ENGEO

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Detailed Environmental Site Investigation

3/144 Dunns Crossing

Rolleston

Canterbury

Submitted to:

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1 Introduction

ENGEO Ltd was requested by Hughes Development Ltd to undertake a combined preliminary and detailed environmental site investigation (PSI/DSI) of the property at 3/144 Dunns Crossing, Rolleston, Canterbury (herein referred to as 'the site'). Figure 1 attached indicated the location of the property. The purpose of the assessment was to assess the property's suitability for a change of land use consent and subdivision under the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES) and to satisfy the requirements of Selwyn District Council (SDC).

This DSI was undertaken in general accordance with the MfE 2011, *Contaminated Land Management Guidelines (CLMG) No.5: Guidelines for Site Investigation and Site Analysis of Soil* and reported in general accordance with the MfE 2011 *CLMG No.1: Reporting on Contaminated Sites in New Zealand*.

1.1 Objectives of the Assessment

The objective of this DSI was to assess conditions indicative of releases and threatened releases of hazardous substances on, at, in or to the subject property and report on the potential risk posed to future site users.

1.2 Approach

To satisfy the objectives, ENGEO sought to gather information regarding the following:

- Current and past property uses and occupancies;
- Current and past uses of hazardous substances;
- Waste management and disposal activities that could have caused a release or threatened release of hazardous substances;
- Current and past corrective actions and response activities to address past and on-going releases of hazardous substances at the subject property; and
- Properties adjoining or located near the subject property that have environmental conditions that could have resulted in conditions indicative of releases or threatened releases of hazardous substances to the subject property.

1.2.1 Review of Site Information

During this assessment, a number of sources of information were contacted for information relating to the site regarding its past and present uses. This included contacting Canterbury Regional Council (CRC) to determine if there were records on the Listed Land Use Register (LLUR), reviewing records held by Selwyn District Council (SDC) including the property file, and obtaining the certificate of titles for the property from Land Information New Zealand (LINZ). A review of a number of historical and current aerial photographs was also undertaken using images from Canterbury Maps and Google Earth.

1.2.2 Site Inspection

A site walkover was undertaken on 6 August 2020 by ENGEO.

2 Site Description and Setting

Site information is summarised in Table 1.

Table 1: Site Information

Item	Description
Location	3/144 Dunns Crossing Road, Rolleston
Legal Description	LOT 3 DP 70352 BLK III LEESTON SD-INT IN R/W EASEMENT DP 72978 OVER LOT 4 DP 7 0352
Site Area	Approximately 4.00 ha
Property Owner	Property is under contract to Hughes Developments Limited
Current Land Use	Residential and Horticultural - Walnut Orchard
Proposed Land Use	Standard residential subdivision, for single dwelling sites with gardens, including home-grown produce consumption (10%)
Building Construction	Main Dwelling: Concrete foundation, brick cladding, concrete tile roof. Garage: Concrete foundation, metal, cement board and timber cladding, metal roof. Shed: Open earth ground, timber pole, metal cladding and roof.
Territorial Authority	Selwyn District Council
Zoning	Inner Plains / Living Z

The site setting is summarised in Table 2.

Table 2: Site Setting

Item	Description
Topography	The site is predominately flat.
Local Setting	The surrounding area is a mix of agricultural and residential.
Nearest Surface Water & Use	An un-named stream runs along the eastern boundary of the site from the south-eastern corner and is diverted at a right angle into the neighbouring paddock to the northeast. The stream is presumed to be used for stormwater runoff.
Geology (GNS Science)	Late Quaternary unconsolidated to poorly consolidated mud, sand, gravel and peat of alluvial and colluvial origin.
Hydrogeology (ECan GIS)	The site is located over an unconfined / semiconfined gravel aquifer. The well on-site logged initial water depth at 6.8 m below ground level. Groundwater is presumed to flow from the northwest to the southeast towards Lake Ellesmere.
Groundwater Abstractions (ECan GIS)	There is one groundwater abstraction located on the site and three within 250 m of the site: M36/5041: Kajens Trading Development Ltd, active well (32.0 m) for domestic supply onsite. M36/5042: Kajens Trading Development Ltd, active well (32.10 m) for domestic supply to the northwest of the site. M36/4450: LK & JC Blackmore, active well (25.2 m) for irrigation to the south of the site. M36/5043: Kajens Trading Development Ltd, active well (35.2 m) for domestic supply to the west of the site.
Discharge Consents (ECan GIS)	There are no active discharge consents located on the site, and one active consent within 250 m of the site: CRC053035: Ogon & Magnum Properties Ltd, active discharge consent for human effluent discharge into land and water to the north of the site.

3 Site History

A number of sources were used to investigate the past uses of the site. The findings of these information searches have been summarised in this section.

3.1 Discussions with Site Owners

A discussion was held between ENGEO and the current site owner on 3 August 2020The owner has owned the site within a family trust for the past eight years. The owner stated that the walnut tree orchard was present when they purchased the property, and that the previous owners had harvested approximately 500 kg of walnuts annually for sale.

The current owners mentioned that the previous owners who planted the orchard were described as “Greenies” but didn’t have explicit information that sprays had or hadn’t been used on the trees. The current owner hasn’t sprayed any of the trees in the last eight years and have removed some of the blocks of trees.

The greenwaste from the trees were burnt off on-site with no additional rubbish, fence posts or other inorganic materials being burnt.

During their occupancy at the site no offal pits were dug on the land, and they cannot recall any pits or areas of land disturbance when they purchased the site.

3.2 Selwyn District Council Property File

The property file for the site, held by Selwyn District Council, was reviewed on 12 August 2020 as part of the DSI. :

- 20 February 1997 – Building consent for a garage
- 8 August 1997 – Building consent for a farm shed
- 8 August 1997 - Building consent for a dwelling
- 18 January 2000 – Building consent for a lean-to garage addition

The property file information did not pertain to any asbestos containing materials being used in the construction of the buildings. Because of the age of the buildings (constructed pre-2000) a full asbestos demolition survey is required; this is to ensure that any asbestos materials are identified prior to demolition works so that they can be removed in a safe manner.

3.3 Certificate of Title

A review of the certificate of title was completed with no information related to potential contaminating activities identified. The Certificates of Title are attached in Appendix 2.

3.4 Listed Land Use Register (LLUR)

Potentially hazardous activities are defined on the Ministry for the Environmental (MfE) Hazardous Activities and Industries List (HAIL). Canterbury Regional Council (CRC) maintains a Listed Land Use Register (LLUR) of past and current land uses within the Canterbury region which have potentially had an activity included on the HAIL undertaken on them. Under the NES, the listing of the property on the LLUR triggers the requirement for a contaminated land assessment prior to development.

The CRC LLUR property statement was requested by ENGEO on 30 July 2020 for the site and is presented in Appendix 3.

Table 3: LLUR Summary

Period From	Period To	HAIL Activity(s)	LLUR Category
2000	Present	A10: Persistent pesticide bulk storage or use	Not Investigated
Additional Information		Area defined on aerial photographs from 2000 to present. Horticultural activities (persistent pesticides) were noted in aerial photographs reviewed.	

3.5 Historical Aerial Photograph Review

Aerial photographs dating from 1940 to 2016 have been reviewed. The relevant visible features are summarised in Table 4.

Table 4: Aerial Photographs

Date	Source	Description
1940-1944	Canterbury Maps	The site is a part of a larger block of land which appears to be grassed and may be used for grazing. A fence line is present running along the current fence line in the north. No buildings are visible on the site. The surrounding area appears to also be undeveloped and used for grazing or cropping. A large forest block is present to the west of Dunns Crossing Road.
1960-1964	Canterbury Maps	The site has no significant changes from the previous photograph. The surrounding area remains mainly unchanged from the previous photograph. Some small land disturbance (stockpiles and cleared areas) is observed in the paddocks to the northwest and west but it is unclear what the stockpiles or cleared areas would have been used for.
1970-1974	Canterbury Maps	The site is mainly unchanged from the previous aerial photograph. The area is still grassed and is used for grazing. The surrounding area is mainly unchanged from the previous photograph.
1980-1984	Canterbury Maps	There is a small area of ponding observed along the eastern boundary line of the site with obvious ponding observed in neighbouring paddocks as well. The site is still grassed and undeveloped. The surrounding area is mainly unchanged from the previous photograph.
1990-1994	Canterbury Maps	The site is undeveloped with apparent channels running across the site from the northwest to the southeast. A tree line is visible along the northern boundary line. The surrounding area is still undeveloped and appears to be used for crop growing and grazing.
2000-2004	Canterbury Maps	The site has been developed into a residential site with a dwelling and shed visible in the western corner and an orchard area covering the remainder of the site. Three lines are visible running northwest to southeast and trees have been divided into smaller square blocks. Many of the surrounding sites have been redeveloped with residential dwellings present on properties to the northwest and west of the site. A horse track is present at 108 Dunns Crossing Road to the south of the site.
2010-2015	Canterbury Maps	The residential dwelling is still present on the site, and small buildings (possible barns) have been constructed to the southwest of the dwelling. The area around the dwelling is planted with a driveway coming into the site from the western corner. A small potential burn off area is apparent to the south of the dwelling. Eight areas are visible that are planted in trees which are bordered with a different tree specimen. There is a block of planting in the southern corner of the site. The site to the north at 4/144 Dunns Crossing Road has planting around the dwelling. The remainder of the surrounding area is mainly unchanged.

2017	Canterbury Maps	Three blocks of trees to the south of the site have been cleared. A ring structure which is presumed to be a horse corral is visible in the southern corner of the site. The remainder of the site appears unchanged since the previous photograph. The surrounding area remains mainly unchanged.

Table 5 below describes the site conditions during the site walkover on 6 August 2020. Photographs taken during the site walkover are included in Appendix 1.

Table 5: Current Site Conditions

Site Conditions	Comments
Visible signs of contamination	Four areas of orchard were observed in the north-eastern section of the site. The walnut trees were planted in rows with eucalyptus trees planted between each area. Three burn piles were observed in the cleared paddocks on the site. The material appeared to be free from any building materials or domestic rubbish. The site owner indicated that the burn piles were used for burning green waste only with no domestic rubbish or treated timber being burnt. The horse corral which was observed in the aerial photograph review was no longer present on site however obvious markings were in the ground from the previous corral ring.
Surface water appearance	No visual indication of potential contamination such as suspended sediment or sheen was observed in the stream running along the north-eastern boundary. The stream was flowing during the visit.
Currently surrounding land use	The properties around the site are all mixed residential and grazing sites.
Local sensitive environments	The stream running along the north-eastern boundary.
Visible signs of plant stress	No visible signs of plant stress were noted on-site.
Additional observations	A well, pump shed and water tank were observed to the south of the dwelling. A previous chicken coup area which was constructed from timber fence poles and metal wire was observed to the south of the dwelling. A glasshouse (domestic scale) was observed near the chicken coup along with several plastic bread trays which were used for drying the walnuts. A few empty 100 L plastic drums were observed on the site which were being used for horse jumps. It was confirmed with the site owners that they were brought onto site as empty containers. A wrecked car was observed near the barn along the south-western boundary line. No staining was observed in surface soils below the car.

4 Potential HAIL Activities

Activities included on the Hazardous Activities and Industries List (HAIL) trigger the requirement for a contaminated land investigation prior to redevelopment. Following the site walkover and review of the desktop information, it is considered that the following HAIL activities are or have been present at the site.

Table 6: Potential HAIL Activities

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES
Orchard – walnut trees	Heavy metals Organochlorine pesticides (OCPs)	The entire site	A10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds

5 Intrusive Investigation

Potential contamination on-site as a result of historical pesticide application is likely limited to shallow soils. An intrusive investigation was developed to investigate the upper 0.3 meters below ground level (m bgl).

The soils were sampled to assess the suitability of the land (from a contamination / human health perspective) for residential use, and to assess the human health risks posed to site works under the commercial / outdoor worker scenario. The results can also be used to indicate whether there is a likely impact to the surrounding environment.

5.1 Methodology

The following was undertaken during the soil sampling works:

- Collection for 40 discrete soil samples from 0.0-0.3 m depth from across the site. The samples were grouped into 10 separate areas defined by areas of trees. The soil samples were composited in the laboratory into ten, four-point composite soil samples.
- Each composite sample was scheduled for analysis for heavy metals and OCPs;
- Each sample was inspected for visual and olfactory indicators of contamination;
- All soil samples collected were placed in jars, which were then sealed, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to RJ Hill Laboratories (Hills) under the standard ENGEO chain of custody documentation provided in Appendix 4;
- To reduce the potential for cross contamination, each sample was collected using disposable nitrile gloves that were discarded following the collection of each sample;

- After collection of each sample, the sampling equipment was decontaminated by scrubbing with a solution of Decon90 and rinsing with tap water followed by deionised water;
- The intrusive sampling was completed in accordance with ENGEO standard operating procedures;
- All fieldwork and sampling was undertaken in general accordance with the procedures for the appropriate handling of potentially contaminated soils as described in the MfE Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils;
- Following receipt of the samples by Hill Laboratories, the soil samples were scheduled for a selection of contaminants of concern including heavy metals (arsenic, cadmium, chromium, copper, mercury, lead, nickel and zinc) and organochlorine pesticides (OCPs); and
- On receipt of the analytical results, an assessment of the soil concentrations for contaminants of concern with applicable standards and soil acceptance criteria for the protection of human health and the environment was undertaken.

Quality Assurance and Quality Control

The quality assurance / quality control (QA / QC) procedures employed during the works included:

- Standard sample registers and chain of custody records have been kept for all samples;
- The use of Hill Laboratories, ISO/IEC 17025 and IANZ accredited laboratory, to conduct all laboratory analysis. To maintain their International Accreditation, Hill Laboratories undertakes rigorous cross checking and routine duplicate sampling testing to ensure the accuracy of their results;
- Prior to sampling the equipment (hand auger) was decontaminated using a triple wash procedure with potable water, Decon 90 solution and deionised water; and
- During the site investigation every attempt was made to ensure that cross contamination did not occur through the use of the procedures outlined within this document.

6 Regulatory Framework and Assessment Criteria

The regulatory frameworks and rules relating to the management and control of contaminated sites in the Canterbury Region are specified in two documents: the NES and the ECan Regional Plan. A summary of each and its implications for the site is provided in Sections 6.1-6.2.

6.1 NES

The NES came into effect on 1 January 2012 (MfE, 2011f).

The NES introduced soil contaminant standards (SCSs) for 12 priority contaminants for the protection of human health under a variety of land use scenarios.

The NES requires the *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values* be used where a NES SCS is not available. The NES does not consider environmental receptors; accordingly, the application of guidelines relevant to

environmental receptors shall be implemented according to the MfE CLMG No. 2 and any relevant rules in the Regional Plan.

In addition, local background levels in soil have been referenced to establish consenting implications under the NES and disposal requirements. Background levels for metals in soils in the area were obtained from ECan's online GIS – Trace Level 2 concentrations.

6.2 Disposal Criteria

An assessment of potential off-site disposal options for excess soil generated during site development works has been conducted. Dependent on the condition of the spoil, off-site disposal options range from disposal to "cleanfill" sites to managed fill sites. As outlined in the publication Waste Management Institute of New Zealand Technical Guidelines for Disposal to Land (August 2018) definition of cleanfill which states:

"Virgin excavated natural materials (VENM) such as clay, soil and rock that are free of:

- Combustible, putrescible, degradable or leachable components;
- Hazardous substances or material (such as municipal solid waste) likely to create leachate by means of biological breakdown;
- Products or materials derived from hazardous waste treatment, stabilisation or disposal practices;
- Materials such as medical and veterinary waste, asbestos or radioactive substances that may present a risk to human health if excavated;
- Contaminated soil and other contaminated materials; and
- Liquid waste."

6.3 Assessment Criteria

Contaminant concentrations in soil were compared to human health criteria based on the following land use:

- Residential land use (10% produce); and
- Commercial / industrial land use (based on an outdoor worker scenario) (for redevelopment workers).

The land use scenarios are relevant to the likely future use of the site and are being used as a surrogate to assess short term risks to redevelopment earth workers on-site during the development activities.

The NES methodology document notes that the exposure parameters assumed for the maintenance / excavation scenario in other New Zealand guidelines are unrealistic (perhaps by a factor of 10 or more). The technical committee preparing the NES decided that a maintenance / excavation worker scenario should not be included in the NES as sites would not be cleaned up to this standard; it was considered more appropriate that exposures to these workers be limited through the use of site-specific controls that are required under health and safety legislation. However, this report uses

commercial / industrial outdoor worker criteria to get a general sense of potential risks to excavation workers during the redevelopment. Note that commercial / industrial outdoor worker criteria are based on personnel carrying out maintenance activities involving soil exposure to surface soil during landscaping activities, and occasional shallow excavation for routine underground service maintenance. Exposure to soil is less intensive than would occur during construction works but occurs over a longer period. For a construction worker developing the site, the soil exposure is limited when compared to a large earthworks project (e.g. for a residential subdivision or industrial development). As such, the commercial / industrial outdoor worker criteria are considered suitable for obtaining a high-level understanding of potential risks to excavation workers during site redevelopment and confirming the need for site controls.

Where appropriate, the standard NES criteria were adjusted according to the requirements for composite samples specified in the MfE (2011) Contaminated Land Management Guidelines No.5 – Site Investigation and Analysis of Soils. As the composite sample consisted of four sub-samples, the guideline criteria were divided by four to result in the adjusted criteria for the composite sample used in this investigation.

The soil analysis results have also been compared to Regional Background concentrations for heavy metals and OCPs. These provide information into the possible disposal options at a clean-fill facility. These criteria have not been adjusted as the composite sample results provide an indication of the average contaminant concentrations. These provide information into the possible disposal options at a cleanfill facility.

7 Results

7.1 Soil Encountered

Please refer to Table 7 from the summary of subsurface soil encountered within the near surface soils in the shallow soils. Please refer to the ENGEO Geotechnical Report (ENGEO, 2020) for deeper soil profiles.

Table 7: Summary of Subsurface Soils

Depth	Soil Description
0.0-0.3	Sandy SILT with trace rootlets and gravel; brown. [TOPSOIL].
0.3-0.4	Sandy fine to coarse GRAVEL with minor cobbles; brownish grey.

7.2 Analytical Results

The analytical results from the ENGEO investigation can be summarised as follows:

- One composite sample (Composite 5) reported arsenic above the adjusted NES criteria for residential land use. The reported concentration of arsenic was 6 mg/kg, where the adjusted NES residential value is 5 mg/kg;
- One composite sample (Composite 5) reported cadmium and lead above the site specific regional background levels;

- Upon request, Hills Laboratory supplied the file for the uncertainty of measure for the laboratory report for the samples (Appendix 4) which reports that the arsenic reported in Composite 5 has an uncertainty measure of 5.7 mg/kg +/- 1.6 mg/kg;
- Organochlorine pesticides (OCPs) were reported as above the laboratory limit of detection; 4,4'-DDE in all samples, and 4,4' DDT for Composite 3 and 4, however all OCP samples are below the NES criteria and the regional background guidelines; and
- All other samples analysed for heavy metals are below the applicable NES criteria and regional background levels.

Please refer to Appendix 4 for the full laboratory certificate and results. Only detectable concentrations of analytes are shown in Table 7 below

Table 8: Analysis Results

Analyte	Units	Composite 1	Composite 2	Composite 3	Composite 4	Composite 5	Composite 6	Composite 7	Composite 8	Composite 9	Composite 10	Assessment Criteria				
No. of sub samples in composite		4	4	4	4	4	4	4	4	4	4	Background (bl) - Canterbury Regional	Residential - 10% produce (unadjusted)	Recreational Land Use (unadjusted)	Commercial/ Industrial Outdoor Worker (unadjusted)	Residential (composite samples adjusted) made up from 4 subsamples
Subsample Numbers		1, 2, 3, 4	5, 6, 7, 8	9, 10, 11, 12	13, 14, 15, 16	17, 18, 19, 20	21, 22, 23, 24	25, 26, 27, 28	29, 30, 31, 32	33, 34, 35, 36	37, 38, 39 40					
Soil Depth		0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3					
Heavy Metals																
Arsenic	mg/kg	2	3	3	3	6	3	3	3	3	3	6.35	20 (A)	80 (A)	70 (A)	5 (A)
Cadmium	mg/kg	0.1	< 0.1	0.1	0.14	**0.27**	< 0.1	0.11	< 0.1	< 0.1	< 0.1	0.14	3 (A)	400 (A)	1300 (A)	0.75 (A)
Chromium (total)	mg/kg	11	10	11	12	12	11	10	11	11	11	19.89	460 (A)	2700 (A)	6300 (A)	115 (A)
Copper	mg/kg	4	4	6	5	8	5	5	5	4	5	11.68	10000 (A)	10000 (A)	10000 (A)	2500 (A)
Lead	mg/kg	13.1	13.3	13.6	13.8	**27**	13.4	13.4	13.8	13.6	14	19.75	210 (A)	880 (A)	3300 (A)	52.5 (A)
Mercury (inorganic)	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.07	310 (A)	1800 (A)	4200 (A)	77.5 (A)
Nickel	mg/kg	8	8	8	10	8	9	8	9	9	8	13.91	400 (B)	1200 (B)	6000 (B)	100 (B)
Zinc	mg/kg	47	47	52	47	58	49	48	51	46	48	59.58	7400 (B)	30000 (B)	400000 (B)	1850 (B)
4,4'-DDD	mg/kg	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	-	1.9 (C)	-	9.6 (C)	0.475 (C)
4,4'-DDE	mg/kg	0.106	0.071	0.09	0.121	0.07	0.045	0.026	0.069	0.07	0.079	-	2 (C)	-	9.3 (C)	0.5 (C)
4,4'-DDT	mg/kg	< 0.013	< 0.013	0.012	0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	-	1.9 (C)	-	8.5 (C)	0.475 (C)
DDT Isomers	mg/kg	0.11	< 0.08	0.1	0.13	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	0.08	-	70 (A)	400 (A)	1000 (A)	17.5 (A)

General Notes:
Cells highlighted red exceed one or more assessment criteria, highlighted yellow exceed the lab detection limit.
Adjusted assessment criteria are developed from the number of subsamples to form an adjusted guideline value
*** represents that the composite's guideline is excluded from dividing by the subsamples.**
This table does not represent the full analytical results, please refer to the laboratory results for full details.
Values in bold exceed the adopted background concentrations.
bl - denotes background samples compared to Canterbury Regional -> Yellow brown stony.
Assumes soil pH of 5.
Criteria for Chromium VI were conservatively selected.

Guideline Notes:
A - Methodology for Deriving Soil Guideline Values Protective of Human Health (NES, 2011), B - National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 2013), C - Regional Screening Levels Targeted Hazard Quotient 1.0 (US EPA, 2020), D - Identifying, Investigating and Managing Risks Associated with Former Sheep-dip Sites (MfE, 2006)

8 Conceptual Site Model

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

- Source of contamination;
- Pathway(s) in which contamination could potentially mobilise along (e.g. vapour or groundwater migration);
- Sensitive receptor(s) which may be exposed to the contaminants; and
- An exposure route, where the sensitive receptor and contaminants come into contact (e.g. ingestion, inhalation, dermal contact).

The potential source, pathway, receptor linkages at this subject site are provided in Table 9.

Table 9: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Orchard	Heavy metals and OCPs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers.	**Yes,** one composite sample was reported above the adjusted residential guideline criteria, however the exceedance is considered marginal.

9 Conclusions and Recommendations

ENGEO Ltd were engaged by Hughes Developments Limited to undertake an environmental assessment of a site situated at 3/144 Dunns Crossing Road in Rolleston for change in land use, subdivision and soil disturbance consent. Information was gathered and reviewed regarding the potential releases of hazardous substances to the subject property.

A review of information identified that the site had been used for grazing since circa 1940 and residential land use with an associated walnut orchard since 1997.

The site is listed on the Canterbury Regional Council's Listed Land Use Register as A10: Persistent pesticide bulk storage or use, with the walnut orchard being identified in a historical aerial review by Selwyn District Council. The property file was obtained from Selwyn District Council and Certificate of Titles obtained by Land Information New Zealand and these files contained no information related to potentially hazardous activities having occurred at the site.

Based on the information gathered during the desk based study, it was considered that site soils may have been impacted by the past and previous uses of the site as an orchard. A total of 40 soil samples were collected from areas across the site and composited into 10 soil samples for analysis of

heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) and organochlorine pesticides (OCPs).

One composite sample (Composite 5), made up of four subsamples, returned concentrations of arsenic above the adjusted NES residential 10% land use criteria. The arsenic concentration reported by the laboratory is 6 mg/kg with the adjusted criteria at 5 mg/kg. The same composite sample also reported concentrations of cadmium and lead above the site specific background levels. Although the arsenic exceedances is considered marginal, it is recommended that analysis of the four subsamples comprising Composite 5 is completed to determine the risk to human health and determine potential remediation and disposal options (if required).

Due to the presence of arsenic concentrations above the adopted human health criterion in an isolated area of the site, additional analysis is recommended to determine whether remediation of soils is required for the site to be suitable for the proposed redevelopment.

If a volume of soil exceeding 25 m^3 per 500 m^2 of development area is proposed to be disturbed, or if a volume of soil exceeding 5 m^3 per 500 m^2 per development area per year is proposed to be disposed of off-site, a consent should be obtained according to the requirements of the NES. Due to the concentrations of the contaminants of concern at the site, a resource consent for land disturbance and removal may be required during the site works.

A stormwater discharge consent is not likely to be required from Canterbury Regional Council for the duration of the redevelopment works on site due to the low concentrations of heavy metal contamination at the site.

Council will likely require preparation of a Site Management Plan (SMP) as part of the resource consent application. The SMP will outline monitoring and management procedures for the earthworks due to the detection of contaminants above background levels and potential for encountering unidentified contamination. If additional sample analysis indicates that remediation of soil is required, provision of a remedial action plan for the disturbance and disposal of these soils will also need to be prepared.

If the groundwater well is to be removed from site during the development works, the well should be appropriately abandoned/disestablished by a suitably qualified professional.

If the buildings on-site are to be refurbished or demolished, the presence of asbestos in these buildings should be identified by undertaking full asbestos demolition surveys. If identified on the outside of the buildings in a deteriorated state, the soils surrounding the buildings should also be tested.

10 References

ECan (2007a). Background Concentrations of Selected Trace Elements in Canterbury Soils. Addendum 1: Additional Samples and Timaru Specific Background Levels. Report prepared for Environment Canterbury by Tonkin & Taylor Limited, Christchurch, New Zealand. Report Number R07/1/2. Tonkin & Taylor Reference: 50875.003.

MfE (2011a). *Ministry for the Environment Hazardous Activities and Industries List.*

MfE (2011b). *Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites*.

MfE (2011c). *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values.*

MfE (2011d). *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils*.

MfE (2011f). *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.*

MfE (2012). *Users' guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.*

11 Limitations

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

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

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

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

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

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

Report prepared by

Natalie Flatman

Environmental Scientist

Report reviewed by

Hazel Atkins, CEnvP

Senior Engineering / Environmental Geologist

Claire Davies, CEnvP

Senior Environmental Consultant

FIGURES

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

Title:

Site Location Plan

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

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

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

ORIGINAL FIGURE PRINTED IN COLOUR

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

Title: Sample Locaiton Plan

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

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Client: Hughes Developments Ltd

Project: 3/144 Dunns Crossing Road Rolleston

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

Proj No: 12903.000.003

Scale: 1:2,000

Figure No: 2

Size: A4

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 1:

Site Photographs

Photo 1: Dwelling

Photo 2: Garage and lean-to

Photo 3: Water tank, well and pumpshed

Photo 4: 4. Shed along south-western boundary line

Photo 5: 5. Burnpile 1

Photo 6: 6. Burnpile 2

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments Ltd**		
Taken by	NF	**Project**	**3/144 Dunns Crossing Road**		
Approved by	HA/CD	**Description**	**Site Photographs**		
Photo No.	1 to 6	**ENGEO Ref:**	12903	**Appendix No.**	1a

Photo 7: Burn pile 3

Photo 8: Orchard area

Photo 9: Orchard area

Photo 10: Stream along north-eastern boundary line

Photo 11: Cleared paddock in south-western section of the site

Photo 12: Horse corral in south-western section of the site

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments Ltd**		
Taken by	NF	**Project**	**3/144 Dunns Crossing Road**		
Approved by	HA/CD	**Description**	**Site Photographs**		
Photo No.	7 to 12	**ENGEO Ref.**	12903	**Appendix No.**	1b

APPENDIX 2:

Certificate of Titles

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Historical Record

R.W. Muir
Registrar-General
of Land

Constituted as a Record of Title pursuant to Sections 7 and 12 of the Land Transfer Act 2017 - 12 November 2018

Identifier **CB40D/788**
Land Registration District **Canterbury**
Date Issued 14 November 1995

Prior References
CB39A/686

Estate	Fee Simple
Area	4.0000 hectares more or less
Legal Description	Lot 3 Deposited Plan 70352

Original Registered Owners
Stuart Robert Pluck and Glenys Joy Pluck

Interests

Subject to Part IV A Conservation Act 1987

A204853.21 Easement Certificate specifying the following easements - 14.11.1995 at 12.12 pm

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way, right to drain sewage, convey water, electric power and telephonic communications	Lot 4 Deposited Plan 70352 - CT CB40D/789	A DP 70352	Lot 3 Deposited Plan 70352 - herein	

The easements specified in Easement Certificate A204853.21 when created will be subject to Section 243(a) Resource Management Act 1991

Fencing Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

Land Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

A290610.4 Mortgage to Bank of New Zealand - 7.4.1997 at 2.25 pm

9224154.1 Discharge of Mortgage A290610.4 - 5.11.2012 at 12:41 pm

9224154.2 Transfer to Robert John Mackie, Elizabeth Gaynor Mackie and Mackie Family Trustees Limited - 5.11.2012 at 12:41 pm

9224154.3 Mortgage to ANZ Bank New Zealand Limited - 5.11.2012 at 12:41 pm

11211027.1 Court Order Varying Land Covenant in Transfer A204853.22 - 24.8.2018 at 7:00 am

References
Prior C/T 39A/686

Transfer No.
N/C. Order No. A204853/4-19

Land and Deeds 69

REGISTER

No. 40D/788

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 14th day of November one thousand nine hundred and ninety-five under the seal of the District Land Registrar of the Land Registration District of CANTERBURY

WITNESSETH that KAJENS TRADING & DEVELOPMENT LIMITED at Christchurch ---

is seised of an estate in fee-simple (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, that is to say: All that parcel of land containing 4.0000 hectares or thereabouts being Lot 3 Deposited Plan 70352 ---

DISTRICT LAND REGISTRAR

ASSISTANT LAND REGISTRAR

Subject to:

Part IVA Conservation Act 1987

Mortgage A141598/3 to Bank of New Zealand - 27.10.1994 at 11.16am

No. A204853/2 Bond pursuant to Section 222 Resource Management Act 1991 to The Selwyn District Council - 14.11.1995 at 12.12pm

A.L.R.

No. A204853/21 Easement Certificate specifying intended easements on DP 70352

Nature	Servient Tenement		Dominant Tenement
Right of way, right to drain sewage, convey water, electric power and telephonic communications	4 (40D/789)	A	3 (herein)

- 14.11.1995 at 12.12pm

A.L.R.

Measurements are Metric

The easements specified in Easement Certificate A204853/21 when created will be subject to Section 243(a) Resource Management Act 1991

A.L.R.

Transfer A204853/22 to Kajens Trading & Development Limited at Christchurch - 14.11.1995 at 12.12pm (Fencing and Land Covenants)

A.L.R.

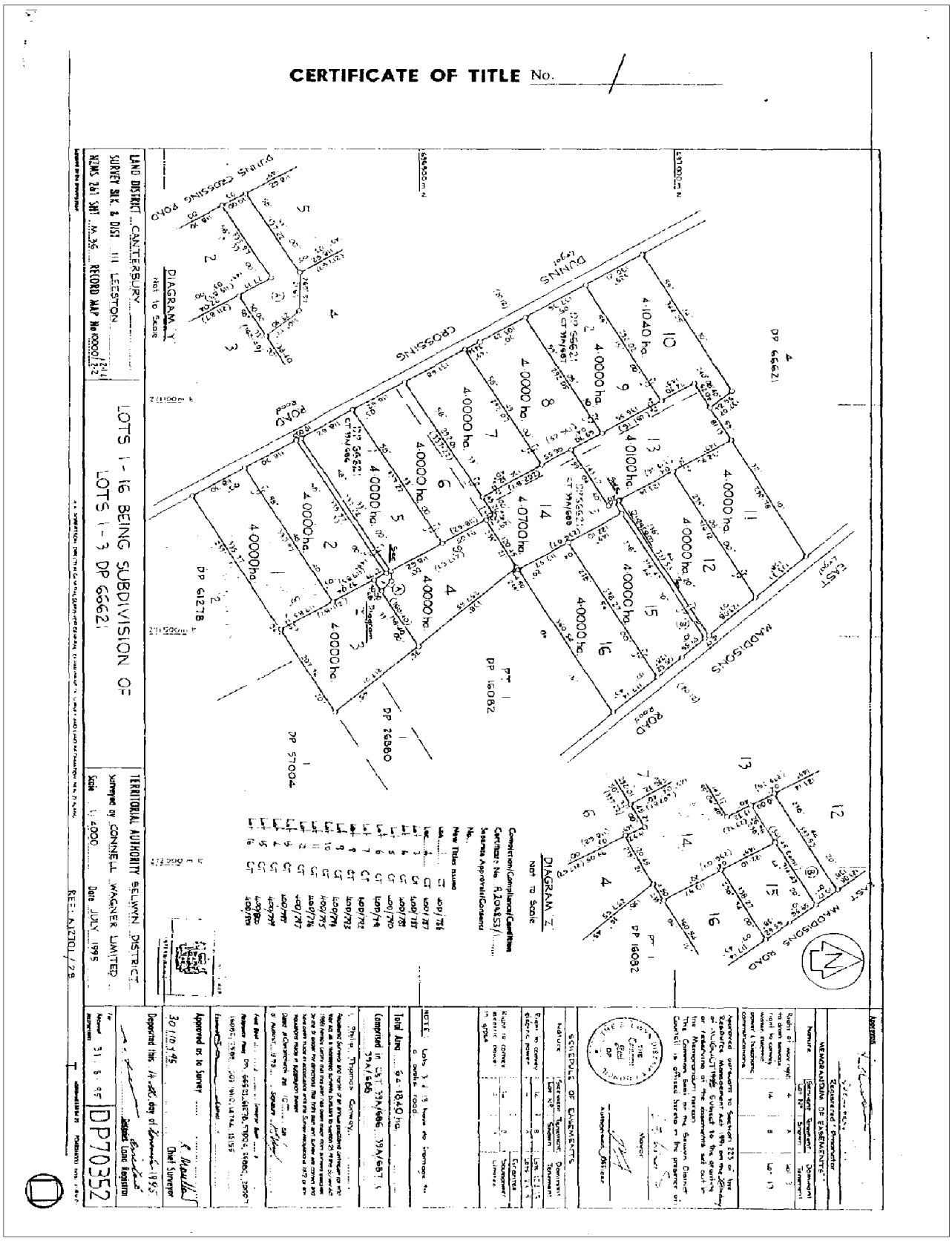
Transfer A290610/3 to Stuart Robert Pluck, Technical Sales Manager and Glenys Joy Pluck, Bank Officer, both of Christchurch - 7.4.1997 at 2.25pm

Mortgage A290610/4 to Bank of New Zealand - 7.4.1997 at 2.25pm

for A.L.R.

No. 40D/788

Identifier **CB40D/788**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

R.W. Muir
Registrar-General
of Land

Identifier **CB40D/788**
Land Registration District **Canterbury**
Date Issued 14 November 1995

Prior References
CB39A/686

Estate	Fee Simple
Area	4.0000 hectares more or less
Legal Description	Lot 3 Deposited Plan 70352

Registered Owners
Robert John Mackie, Elizabeth Gaynor Mackie and Mackie Family Trustees Limited

Interests

Subject to Part IV A Conservation Act 1987

A204853.21 Easement Certificate specifying the following easements - 14.11.1995 at 12.12 pm

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way, right to drain sewage, convey water, electric power and telephonic communications	Lot 4 Deposited Plan 70352 - CT CB40D/789	A DP 70352	Lot 3 Deposited Plan 70352 - herein	

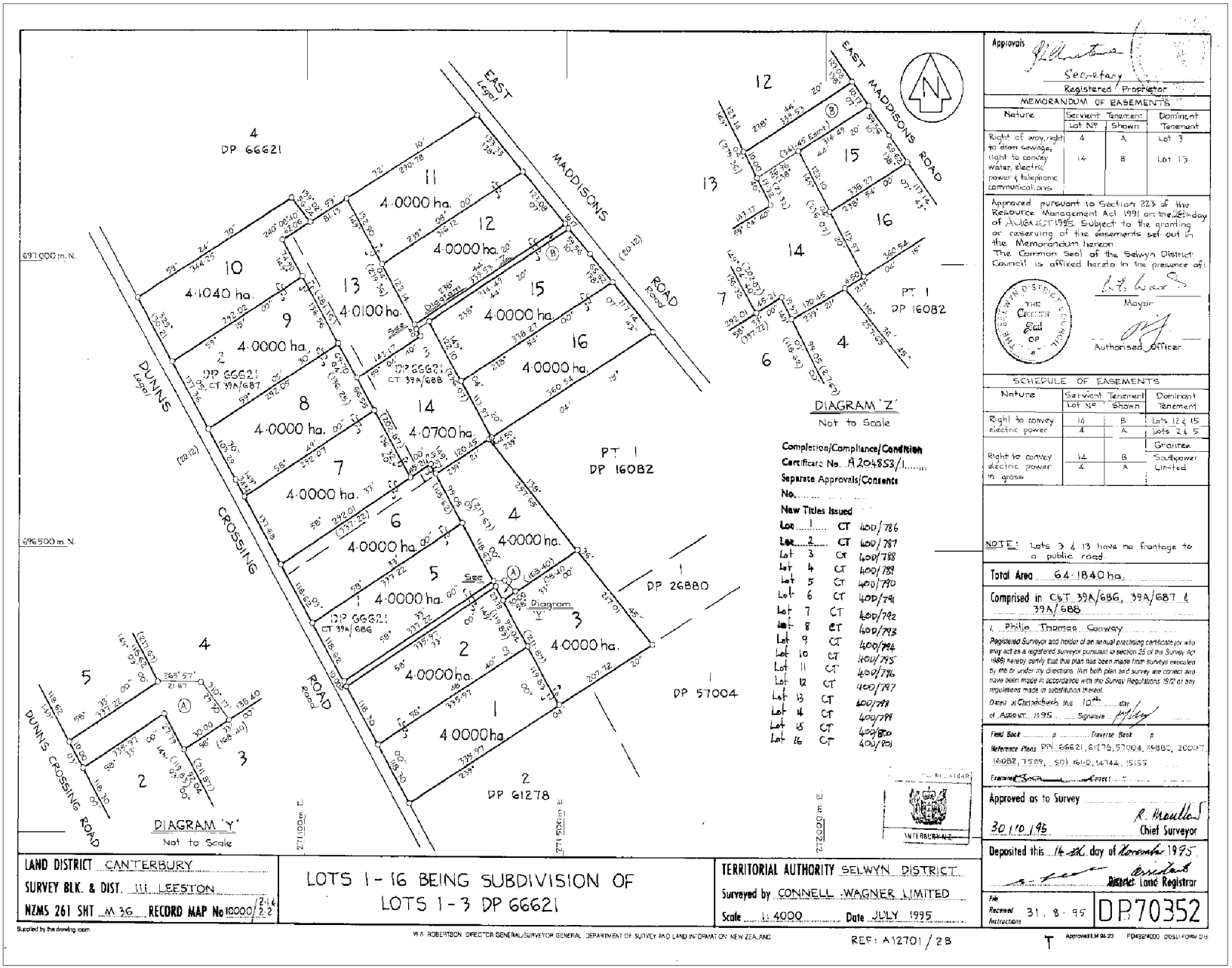
The easements specified in Easement Certificate A204853.21 when created will be subject to Section 243(a) Resource Management Act 1991

Fencing Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

Land Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

9224154.3 Mortgage to ANZ Bank New Zealand Limited - 5.11.2012 at 12:41 pm

11211027.1 Court Order Varying Land Covenant in Transfer A204853.22 - 24.8.2018 at 7:00 am



Completion/Compliance/Condition
Certificate No. A204853/1
Separate Approvals/Consents No.
New Titles Issued

Lot 1	CT	400/786
Lot 2	CT	400/787
Lot 3	CT	400/788
Lot 4	CT	400/789
Lot 5	CT	400/790
Lot 6	CT	400/791
Lot 7	CT	400/792
Lot 8	CT	400/793
Lot 9	CT	400/794
Lot 10	CT	400/795
Lot 11	CT	400/796
Lot 12	CT	400/797
Lot 13	CT	400/798
Lot 14	CT	400/799
Lot 15	CT	400/800
Lot 16	CT	400/801

Approvals
Secretary
Registered Proprietor

MEMORANDUM OF EASEMENTS

Nature	Servient Tenement Lot No	Shown	Dominant Tenement
Right of way, right to drain sewage, right to convey water, electric power & telephonic communications	4	A	Lot 3
	14	B	Lot 13

Approved pursuant to Section 223 of the Resource Management Act 1991 on the 22nd day of AUGUST 1995. Subject to the granting or reserving of the easements set out in the Memorandum hereon.
The Common Seal of the Selwyn District Council is affixed hereto in the presence of:
Mayor
Authorised Officer

SCHEDULE OF EASEMENTS

Nature	Servient Tenement Lot No	Shown	Dominant Tenement
Right to convey electric power	14	B	Lots 12 & 15
	4	A	Lots 2 & 5
			Grantee
Right to convey electric power in gross	14	B	Southpower Limited
	4	A	

NOTE: Lots 3 & 13 have no frontage to a public road.

Total Area 64·1840 ha.
Comprised in CST 39A/686, 39A/687 & 39A/688

I, Philip Thomas Conway
Registered Surveyor and holder of an annual practising certificate (or who may act as a registered surveyor pursuant to section 23 of the Survey Act 1986) hereby certify that this plan has been made from surveys executed by me or under my directions, that both plan and survey are correct and have been made in accordance with the Survey Regulations 1972 or any regulations made in substitution thereof.
Dated at Christchurch, this 10th day of August 1995. Signature

Field Book p Traverse Book p
Reference Plans PTN 66621, 61278, 57004, 26880, 20007, 16082, 7589, SO 16110, 14744, 15155
Examined Correct

Approved as to Survey
30/10/95
Chief Surveyor

Deposited this 14th day of November 1995
District Land Registrar

File
Received 31.8.95
Instructions

DP 70352

LAND DISTRICT CANTERBURY
SURVEY BLK. & DIST. III LEESTON
NZMS 261 SHT M 36 RECORD MAP No 10000/2·1·4 2·2

LOTS 1-16 BEING SUBDIVISION OF LOTS 1-3 DP 66621

TERRITORIAL AUTHORITY SELWYN DISTRICT
Surveyed by CONNELL WAGNER LIMITED
Scale 1:4000 Date JULY 1995

Supplied by the drawing room

W.A. ROBERTSON, DIRECTOR GENERAL/SURVEYOR GENERAL, DEPARTMENT OF SURVEY AND LAND INFORMATION, NEW ZEALAND

REF: A12701/2B

Approved LM 94.23 PD492/4000 DOSLI FORM D15

APPENDIX 3:

LLUR Statement

Property Statement
from the Listed Land Use Register

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

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

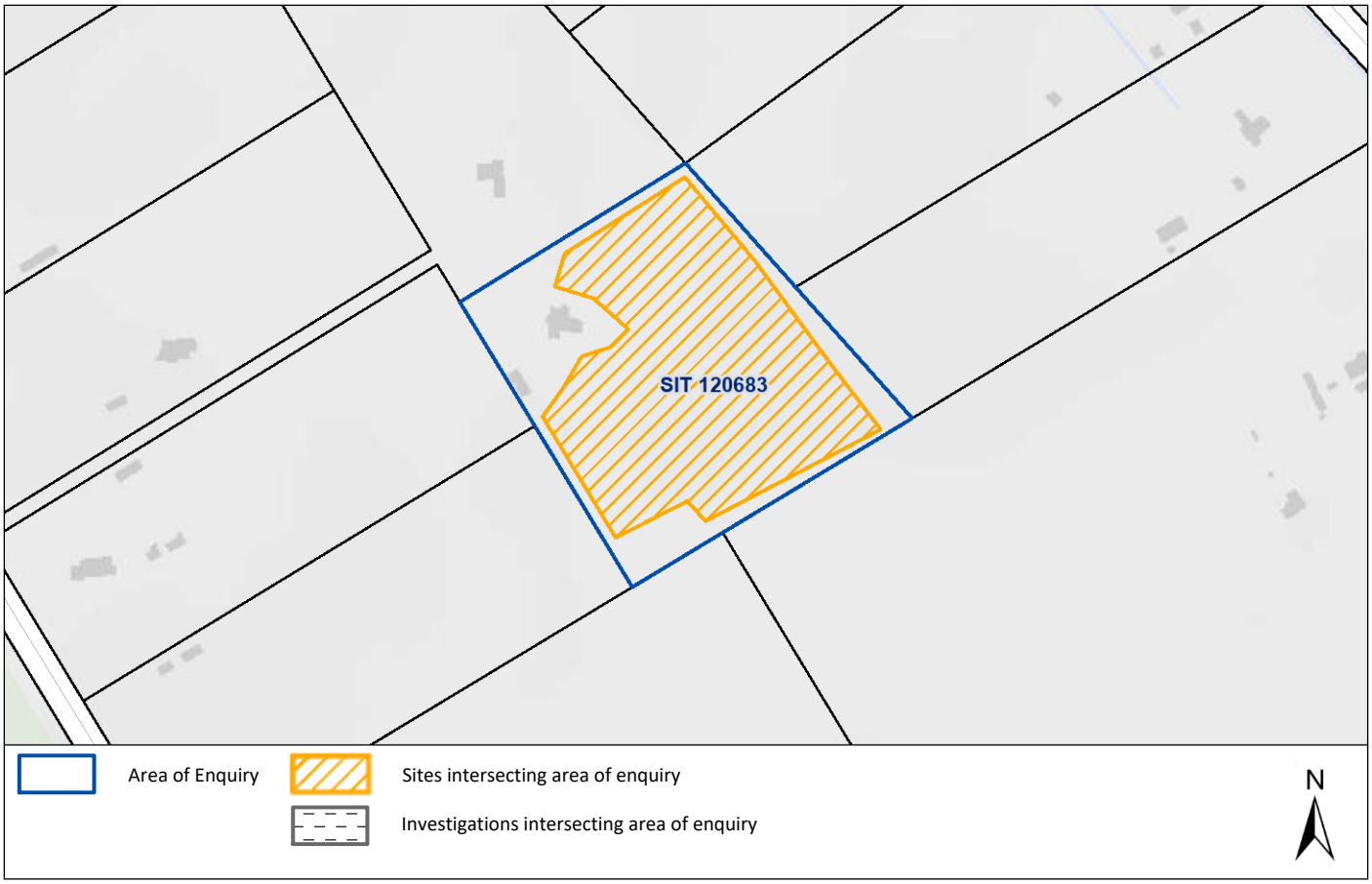
Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

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

www.ecan.govt.nz

Date:	30 July 2020
Land Parcels:	Lot 3 DP 70352 Valuation No(s): 2405537600;2405537700



The information presented in this map is specific to the property you have selected. Information on nearby properties may not be shown on this map, even if the property is visible.

Summary of sites:

Site ID	Site Name	Location	HAIL Activity(s)	Category
120683	3/144 Dunns Crossing Road, Rolleston	3/144 Dunns Crossing Road, Rolleston	A10 - Persistent pesticide bulk storage or use;	Not Investigated

Please note that the above table represents a summary of sites and HAILs intersecting the area of enquiry only.

Information held about the sites on the Listed Land Use Register

Site 120683: 3/144 Dunns Crossing Road, Rolleston (Intersects enquiry area.)

Site Address:	3/144 Dunns Crossing Road, Rolleston
Legal Description(s):	Lot 3 DP 70352

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

Land Uses (from HAIL):

Period From	Period To	HAIL land use
2000	Present	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

Notes:

8 Jan 2016 This record was created as part of the Selwyn District Council 2015 HAIL identification project.

8 Jan 2016 Area defined from 2000 to Present aerial photographs. Horticultural activities (persistent pesticides) were noted in aerial photographs reviewed.

Investigations:

There are no investigations associated with this site.

Information held about other investigations on the Listed Land Use Register

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ260363.

Disclaimer: ***The enclosed information is derived from Environment Canterbury's Listed Land Use Register and is made available to you under the Local Government Official Information and Meetings Act 1987 and Environment Canterbury's Contaminated Land Information Management Strategy (ECan 2009).***

The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness of this information. It is released only as a copy of Environment Canterbury's records and is not intended to provide a full, complete or totally accurate assessment of the site. It is provided on the basis that Environment Canterbury makes no warranty or representation regarding the reliability, accuracy or completeness of the information provided or the level of contamination (if any) at the relevant site or that the site is suitable or otherwise for any particular purpose. Environment Canterbury accepts no responsibility for any loss, cost, damage or expense any person may incur as a result of the use, reference to or reliance on the information contained in this report.

Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

APPENDIX 4:

Laboratory Reports

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2415802	SPv1
Contact:	Natalie Flatman	**Date Received:**	10-Aug-2020	
	C/- Engeo Limited	**Date Reported:**	13-Aug-2020	
	PO Box 373	**Quote No:**	82742	
	Christchurch 8140	**Order No:**		
		Client Reference:	12903.003.000	
		Submitted By:	Natalie Flatman	

Sample Type: Soil

Sample Name:		Composite of S1, S2, S3 & S4	Composite of S5, S6, S7 & S8	Composite of S9, S10, S11 & S12	Composite of S13, S14, S15 & S16	Composite of S17, S18, S19 & S20
Lab Number:		2415802.41	2415802.42	2415802.43	2415802.44	2415802.45
Individual Tests						
Dry Matter	g/100g as rcvd	77	80	78	78	76
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	2	3	3	3	6
Total Recoverable Cadmium	mg/kg dry wt	0.10	< 0.10	0.10	0.14	0.27
Total Recoverable Chromium	mg/kg dry wt	11	10	11	12	12
Total Recoverable Copper	mg/kg dry wt	4	4	6	5	8
Total Recoverable Lead	mg/kg dry wt	13.1	13.3	13.6	13.8	27
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	8	8	8	10	8
Total Recoverable Zinc	mg/kg dry wt	47	47	52	47	58
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
alpha-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
beta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
delta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
cis-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
trans-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDE	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDE	mg/kg dry wt	0.106	0.071	0.090	0.121	0.070
2,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	0.012	0.013	< 0.013
Total DDT Isomers	mg/kg dry wt	0.11	< 0.08	0.10	0.13	< 0.08
Dieldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan I	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan II	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan sulphate	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin aldehyde	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin ketone	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor epoxide	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Hexachlorobenzene	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Methoxychlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013

Sample Type: Soil						
Sample Name:		Composite of S21, S22, S23 & S24	Composite of S25, S26, S27 & S28	Composite of S29, S30, S31 & S32	Composite of S33, S34, S35 & S36	Composite of S37, S38, S39 & S40
Lab Number:		2415802.46	2415802.47	2415802.48	2415802.49	2415802.50
Individual Tests						
Dry Matter	g/100g as rcvd	80	77	80	78	80
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.11	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	10	11	11	11
Total Recoverable Copper	mg/kg dry wt	5	5	5	4	5
Total Recoverable Lead	mg/kg dry wt	13.4	13.4	13.8	13.6	14.0
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	9	8	9	9	8
Total Recoverable Zinc	mg/kg dry wt	49	48	51	46	48
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
alpha-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
beta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
delta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
cis-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
trans-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDE	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDE	mg/kg dry wt	0.045	0.026	0.069	0.070	0.079
2,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Total DDT Isomers	mg/kg dry wt	< 0.08	< 0.08	< 0.08	< 0.08	0.08
Dieldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan I	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan II	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan sulphate	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin aldehyde	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin ketone	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor epoxide	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Hexachlorobenzene	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Methoxychlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	41-50
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	41-50
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD or GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8081 or 8270.	0.010 - 0.06 mg/kg dry wt	41-50
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	41-50

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-40

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 11-Aug-2020 and 12-Aug-2020. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Martin Cowell - BSc
Client Services Manager - Environmental

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TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2415802 SUPv1
Contact:	Natalie Flatman C/- Engeo Limited PO Box 373 Christchurch 8140	**Date Received:**	10-Aug-2020
		Date Reported:	13-Aug-2020
		Quote No:	82742
		Order No:	
		Client Reference:	12903.003.000
		Submitted By:	Natalie Flatman

Sample Type: Soil

		Sample Name:	Composite of S1, S2, S3 & S4	Composite of S5, S6, S7 & S8	Composite of S9, S10, S11 & S12	Composite of S13, S14, S15 & S16
		Lab Number:	2415802.41	2415802.42	2415802.43	2415802.44
Individual Tests						
Dry Matter	g/100g as rcvd		77.1 ± 5.0	79.6 ± 5.0	77.6 ± 5.0	78.2 ± 5.0
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt		2.4 ± 1.4	2.6 ± 1.4	3.0 ± 1.4	3.3 ± 1.4
Total Recoverable Cadmium	mg/kg dry wt		0.101 ± 0.067	< 0.10 ± 0.067	0.102 ± 0.067	0.138 ± 0.068
Total Recoverable Chromium	mg/kg dry wt		11.4 ± 2.2	10.1 ± 2.1	11.1 ± 2.2	12.2 ± 2.3
Total Recoverable Copper	mg/kg dry wt		4.0 ± 1.5	4.1 ± 1.5	6.4 ± 1.6	5.3 ± 1.5
Total Recoverable Lead	mg/kg dry wt		13.1 ± 2.0	13.3 ± 2.1	13.6 ± 2.1	13.8 ± 2.1
Total Recoverable Mercury	mg/kg dry wt		< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067
Total Recoverable Nickel	mg/kg dry wt		8.1 ± 1.7	8.3 ± 1.7	8.2 ± 1.7	9.6 ± 1.8
Total Recoverable Zinc	mg/kg dry wt		47.2 ± 4.3	46.5 ± 4.3	52.5 ± 4.6	47.3 ± 4.3
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt		< 0.013 ± 0.0048	< 0.013 ± 0.0047	< 0.013 ± 0.0048	< 0.013 ± 0.0048
alpha-BHC	mg/kg dry wt		< 0.013 ± 0.0048	< 0.013 ± 0.0047	< 0.013 ± 0.0048	< 0.013 ± 0.0048
beta-BHC	mg/kg dry wt		< 0.013 ± 0.0055	< 0.013 ± 0.0054	< 0.013 ± 0.0055	< 0.013 ± 0.0055
delta-BHC	mg/kg dry wt		< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0051	< 0.013 ± 0.0051
gamma-BHC (Lindane)	mg/kg dry wt		< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0046	< 0.013 ± 0.0047
cis-Chlordane	mg/kg dry wt		< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
trans-Chlordane	mg/kg dry wt		< 0.013 ± 0.0048	< 0.013 ± 0.0047	< 0.013 ± 0.0048	< 0.013 ± 0.0048
2,4'-DDD	mg/kg dry wt		< 0.013 ± 0.0053	< 0.013 ± 0.0052	< 0.013 ± 0.0053	< 0.013 ± 0.0053
4,4'-DDD	mg/kg dry wt		< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0064
2,4'-DDE	mg/kg dry wt		< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
4,4'-DDE	mg/kg dry wt		0.106 ± 0.053	0.071 ± 0.036	0.090 ± 0.045	0.121 ± 0.061
2,4'-DDT	mg/kg dry wt		< 0.013 ± 0.0068	< 0.013 ± 0.0067	< 0.013 ± 0.0068	< 0.013 ± 0.0068
4,4'-DDT	mg/kg dry wt		< 0.013 ± 0.0075	< 0.013 ± 0.0072	0.0124 ± 0.0074	0.0125 ± 0.0075
Total DDT Isomers	mg/kg dry wt		0.106 ± 0.055	< 0.08 ± 0.039	0.102 ± 0.047	0.134 ± 0.063
Dieldrin	mg/kg dry wt		< 0.013 ± 0.0061	< 0.013 ± 0.0059	< 0.013 ± 0.0060	< 0.013 ± 0.0061
Endosulfan I	mg/kg dry wt		< 0.013 ± 0.0053	< 0.013 ± 0.0052	< 0.013 ± 0.0053	< 0.013 ± 0.0053
Endosulfan II	mg/kg dry wt		< 0.013 ± 0.0061	< 0.013 ± 0.0059	< 0.013 ± 0.0060	< 0.013 ± 0.0061
Endosulfan sulphate	mg/kg dry wt		< 0.013 ± 0.0079	< 0.013 ± 0.0076	< 0.013 ± 0.0078	< 0.013 ± 0.0078
Endrin	mg/kg dry wt		< 0.013 ± 0.0083	< 0.013 ± 0.0080	< 0.013 ± 0.0082	< 0.013 ± 0.0082
Endrin aldehyde	mg/kg dry wt		< 0.013 ± 0.0072	< 0.013 ± 0.0071	< 0.013 ± 0.0072	< 0.013 ± 0.0072
Endrin ketone	mg/kg dry wt		< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0064
Heptachlor	mg/kg dry wt		< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0051	< 0.013 ± 0.0051
Heptachlor epoxide	mg/kg dry wt		< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0046	< 0.013 ± 0.0047
Hexachlorobenzene	mg/kg dry wt		< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0051	< 0.013 ± 0.0051
Methoxychlor	mg/kg dry wt		< 0.013 ± 0.0083	< 0.013 ± 0.0080	< 0.013 ± 0.0082	< 0.013 ± 0.0082

Sample Type: Soil					
	Sample Name:	Composite of S17, S18, S19 & S20	Composite of S21, S22, S23 & S24	Composite of S25, S26, S27 & S28	Composite of S29, S30, S31 & S32
	Lab Number:	2415802.45	2415802.46	2415802.47	2415802.48
Individual Tests					
Dry Matter	g/100g as rcvd	75.9 ± 5.0	79.8 ± 5.0	77.5 ± 5.0	79.6 ± 5.0
Heavy Metals with Mercury, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt	5.7 ± 1.6	2.9 ± 1.4	3.1 ± 1.4	2.6 ± 1.4
Total Recoverable Cadmium	mg/kg dry wt	0.270 ± 0.076	< 0.10 ± 0.067	0.107 ± 0.067	< 0.10 ± 0.067
Total Recoverable Chromium	mg/kg dry wt	12.4 ± 2.4	11.2 ± 2.2	10.2 ± 2.1	11.5 ± 2.2
Total Recoverable Copper	mg/kg dry wt	8.2 ± 1.8	4.7 ± 1.5	4.5 ± 1.5	4.9 ± 1.5
Total Recoverable Lead	mg/kg dry wt	26.5 ± 4.0	13.4 ± 2.1	13.4 ± 2.1	13.8 ± 2.1
Total Recoverable Mercury	mg/kg dry wt	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067
Total Recoverable Nickel	mg/kg dry wt	7.9 ± 1.7	8.6 ± 1.8	8.3 ± 1.7	9.2 ± 1.8
Total Recoverable Zinc	mg/kg dry wt	57.6 ± 4.9	48.9 ± 4.4	48.2 ± 4.4	50.7 ± 4.5
Organochlorine Pesticides Screening in Soil					
Aldrin	mg/kg dry wt	< 0.013 ± 0.0049	< 0.013 ± 0.0048	< 0.013 ± 0.0048	< 0.013 ± 0.0048
alpha-BHC	mg/kg dry wt	< 0.013 ± 0.0049	< 0.013 ± 0.0048	< 0.013 ± 0.0048	< 0.013 ± 0.0048
beta-BHC	mg/kg dry wt	< 0.013 ± 0.0056	< 0.013 ± 0.0054	< 0.013 ± 0.0055	< 0.013 ± 0.0055
delta-BHC	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0052	< 0.013 ± 0.0052
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0047	< 0.013 ± 0.0047
cis-Chlordane	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
trans-Chlordane	mg/kg dry wt	< 0.013 ± 0.0049	< 0.013 ± 0.0048	< 0.013 ± 0.0048	< 0.013 ± 0.0048
2,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0054	< 0.013 ± 0.0053	< 0.013 ± 0.0053	< 0.013 ± 0.0053
4,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0065
2,4'-DDE	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
4,4'-DDE	mg/kg dry wt	0.070 ± 0.035	0.045 ± 0.023	0.026 ± 0.014	0.069 ± 0.035
2,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0069	< 0.013 ± 0.0067	< 0.013 ± 0.0068	< 0.013 ± 0.0069
4,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0075	< 0.013 ± 0.0073	< 0.013 ± 0.0074	< 0.013 ± 0.0075
Total DDT Isomers	mg/kg dry wt	< 0.08 ± 0.038	< 0.08 ± 0.027	< 0.08 ± 0.020	< 0.08 ± 0.038
Dieldrin	mg/kg dry wt	< 0.013 ± 0.0061	< 0.013 ± 0.0060	< 0.013 ± 0.0061	< 0.013 ± 0.0061
Endosulfan I	mg/kg dry wt	< 0.013 ± 0.0054	< 0.013 ± 0.0053	< 0.013 ± 0.0053	< 0.013 ± 0.0053
Endosulfan II	mg/kg dry wt	< 0.013 ± 0.0061	< 0.013 ± 0.0060	< 0.013 ± 0.0061	< 0.013 ± 0.0061
Endosulfan sulphate	mg/kg dry wt	< 0.013 ± 0.0080	< 0.013 ± 0.0077	< 0.013 ± 0.0078	< 0.013 ± 0.0079
Endrin	mg/kg dry wt	< 0.013 ± 0.0084	< 0.013 ± 0.0081	< 0.013 ± 0.0083	< 0.013 ± 0.0083
Endrin aldehyde	mg/kg dry wt	< 0.013 ± 0.0073	< 0.013 ± 0.0071	< 0.013 ± 0.0072	< 0.013 ± 0.0073
Endrin ketone	mg/kg dry wt	< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0065
Heptachlor	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0052	< 0.013 ± 0.0052
Heptachlor epoxide	mg/kg dry wt	< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0047	< 0.013 ± 0.0047
Hexachlorobenzene	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0052	< 0.013 ± 0.0052
Methoxychlor	mg/kg dry wt	< 0.013 ± 0.0084	< 0.013 ± 0.0081	< 0.013 ± 0.0083	< 0.013 ± 0.0083

	Sample Name:	Composite of S33, S34, S35 & S36	Composite of S37, S38, S39 & S40		
	Lab Number:	2415802.49	2415802.50		
Individual Tests					
Dry Matter	g/100g as rcvd	78.1 ± 5.0	79.8 ± 5.0	-	-
Heavy Metals with Mercury, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt	2.7 ± 1.4	2.9 ± 1.4	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10 ± 0.067	< 0.10 ± 0.067	-	-
Total Recoverable Chromium	mg/kg dry wt	11.0 ± 2.2	11.0 ± 2.2	-	-
Total Recoverable Copper	mg/kg dry wt	4.2 ± 1.5	4.5 ± 1.5	-	-
Total Recoverable Lead	mg/kg dry wt	13.6 ± 2.1	14.0 ± 2.2	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10 ± 0.067	< 0.10 ± 0.067	-	-
Total Recoverable Nickel	mg/kg dry wt	8.5 ± 1.8	8.1 ± 1.7	-	-
Total Recoverable Zinc	mg/kg dry wt	46.1 ± 4.2	47.8 ± 4.3	-	-
Organochlorine Pesticides Screening in Soil					
Aldrin	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0048	-	-
alpha-BHC	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0048	-	-
beta-BHC	mg/kg dry wt	< 0.013 ± 0.0055	< 0.013 ± 0.0054	-	-

Sample Type: Soil						
Sample Name:		Composite of S33, S34, S35 & S36	Composite of S37, S38, S39 & S40		
Lab Number:		2415802.49	2415802.50		
Organochlorine Pesticides Screening in Soil					
delta-BHC	mg/kg dry wt	< 0.013 ± 0.0051	< 0.013 ± 0.0051	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013 ± 0.0046	< 0.013 ± 0.0046	-	-
cis-Chlordane	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	-	-
trans-Chlordane	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0048	-	-
2,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0053	< 0.013 ± 0.0052	-	-
4,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0064	< 0.013 ± 0.0063	-	-
2,4'-DDE	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	-	-
4,4'-DDE	mg/kg dry wt	0.070 ± 0.035	0.079 ± 0.040	-	-
2,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0068	< 0.013 ± 0.0067	-	-
4,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0074	< 0.013 ± 0.0073	-	-
Total DDT Isomers	mg/kg dry wt	< 0.08 ± 0.038	0.079 ± 0.042	-	-
Dieldrin	mg/kg dry wt	< 0.013 ± 0.0060	< 0.013 ± 0.0060	-	-
Endosulfan I	mg/kg dry wt	< 0.013 ± 0.0053	< 0.013 ± 0.0052	-	-
Endosulfan II	mg/kg dry wt	< 0.013 ± 0.0060	< 0.013 ± 0.0060	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.013 ± 0.0078	< 0.013 ± 0.0077	-	-
Endrin	mg/kg dry wt	< 0.013 ± 0.0082	< 0.013 ± 0.0081	-	-
Endrin aldehyde	mg/kg dry wt	< 0.013 ± 0.0072	< 0.013 ± 0.0071	-	-
Endrin ketone	mg/kg dry wt	< 0.013 ± 0.0064	< 0.013 ± 0.0063	-	-
Heptachlor	mg/kg dry wt	< 0.013 ± 0.0051	< 0.013 ± 0.0051	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.013 ± 0.0046	< 0.013 ± 0.0046	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.013 ± 0.0051	< 0.013 ± 0.0051	-	-
Methoxychlor	mg/kg dry wt	< 0.013 ± 0.0082	< 0.013 ± 0.0081	-	-

The reported uncertainty is an expanded uncertainty with a level of confidence of approximately 95 percent (i.e. two standard deviations, calculated using a coverage factor of 2). Reported uncertainties are calculated from the performance of typical matrices, and do not include variation due to sampling.

For further information on uncertainty of measurement at Hill Laboratories, refer to the technical note on our website: www.hill-laboratories.com/files/Intro_To_UOM.pdf, or contact the laboratory.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	41-50
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	41-50
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD or GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8081 or 8270.	0.010 - 0.06 mg/kg dry wt	41-50
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	41-50
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-40

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 11-Aug-2020 and 12-Aug-2020. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Kim Harrison MSc
Client Services Manager - Environmental