;	Review in Progress
955	Formerly Scotts Engineering	Sawyers Arms Road and Nathan Place, Papanui, Christchurch	F8 - Transport depots;A17 - Storage tanks or drums for fuel, chemicals or liquid waste;D1 - Abrasive blasting;D3 - Metal treatment or coating;G3 - Landfill sites;	Closed Parent
987	G Van Ameyde	108 Waimakariri Road, Harewood, Christchurch	A17 - Storage tanks or drums for fuel, chemicals or	Not Investigated

			liquid waste;	
2859	Formerly Niagara Sawmilling	700 Johns Road and 16 McLeans Island Road, Harewood, Christchurch	A18 - Wood treatment or preservation and bulk storage of treated timber;F8 - Transport depots;	Closed Parent
3007	Formerly Scotts Engineering	11 Nathan Place, Christchurch	F8 - Transport depots;A17 - Storage tanks or drums for fuel, chemicals or liquid waste;D1 - Abrasive blasting;D3 - Metal treatment or coating;G3 - Landfill sites;	Partially Investigated
3182	Christchurch International Airport Fire Training Area and Pit	700 Memorial Avenue, Christchurch	G3 - Landfill sites;	Review in Progress
23997	NZTA - Johns Road and Sawyers Arms Road, Christchurch	Johns Road and Sawyers Arms Road, Christchurch	G3 - Landfill sites;	Not Categorised – IN PROGRESS
25186	25186	Waimakariri Road, Harewood	A10 - Persistent pesticide bulk storage or use;	Not Investigated
26841	26841	Waimakariri Road, Harewood	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 within a 100m buffer.

Information held about the sites on the Listed Land Use Register

Site 78: Peter Stevens Ltd / Niagara Sawmilling Co Ltd / Inwood Cartage (Within 100m of enquiry area.)

Site Address:	12A McLeans Island Road, Harewood, Christchurch
Legal Description(s):	Lot 1 DP 375764,Lot 1 DP 412022,Lot 10 DP 375764,Lot 100 DP 412877,Lot 101 DP 412877,Lot 12 DP 375764,Lot 13 DP 375764,Lot 15 DP 375764,Lot 17 DP 375764,Lot 18 DP 375764,Lot 19 DP 375764,Lot 2 DP 375764,Lot 2 DP 412022,Lot 20 DP 375764,Lot 3 DP 375764,Lot 4 DP 375764,Lot 5 DP 375764,Lot 6 DP 375764,Lot 7 DP 375764,Lot 8 DP 375764,Lot 9 DP 375764

Site Category:	Review in Progress
Definition:	Investigation reports have been received and are currently being reviewed to determine the most appropriate site category.

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1970	1997	Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or bulk storage of treated timber outside
1997	2004	Transport depots or yards including areas used for refuelling or the bulk storage of hazardous substances

Notes:

5 Oct 2007

The site represents a section of land previously occupied by a timber processing site Niagara Sawmilling Co. Ltd and an abutting designated railway corridor. The railway was never constructed and the designated land was occupied by the adjacent timber processing sites. The land has been subdivided and is being redeveloped as an industrial/commercial park.

From circa 1974 to 1994 a finger jointing and glue lamination plant operated at the south-western part of the site. Glue-lamination and finger-jointing were carried out at the site using phenol resorcinol formaldehyde and casein-based resins. In addition, parts of the site yard were used for storage of CCA treated wood and processing wastes according to the 1994 Loe Pearce and Associates survey of the adjacent Niagara Sawmilling Co. Ltd site.

In May 1990 a pollution complaint was laid with Canterbury Regional Council for a ground discharge of factory wash-down wastewater containing formaldehyde and phenol products. The discharge occurred until the containment system was redesigned and a new collection sump was installed in September 1991. Soil and groundwater impact were not assessed.

Following the cessation of timber processing in 1994, the section containing the finger jointing and lamination plant, known as Lot 1 DP 52209, was leased by Inwood Cartage from Niagara Sawmilling. It was used as a transport company depot, and small quantities of petrol, diesel and paint were stored in drums on a covered concrete bunded area.

The eastern part of the site, previously identified as Lot 2 DP 52209, has been generally vacant since 1970s. Parts of it had been used for storage of untreated logs and for manufacture and sale of transportable buildings. According to the 2005 Glasson Potts Fowler desktop study, its ground surface has been levelled by filling using inert material.

The strip of land previously designated for a railway corridor ran along the northern boundary of the site and was approximately 20 m wide. The railway corridor was occupied by the adjoining timber processing companies, but the exact use of the corridor area is not known. An excavation at its north-eastern part, now under Logistics Drive, was reportedly filled by P.G. Morrison using wood processing and miscellaneous wastes.

The land use history for the site has been summarised within the Loe and Pearce (1994) and the Pattle Delamore Partners

(2001) preliminary investigations. A most recent desktop investigation was prepared in support of a consent application for the industrial/commercial redevelopment. It was prepared in 2005 by Glasson Potts Fowler and did not identify any potential historical sources of contamination at the site, the exception being the disposal of waste beneath the Logistics Drive.

12 Nov 2008 In August 2008 the Ministry for the Environment carried out an investigation into all former and currently operating timber treatment sites in New Zealand. The investigation identified the potential for an undetermined level of contamination to be present in the soil of this property due to its former use as a sawmill at a time when it was common practice to use pentachlorophenol (PCP). Dioxins may be present in soil on the site, especially in areas where PCP was applied to timber. As a precaution, and in the absence of soil test information, the following measures would minimise exposure to contamination: 1 - avoid consuming animal produce (eg chickens, eggs, other livestock) grown on the property 2 - Vegetables can be grown safely in a raised bed using clean imported soil.

Investigations:

30 Apr 1993 **INV 3079: Preliminary survey of pentachlorophenol use in the timber industry in Canterbury** (Detailed Site Investigation)
Loe Pearce & Associates

1 Jun 1994 **INV 2275: A Preliminary Investigation of the Use of CCA, Boron, Antisapstain and other Chemicals at 23 Sites** (Detailed Site Investigation)
Loe Pearce & Associates

Summary of investigation(s):

Niagara Sawmilling Co Ltd site was included in the 1994 Loe Pearce and Associates survey of timber treatment chemical use (referred as site 27). The survey report summarises the timber treatment and processing operations that have taken place at the site.

A timber treatment plant was established at the site in 1974. At the time of the survey, pressure treatment of timber was carried out using CCA (copper, chrome and arsenic), AAC (alkyl dimethyl benzyl ammonium chloride), and boron. Boron had previously been applied to timber using both spray and diffusion methods. Pentachlorophenol had not been used at the site.

In circa 1984, a finger jointing and glue lamination plant was constructed at the site. Chemicals used by the plant included phenol/resorcinol formaldehyde adhesives, a paraformaldehyde-based hardener, casein-based glues and a melamine-urea formaldehyde resin. Chemical storage, use, and waste disposal procedures were documented within the report.

The existing chemical containment design was described in the report, and the history of site upgrades was reconstructed based on the previous council survey reports. For example, a survey carried out in 1983 noted that freshly treated timber was held on the drip pad for 2-3 hours. The subsequent survey in 1991 reported that the drip pad was enlarged to enable for a 40 hour storage period.

Sources of waste were identified and the existing and historic disposal practices were described. Waste, including some treated material from the previous operators, had previously been dumped in an area on the eastern boundary of the site. Documented incidents of timber treatment chemicals and adhesives discharges to ground, occurring due to the inadequacies of the contaminant design, were summarised.

Ground drainage was described. Site was noted as being susceptible to dust generation. Water supply to the site was identified, as were the nearby wells and the unconfined nature of the aquifer. Surrounding land use was described.

Finally, on the basis of the above background information, the report made a recommendation for further assessment of soil and water impact.

1 May 2001 **INV 2276: Stage One Environmental Site Assessment at the former Niagara Sawmilling Company Limited Site, 700 Johns Road & 12A McLeans Island Road, Harewood** (Preliminary Site Investigation)
Pattle Delamore Partners Ltd

Summary of investigation(s):

Pattle Delamore Partners conducted a preliminary desktop assessment of land previously leased by Niagara Sawmilling Co Ltd.

Timber treatment plants (CCA, AAC, and boron) and a timber finger jointing and glue lamination factory operated at the site from 1973 to approximately 1994. Petrol and diesel were stored at the site in underground storage tanks (UST) for an unknown period of time until their removal in August 1995. A diesel above ground storage tank (AST) was also present at the site.

The timber treatment plants and the treated timber storage yards were located on the northern portion of the former Niagara Sawmilling Co Ltd site (***Site 207***, Lot 4 DP 36871). At the time of the Pattle Delamore Partners investigation, Lot 4 DP 36871 was leased by Carters Timber and Brazzier Scaffolding. The underground storage tanks and an above ground storage tank removed in August 1995 were located on Lot 4 DP 36871.

The southern part of the study area, previously described as Lots 1-2 DP 52209, has since the Pattle Delamore Partners investigation been subdivided and redeveloped as an industrial park (***Site 78***, Lots 1-18 DP 375764). The western part of this section (formerly Lot 1 DP 52209) held the finger jointing and glue lamination factory. Due to failure in the factory's containment system, the washdown water from the plant - containing formaldehyde and phenols - was discharged directly to ground from May 1990 to August 1991. Based on a 1988 aerial photograph, the land surrounding the factory building was in use for storage of timber. According to the 1994 Loe Pearce and Associates review of the Niagara Sawmilling Co. site, portions of the southern section were used for storage of treated timber and processing waste. Following the closure of the finger jointing and glue lamination factory the facility was used as a transport depot by Inwood Cartage. Small quantities of petrol, diesel and paint were stored in drums on a covered concrete bunded area at the depot. The eastern part of the southern section, formerly described as Lot 2 DP 52209, was reportedly occupied by a company manufacturing and selling transportable buildings.

The former Niagara Sawmilling Co Ltd site is located over an unconfined aquifer and soils in the site vicinity and surrounds are therefore at risk from any discharges to ground of hazardous substances that may have occurred. Discharges of timber treatment chemicals (CCA and boron), adhesives, and hydrocarbons are known to have occurred at the site. Chemical residues are expected to remain in soils at the site. These chemical residues may pose a risk to groundwater users on and downgradient of the site and to excavation workers, should earthworks be carried out at the site in the future. Dust migration may also be an issue on the site and to surrounding sites.

1 Mar 2005 **INV 2277: Amherst Properties Limited - Site Contamination Report to Christchurch City Council** (Preliminary Site Investigation)
Glasson Potts Fowler Limited

Summary of investigation(s):

Although the objective of the investigation was not explicitly stated, the desktop review was conducted to examine the historical land uses at the proposed industrial/commercial development (Lot 1-18 DP 375764) with respect to the potential presence of soil contamination. The development compromised the southern part of the section previously leased by Niagara Sawmilling Co Ltd (Lots 1-2 DP 52209) and a designated railway corridor that ran along the northern boundary of this section. The railway corridor land was historically occupied by the adjacent timber treatment and processing sites (Niagara Sawmilling Co Ltd, PG Morrison Ltd, Firth Industries Ltd).
The report was prepared in support of a consent application for the discharge of stormwater to land from an industrial development. The information sources were not extensive. They included discussions with Environment Canterbury property officers, historic aerial photographs and interviews with former employees of businesses located within the general area. Therefore, the report was less exhaustive than the two former desktop reports, produced by Loe and Pearce associates in 1994 and by Pattle Delamore Partners in 2001.
The report identifies historical disposal of inert waste material in depressions along the north-eastern part of the study area as the only potential source of contamination. The landfilling reportedly occurred within a designated railway corridor, which is now a sealed entrance road for the industrial development, and it is thought that waste included concrete and miscellaneous wood processing waste from the PG Morrison Ltd treatment plant. The report fails to comment on the finger jointing and lamination activities and the storage of treated timber and process wastes. This is a major deficiency of the report, reflecting the limited examination of the existing sources of information.

INV 13641: ***notification of site investigation PDP received 2 November 2012*** (Detailed Site Investigation)
Pattle Delamore Partners Ltd

Summary of investigation(s):

Report(s) have not yet been audited.

Site 955: Formerly Scotts Engineering (Within 100m of enquiry area.)

Site Address:	Sawyers Arms Road and Nathan Place, Papanui, Christchurch
Legal Description(s):	Lot 1 DP 55072; Lot 2 DP 55072; Lot 3 DP 55072; Lot 1 DP 70619; Lot 1 DP 45800

Site Category:	Closed Parent
Definition:	Parent record created only to link child sites together

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1990	present	Transport depots or yards including areas used for refuelling or the bulk storage of hazardous substances
1962	present	Storage tanks or drums for fuel, chemicals or liquid waste
pre 1962	1980s	Abrasive blasting including abrsive blast cleaning (excluding cleaning carried out in fully enclosed booths) or the disposal of abrasive blasting material
pre 1962	1980s	Metal treatment or coating including polishing, anodising, galvanising, pickling, electroplating, or heat treatment or finishing using cyanide compounds
pre 1962	1980s	Landfill sites

Notes:

13 Jun 2003 There is one underground storage tank (UST) on site which is about 7-8 years old (i.e. installed in about 1991). It is a 45,000 L UST containing class 3(c) substances. This UST replaced an old UST. Canterbury Regional Council information from 1966 and 1970 gave the size of the old UST as 4546 L containing class 3(a) substances in 1966 and class 3(c) substances in 1970. The site also has some oil in containers in a garage area. The supplying company was BP until the new UST was installed, after which the supplier was Caltex.

Investigations:

1 May 2001 **INV 1707: Stage One Environmental Assessment at 7 Nathan Place Harewood, Christchurch** (Preliminary Site Investigation)
Pattle Delamore Partners Ltd

Summary of investigation(s):

A preliminary survey of 7 Nathan Place, Harewood, has shown that landfilling, storage of reclaimed waste oil, and sandblasting and metal spraying have historically been carried out at the site.
The refuse disposed of in the landfill pits is expected to have comprised predominantly inert hardfill material. However, excavations at the site have indicated that other material including plastic and metal objects are also present. Any hazardous material that may have been disposed of in the pits would pose a risk to the shallow water table underlying the site and also to excavation workers should earthworks be carried out at the site.
A risk is also posed to soils and groundwater in the site vicinity from any spillages of substances associated with the storage of waste oil, and sandblasting and metal spraying activities carried out at the site.
A site water supply bore is located within 50m of an old timber treatment site and may be at risk from associated migrating chemicals.

16 Jul 2004 **INV 1709: Preliminary Site Assessment of 11 Nathan Place, Harewood** (Detailed Site Investigation)
CRL Energy Ltd

Exceedences of environmental guideline values				
Document	**Contaminant**	**Pathway**	**Media**	**Land Use**
UK DEFRA	Lead	All pathways	Soil	Commercial/Industrial

9 Mar 2007 **INV 1871: Preliminary Site Investigation at Nathan Place, Christchurch** (Detailed Site Investigation)
CRL Energy Ltd

Summary of investigation(s):

The area of the site investigated by CRL in 2007 site is currently used as a storage facility and has previously been used for land filling, sandblasting, metal spraying and timber treatment, with fuel storage tanks previously located nearby on part of the greater site.

12 soil samples were collected during the excavation of 4 soak pits at the site in 2004. Samples collected from the base of one of the pits and from the excavated material were found to have concentrations of lead exceeding relevant guideline values. The location of this excavation is not clear, and the extent of contamination was not delineated at the time.

8 composite samples (made up of 2, 3 or 4 sub-samples) were collected from an area of the site occupied by Royal Wolf in 2007. All of the samples were collected from the surface soils and analysed for 7 heavy metals. 1 sample was also analysed for PCP and Boron. Concentrations of the contaminants tested for were all below relevant environmental guidelines.

The sample results provide an indication that the surface soils are of acceptable quality for commercial/industrial land use, however the sampling was not sufficient to provide a complete characterisation of the site. No description of the methodology used to create the composites is provided, and it is not known if equal weight sub-samples were used. It is reported that PCP and Boron concentrations are likely to be correlated with metal concentrations; however there is no evidence presented that this should be the case at the site. Considering the identified historic uses of the site, composite samples are not considered appropriate for identifying hotspots of contamination, or areas requiring further investigation. As lead contamination had been identified in the excavated pits as part of the 2004 investigation, it may have been appropriate to collect samples from depth as part of this more recent work.

Due to these limitations of the investigation and considering the investigation targeted only the areas of the site which were occupied by Royal Wolf at the time, it is recommended the site be classified as 'Partially Investigated'. Based on the current information, the area of lead contamination identified in the 2004 investigation is not considered to pose a significant risk to site occupiers.

Site 987: G Van Ameyde (Intersects enquiry area.)

Site Address:	108 Waimakariri Road, Harewood, Christchurch
Legal Description(s):	Lot 5 DP 4009; Lot 2 DP 56438; Pt Lot 1 DP 4009

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

Land Uses (from HAIL):

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

Notes:

14 Apr 1999 Site holds a 1,750 L above ground storage tank (AST) for class 3(c) products. Record of a class 3(c) 2,250 L underground storage tank was previously associated with the site, however the owner of the property since 1966 has informed Environment Canterbury that underground storage tanks have not been present at the site.

Investigations:

There are no investigations associated with this site.

Site 2859: Formerly Niagara Sawmilling (Within 100m of enquiry area.)

Site Address:	700 Johns Road and 16 McLeans Island Road, Harewood, Christchurch
Legal Description(s):	Lot 1-18 DP 375764; Lot 4 DP 36871

Site Category:	Closed Parent
Definition:	Parent record created only to link child sites together

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1970	1997	Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or bulk storage of treated timber outside
1997	2004	Transport depots or yards including areas used for refuelling or the bulk storage of hazardous substances

Notes:

13 Jun 2003 Land use history at this site has been reviewed in a number of preliminary investigations. The site was part of Loe Pearce and Associates preliminary surveys into the use of timber treatment chemicals in Canterbury. The site was included in the Loe Pearce and Associates 1994 review report on the use of CCA, boron and antisapstain chemicals at selected timber treatment sites. Its land use history was also investigated as part of the preliminary study of Environment Canterbury owned land, undertaken by Pattle Delamore Partners in May 2001. The resulting report is titled "Stage One Environmental Site Assessment at the former Niagra Sawmilling Company Limited Site, 700 Johns Road, & 12A McLeans Island Road, Harewood, Christchurch (SN 78)".

Investigations:

30 Apr 1993 **INV 3079: Preliminary survey of pentachlorophenol use in the timber industry in Canterbury** (Detailed Site Investigation)
Loe Pearce & Associates

1 Jun 1994 **INV 2275: A Preliminary Investigation of the Use of CCA, Boron, Antisapstain and other Chemicals at 23 Sites** (Detailed Site Investigation)
Loe Pearce & Associates

Summary of investigation(s):

Niagara Sawmilling Co Ltd site was included in the 1994 Loe Pearce and Associates survey of timber treatment chemical use (referred as site 27). The survey report summarises the timber treatment and processing operations that have taken place at the site.

A timber treatment plant was established at the site in 1974. At the time of the survey, pressure treatment of timber was carried out using CCA (copper, chrome and arsenic), AAC (alkyl dimethyl benzyl ammonium chloride), and boron. Boron had previously been applied to timber using both spray and diffusion methods. Pentachlorophenol had not been used at the site.

In circa 1984, a finger jointing and glue lamination plant was constructed at the site. Chemicals used by the plant included phenol/resorcinol formaldehyde adhesives, a paraformaldehyde-based hardener, casein-based glues and a melamine-urea formaldehyde resin. Chemical storage, use, and waste disposal procedures were documented within the report.

The existing chemical containment design was described in the report, and the history of site upgrades was reconstructed based on the previous council survey reports. For example, a survey carried out in 1983 noted that freshly treated timber was held on the drip pad for 2-3 hours. The subsequent survey in 1991 reported that the drip pad was enlarged to enable for a 40 hour storage period.

Sources of waste were identified and the existing and historic disposal practices were described. Waste, including some treated material from the previous operators, had previously been dumped in an area on the eastern boundary of the site. Documented incidents of timber treatment chemicals and adhesives discharges to ground, occurring due to the inadequacies of the contaminant design, were summarised.

Ground drainage was described. Site was noted as being susceptible to dust generation. Water supply to the site was identified, as were the nearby wells and the unconfined nature of the aquifer. Surrounding land use was described.

Finally, on the basis of the above background information, the report made a recommendation for further assessment of soil and water impact.

1 May 2001 **INV 2276: Stage One Environmental Site Assessment at the former Niagara Sawmilling Company Limited Site, 700 Johns Road & 12A McLeans Island Road, Harewood** (Preliminary Site Investigation)
Pattle Delamore Partners Ltd

Summary of investigation(s):

Pattle Delamore Partners conducted a preliminary desktop assessment of land previously leased by Niagara Sawmilling Co Ltd.

Timber treatment plants (CCA, AAC, and boron) and a timber finger jointing and glue lamination factory operated at the site from 1973 to approximately 1994. Petrol and diesel were stored at the site in underground storage tanks (UST) for an unknown period of time until their removal in August 1995. A diesel above ground storage tank (AST) was also present at the site.

The timber treatment plants and the treated timber storage yards were located on the northern portion of the former Niagara Sawmilling Co Ltd site (***Site 207***, Lot 4 DP 36871). At the time of the Pattle Delamore Partners investigation, Lot 4 DP 36871 was leased by Carters Timber and Brazzier Scaffolding. The underground storage tanks and an above ground storage tank removed in August 1995 were located on Lot 4 DP 36871.

The southern part of the study area, previously described as Lots 1-2 DP 52209, has since the Pattle Delamore Partners investigation been subdivided and redeveloped as an industrial park (***Site 78***, Lots 1-18 DP 375764). The western part of this section (formerly Lot 1 DP 52209) held the finger jointing and glue lamination factory. Due to failure in the factory's containment system, the washdown water from the plant - containing formaldehyde and phenols - was discharged directly to ground from May 1990 to August 1991. Based on a 1988 aerial photograph, the land surrounding the factory building was in use for storage of timber. According to the 1994 Loe Pearce and Associates review of the Niagara Sawmilling Co. site, portions of the southern section were used for storage of treated timber and processing waste. Following the closure of the finger jointing and glue lamination factory the facility was used as a transport depot by Inwood Cartage. Small quantities of petrol, diesel and paint were stored in drums on a covered concrete bunded area at the depot. The eastern part of the southern section, formerly described as Lot 2 DP 52209, was reportedly occupied by a company manufacturing and selling transportable buildings.

The former Niagara Sawmilling Co Ltd site is located over an unconfined aquifer and soils in the site vicinity and surrounds are therefore at risk from any discharges to ground of hazardous substances that may have occurred. Discharges of timber treatment chemicals (CCA and boron), adhesives, and hydrocarbons are known to have occurred at the site. Chemical residues are expected to remain in soils at the site. These chemical residues may pose a risk to groundwater users on and downgradient of the site and to excavation workers, should earthworks be carried out at the site in the future. Dust migration may also be an issue on the site and to surrounding sites.

1 Mar 2005 **INV 2277: Amherst Properties Limited - Site Contamination Report to Christchurch City Council** (Preliminary Site Investigation)
Glasson Potts Fowler Limited

Summary of investigation(s):

Although the objective of the investigation was not explicitly stated, the desktop review was conducted to examine the historical land uses at the proposed industrial/commercial development (Lot 1-18 DP 375764) with respect to the potential presence of soil contamination. The development compromised the southern part of the section previously leased by Niagara Sawmilling Co Ltd (Lots 1-2 DP 52209) and a designated railway corridor that ran along the northern boundary of this section. The railway corridor land was historically occupied by the adjacent timber treatment and processing sites (Niagara Sawmilling Co Ltd, PG Morrison Ltd, Firth Industries Ltd).
The report was prepared in support of a consent application for the discharge of stormwater to land from an industrial development. The information sources were not extensive. They included discussions with Environment Canterbury property officers, historic aerial photographs and interviews with former employees of businesses located within the general area. Therefore, the report was less exhaustive than the two former desktop reports, produced by Loe and Pearce associates in 1994 and by Pattle Delamore Partners in 2001.
The report identifies historical disposal of inert waste material in depressions along the north-eastern part of the study area as the only potential source of contamination. The landfilling reportedly occurred within a designated railway corridor, which is now a sealed entrance road for the industrial development, and it is thought that waste included concrete and miscellaneous wood processing waste from the PG Morrison Ltd treatment plant. The report fails to comment on the finger jointing and lamination activities and the storage of treated timber and process wastes. This is a major deficiency of the report, reflecting the limited examination of the existing sources of information.

INV 13641: ***notification of site investigation PDP received 2 November 2012*** (Detailed Site Investigation)
Pattle Delamore Partners Ltd

Summary of investigation(s):

Report(s) have not yet been audited.

Site 3007: Formerly Scotts Engineering (Within 100m of enquiry area.)

Site Address:	11 Nathan Place, Christchurch
Legal Description(s):	Lot 1 DP 70619

Site Category:	Partially Investigated
Definition:	Verified HAIL has been partially investigated.

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1990	present	Transport depots or yards including areas used for refuelling or the bulk storage of hazardous substances
1962	present	Storage tanks or drums for fuel, chemicals or liquid waste
pre 1962	1980s	Abrasive blasting including abrsive blast cleaning (excluding cleaning carried out in fully enclosed booths) or the disposal of abrasive blasting material
pre 1962	1980s	Metal treatment or coating including polishing, anodising, galvanising, pickling, electroplating, or heat treatment or finishing using cyanide compounds
pre 1962	1980s	Landfill sites

Notes:

10 Aug 2006

Site has a history of light commercial and industrial land uses. Former land uses include landfilling, sandblasting and metal spraying, engineering, transport depot and timber treatment.

Royal Woolf occupy two portions of the site and carry out repair and retail of storage containers, including spray painting, washing/cleaning and light metal fabrication. Chemicals are stored in a purpose built facility, and they comprise cellulose based spray paint, thinners and small amounts of fuel. A separate workshop building is located at the site. An electrical transformer is located on the south-western part of the land parcel.

A separate portion of the site, located in the north-western corner, is used for concrete product manufacture.

Investigations:

1 May 2001 **INV 1707: Stage One Environmental Assessment at 7 Nathan Place Harewood, Christchurch** (Preliminary Site Investigation)
Pattle Delamore Partners Ltd

Summary of investigation(s):

A preliminary survey of 7 Nathan Place, Harewood, has shown that landfilling, storage of reclaimed waste oil, and sandblasting and metal spraying have historically been carried out at the site.
The refuse disposed of in the landfill pits is expected to have comprised predominantly inert hardfill material. However, excavations at the site have indicated that other material including plastic and metal objects are also present. Any hazardous material that may have been disposed of in the pits would pose a risk to the shallow water table underlying the site and also to excavation workers should earthworks be carried out at the site.
A risk is also posed to soils and groundwater in the site vicinity from any spillages of substances associated with the storage of waste oil, and sandblasting and metal spraying activities carried out at the site.
A site water supply bore is located within 50m of an old timber treatment site and may be at risk from associated migrating chemicals.

16 Jul 2004 **INV 1709: Preliminary Site Assessment of 11 Nathan Place, Harewood** (Detailed Site Investigation)
CRL Energy Ltd

Exceedences of environmental guideline values				
Document	**Contaminant**	**Pathway**	**Media**	**Land Use**
UK DEFRA	Lead	All pathways	Soil	Commercial/Industrial

9 Mar 2007 **INV 1871: Preliminary Site Investigation at Nathan Place, Christchurch** (Detailed Site Investigation)
CRL Energy Ltd

Summary of investigation(s):

The area of the site investigated by CRL in 2007 site is currently used as a storage facility and has previously been used for land filling, sandblasting, metal spraying and timber treatment, with fuel storage tanks previously located nearby on part of the greater site.

12 soil samples were collected during the excavation of 4 soak pits at the site in 2004. Samples collected from the base of one of the pits and from the excavated material were found to have concentrations of lead exceeding relevant guideline values. The location of this excavation is not clear, and the extent of contamination was not delineated at the time.

8 composite samples (made up of 2, 3 or 4 sub-samples) were collected from an area of the site occupied by Royal Wolf in 2007. All of the samples were collected from the surface soils and analysed for 7 heavy metals. 1 sample was also analysed for PCP and Boron. Concentrations of the contaminants tested for were all below relevant environmental guidelines.

The sample results provide an indication that the surface soils are of acceptable quality for commercial/industrial land use, however the sampling was not sufficient to provide a complete characterisation of the site. No description of the methodology used to create the composites is provided, and it is not known if equal weight sub-samples were used. It is reported that PCP and Boron concentrations are likely to be correlated with metal concentrations; however there is no evidence presented that this should be the case at the site. Considering the identified historic uses of the site, composite samples are not considered appropriate for identifying hotspots of contamination, or areas requiring further investigation. As lead contamination had been identified in the excavated pits as part of the 2004 investigation, it may have been appropriate to collect samples from depth as part of this more recent work.

Due to these limitations of the investigation and considering the investigation targeted only the areas of the site which were occupied by Royal Wolf at the time, it is recommended the site be classified as 'Partially Investigated'. Based on the current information, the area of lead contamination identified in the 2004 investigation is not considered to pose a significant risk to site occupiers.

Site 3182: Christchurch International Airport Fire Training Area and Pit (Within 100m of enquiry area.)

Site Address:	700 Memorial Avenue, Christchurch
Legal Description(s):	Lot 47 DP 323331

Site Category:	Review in Progress
Definition:	Investigation reports have been received and are currently being reviewed to determine the most appropriate site category.

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1980	1983	Landfill sites

Notes:

8 Jan 2007

Former landfills. Extent of this site includes all the land historically filled on this parcel, including the Fire Training Pit. The Fire Training Pit is located at the south end of the site. It received mixed waste in an unregulated manner. A pit where groundwater used to pool has been recently filled with hardfill.

Part of the site is used for fire fighting training, using hydrocarbons and fire fighting foam substances. Historically, various hydrocarbons products were used at the site, but this practice has been changed and jet fuel is presently the only product used. Consent CRC916231 exists to manage the stormwater discharge resulting from the training activities. Stormwater from the fire fighting activity flows through an interceptor and a treatment system before it is discharged into the ground via a soakhole. The treatment system was malfunctioning in 2005, with hydrocarbons released at concentrations exceeding the consent conditions. Work was completed to improve the discharge, and the soakhole was excavated and reinstated, with validation samples collected.

2 Sep 2014

An Assessment of Environmental Effects (August 2014) describes the north end of the north-south runway as Landfill B (west end of Site 3182). Approximately 208,000 m3 of unregulated public landfill was buried in the late 1950's to 1967 to a depth of 4 m below ground level. 44,000 m3 of material was removed from Landfill B and used as fill at the north end of the runway in 1983 and across the remainder of Site 3182.

Investigations:

There are no investigations associated with this site.

Site 23997: NZTA - Johns Road and Sawyers Arms Road, Christchurch (Within 100m of enquiry area.)

Site Address:	Johns Road and Sawyers Arms Road, Christchurch
Legal Description(s):	

Site Category:	Not Categorised – IN PROGRESS
Definition:	No category has been assigned to this site. Still in progress to be reviewed.

Land Uses (from HAIL):

Period From	Period To	HAIL land use
?	?	Landfill sites

Notes:

Investigations:

19 Apr 2013 **INV 17837: Johns Road - Preliminary Environmental Assessment of the encountered landfill** (Detailed Site Investigation)
Geoscience Consulting Ltd

8 May 2013 **INV 17834: Johns Road - Contamination Assessment of Excavated Landfill Material** (Detailed Site Investigation)
Geoscience Consulting Ltd

18 Jul 2013 **INV 19126: Johns Road Motorway Upgrade: Landfill Extents Investigation** (Detailed Site Investigation)
Geoscience Consulting Ltd

Summary of investigation(s):

Report(s) have not yet been audited.

Site 25186: 25186 (Within 100m of enquiry area.)

Site Address:	Waimakariri Road, Harewood
Legal Description(s):	Lot 2 DP 18312

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

Land Uses (from HAIL):

Period From	Period To	HAIL land use
Pre-1941	Pre-1984	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

Notes:

Investigations:

There are no investigations associated with this site.

Site 26841: 26841 (Within 100m of enquiry area.)

Site Address:	Waimakariri Road, Harewood
Legal Description(s):	Lot 1 DP 51775,Lot 1 DP 55048,Lot 1 DP 74671,Lot 2 DP 18489,Lot 2 DP 51775,Lot 2 DP 74671

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

Land Uses (from HAIL):

Period From	Period To	HAIL land use
Pre-1955	2011	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

Notes:

18 Oct 2013 Area defined from: 1946 to 2011 ECan Aerial Photographs.

Market garden plots and glass houses 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

11 Jul 2014 **INV 64414: Preliminary Site Investigation (Contamination) - Waimakariri Substation** (Detailed Site

Investigation)
Beca Limited

Summary of investigation(s):

Report(s) have not yet been audited.

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ145983.

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.

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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.

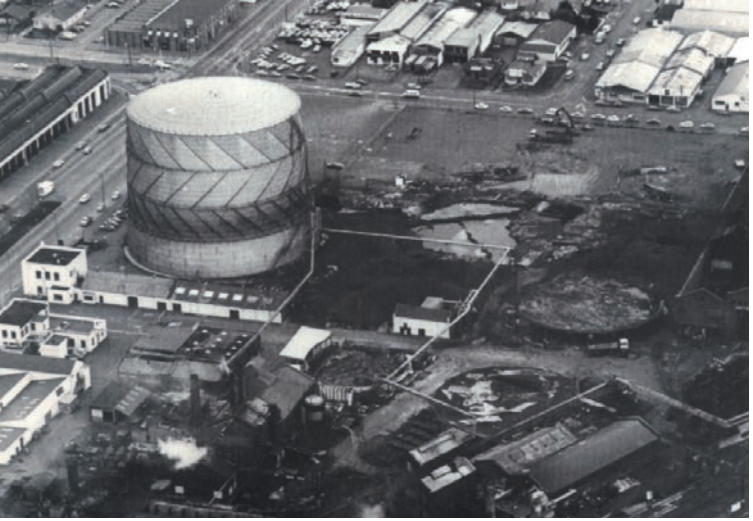
Please refer to the Site Categories and Definitions factsheet for further information.

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.

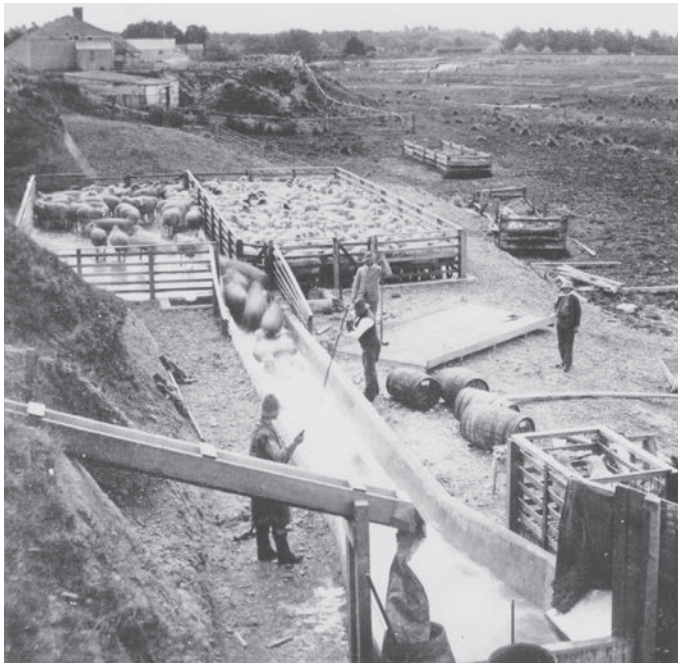
We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

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)

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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

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E13/102

APPENDIX B

Site Photographs

Photo 1: View from south site boundary facing north

Photo 2: Stockpiled soil with concrete debris

Photo 3: Dense vegetation bordering ditch

Photo 4: Chain link fence enclosure

Photo 5: Earthen bund along southern site boundary

Photo 6: Gravel pathway through site

ENGEO
Expect Excellence

Date taken	Feb-17	**Client**	**McCracken and Associates Ltd**		
Taken by	JL	**Project**	**711 Johns Road, Belfast**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	1 to 6	**ENGEO Ref.**	13396	**Appendix:**	B