ENGEO

Expect Excellence

Combined Preliminary and Detailed Site Investigation

108 Dunns Crossing Road

Springston

Canterbury

Submitted to:

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1 Introduction

ENGEO Ltd was requested by Hughes Developments Limited to undertake a combined preliminary and detailed site investigation of the property at 108 Dunns Crossing Road in Springston, Canterbury.

The site location and investigation areas are shown in Figure 1. ENGEO understands that the site is to be redeveloped into a residential subdivision. The environmental assessment was performed as part of an investigation into the potential contaminants at the site and the suitability of the site for residential land use.

This combined PSI / DSI was completed in order to satisfy Selwyn District Council (SDC) resource consent requirements in accordance with the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES).

This DSI was performed in general accordance with the MfE's *Contaminated Land Management Guidelines (CLMG) No.5: Site Investigation and Analysis of Soils* and reported in general accordance with the MfE's *CLMG No.1: Reporting on Contaminated Sites in New Zealand*.

1.1 Objectives of the Assessment

The objectives of this assessment were to:

- Evaluate and identify conditions indicative of releases and threatened releases of hazardous substances on, at, in or to the subject property;
- Evaluate the presence of and extent of identified contaminants of concern (COC) at the site; and
- Assess whether the COCs pose an unacceptable risk to human health or the environment during and post site redevelopment.

1.2 Approach

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

- Current and past property uses and occupancies;
- Current and past uses of hazardous substances;
- Waste management and disposal activities that could have caused a release or threatened release of hazardous substances;
- Current and past corrective actions and response activities to address past and on-going releases of hazardous substances at the subject property;
- Properties adjoining or located near the subject property that have environmental conditions that could have resulted in conditions indicative of releases or threatened releases of hazardous substances to the subject property; and
- Following the desktop review, ENGEO collected representative soil samples for laboratory analysis from shallow soil sampling completed across the site.

2 Site Description and Setting

The total site area is 101,150 m^2 and has the legal description of LOT 2 DP 61278. We understand that the property at 108 Dunns Crossing Road is to be subdivided into residential lots. The site location is displayed in Figure 1.

Site information is summarised in Table 1 with photographs of the site taken during the site sampling works provided in Appendix 1.

Table 1: Site Information

Item	Description
Location	108 Dunns Crossing Road, Springston, Canterbury
Legal Description	Lot 2 DP 61278
Site Area	10.1 ha
Property Owner	Under contract to Hughes Developments Limited
Current Land Use	Mixed residential and agricultural
Proposed Land Use	Residential
Territorial Authority	Selwyn District Council

The site setting is summarised in Table 2.

Table 2: Site Setting

Item	Description
Topography	The site is generally flat.
Local Setting	The surrounding area is mixed agricultural and residential lifestyle blocks. The remnants of an orchard are visible at 3/144 Dunns Crossing Road.
Nearest Surface Water & Use	There is an unnamed stream/drain approximately 420 m to the northeast of the site, running northwest to northeast.

2.1 Geology and Hydrogeology

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

Table 3: Geology and Hydrogeology

Item	Description
Geology	Unconsolidated to poorly consolidated mud, sand, gravel and peat of alluvial and colluvial origin.
Groundwater Abstractions	There is one groundwater abstraction located on the site and six active abstractions within 250 m of the site: M36/4450: LK & JC Blackmore, active well (25.2 m) for irrigation use on the site. M36/5041: Kajens Trading Development Ltd, active well (32.0 m) for domestic supply to the north of the site. M36/4449: GJ & FR Tyack, active well (24.2 m) for irrigation use of the south of the site. M36/4451: GJ & FR Tyack active well (no depth) for domestic supply to the south of the site. M36/8130: DB Irvine, active well (97.11 m) for irrigation use to the west of the site. M36/5038: Kajens Trading Developments Ltd, active well (32.1 m) for domestic supply to the northwest of the site. M36/5040: Kajens Trading Developments Ltd, active well (34.5 m) for irrigation use to the northwest of the site.
Discharge Consents	There are no discharge consents located on or within 250 m of the site.

2.2 Groundwater and Surface Water Sensitivity

Groundwater is not considered to be shallow with a groundwater bore search indicating that there are no groundwater abstractions located within 100 m of the site.

An assessment to establish whether the groundwater aquifer below the site is a 'sensitive aquifer, as defined by the Ministry for the Environment (MfE) Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand – Module 5 – Tier 1 Groundwater Acceptance Criteria (2011), has been undertaken (refer to Table 4). It is noted that an aquifer is sensitive when either all of the first three criteria set out below are met or the fourth criterion is met in accordance with Modules 5.2.3 of the MfE Guidelines.

Table 4: Groundwater Sensitivity

Criteria	Assessment
The aquifer is not artesian or confined.	**No**. The site is overlying an unconfined or semi-confined aquifer.
The aquifer is expected to be less than 10 m below the potential suspected source of impact.	**No**. The aquifer is expected to be greater than 10 m below the site.
The aquifer is of a quality appropriate for use, can yield water at a useful rate and is in an area where abstraction and use of groundwater may be reasonably foreseen.	**Yes**. There is a groundwater abstraction on-site for irrigation supply.
The source is less than 100 m from a sensitive surface water body (i.e. a surface water body where limited dilution is available to mitigate the impact of contaminated groundwater discharging into the surface water body).	**No**. The nearest surface water is approximately 420 m to the east of the site.
Sensitivity Assessment	The aquifer is considered **NOT SENSITIVE**

Groundwater is considered to be NOT SENSITIVE in relation to the MfE sensitive aquifer assessment.

The Canterbury Land and Water Regional Plan (LWRP) Rule 5.187, states that the passive discharge of contaminants from contaminated land onto or into in circumstance where those contaminants may enter water is a permitted activity, provided the following conditions are met:

1. There has been a site investigation report provided to the CRC in accordance with Rule 5.185.
2. Either the site investigation report or water quality sampling demonstrates that the discharge does not result in the concentration of contaminants in groundwater:
    a. At the property boundary.
    b. At any existing groundwater bore (excluding any monitoring bore located on the property).
    c. Within a Community Drinking-Water Protection Zone.
    d. Exceeding the limits applicable to groundwater set out in Schedule 8.
3. Either the site investigation report or water quality sampling demonstrates that the discharge does not result in the concentration of contaminants in groundwater at any point where groundwater exits to surface water, exceeding the receiving water quality standards in Schedule 5 for 90% of species.
4. At any point where the groundwater exits to surface water the discharge does not produce any:
    a. Conspicuous oil or grease films, scums of foam, or floatable or suspended materials.

b. Conspicuous change in the colour or visual clarity.

3 Site History

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

3.1 Conversations with Site Owner/Occupier

A conversation with Lindsay Blackmore was held regarding the site and its current and past uses. Lindsay bought the property in 1992 and the site was undeveloped at the time of purchase. Lindsay stated that he had never used any chemical sprays on plants and only used snail bait and small amounts of fertilisers on the vegetable garden to the north of the dwelling. The horse track had been constructed by stripping back the topsoil from the ground and then placing a small amount of imported gravel to form the track. A small amount of left-over soil and gravel is observed to the west of the track. He stated that the top north-western corner of the site was planted with gum trees (*Eucalyptus*) and he was not aware if the neighbour from 3/144 had used pesticides on the trees prior to selling the property to the new owners. He stated that he had never buried any offal or rubbish on the property but had burnt small piles of green waste historically in different sections of the site.

3.2 Listed Land Use Register (LLUR)

Canterbury Regional Council (CRC) maintains a Listed Land Use Register (LLUR) of past and current land uses within the Canterbury Region. The LLUR documents properties on which potentially hazardous activities have been undertaken. The potentially hazardous activities are defined on the MfE HAIL. Identifying a HAIL activity on the site triggers the requirement for a contaminated land assessment prior to development.

The CRC LLUR property statement was requested by ENGEO on 24 October 2019 for the site and is presented in Appendix 2. No areas of concern were identified on the CRC LLUR for the sites.

3.3 Selwyn District Council Property File

The property file for the site, held by Selwyn District Council, was reviewed on 5 November 2019 as a part of the PSI / DSI. The information below was gathered from the property file:

- 12 October 1995: Resource consent to erect 3 poultry sheds and establish a factory farming operation – retracted.
- 30 May 1997: Building consent for a hay/implement shed.
- 19 March 2003: Building consent for a 5 bay farm building – 120 m^2.
- 3 June 2003: Building consent for a 3 bedroom domestic dwelling with attached garage.

3.4 Certificate of Title

A review of the certificate of title was completed with no information related to the potential contaminating activities listed. The Certificates of Titles are attached in Appendix 3.

3.5 Historical Aerial Photograph Review

Aerial photographs obtained from Canterbury Maps and Google Earth from 1940 to 2017 have been reviewed. The relevant visible features are summarised in Table 5.

Table 5: Historical Aerial Photograph Review

Date	Source	Description
1940-1944	Canterbury Maps	The site appears to be a part of two relatively large paddocks which appear to have been ploughed or are bare (non-vegetated). Visible paleo channels are visible across the site running from the northwest boundary to the southeast boundary. The surrounding sites to the north, east and south are undeveloped and appear to be used for grazing. A small shed is visible along the south-western boundary at 92 Dunns Crossing Road. The sites to the west across Dunns Crossing Road is planted in forest.
1960-1964	Canterbury Maps	The site appears to be unchanged. The north-eastern section of the paddocks appears to be planted in crops in visible large sections. Sheep are visible in the south-western section of the site. The surrounding area remains mainly unchanged. One additional structure has been constructed along the south-western boundary line at 92 Dunns Crossing Road. This structure may be a sheep dip.
1970-1974	Canterbury Maps	The site no longer appears to have any crops growing on it and appears to be used for grazing. The potential sheep dip structure at 92 Dunns Crossing Road is still present. Additional trees have been planted along the roadside across Dunns Crossing Road in the forest area.
1980-1984	Canterbury Maps	The site appears to still be used for grazing. A large area of ponding is visible from the top north corner of the site to the south-eastern boundary line. It is presumed this area is ponding of water as there are other areas of ponding visible in paddocks to the northeast of the site. The surrounding areas remain mainly unchanged. The sheep dip structure appears to still be in place at 92 Dunns Crossing Road, however the photograph is low quality so it may be disused. Some of the forest block across Dunns Crossing Road appears to have been cleared.
1990-1994	Canterbury Maps	The site appears to still be used for grazing. Three paddocks are now visible with a new hedge/vegetation line running northwest to southeast across the top third of the site. The sites to the north and east of the site remain unchanged. The site at 92 Dunns Crossing Road appears to have been developed with a residential dwelling and associated sheds present in the western section of the site. A horse track is visible which covers most of the east section of the site. The sites across Dunns Crossing Road appear to have been replanted in trees.

Date	Source	Description
2000-2004	Canterbury Maps	The site has been developed. A horse track is visible which covers most of the north-western part of the site. The top north-western corner of the site appears to be vegetated. A shed or barn has been constructed in the south-eastern corner of the site with a driveway running to the barn from Dunns Crossing Road. Vegetation is visible planted in a rectangular shape (around current dwelling) to the north of the driveway. An area of land disturbance is visible on the western corner of the race track. Residential development has occurred to the sites to the northwest of the site. The remainder of the surrounding area remains mainly unchanged.
2010-2015	Canterbury Maps	A residential dwelling has been constructed to the north of the driveway coming off Dunns Crossing Road. Trees and other vegetation has been planted around the dwelling. A small vegetable garden and small sheds are visible on the north-eastern side of the dwelling. The shed/barn to the south of the driveway appears to have been added onto or another barn has been constructed next to the original. The horse track is still visible. The trees in the north-western corner of the site have matured. A small burn pit is visible in the middle of the horse track area. An orchard is visible at 3/144 Dunns Crossing Road directly northwest of the site. There is an area of land disturbance or ponding at 597 East Maddisons Road just beyond the north-eastern boundary of the site. The forestry block across Dunns Crossing Road has been cleared and is undeveloped. A small residential dwelling and shed has been constructed at 130 Dunns Crossing Road to the northwest of the site.
2018	Canterbury Maps	The site remains unchanged from the previous photograph. Some of the orchard at 3/144 Dunns Crossing Road has been cleared. The remainder of the surrounding area is unchanged from the previous photograph.

4 Current Site Conditions

A site walkover was completed by an ENGEO representative on 4 November 2019. A summary of the walkover is provided in Table 6 below.

Table 6: Current Site Conditions

Site Conditions	Comments
Visible signs of contamination	No visible signs of contamination were observed on either site.
Surface water appearance	There was no surface water identified on the site.

Site Conditions	Comments
Currently surrounding land use	The sites to the north, east, south and west are all mixed use – residential and agricultural.
Local sensitive environments	No sensitive environments were observed on-site.
Visible signs of plant stress	No visible signs of plant stress were observed on the site.
Additional observations	Small stockpile of gravel was observed to the west of the horse track. Small piles of greenwaste were observed in the north-west corner of the site below the gum trees. One 10L drum and one 100L drum were observed near the sheds. These drums were empty and no soil staining was visible on the ground.

5 Summary of Preliminary Site Investigation

Potential sources of contamination at the site were assessed. The information is summarised in Table 7 below.

Table 7: Potential Contaminants at the Site

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES (Soil)	Potential to be a risk on-site?
Horse track	Heavy metals PAHs	Area of horse track	I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.	**Unknown.** Analysis of soils from track required.

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES (Soil)	Potential to be a risk on-site?
Spray Drift from Neighbouring Orchard.	Heavy metals. Organochlorine pesticides.	North-western section of the site.	H: Any land that has been subject to the migration of hazardous substances from adjacent land in sufficient quantity that it could be a risk to human health or the environment. A10: Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds.	**Unknown.** Analysis of soil in north-western section of the site is required.

6 Intrusive Investigation

An intrusive investigation was developed to investigate if the soils have been impacted to 0.3 meters below ground level (m bgl). The soils were sampled to assess the suitability of the land (from a contamination / human health perspective) for residential use, and to assess the human health risks posed to site works under the commercial / outdoor worker scenario.

6.1 Methodology

The following was undertaken during the soil sampling works:

- Collection of four soil samples using a hand trowel from across the horse track area from the imported fill (0.0-0.3 m);
- Collection of six soil samples using a hand trowel from across the north-western section of the site close to the neighbouring orchard (0.0-0.3 m);
- Each sample was inspected for visual and olfactory indicators of contamination;
- All soil samples collected were placed in jars, which were then sealed, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to Hill Laboratories under the standard chain of custody documentation provided in Appendix 4;
- To reduce the potential for cross contamination, each sample was collected using disposable nitrile gloves that were discarded following the collection of each sample;
- After collection of each sample, the sampling equipment was decontaminated by scrubbing with a solution of Decon90 and rinsing with tap water followed by deionised water;

- The intrusive sampling was completed in accordance with ENGEO standard operating procedures while geological logging was completed in general accordance with the New Zealand Geotechnical Society Inc. '*Guideline for the Field Classification of Soil and Rock for Engineering Purposes' December 2005*;
- All fieldwork and sampling was undertaken in general accordance with the procedures for the appropriate handling of potentially contaminated soils as described in the MfE Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils;
- Following receipt of the samples by Hill Laboratories, the soil samples were scheduled for a selection of contaminants of concern including heavy metals, polycyclic aromatic hydrocarbons (PAHs) and organochlorine pesticides (OCPs); and
- On receipt of the analytical results, an assessment of the soil concentrations for contaminants of concern with applicable standards and soil acceptance criteria for the protection of human health and the environment was undertaken.

Quality Assurance and Quality Control

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

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

7 Regulatory Framework and Assessment Criteria

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

7.1 NES

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

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

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

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

7.2 Disposal Criteria

An assessment of potential off-site disposal options for any excess spoil generated during site development works has been conducted. Dependent on the contamination conditions of the spoil, off-site disposal options range from disposal to "cleanfill" sites to management fill sites. As outlined in the publication "A Guide to the Management of Clean Fills" (MfE, 2002), cleanfill is defined as:

"Material that when buried will have no adverse effect on people or the environment. Cleanfill material includes virgin natural materials such as clay, soil and rock, and other inert materials such as concrete or brick that are free of:

- Combustible, putrescible, degradable or leachable components;
- Hazardous substances;
- Products or materials derived from hazardous waste treatment, hazardous waste stabilization or hazardous waste disposal practices;
- Material that may present a risk to human health such as medical and veterinary waste, asbestos or radioactive substances; and
- Liquid waste."

7.3 Assessment Criteria

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

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

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

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

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

The soil analysis results have also been compared to Regional Background levels for heavy metals (arsenic, copper, cadmium, mercury, nickel, zinc) and organochlorine pesticides (OCPs). These provide information into the possible disposal options at a cleanfill facility.

8 Results

8.1 Soil Encountered

Please refer to Table 8 from the summary of subsurface soil encountered within the near surface soils in the burn pit area. Please refer to ENGEO's Geotechnical Report (ENGEO, 2019) for the site for additional soil profiles.

No potential asbestos containing material was visually identified in the fill material on the race track; therefore soil analysis for asbestos was not undertaken.

Table 8: Summary of Subsurface Soils

	Depth	Soil Description
Orchard	0.0-0.1	SILT with some sand, trace gravel and rootlets.
	0.1-0.3	SILT with some sand, trace gravel.
Horse Track	0.0-0.15	Silty GRAVEL with some sand.
	0.15-0.3	SILT with some sand, trace gravel.

8.2 Analytical Results

Six samples were collected from around the north-western section of the site closest to the neighbouring orchard in the surface soils (0.1 m bgl). All samples returned concentrations of heavy metals and OCPs below the applicable NES criteria and below the site specific background levels. Samples O-3, O-4, O-5 and O-6 reported very low concentrations of 4,4'-DDT, however these concentrations are only marginally above the laboratory detection of limit.

The horse rack samples (T-1, T-2, T-3, T-4) analysed for heavy metals and PAHs were reported below the applicable NES criteria and below the site specific background levels. All PAH analytes were reported below the laboratory detection of limit.

Table 9: Sample Analysis Results

Sample Name	T-1	T-2	T-3	T-4	O-1	O-2	O-3	O-4	O-5	O-6	Human health criteria – Residential Land Use	Human health criteria - Commercial / industrial outdoor worker (unpaved)[a]	Regional background - Trace Elements (Level 2)[b]
Soil Type	GRAVEL	GRAVEL	GRAVEL	GRAVEL	SILT	SILT	SILT	SILT	SILT	SILT			
Sample Depth, m	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.1-0.3	0.1-0.3	0.1-0.3	0.1-0.3	0.1-0.3	0.1-0.3			
Heavy Metals in soil, mg/kg													
Arsenic	3	3	3	3	3	3	3	3	3	3	20	70	6.35
Cadmium[c]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	0.10	3	1,300	0.14
Chromium[d]	12	11	11	12	13	12	13	11	13	12	460	6,300	19.89
Copper	4	5	5	4	3	5	4	4	4	4	>10,000	>10,000	11.68
Lead	16.7	11.3	12.4	13.7	16.7	13.7	14.8	11.6	13.7	12.5	210	3,300	19.75
Mercury	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	310	4,200	0.07
Nickel	8	8	8	8	8	7	8	7	8	7	400[c]	6,000[c]	13.91
Zinc	51	41	42	44	50	46	49	42	46	43	7,400[c]	400,000[c]	69.58
Organochlorine Pesticides in soil, mg/kg													
∑DDT	-	-	-	-	<0.07	<0.07	0.07	0.12	0.14	0.12	23.33	333.33	0.431
Dieldrin	-	-	-	-	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	0.86	53.33	-
Polycyclic aromatic hydrocarbons in soil, mg/kg													
BaP eq.	<0.03	<0.03	<0.03	0.03	-	-	-	-	-	-			0.922

[a] Human health criteria from the NES except where noted.
Bold text indicates that the concentration exceeds the Residential land use criterion.
Italics indicates that the concentration exceeds the Commercial/industrial land user criterion.
[b] ECan (2007) Background Concentrations of Selected Trace Elements in Canterbury Soils. Exceedances are underlined.
[c] Assumes soil pH of 5.
[d] Criteria for Chromium VI were conservatively selected.

9 Conceptual Site Model

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

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

The potential source, pathway, receptor linkages at this subject site are provided in Table 10.

Table 10: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Horse Track	Heavy metals and PAHs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers.	**Yes.** All samples were below the applicable NES criteria.
Orchard	Heavy metals and OCPs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers.	**Yes.** All samples were below the applicable NES criteria.

10 Conclusions and Recommendations

ENGEO Ltd was engaged by Hughes Developments Ltd to undertake a Preliminary and Detailed Site Investigation at a 10.1 ha site, situated at 108 Dunns Crossing Road, Rolleston, for a change in land use, subdivision and soil disturbance consent. Information was gathered and reviewed regarding the current and past uses of the site that could have resulted in releases or potential releases of hazardous substances to the subject property.

The review of information identified that the site has been used for agricultural grazing from circa 1940, and residential land use including a horse trotting track and various shed since 1990's/2000's.

No activities were identified on Canterbury Regional Council's Listed Land Use Register (CRC LLUR). The property file for the site was viewed at Selwyn District Council, and contained no information related to potential hazardous activities having occurred at the site.

During the site walkover the horse track was sampled for impacted imported fill material. It was noted that the imported fill consisted of gravel and shells. The laboratory analysis of four samples from around the trotting track area were submitted for analysis for heavy metals and PAHs. Six samples were also collected from the north-western corner of the site for heavy metals and OCPs due to the neighbouring site being a historic orchard. All ten samples returned concentrations below the site specific regional background criteria and the applicable NES human health criteria.

Based on the information gathered, we consider that it is highly unlikely for the soils to have been impacted from past and current uses of the site. As per regulation 7 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011, it is highly unlikely that an activity included on the HAIL has or is being carried out on the site therefore this piece of land is not covered by this piece of legislation.

11 References

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

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

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

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

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

12 Limitations

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

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

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

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

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

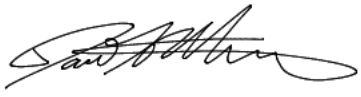
We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by

Natalie Flatman

Environmental Scientist

Report reviewed by



Dave Robotham, CEnvP SC

Principal Environmental Consultant

FIGURES

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Legend

Site boundary

Sample locations

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

ENGEO

Christchurch Office
124 Montreal Street, Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title: Site Location Plan

Client: Hughes Developments Ltd		Figure No: 1
Project: 108 Dunns Crossing Road Rolleston	Designed: NF Drawn: NF Checked: XX Date: Nov 19	Size: A3
Proj No: 12903.001.000	Scale: 1:2,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 1:

Site Photographs

Photo 1: Dwelling at 108 Dunns Crossing Road

Photo 2: Shed on site

Photo 3: Shed on site

Photo 4: Small sheds to the north of the dwelling

Photo 5: Residential vegetable garden to the north of the dwelling

Photo 6: Horse track

ENGEO
Expect Excellence

Date taken	Nov 19	**Client**	**Hughes Developments**		
Taken by	JH	**Project**	**108 Dunns Crossing Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	1 to 6	**ENGEO Ref.**	12903	**Appendix No.**	1a

Photo 7: Middle of horse track looking north

Photo 8: Middle of horse track area

Photo 9: Southern Gravel Stockpile (old oval track material)

Photo 10: Typical strata of horse track material

Photo 11: Green waste pile in gum trees northwest corner of the site

Photo 12: Empty storage containers near sheds

ENGEO
Expect Excellence

Date taken	Nov 19	**Client**	**Hughes Developments**		
Taken by	JH	**Project**	**108 Dunns Crossing Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	7 to 12	**ENGEO Ref**	12903	**Appendix No**	1b

APPENDIX 2:

CRC LLUR

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

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

www.ecan.govt.nz

Dear Sir/Madam

Thank you for submitting your property enquiry in regards to our Listed Land Use Register (LLUR) which holds information about sites that have been used, or are currently used for activities which have the potential to have caused contamination.

The LLUR statement provided indicates the location of the land parcel(s) you enquired about and provides information regarding any LLUR sites within a radius specified in the statement of this land.

Please note that if a property is not currently entered on the LLUR, it does not mean that an activity with the potential to cause contamination has never occurred, or is not currently occurring there. The LLUR is not complete, and new sites are regularly being added as we receive information and conduct our own investigations into current and historic land uses.

The LLUR only contains information held by Environment Canterbury in relation to contaminated or potentially contaminated land; other information relevant to potential contamination may be held in other files (for example consent and enforcement files).

If your enquiry relates to a farm property, please note that many current and past activities undertaken on farms may not be listed on the LLUR. Activities such as the storage, formulation and disposal of pesticides, offal pits, foot rot troughs, animal dips and underground or above ground fuel tanks have the potential to cause contamination.

Please contact and Environment Canterbury Contaminated Sites Officer if you wish to discuss the contents of the LLUR statement, or if you require additional information.
For any other information regarding this land please contact Environment Canterbury Customer Services.

Yours sincerely

Contaminated Sites Team

Property Statement
from the Listed Land Use Register

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

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

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

www.ecan.govt.nz

Date:	24 October 2019	
Land Parcels:	Lot 2 DP 61278	Valuation No(s): 2405538000

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

Summary of sites:

There are no sites associated with the area of enquiry.

Information held about the sites on the Listed Land Use Register

There are no sites associated with the area of enquiry.

Information held about other investigations on the Listed Land Use Register

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ244766.

Disclaimer:

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

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

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

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know

Everything is connected

What is the Listed Land Use Register (LLUR)?

The LLUR is a database that Environment Canterbury uses to manage information about land that is, or has been, associated with the use, storage or disposal of hazardous substances.

Why do we need the LLUR?

Some activities and industries are hazardous and can potentially contaminate land or water. We need the LLUR to help us manage information about land which could pose a risk to your health and the environment because of its current or former land use.

Section 30 of the Resource Management Act (RMA, 1991) requires Environment Canterbury to investigate, identify and monitor contaminated land. To do this we follow national guidelines and use the LLUR to help us manage the information.

The information we collect also helps your local district or city council to fulfil its functions under the RMA. One of these is implementing the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil, which came into effect on 1 January 2012.

For information on the NES, contact your city or district council.

How does Environment Canterbury identify sites to be included on the LLUR?

We identify sites to be included on the LLUR based on a list of land uses produced by the Ministry for the Environment (MfE). This is called the Hazardous Activities and Industries List (HAIL)[1]. The HAIL has 53 different activities, and includes land uses such as fuel storage sites, orchards, timber treatment yards, landfills, sheep dips and any other activities where hazardous substances could cause land and water contamination.

We have two main ways of identifying HAIL sites:

- We are actively identifying sites in each district using historic records and aerial photographs. This project started in 2008 and is ongoing.
- We also receive information from other sources, such as environmental site investigation reports submitted to us as a requirement of the Regional Plan, and in resource consent applications.

[1] The Hazardous Activities and Industries List (HAIL) can be downloaded from MfE's website www.mfe.govt.nz, keyword search HAIL

How does Environment Canterbury classify sites on the LLUR?

Where we have identified a HAIL land use, we review all the available information, which may include investigation reports if we have them. We then assign the site a category on the LLUR. The category is intended to best describe what we know about the land use and potential contamination at the site and is signed off by a senior staff member.

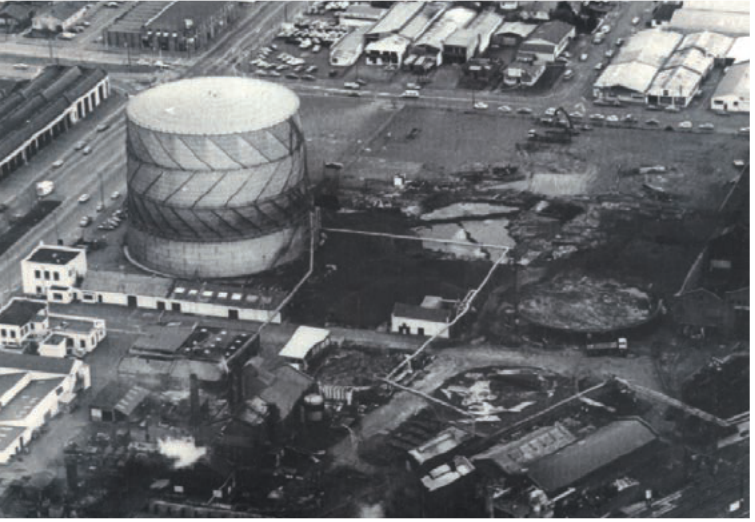
Please refer to the Site Categories and Definitions factsheet for further information.

What does Environment Canterbury do with the information on the LLUR?

The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list of any investigation reports.

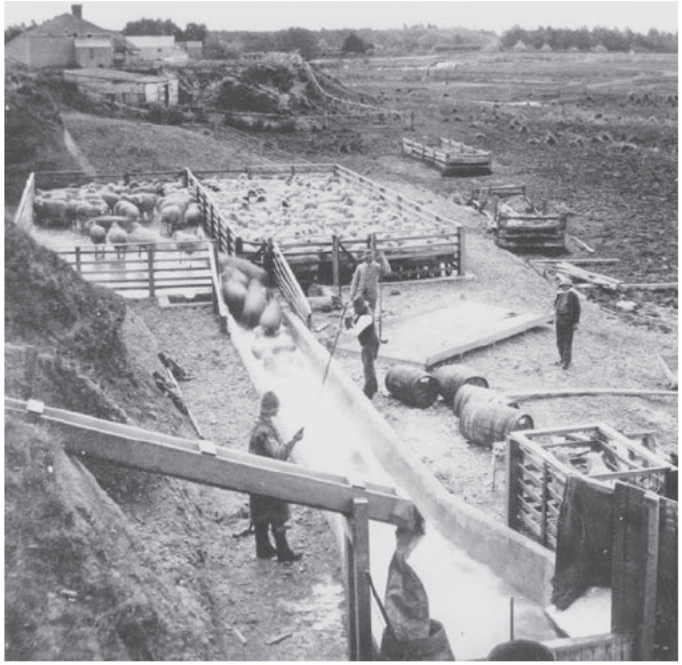
We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

If you are conducting an environmental investigation or removing an underground storage tank at your property, you will need to comply with the rules in the Regional Plan and send us a copy of the report. This means we can keep our records accurate and up-to-date, and we can assign your property an appropriate category on the LLUR. To find out more, visit www.ecan.govt.nz/HAIL.



IMPORTANT!

The LLUR is an online database which we are continually updating. A property may not currently be registered on the LLUR, but this does not necessarily mean that it hasn't had a HAIL use in the past.



Sheep dipping (ABOVE) and gas works (TOP) are among the former land uses that have been identified as potentially hazardous. (Photo above by Wheeler & Son in 1987, courtesy of Canterbury Museum.)

My land is on the LLUR – what should I do now?

IMPORTANT! Just because your property has a land use that is deemed hazardous or is on the LLUR, it doesn't necessarily mean it's contaminated. The only way to know if land is contaminated is by carrying out a detailed site investigation, which involves collecting and testing soil samples.

You do not need to do anything if your land is on the LLUR and you have no plans to alter it in any way. It is important that you let a tenant or buyer know your land is on the Listed Land Use Register if you intend to rent or sell your property. If you are not sure what you need to tell the other party, you should seek legal advice.

You may choose to have your property further investigated for your own peace of mind, or because you want to do one of the activities covered by the National Environmental Standard for Assessing and Managing Contaminants in Soil. Your district or city council will provide further information.

If you wish to engage a suitably qualified experienced practitioner to undertake a detailed site investigation, there are criteria for choosing a practitioner on www.ecan.govt.nz/HAIL.

I think my site category is incorrect – how can I change it?

If you have an environmental investigation undertaken at your site, you must send us the report and we will review the LLUR category based on the information you provide. Similarly, if you have information that clearly shows your site has not been associated with HAIL activities (eg. a preliminary site investigation), or if other HAIL activities have occurred which we have not listed, we need to know about it so that our records are accurate.

If we have incorrectly identified that a HAIL activity has occurred at a site, it will be not be removed from the LLUR but categorised as Verified Non-HAIL. This helps us to ensure that the same site is not re-identified in the future.

Contact us

Property owners have the right to look at all the information Environment Canterbury holds about their properties.

It is free to check the information on the LLUR, online at www.llur.ecan.govt.nz.

If you don't have access to the internet, you can enquire about a specific site by phoning us on (03) 353 9007 or toll free on 0800 EC INFO (32 4636) during business hours.

Contact Environment Canterbury:

Email: ecinfo@ecan.govt.nz

Phone:
Calling from Christchurch: (03) 353 9007
Calling from any other area: 0800 EC INFO (32 4636)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

Listed Land Use Register

Site categories and definitions

When Environment Canterbury identifies a Hazardous Activities and Industries List (HAIL) land use, we review the available information and assign the site a category on the Listed Land Use Register. The category is intended to best describe what we know about the land use.

If a site is categorised as **Unverified** it means it has been reported or identified as one that appears on the HAIL, but the land use has not been confirmed with the property owner.

If the land use has been confirmed but analytical information from the collection of samples is not available, and the presence or absence of contamination has therefore not been determined, the site is registered as:

Not investigated:

- A site whose past or present use has been reported and verified as one that appears on the HAIL.
- The site has not been investigated, which might typically include sampling and analysis of site soil, water and/or ambient air, and assessment of the associated analytical data.
- There is insufficient information to characterise any risks to human health or the environment from those activities undertaken on the site. Contamination may have occurred, but should not be assumed to have occurred.

If analytical information from the collection of samples is available, the site can be registered in one of six ways:

At or below background concentrations:

The site has been investigated or remediated. The investigation or post remediation validation results confirm there are no hazardous substances above local background concentrations other than those that occur naturally in the area. The investigation or validation sampling has been sufficiently detailed to characterise the site.

Below guideline values for:

The site has been investigated. Results show that there are hazardous substances present at the site but indicate that any adverse effects or risks to people and/or the environment are considered to be so low as to be acceptable. The site may have been remediated to reduce contamination to this level, and samples taken after remediation confirm this.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Managed for:

The site has been investigated. Results show that there are hazardous substances present at the site in concentrations that have the potential to cause adverse effects or risks to people and/or the environment. However, those risks are considered managed because:

- the nature of the use of the site prevents human and/or ecological exposure to the risks; and/or
- the land has been altered in some way and/or restrictions have been placed on the way it is used which prevent human and/or ecological exposure to the risks.

Partially investigated:

The site has been partially investigated. Results:

- demonstrate there are hazardous substances present at the site; however, there is insufficient information to quantify any adverse effects or risks to people or the environment; or
- do not adequately verify the presence or absence of contamination associated with all HAIL activities that are and/or have been undertaken on the site.

Significant adverse environmental effects:

The site has been investigated. Results show that sediment, groundwater or surface water contains hazardous substances that:

- have significant adverse effects on the environment; or
- are reasonably likely to have significant adverse effects on the environment.

Contaminated:

The site has been investigated. Results show that the land has a hazardous substance in or on it that:

- has significant adverse effects on human health and/or the environment; and/or
- is reasonably likely to have significant adverse effects on human health and/or the environment.

If a site has been included incorrectly on the Listed Land Use Register as having a HAIL, it will not be removed but will be registered as:

Verified non-HAIL:

Information shows that this site has never been associated with any of the specific activities or industries on the HAIL.

Please contact Environment Canterbury for further information:

(03) 353 9007 or toll free
on 0800 EC INFO (32 4636)
email ecinfo@ecan.govt.nz

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

E13/102

APPENDIX 3:

Certificate of Titles

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **CB36C/248**
Land Registration District **Canterbury**
Date Issued 29 October 1992

Prior References
CB33K/66

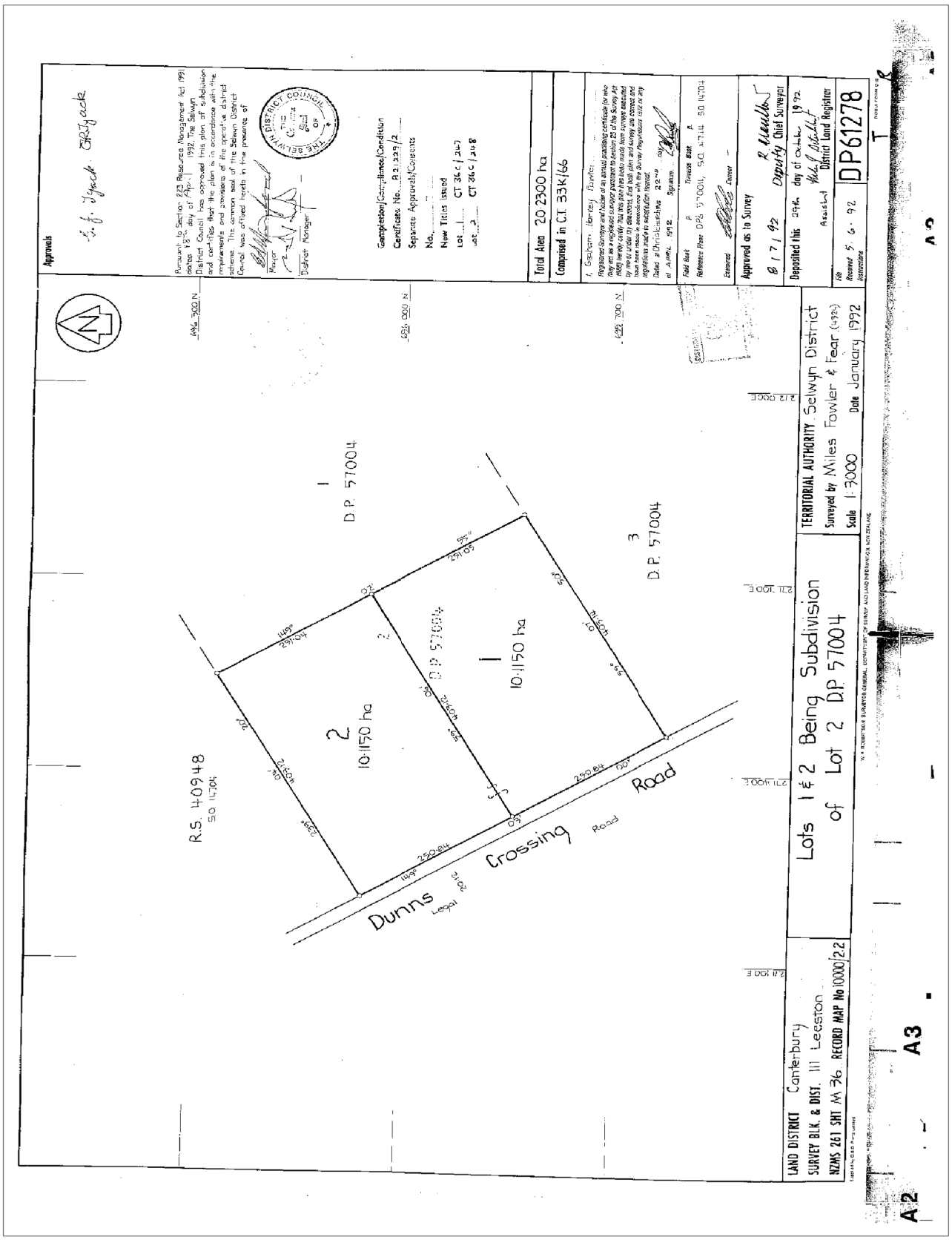
Estate	Fee Simple
Area	10.1150 hectares more or less
Legal Description	Lot 2 Deposited Plan 61278

Registered Owners
Lindsay Kenneth Blackmore as to a 1/2 share
Judith Christina Blackmore as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

Identifier **CB36C/248**



APPENDIX 4:

Laboratory Certificates

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2269325 SPv2
Contact:	Natalie Flatman C/- Engeo Limited PO Box 373 Christchurch 8140	**Date Received:**	05-Nov-2019
		Date Reported:	07-Nov-2019
		Quote No:	82742
		Order No:	
		Client Reference:	12903.000.000-108DC
		Submitted By:	Natalie Flatman

Sample Type: Soil

		Sample Name:	T-1 @ 0.0-0.1 04-Nov-2019	T-2 @ 0.0-0.1 04-Nov-2019	T-3 @ 0.0-0.1 04-Nov-2019	T-4 @ 0.0-0.1 04-Nov-2019	0-1 @ 0.1-0.3 04-Nov-2019
		Lab Number:	2269325.1	2269325.2	2269325.3	2269325.4	2269325.5
Individual Tests							
Dry Matter	g/100g as rcvd		87	97	96	92	84
Heavy Metals, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		3	3	3	3	-
Total Recoverable Cadmium	mg/kg dry wt		< 0.10	< 0.10	< 0.10	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt		12	11	11	12	-
Total Recoverable Copper	mg/kg dry wt		4	5	5	4	-
Total Recoverable Lead	mg/kg dry wt		16.7	11.3	12.4	13.7	-
Total Recoverable Nickel	mg/kg dry wt		8	8	8	8	-
Total Recoverable Zinc	mg/kg dry wt		51	41	42	44	-
Heavy Metals with Mercury, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		-	-	-	-	3
Total Recoverable Cadmium	mg/kg dry wt		-	-	-	-	< 0.10
Total Recoverable Chromium	mg/kg dry wt		-	-	-	-	13
Total Recoverable Copper	mg/kg dry wt		-	-	-	-	3
Total Recoverable Lead	mg/kg dry wt		-	-	-	-	16.7
Total Recoverable Mercury	mg/kg dry wt		-	-	-	-	< 0.10
Total Recoverable Nickel	mg/kg dry wt		-	-	-	-	8
Total Recoverable Zinc	mg/kg dry wt		-	-	-	-	50
Organochlorine Pesticides Screening in Soil							
Aldrin	mg/kg dry wt		-	-	-	-	< 0.012
alpha-BHC	mg/kg dry wt		-	-	-	-	< 0.012
beta-BHC	mg/kg dry wt		-	-	-	-	< 0.012
delta-BHC	mg/kg dry wt		-	-	-	-	< 0.012
gamma-BHC (Lindane)	mg/kg dry wt		-	-	-	-	< 0.012
cis-Chlordane	mg/kg dry wt		-	-	-	-	< 0.012
trans-Chlordane	mg/kg dry wt		-	-	-	-	< 0.012
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt		-	-	-	-	< 0.04
2,4'-DDD	mg/kg dry wt		-	-	-	-	< 0.012
4,4'-DDD	mg/kg dry wt		-	-	-	-	< 0.012
2,4'-DDE	mg/kg dry wt		-	-	-	-	< 0.012
4,4'-DDE	mg/kg dry wt		-	-	-	-	< 0.012
2,4'-DDT	mg/kg dry wt		-	-	-	-	< 0.012
4,4'-DDT	mg/kg dry wt		-	-	-	-	< 0.012
Total DDT Isomers	mg/kg dry wt		-	-	-	-	< 0.08
Dieldrin	mg/kg dry wt		-	-	-	-	< 0.012
Endosulfan I	mg/kg dry wt		-	-	-	-	< 0.012
Endosulfan II	mg/kg dry wt		-	-	-	-	< 0.012

ilac-MRA IANZ ACCREDITED LABORATORY

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with he terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		T-1 @ 0.0-0.1 04-Nov-2019	T-2 @ 0.0-0.1 04-Nov-2019	T-3 @ 0.0-0.1 04-Nov-2019	T-4 @ 0.0-0.1 04-Nov-2019	0-1 @ 0.1-0.3 04-Nov-2019
Lab Number:		2269325.1	2269325.2	2269325.3	2269325.4	2269325.5
Organochlorine Pesticides Screening in Soil						
Endosulfan sulphate	mg/kg dry wt	-	-	-	-	< 0.012
Endrin	mg/kg dry wt	-	-	-	-	< 0.012
Endrin aldehyde	mg/kg dry wt	-	-	-	-	< 0.012
Endrin ketone	mg/kg dry wt	-	-	-	-	< 0.012
Heptachlor	mg/kg dry wt	-	-	-	-	< 0.012
Heptachlor epoxide	mg/kg dry wt	-	-	-	-	< 0.012
Hexachlorobenzene	mg/kg dry wt	-	-	-	-	< 0.012
Methoxychlor	mg/kg dry wt	-	-	-	-	< 0.012
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	-
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Acenaphthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[a]anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[e]pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Chrysene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	0.012	-
Fluorene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	-
Perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Phenanthrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-

Sample Name:		0-2 @ 0.1-0.3 04-Nov-2019	0-3 @ 0.1-0.3 04-Nov-2019	0-4 @ 0.1-0.3 04-Nov-2019	0-5 @ 0.1-0.3 04-Nov-2019	0-6 @ 0.1-0.3 04-Nov-2019
Lab Number:		2269325.6	2269325.7	2269325.8	2269325.9	2269325.10
Individual Tests						
Dry Matter	g/100g as rcvd	83	83	91	83	90
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.10	0.10
Total Recoverable Chromium	mg/kg dry wt	12	13	11	13	12
Total Recoverable Copper	mg/kg dry wt	5	4	4	4	4
Total Recoverable Lead	mg/kg dry wt	13.7	14.8	11.6	13.7	12.5
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	7	8	7	8	7
Total Recoverable Zinc	mg/kg dry wt	46	49	42	46	43
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
alpha-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
beta-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
delta-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
gamma-BHC (Lindane)	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011

Sample Type: Soil						
Sample Name:		0-2 @ 0.1-0.3 04-Nov-2019	0-3 @ 0.1-0.3 04-Nov-2019	0-4 @ 0.1-0.3 04-Nov-2019	0-5 @ 0.1-0.3 04-Nov-2019	0-6 @ 0.1-0.3 04-Nov-2019
Lab Number:		2269325.6	2269325.7	2269325.8	2269325.9	2269325.10
Organochlorine Pesticides Screening in Soil						
cis-Chlordane	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
trans-Chlordane	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
4,4'-DDD	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
2,4'-DDE	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
4,4'-DDE	mg/kg dry wt	< 0.012	0.013	0.064	0.078	0.060
2,4'-DDT	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
4,4'-DDT	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Total DDT Isomers	mg/kg dry wt	< 0.07	< 0.07	< 0.07	0.08	< 0.07
Dieldrin	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endosulfan I	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endosulfan II	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endosulfan sulphate	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endrin	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endrin aldehyde	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endrin ketone	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Heptachlor	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Heptachlor epoxide	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Hexachlorobenzene	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Methoxychlor	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011

Analyst's Comments

Appendix No.1 - Chain of Custody

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-10
Total of Reported PAHs in Soil	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg dry wt	1-4
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-4
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	5-10
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082). Tested on as recieved sample	0.010 - 0.06 mg/kg dry wt	5-10
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.3 mg/kg dry wt	1-4
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-10
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-4

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Benzo[a]pyrene Toxic Equivalence (TEF)	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-4

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

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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

Martin Cowell - BSc
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street, Hamilton 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

Job No: **226 9325**

Date Recv: 05-Nov-19 05:49

Received by: Nathaniel Sue

3122693254

Quote No

Primary Contact Natalie Flatman

Submitted By Natalie Flatman

Client Name ENGEO Ltd

Address 124 Montreal Street, Syndeham

Christchurch *Postcode* 8014

Phone *Mobile* s 9(2)(a)

Email s 9(2)(a)

Charge To ENGEO Ltd

Client Reference 12903.000.000_108DC

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☑ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

ADDITIONAL INFORMATION

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories

Date & Time: 4/11/19 4:00

Name: N Flatman

☑ *Tick if you require COC to be emailed back*

Signature:

Received at Hill Laboratories

Date & Time:

Name:

Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen

Temp: >3

☐ *Sample and Analysis details checked*

Signature:

Priority ☐ Low ☐ Normal ☑ High

☐ **Urgent** (ASAP, extra charge applies, please contact lab first)

Requested Reporting Date:

No.	Sample Name	Sample Date	Sample Time	Sample Type	Tests Required (if not as per Quote)
1	T-1 @0.0-0.1	4/11/19		ES	Heavy metals & PAHs
2	T-2 @0.0-0.1				" "
3	T-3 @0.0-0.1				" "
4	T-4 @0.0-0.1				" "
5	D-1 @0.1-0.3				Heavy metals incl Mercury & OCPs
6	D-2 @0.1-0.3				" "
7	D-3 @0.1-0.3				" "
8	D-4 @0.1-0.3				" "
9	D-5 @0.1-0.3				" "
10	D-6 @0.1-0.3				" "
11					
12					

Continued on next page