

Attachment F:

Contaminated Land Information



ENGEO

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Project Number 21517.000.001

**Updated Combined Preliminary and
Detailed Site Investigation**

29 Hamilton Street, Gore

Submitted to:

Kāinga Ora

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SQEP Certifying Statement

I certify that the site has been assessed in accordance with current New Zealand Regulations and guidance documents and reported in general accordance with the Ministry for the Environment's Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand (dated 2021).

I am considered by ENGEO Limited to be a suitably qualified and experienced practitioner (SQEP) able to certify reports pursuant to the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011, based on the company's definition of a SQEP as given below.



Dated: 26 April 2023

ENGEO Limited requires that a SQEP has the following Qualifications / Experience:

- *Tertiary science or engineering qualification relevant to environmental assessment.*
- *A minimum of ten years of relevant experience.*
- *Registration with a professional body that assess and certifies environmental professionals in the competency criteria of training, experience, professional conduct and ethical behaviour.*

Executive Summary

Site Address	29 Hamilton Street, Gore, Southland	
Legal Description	LOT 3 DP 391234; LOT 9 DP 1219, LOT 10 DP 1219	
Site Investigation Area	Approximately 7,683 m ²	
Proposed Redevelopment	Construction of new dwellings	
Adopted land use scenario from the NES	Residential 10% Produce	
Historical / Current Land Use	Tavern and function centre	
Analytical Results	<i>Exceedance(s) of human health criteria</i>	Yes
	<i>Exceedance(s) of environmental discharge criteria</i>	No
	<i>Exceedance(s) of regional background criteria</i>	Yes
Applicable HAIL activity as defined by the NES (Soil)	The Environment Southland Selected Land Use Sites Register (SLUS) was reviewed for this desktop study. All three properties that make up the site, 29 Hamilton Street are not currently listed as HAIL sites.	
Regulatory Compliance	<p>Future land disturbance and disposal is a controlled activity under Regulation 9 of the NES, if permitted activity requirements of Regulation 8(3) cannot be met.</p> <p>Due to the level of contamination at the site, a discharge consent is likely to be required. The requirements for a separate discharge consent should be confirmed with Environment Southland prior to disturbance of soils on-site.</p>	
Recommendations	Due to the exceedances of human health criteria and predicted background concentrations, works shall be managed in accordance with the appended Site Management Plan.	

1 Introduction

ENGEO Ltd was requested by Kāinga Ora to update the existing Preliminary and Detailed Site Investigation (PSI / DSI) (EC Otago 2022) of the property at 29 Hamilton Street, Gore (herein referred to as 'the site'; attached Figure 1). This work has been carried out in accordance with the signed agreement dated 7 December 2022 (ENGEO, 2022) and signed CCCS dated 17 January 2023.

This PSI / DSI has been undertaken to satisfy the requirements of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (the "NES") (Parliamentary Counsel Office, 2011). This investigation provides information regarding the presence of land contaminants that pose a risk to future site users and site redevelopment workers. The results of this investigation have been used to evaluate whether remediation is necessary prior to site redevelopment, and to assess the resource consents required under the NES. As requested by Kāinga Ora, the investigation does not include the "halo" around the buildings on-site.

This investigation also addresses the requirements of regional regulations covering discharges to the environment from contaminated sites during and post-redevelopment works; namely, the Proposed Southland Water and Land Plan- partially operative (2021).

This investigation was undertaken in general accordance with the Ministry for the Environment (MfE) Contaminated Land Management Guidelines (CLMG) No. 1: Reporting on Contaminated Sites in New Zealand (Ministry for the Environment, Revised 2021) and CLMG No 5: Site Investigation and Analysis of Soils (Ministry for the Environment, Revised 2021). This report has been certified by a Suitably Qualified and Experienced Practitioner in accordance with the requirements of the NES. Additionally, investigation work and reporting was undertaken in general accordance with the Kāinga Ora - Homes and Communities (Kāinga Ora) generic investigation and reporting protocol and sampling and analysis plan (dated July 2022).

1.1 Scope and Objectives of the Assessment

The scope of works included a review of the previous PSI and DSI, review of historical site information, and observations during the site walkover undertaken on 25 January 2023. The objective was to gather information relating to current and historical potentially contaminating activities at the site and to prepare a Preliminary Site Investigation (PSI) report.

Soil quality sampling and analysis was conducted where the review of the previous report identified gaps in data and the PSI identified a land use from the MfE Hazardous Activities and Industry List (HAIL) had (or potentially had) occurred. The objective of the soil sampling and analysis work was to verify the findings of the PSI, and to prepare a Detailed Site Investigation (DSI) report where required by the NES to assess:

- The type, extent, and level of contamination within the proposed development area.
- Whether contaminants of concern present an unacceptable risk to human health or identified environmental receptors.

The investigation was supervised, and report reviewed and approved by a suitably qualified and experienced contaminated land practitioner in accordance with national environmental regulations for soil contamination. ENGEO's statement of limitations for the project are provided in Attachment A.

2 Site Description

Site information is summarised in Table 1. The site location is shown on Figure 1 appended to this report.

Table 1: Site Information

Item	Description
Address	29 Hamilton Street, Gore, Southland
Legal Description	LOT 3 DP 391234; LOT 9 DP 1219, LOT 10 DP 1219
Current and Proposed Land Use	Current land use is as a vacant tavern and function centre. Proposed land use is the construction of new dwellings for residential use.
Site Investigation Area	Approximately 7,000 m ² (site area excluding the building footprint and building halo as defined in the General Kāinga Ora Contaminated Site Management Plan).
Site Setting	The site consists of a vacant tavern and function centre with associated infrastructure. The area to the north of the buildings is grassed with five large (non-NZ native) trees with the remainder of the site under asphalt for parking.
Topography	The site slopes gently from west to east.
Territorial Authority	Environment Southland.
Zoning	Residential.
Geology	The site has been regionally mapped to be underlain by fluvial deposits (Q2a) and adjacent to sandstones and siltstones of the regional Murihiku Supergroup (Turnball et al, 2003). Siltstone and mudstones are mapped as placed during the Jurassic to Cretaceous and therefore are anticipated to be much denser / harder compared with the younger fluvial deposits.
Hydrogeology	The 2022 investigation which conducted test pitting down to 2.3 m bgl did not encounter ground water. The Mataura River is at approximately elevation 70 - 71 m RL, 150 m to the west of the site. Depth to water measurements in boreholes suggest the site may be hydraulically connected to the Mataura groundwater table. Although crude, this suggests regional groundwater is likely to be shallow beneath the site (ENGEO 2023).

3 Site History

ENGEO obtained and reviewed available environmental and geological information relevant to the site, including historical aerial photographs and the Environmental Southland Selected Land Use Sites (SLUS) Register. Historical site information obtained during review of this information is summarised in this section.

3.1 Aerial Photograph Review

Aerial photographs dating from 1948 to 2022 have been reviewed; and a selection of these aerial images have been included in the appendices as Attachment B for reference.

Aerial photographs were sourced from Retrolens and Google Earth Pro. Relevant visible features on the site and surrounding area are summarised in Table 2.

Table 2: Aerial Photograph Summary

Date	Description
1948	The site is undeveloped and rural in nature. Residential development is visible to the north along Waverley Street. The site is bordered by agricultural land to the east, south and west.
1962	The site remains undeveloped and rural in nature. Further residential development to the south and west of the site. Agricultural land remains on the east boundary.
1971	Development of the structures currently on-site is underway in 1971 with the main tavern building visible in the 1971 image. Further residential development to north, south and west with the eastern boundary remaining agricultural land.
1985 - 2021	The site is as it appears today with the development of the tavern and function centre complete. The large non-native trees are visible on the north side of the property and the asphalt carpark has been formed. Residential development to the north, south and west is as it appears today. The eastern boundary remains agricultural land.

3.2 Environment Southland Selected Land Sites Register

The Environment Southland Selected Land Use Sites (SLUS) Register was reviewed as part of the desktop component of the preliminary site investigation. The site was not recorded on the SLUS.

The nearest HAIL Site is at 13 Oxford Street bordering the site to the south:

- SLUS -00000867: A10 Persistent pesticide bulk storage or use.

Environment Southland have classified this site as “Acceptable”.

3.3 EC Otago Soil Sampling Summary Report – 29 Hamilton Street, Gore, 2022

EC Otago staff undertook sampling at the site on 26 April 2022:

3.3.1 Site Investigations

- 16 shallow soil samples (0 – 0.1/0.15 m depth) were collected by hand auger from the lawn and garden areas.

- Fifteen samples (HA1, HA2, HA3, HB1, HB2, HB3, HC1, HC2, HC3, HE1, HE2, HE3, HA4, HB4, HC4) were composited by the laboratory into five, three-point composite samples, and analysed for organochlorine pesticides (OCPs) and / or heavy metals / metalloid, as the primary contaminants of concern for the potential HAIL activities identified.
- The remaining sample (HD), collected from the northeast corner of the property where recent aerial images show multiple cars to be parked, was analysed for heavy metals / metalloid and polycyclic aromatic hydrocarbons (PAH).
- Three soil samples (HA4, HB4 and HC4) collected from soil adjacent to the existing building and a single sample of fibre cement sheet, were analysed for the presence / absence of asbestos.
- Additional sampling was conducted across the property in conjunction with the geotechnical investigation:
 - Twelve soil samples (were collected from various depths, depending on the material encountered, across seven machine auger and machine excavated test pit locations:
 - HM1 (0.5-0.8 m bgl)
 - HM1 (1.1 m bgl)
 - HM2 (0-0.3 m bgl)
 - HM2 (0.4-0.8 m bgl)
 - HM3 (0-0.2 m bgl)
 - HM3 (1.2 m bgl)
 - HM4 (0-0.2-0.4 m bgl)
 - HM4 (0.6-1 m bgl)
 - HM5 (0.7-1.3 m bgl)
 - HM6 (0.2-0.5 m bgl)
 - HM7 (0.4-0.6 m bgl)
 - HM7 (1.4-1.6 m bgl)
 - All of the machine auger and test pit locations, except for location HM7, encountered fill material at depths ranging from 0.5 m to 1.7 m.

3.3.2 Results

- Site data was compared to the Soil Contamination Standards residential land use criteria (Ministry for the Environment, 2012. Users' Guide - National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health). To assess potential discharges to the environment, results were also compared to the Canadian Council of Ministers of the Environment (CCME) Soil Guidelines for the Protection of Environmental and Human Health.

- The concentration of contaminants in fill material across the site was generally consistent with predicted background concentrations.
- The concentration of lead in a soil sample collected from investigation location HM1, at a depth of 0.5-0.8 m bgl, exceeded the human health criterion for Residential 10% Produce. A marginal exceedance of the background concentration for cadmium and zinc were also identified in this sample. The results of a deeper sample (collected at 1.1 m bgl) indicate that elevated concentrations are likely limited to the shallower fill material.
- OCPs were detected in surface soil samples collected from around the building; however, the detectable concentrations are below guidance criteria.
- The concentration of arsenic and copper in one composite sample exceeded the adopted human health criteria (composite HA4, HB4 and HC4).
- The concentration of arsenic was below the human health criterion. One exceedance of background criteria was identified in sample HB4.
- The results for arsenic from HA4 were initially reported at 60 mg/kg, however repeat analysis as part of the in-house laboratory quality control procedures reported an average arsenic concentration of 8 mg/kg.
- Copper is also elevated above background in HA4 and HB4, chromium is elevated above background in HB4 (relative to the other surface samples) and zinc is elevated above background in HC4.
- PAH results from the asphalt sample collected in the car park indicates that the asphalt is unlikely to contain coal tar.
- BAP_{eq}^C calculations for PAH contamination is returned values of between <0.03 and 0.44 mg/kg therefore below the adopted criteria.
- No samples were found to exceed the Commercial/Industrial SCS.

3.3.3 EC Otago Recommendations

- The results of this investigation indicate that fill between 0.5 and 0.8 m bgl in the southwest of the site will require remediation for the site to be suitable for future residential land use. Further investigation is recommended to assess the extent of the area of impact and inform remediation.
- Exceedances of regional background concentrations for heavy metals and detectable concentrations of OCPs indicates the shallow soil and fill material across the site is suitable to remain, however would not be considered cleanfill for disposal purposes.
- Given the low sampling density for the size of the site and the high variability of contaminant concentrations within the fill material and some surface soils, additional sampling and analysis is highly recommended.

3.3.4 ENGEO Recommendations

- Additional soil analysis to increase the sampling density of the site. Given the variation of the fill noted during the previous investigations additional sampling will provide further information on possible contamination within the uncontrolled fill on-site. Samples will be taken in conjunction with the geotechnical investigations. Soil sample will be collected from the four proposed boreholes and hand augers (where possible) on-site.
- Additional samples to be taken within the footprint of the carpark where no samples were previously taken and in the vicinity of the identified area of lead contamination in the southwest of the site.
- Samples will be collected from 0.1, 0.3 and 0.5 m bgl and at additional depths depending on the material encountered.
- The soil samples will be analysed at an accredited laboratory for heavy metals (arsenic, copper, lead and zinc) and PAH where appropriate.

4 Redevelopment Proposal

The redevelopment plans for the site propose the demolition of the current site building to allow for the construction of 24 Units in 17 buildings consisting of:

- 7 x 1 bed dwellings.
- 10 x 2 bed dwellings.
- 4 x 3 bed dwellings.
- 2 x 4 bed dwellings.
- 1 x 5 bed dwellings.

ENGEO understands that redevelopment activities will include earthworks.

5 Sampling and Analysis Plan

The additional investigation was undertaken in tandem with the geotechnical investigations and in general accordance with the MfE CLMG No 5: Site Investigation and Analysis of Soils (Ministry for the Environment, Revised 2021) and Kāinga Ora generic investigation and reporting protocol and sampling and analysis plan (dated July 2022). Due to the identification of uncontrolled fill on-site in the EC Otago (2022) report and heavy metal contamination below 0.3 m bgl the site is not considered to meet the Conceptual Site Model set out in the Kāinga Ora Soil Sampling and Analysis Plan.

5.1 Potential Contaminants of Concern

Based on the information reviewed, the potential contaminants of concern are summarised in Table 3.

Table 3: Potential Contaminants

Potential Source of Contamination	Primary Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as Defined by the NES (Soil)
Uncontrolled fill identified in previous investigations	Heavy metals	Site wide	Category I: <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.</i>
Former agricultural use of the site and OCP storage on adjacent site.	Heavy metals & OCPs	Grassed areas of site	HAIL Category A10: <i>Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds.</i>
Combustion debris within fill.	PAHs	Site wide	Category I: <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.</i>

5.2 Regulatory Context

The NES

The National Environmental Standards (NES, 2011) applies when a person wants to undertake an activity listed in Regulations 5(2) to 5(6) of the NES, on a piece of land that is described under Regulations 5(7) or 5(8) of the NES.

The following activities listed in the NES have been assessed:

- Regulation 5(4) – disturbing soil.
- Regulation 5(5) – subdividing land.
- Regulation 5(6) – changing land use.

Based on our review of available information, the piece of land is considered to potentially meet the definition of “land covered” under Regulation 5(7) of the NES because an activity or industry described in the HAIL has potentially been undertaken on it; specifically:

- HAIL ID I.
- HAIL Category A10.

Proposed Southland Water and Land Plan – Rule 46 Land Contaminated by a Hazardous Substance

The Proposed Southland Water and Land Plan - partially operative (2021) considers the discharge of hazardous substances or wastes onto or into land or water, and issues associated with remedying or mitigating the adverse effects of those contaminated discharges.

The Proposed Southland Water and Land Plan considers the discharge of contaminants or soil from land contaminated by a hazardous substance onto or into land in circumstances which may result in those contaminants entering water that does not meet one or more of the conditions of Rule 46(a) or (b) is a discretionary activity.

5.3 Investigation Methodology

Sample locations were selected in conjunction with the geotechnical investigations and additional samples where possible in the vicinity of the EC Otago identified lead contamination. The potential sources of contamination and areas of impact identified (Section 5.1) outside of the building halos. Investigation locations are shown on attached Figure 2 (appended).

The intrusive investigation is summarised below:

- Four sample locations in the geotechnical investigation boreholes located outside the current and former building halos. Soil samples collected from 0 - 0.1 m bgs, 0.3 m bgs and 0.5 m bgs.
- One additional borehole advanced to 1 m bgl in the carpark. Soil samples collected from 0 - 0.1 m bgs, 0.3 m bgs and 0.5 m bgs.
- Two additional boreholes advanced to 1 m bgl in the vicinity of the EC Otago identified lead contamination (HM1). Soil samples collected from between 0.5 and 0.8 m bgl in line with the EC Otago contamination discovery.

5.4 Acceptance Criteria

Analytical results were assessed to determine consenting requirements and options for disposal of any soil which may be taken off-site. The following criteria were used.

Human Health Criteria

The following criteria were used to assess the risk to future site users, or to workers undertaking redevelopment activities:

- The soil contaminant standards from the NES for standard residential land use (Ministry for the Environment, Revised 2021).

For contaminants not listed in the above criteria were chosen in accordance with MfE's Contaminated Land Management Guidelines No.2 – *Hierarchy and Application in New Zealand of Environmental Guideline Values* (Ministry for the Environment, Revised 2011).

As discussed in Section 3.2.1 of MfE *Methodology for Deriving Contaminants in Soil to Protect Human Health* (Ministry for the Environment, 2011), the NES does not assess a maintenance or excavation worker exposure scenario as the risks to those workers is more appropriately managed under New Zealand health and safety legislation. Therefore, potential risks to contractors responsible for carrying out future maintenance are not further assessed.

Surrounding residential land users are considered to be adequately protected on the basis that the risks to earthworks contractors will be managed, and on the basis that the long-term risk to future site users is acceptable.

Background Criteria

The soil analysis results have also been compared to the regional predicted background concentration for heavy metals (Landcare Research Limited, Updated 2016) using the 'Fill' soil type for contaminant comparison. This comparison allows for further assessment of consenting requirements under the NES and provides information regarding disposal options for excess spoil.

Ecological Risk Screening Criteria

In absence of a specific environmental discharge or ecological protection criteria for the Southland Region, the Background soil concentrations and soil guideline values for the protection of ecological receptors, (Landcare Research Manaaki Whenua, 2016), were used to assess the potential risk to environmental and ecological receptors. These guideline values were developed to protect ecological receptors and to provide a useful means to readily assess potential environmental impact.

Cleanfill Criteria

The Waste Management Institute New Zealand (WasteMINZ) defines cleanfill in the Technical Guidelines for Disposal to land (Waste Management Institute New Zealand (WasteMINZ), 2018) as:

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

- combustible, putrescible, degradable or leachable components;
- hazardous substances or materials (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.

When discharged to the environment, clean fill material will not have a detectable effect relative to the background.

5.5 Analytical Results

Soil contaminant concentrations are compared with the relevant criteria in Table 1 (appended). Full analytical laboratory reports are included in Attachment E.

A summary of testing results is provided below:

- Elevated concentrations of heavy metals (Arsenic, Cadmium, Copper, Lead and Zinc) were noted when compared to the predicted background concentrations in five of the 16 samples taken as part of the EC Otago (2022) investigations.
- One location was identified in the EC Otago (2022) investigations (HM1) with an exceedance for lead of the applicable human health or adopted environmental discharge criteria were identified. Two samples (ENV2 and ENV3) were taken during the ENGEO sampling in close proximity (ENV2 – 2.5 m and ENV3 – 1 m) to HM1.
- Analysis of the samples from ENV2 returned results below adopted human health criteria and expected background levels of the analytes tested.
- Analysis of samples taken from ENV3 returned results in exceedance of Residential 10% human health criteria (SCS) for lead and expected background levels for lead and zinc.
- No exceedances of the human health or expected background levels were identified in the additional ENGEO samples BH1, BH2, BH3, BH4, ENV1, HA1, HA2 or HA3.
- OCPs below adopted residential criteria was noted in one composite sample in the EC Otago (2022) investigations.
- No OCP presence was noted in the additional sample ENV1 tested for OCP as part of the additional ENGEO investigations.
- BAP_{eq}^C calculations for PAH contamination returned values of between <0.03 and 0.44 mg/kg during the EC Otago (2022) investigations. These results are below the human health criteria.
- BAP_{eq}^C calculations for PAH contamination returned values of between <0.04 and 0.14 mg/kg during the ENGEO investigations from sample ENV01. These results are below the human health criteria.

5.6 Soil Sampling Procedures

To help ensure that soil sample results accurately reflect the soil conditions at the site, the following were undertaken:

- Samples were given a unique sample ID to identify the location and depth from where they were collected on-site.
- Samples were placed into laboratory supplied sample containers using a new pair of nitrile gloves for each sample. Prior to sampling, the equipment was decontaminated using potable water, Decon 90 solution and distilled water.
- The use of standard sample registers and chain of custody records for samples collected.
- Samples were placed directly into an insulated container prior to transport to Hill Laboratories (Hills) under ENGEO standard chain of custody.

- Fieldwork and sampling were 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 (Ministry for the Environment, Revised 2021).

5.7 Laboratory Quality Assurance / Quality Control

Hill Laboratories (Hills) are accredited by International Accreditation New Zealand (IANZ) for the analyses performed.

The sample integrity checklist at the back of the laboratory report indicated samples were appropriately received at the laboratory.

6 Investigation Findings

Ground conditions encountered during the additional intrusive investigation carried out by ENGEO correlate with the conditions identified by EC Otago. These generally comprised of a thin layer of surficial topsoil or asphalt, underlain by uncontrolled fill averaging ~1.3 m in thickness. The fill is underlain by alluvial sand and silt deposits to a depth of at least 2.2 m below the existing ground surface.

The uncontrolled fill is of variable composition across the site, but in most locations is a mixture primarily of loose to medium dense sandy or silty GRAVEL. Occasionally, some rubbish was included with the fill such as brick and concrete fragments. Occasional coal fragments / combustion products were noted.

The results of both the EC Otago investigations showed:

“The results indicate that fill materials across the site are generally found to be consistent with predicted background concentrations. However, one location (HM1) reported concentrations of lead above the Residential SCS at depth (0.5 – 0.8 m), along with elevated concentrations of cadmium and zinc. Location HM2 also reported elevated concentrations of lead at depth (0.4 – 0.8 m), indicating that there is variability within the underlying fill materials and isolated areas of contamination are likely to be present.” (EC Otago 2022)

Further sampling was undertaken by ENGEO in conjunction with the geotechnical investigations on-site. This included samples in the vicinity of EC Otago sample HM1 (ENGEO - ENV2 and ENV3) and within the carpark footprint where no previous sampling had been undertaken (ENV1).

- Analysis of the samples taken from ENV3 showed elevated concentrations of heavy metals (lead and zinc). The result for lead was in exceedance of the residential 10% human health criteria (SCS) at 0.3 m bgl but below human health criteria at 0.1 m, 0.5 m and 0.9 m bgl.

Both lead and zinc were in exceedance of predicted background concentrations at 0.3 m bgl but below predicted background concentrations at 0.1 m, 0.5 m and 0.9 m bgl.

HM1 (EC Otago) reported results (at 0.5-0.8 m bgl) of:

- Lead – 400 mg/kg (> Residential 10% Produce human health criteria but < High Density Residential Human Health Criteria).
- Zinc – 390 mg/kg (> background levels).
- Cadmium – 0.43 mg/kg (> background levels).

ENV3 (ENGEO) reported results (at 0.3 m bgl) of:

- Lead – 240 mg/kg (>Residential human health criteria, > background levels).
- Zinc – 126 mg/kg (<Residential human health criteria, > background levels).
- Cadmium – 0.22 mg/kg (<Residential human health criteria, > background levels).

These results indicate a likely hotspot of lead between 0.3m and 0.8m bgl above the Residential (10% produce) Human Health criteria and greater than expected background levels within the fill material in the vicinity of HM1/ENV3.

ENV3 is located approximately 1 m northeast of HM1 indicating the levels of contamination reduce but remain above human health criteria over this distance. Due to the presence of asphalt and not being able to advance a hand auger through the fill, it was not possible to take further samples around HM1 to more accurately delineate the contamination.

The elevated levels of heavy metals above expected background levels in samples analysed across the site at depths of 0.0 m and 0.8 m bgl by EC Otago and ENGEO indicates there is contamination above background levels at numerous locations across the site.

The potential source, pathway, receptor linkages at this subject site are provided in Table 4.

Table 4: Conceptual Site Model

Source	Exposure Pathway	Potential Receptor	Acceptable Risk?
Soil containing elevated concentration of heavy metals.	Soil ingestion, inhalation of dust, and / or dermal contact.	Future site users Surrounding residents and environment.	NO Evidence of contaminants above the selected human health criteria or adopted environmental discharge criteria were noted.
	Leaching of contaminants.	Surrounding environment.	

7 Delineation Sampling

ENGEO undertook further sampling (March 2023) to identify the extent of the lead contamination in the area around ENV3. Samples were taken from 0.3 m, 0.5 m and 0.8 m bgl from locations 2 m north, south, east and west of ENV3 and then at 4 m and 6 m from HM1 until either a previously negative sample location was reached or the site boundary was encountered. Beyond 6 m the samples to the north and west were taken at 10 m, 15 m and 20 m distance from HM1.

These samples were dispatched for laboratory analysis for heavy metals. The 0.3 m bgl samples were analysed with the deeper samples kept on hold to be analysed on receipt of an above residential human health criteria result from the 0.3 m bgl samples.

7.1 Delineation Sampling Results

The results from the ENGEO lead delineation sampling are presented in Table 2 (Appended) and summarised below.

Samples from 0.3 m bgl were analysed for heavy metals.

- No samples from 0.3 m bgl returned results in excess of residential human health criteria.
- DL02 (2 m south of ENV3) and DL05 (4 m south of ENV) returned result for zinc in exceedance of predicted background levels.

On the basis of these results no further analysis of the samples is required to delineate the impact noted at ENV3.

7.2 Discussion of Delineation Sampling Results

Based on the results from the samples analysed the area of lead contamination identified at HM1 can be delineated to an area bounded to an area approximately:

- 4 m north of HM1;
- 2 m east of HM1;
- 2 m south of HM1; and
- 2 m west of HM1.

The required remediation is to a depth of 0.8 m bgl.

8 Risk Assessment and Regulatory Compliance

8.1 Consenting Requirements under the NES

Elevated heavy metals when compared to the nominated human health criteria have been identified in two soil samples and elevated heavy metals compared predicted background concentrations are present at the site.

Soil Disturbance

Regulation 8(3) of the NES provides for the disturbance of contaminated soil on a piece of land as a Permitted Activity, providing that the following is met:

- Controls are in place to minimise the exposure of humans to mobilised contaminants.
- The soil must be reinstated to an erosion-resistant state within one month following earthworks.
- The volume of soil disturbance must be no more than 25 m³ per 500 m² of the “piece of land”.
- Soil must not be taken away from the site that exceeds 5 m³ per 500 m² of the “piece of land” per year.
- Soil must be disposed of at a facility authorised to receive such material.
- The duration of the land disturbance works must not exceed two months.
- The integrity of any structure containing contaminated soil must not be compromised.

With regards to the above (and taking into the account the site area of 7,683 m²), the NES allows 384.1 m³ of soil to be disturbed as a Permitted Activity, and for 77 m³ of soil to be removed for disposal per year.

If earthworks will not meet the permitted activity limits specified in Regulation 8(3) of the NES, soil disturbance and soil disposal **will be a restricted discretionary activity under Regulation 10 of the NES.**

Subdivision and Change of Land Use

The change in land use is considered '*reasonably likely to harm human health*' and therefore the redevelopment is subject to Change in Land Use under Regulation 5(6).

One sample contained lead above the adopted soil acceptance criterion for the proposed Residential 10% human health criteria. The change in land use and subdivision are unable to meet the permitted activity standards under Regulation 8(4) of the NES, or the controlled activity standards of Regulation 9(3) of the NES.

Subject to Council approval of a Remedial Action Plan, change in land use and subdivision are restricted discretionary activities under Regulation 10 of the NES.

8.2 Consenting Requirements under the Environment Southland Proposed Southland Water and Land Plan - partially operative (2021)

Environment Southland defines a contaminated site as a site where any hazardous substances present could pose a threat to human health or the environment.

Due to the presence of lead at concentrations above the selected human health criteria, the site is classified as a contaminated site. A separate consent for land disturbance may be required.

The requirements for a separate discharge consent should be confirmed with the Environment Southland prior to disturbance of soils on-site.

8.3 Material Handling Requirements

The soil impacts identified at HM1/ENV3 are likely to be the result of anthropogenic activities including the release of contaminants from uncontrolled fill.

Impacted soils in the area of HM1/NEV3 can either be removed from site or capped in areas unlikely to be disturbed prior to the site being used for residential use.

Due to the presence of uncontrolled material within the site the geotechnical report (ENGEO 2023) indicates that fill is not considered suitable as engineered fill for construction on-site: "all uncertified fill or organic material must be removed beneath their footprints". This material cannot be considered cleanfill for use on other sites and will require disposal off-site at a suitably licenced landfill. This would likely require consent for the disturbance of the 'contaminated site' during remediation.

Prior to disposal a disposal permit and results of Toxicity Characteristics Leaching Procedure (TCLP) testing will be required to confirm the material is suitable for disposal at AB Lime.

Following discussions with the Geotech team the preferred foundation option for the site is deep (pile) foundations which do not require the removal of fill material below each footprint. As a result the area of HM1/ENV3, the elevated levels of lead contamination and an indicative area of potential contamination around HM1 can remain *in situ* for geotechnical purposes. To reduce the potential risk to site end users to an acceptable level, if the soils are to remain on-site then a suitable cap would be required. The cap should include 0.5 m of clean top soil or 0.1 m of hard standing. This would prevent the site end users coming into contact with the impacted soils. Controls should be put in place to reduce risks to the site workers and surrounding environment during site development works. An ongoing site management plan would also be required to manage future small scale soil disturbance in this area.

The delineation testing has identified an impacted area of:

- 4 m north of HM1;
- 2 m east of HM1;
- 2 m south of HM1; and
- 2 m west of HM1.

The required remediation is to a depth of 0.8 m bgl.

If removal off site was the preferred option this would require the excavation, removal and disposal of an area of soil approximately 24 m² to a depth of 0.8 m bgl. The volume of soil requiring removal in this scenario is approximately 19.2 m³.

Currently the estimated fee for the disposal of 19.2m³ of contaminated fill material is between \$5,891 and \$7,703 (excluding TCLP testing, permitting, excavation and cartage). Costing for the disposal of this material is based on information provided at the time of writing with an average disposal fee of \$236 / tonne (AB Lime, Winton February 2023), an *in situ* bulk density of 1.3 to 1.7 tonnes / m³. The Remedial Action Plan (Attachment F) has been written for this scenario.

Following the excavation and removal of the fill material around HM1, validation sampling will be required to confirm the remaining fill in the identified area of lead contamination is below the Residential SCS.

The conclusions and recommendations of this report are limited to the areas / depths of soil sampled. Therefore, there is the potential for unidentified hot spots of contamination to exist at the site. A remedial strategy and site management plan (SMP) should be prepared to outline procedures to identify and mitigate exposure to unidentified contamination, if encountered during the redevelopment works

9 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, Kāinga Ora, 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



Gareth Ward, MSC FRGS

Senior Environmental Scientist

Report reviewed by



Dave Robotham, CEnvP SC

Principal Environmental Consultant

10 References

EC Otago (2022). *Soil Sampling Report – 29 Hamilton Street, Gore*

ENGEO (2023). *Geotechnical Investigation - 29 Hamilton Street Gore, Southland*

MfE (2010): *Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand.*

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

MfE (2021). *Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites.*

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

MfE (2021). *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils.*

MfE (2011). *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.*

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

TABLES

Analyte	Units	IS-ENG23-DL01(e) 0	IS-ENG23-DL02 (e) 0	IS-ENG23-DL03(w) 0	IS-ENG23-DL04(n) 0	IS-ENG23-DL05(e) 0	IS-ENG23-DL06(w) 0	IS-ENG23-DL07(n) 0	IS-ENG23-DL08(w) 0	IS-ENG23-DL09(n) 0	IS-ENG23-DL10(w) 0	IS-ENG23-DL11(n) 0	IS-ENG23-DL13(n) 0	Human Health, Residential	Background Criteria (Other (LRIS) - fill)
Depth															
Sampled Date															
Zinc	mg/kg	30	116	56	62	108	30	30	30	19	25	25	26	7,400 ¹	99.99
Arsenic	mg/kg	<2	4	3	3	5	<2	3	<2	<2	<2	2	2	20 ²	99.99
Cadmium	mg/kg	<0.1	0.12	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	3 ³	99.99
Chromium	mg/kg	9	12	11	10	14	9	11	9	8	8	9	10	460 ²	81.62
Copper	mg/kg	8	11	8	9	11	7	8	7	6	6	7	9	10,000 ²	44.45
Lead	mg/kg	8.1	70	27	37	51	9.2	10.8	10.4	4.2	7	5.2	6.9	210 ²	99.99
Nickel	mg/kg	6	7	7	7	9	6	7	6	5	6	6	6	400 ¹	99.99

Scenarios:

Shaded indicates concentrations exceed Human Health, Residential

Bold indicates concentrations exceed Background Criteria (Other (LRIS) - fill)

Criteria adopted from the following guidelines:

¹NEPM 2013 HILS. Criteria for Human Health, Residential land use

²Methodology for Deriving Soil Guideline Values Protective of Human Health (NES, 2011). Criteria for Human Health, Residential land use

Notes:

This table does not represent the full analytical results, please refer to the laboratory results for full details.

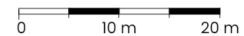
Assumes soil pH of 5 for Cadmium.

FIGURES



Legend

 Site Boundary

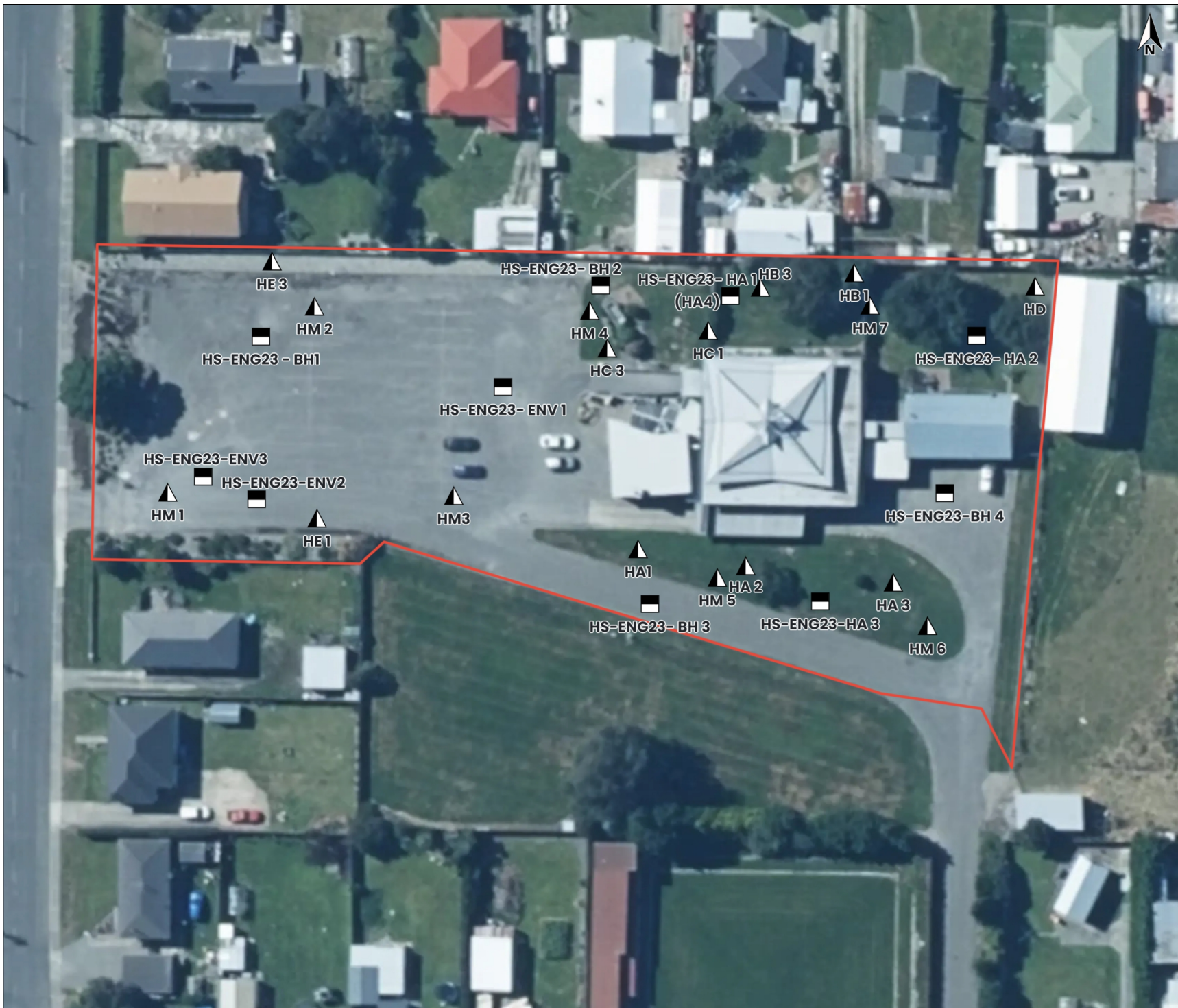


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Produced by **Datanest.earth**

Title: Site Location Plan		
Client: Kāinga Ora		Figure No.: 1 Size: A4
Project: 29 Hamilton Road, Gore	Drawn: GW	
Date: 01-03-2023	Checked: DR	Version: Final
Proj No.: 21517.000.001	Scale: 1:749	



Legend

- ENGEO Sample Locations
- ▲ EC Otago Sample Locations
- Site Boundary

N

0 10 m 20 m

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ENGEO

Produced by **Datanest.earth**

Title: Sample Location Plan		
Client: Kāinga Ora		Figure No.: 2 Size: A4
Project: 29 Hamilton Road, Gore	Drawn: GW	
Date: 01-03-2023	Checked: DR	Version: Final
Proj No.: 21517.000.001	Scale: 1:776	



Legend

- Indicative area of remediation
- ENGEO Sample Locations
- EC Otago Sample Locations
- Site Boundary

0 5 m 10 m
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Produced by [Datanest.earth](https://www.datanest.com)

Title: Remedial Areas Plan		
Client: Kāinga Ora		Figure No.:3 Size: A4
Project: 29 Hamilton Road, Gore	Drawn: GW	
Date: 06-04-2023	Checked: DR	
Proj No.: 21517.000.001	Scale: 1:382	Version: Final



ATTACHMENT A:
Statement of 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, Kāinga Ora, 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.
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ATTACHMENT B:
Aerial Photographs



1948 (Retrolens NZ)



1962 (Retrolens NZ)



1971 (Retrolens NZ)



2015 Google Earth Pro)



ATTACHMENT C:
Site Photographs



Photograph 1: 29 Hamilton Street, looking west across the carpark



Photograph 2: 29 Hamilton Street, looking east across the carpark.



Photograph 3: 29 Hamilton Street, looking northwest



Photograph 4: 29 Hamilton Street, north area of the site.



ATTACHMENT D:
Soil Conditions Summary



LOG OF BORING HS-ENG23-BH1

29 Hamilton Road
29 Hamilton Road Gore
21517

Client : Kainga Ora
Date : 15/2/2023
Hole Depth : 9.42 m
Drilling Method : Sonic
Drilling Contractor : Speight

Core Diameter : mm
Energy Transfer Ratio : %
Logged By/Reviewed By : JJ/BH /
Latitude : 1287443
Longitude : 4887913

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Installation
0.5	FILL			SILT with some fine gravel, dark brown, non plastic [FILL]									
0.5 - 1.0				Fine to coarse GRAVEL, with some some fine to coarse sand, light grey, homogenous, well graded. Gravel: rounded [FILL]									
1.0 - 1.5			ML	SILT with some clay, light grey mottled orange, homogenous, very soft to soft, high plasticity [LACUSTRINE?]		72		M	Very Soft - Soft	SPT@1.5m 1,1,1,2,2,2 N=7			
1.5 - 3.0	LACUSTRINE?		ML	SILT, minor organics, trace clay, dark brown, very soft, low plasticity. Organics: fibrous wood fragments [LACUSTRINE?]		71			Very Soft	SPT@3m 0,0,0,0,1,10 N=11			
3.0 - 3.5				Unweathered, dark brown, laminated, SILTSTONE, weak [BEDROCK]									
3.5 - 4.3				At 3.70m: thin fine sand band		69		D	Hard				
4.3 - 4.5				At 4.30m: 900 mm of fine to medium SAND, trace silt.				M	Very Dense	SPT@4.5m 3,6,8,8,10,15 N=41			
4.5 - 6.0	BEDROCK					68							
6.0 - 6.8				At 6.80m: thin band of fine sand		67				SPT@6m 3,7,12,18,20 N=50			
6.8 - 7.3				At 7.30m: laminations faint.		66		D	Hard				
7.3 - 8.6						65				SPT@7.5m 7,7,8,16,20,6 N=50			
8.6 - 8.8				At 8.60m: Moderately thick layer of fine to medium SAND, trace silt.		64			Very Dense	SPT@9m 10,9,16,10,13,11 N=50			
8.8 - 9.0				At 8.80m: Moderately thin layer of organic SILT, trace fine sand. Organics: fibrous wood fragments				M	Soft				
9.0 - 9.42				At 8.90m: Moderately thick layer of silty fine SAND, greenish grey, homogenous.					Very Dense				
				End of Hole Depth: 9.42 m Termination: Target depth									

ENGEO MACHINE BOREHOLE LOG (SOIL) 21517 - GINT MASTER.GPJ NZ DATA TEMPLATE 2.GDT 21/2/23

Groundwater observed at collar immediately after drilling, likely drilling water.

Water Level | Date : Time | Hole Depth
1)
2)
3)
4)



LOG OF BORING HS-ENG23-BH2

29 Hamilton Road
29 Hamilton Road Gore
21517

Client : Kainga Ora
Date : 15/2/2023
Hole Depth : 9.45 m
Drilling Method : Sonic
Drilling Contractor : Speight

Core Diameter : mm
Energy Transfer Ratio : %
Logged By/Reviewed By : JJ/BH /
Latitude : 1287496
Longitude : 4887917

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Installation
0.5	FILL			SILT, with some fine to medium gravel, some fine sand, brown. Non-plastic [FILL]								25 50 75	
0.5 - 1.0			ML	SILT, with minor clay, grey mottled orange, homogenous, stiff to very stiff, low plasticity [LACUSTRINE?]		73				SPT@1.5m 1,1,1,2,1,3 N=7			
1.0 - 2.0	LACUSTRINE?					72		M	Stiff - Very Stiff				
2.0 - 3.0				At 2.70m: becomes clayey SILT, high plasticity, very soft.		71			Very Soft	SPT@3m 0,0,0,0,4,6 N=10			
3.0 - 4.0			GW	Fine to coarse GRAVEL, with some fine to coarse sand, grey, homogenous, 'loose', well graded. Gravels: rounded [LACUSTRINE?]		70			Loose				
4.0 - 4.5				Unweathered, dark brown with grey banding, laminated, SILTSTONE, weak [BEDROCK]						SPT@4.5m 3,4,8,9,15,16 N=48			
4.5 - 5.5				At 5.20m: moderately thick layer of cemented clasts inclusions		69							
5.5 - 6.0						68				SPT@6m 4,2,8,8,7,9 N=32			
6.0 - 7.0	BEDROCK					67		D	Hard				
7.0 - 7.5						66				SPT@7.5m 1,3,3,9,14,22 N=48			
7.5 - 8.0						65				SPT@9m 1,1,6,9,17,18 N=50			
8.0 - 9.0													

End of Hole Depth: 9.45 m
Termination: Target depth

ENGEO MACHINE BOREHOLE LOG (SOIL) 21517 - GINT MASTER.GPJ NZ DATA TEMPLATE 2.GDT 21/2/23

Water Level | Date : Time | Hole Depth

- 1)
- 2)
- 3)
- 4)

Hole dipped immediately after 1 hour and two hours after drilling all at 2.1m below collar likely drilling water.



LOG OF BORING HS-ENG23-BH3

29 Hamilton Road
29 Hamilton Road Gore
21517

Client : Kainga Ora
Date : 14/2/2023
Hole Depth : 9.45 m
Drilling Method : Sonic
Drilling Contractor : Speight

Core Diameter : mm
Energy Transfer Ratio : %
Logged By/Reviewed By : JJ/BH /
Latitude : 1287503
Longitude : 4887872

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Installation
0.5	FILL	X		Fine to coarse gravelly fine to coarse SAND, with minor silt, grey homogenous, well graded. Gravel: subrounded to sub angular [FILL]	X	73		M				25 50 75	
1.0						72							
1.5	LACUSTRINE?	ML		SILT, with some clay, grey, very soft, homogenous, highly plastic [LACUSTRINE?]		71		M	Very Soft	SPT@1.5m 1,0,1,1,1,1 N=4			
2.0						70							
3.0						69							
3.5	BEDROCK	X		Unweathered, dark brown with grey banding, laminated, SILTSTONE, weak [BEDROCK]	X	68		D	Hard	SPT@4.5m 2,5,8,8,14,20 N=50			
4.0						67							
4.5						66							
5.0						65							
5.5	BEDROCK	X		At 5.20m: thick bed of dark brown / black silt, with medium gravel cemented clast inclusions.	X	64		M		SPT@6m 1,1,7,5,15,28 N=50			
6.0						63							
6.5						62							
7.0						61							
7.5	BEDROCK	X		Unweathered, grey speckled dark brown, massive, SANDSTONE, weak. Sand: fine. [BEDROCK]	X	60		D	Very Dense	SPT@7.5m 2,4,8,12,16,14 N=50			
8.0						59							
8.5						58							
9.0	BEDROCK	X			X	57		D		SPT@9m 3,7,11,12,13,14 N=50			
9.45						56							

End of Hole Depth: 9.45 m
Termination: Target depth

ENGEO MACHINE BOREHOLE LOG (SOIL) 21517 - GINT MASTER.GPJ NZ DATA TEMPLATE 2.GDT 21/2/23

Water Level | Date : Time | Hole Depth

- 1)
- 2)
- 3)
- 4)

Groundwater dipped immediately after drilling at 2m below collar - likely drilling water. Collapsed next morning.



LOG OF BORING HS-ENG23-BH4

29 Hamilton Road
29 Hamilton Road Gore
21517

Client : Kainga Ora
Date : 14/2/2023
Hole Depth : 9.45 m
Drilling Method : Sonic
Drilling Contractor : Speight

Core Diameter : mm
Energy Transfer Ratio : %
Logged By/Reviewed By : JJ/BH /
Latitude : 1287557
Longitude : 4887893

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Installation
0.5	FILL	X		Fine to coarse gravelly fine to medium SAND, with minor silt, grey, homogenous. Gravel: subrounded to sub angular [FILL]	[Cross-hatch pattern]	73		D		SPT@1.5m 2,3,2,2,2,4 N=10		[Grey bar]	
1.0				72									
1.5				71									
2.0	LACUSTRINE?	X	GW	Fine to coarse GRAVEL with some sand dark grey. Well graded homogenous. Gravel: sub rounded to sub angular [FILL]	[Cross-hatch pattern]	70		M		SPT@3m 5,8,9,7,7,7 N=30		[Grey bar]	
2.5				69									
3.0	BEDROCK	X		At 2.8m: becomes red brown	[Cross-hatch pattern]	70		W Dense		SPT@4.5m 6,8,9,8,8,8 N=33		[Grey bar]	
3.5				68									
4.0				67									
4.5	BEDROCK	X		Fine to coarse sandy fine to coarse GRAVEL, with some silt, light grey, homogenous, well-graded. Gravel sub rounded to sub-angular [LACUSTRINE?]	[Cross-hatch pattern]	69		M Hard		SPT@6m 6,6,10,18,20,2 N=50		[Grey bar]	
5.0				68									
5.5				67									
6.0	BEDROCK	X		Unweathered, grey, massive, SILTSTONE, weak [BEDROCK]	[Cross-hatch pattern]	68				SPT@7.5m 2,5,8,12,20,10 N=50		[Grey bar]	
6.5				67									
7.0				66									
7.5	BEDROCK	X			[Cross-hatch pattern]	66				SPT@9m 2,4,6,14,19,7 N=50		[Grey bar]	
8.0				65									
8.5	BEDROCK	X			[Cross-hatch pattern]	65						[Grey bar]	
9.0				65									

End of Hole Depth: 9.45 m
Termination: Target depth

Water Level | Date : Time | Hole Depth

- 1)
- 2)
- 3)
- 4)

Groundwater dipped immediately after drilling at 1.8m below collar - likely drilling water. Collapsed next morning

ENGEO MACHINE BOREHOLE LOG (SOIL) 21517 - GINT MASTER.GPJ NZ DATA TEMPLATE 2.GDT 21/2/23

LOG OF BORING HS-ENG23-BH5

29 Hamilton Road
29 Hamilton Road Gore
21517

Client : Kainga Ora
Date : 15/2/2023
Hole Depth : 0.9 m
Drilling Method : Sonic
Drilling Contractor : Speight

Core Diameter : mm
Energy Transfer Ratio : %
Logged By/Reviewed By : JJ/BH /
Latitude : 1287449
Longitude : 4887884

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Installation
0.5	FILL			Silty fine to coarse SAND, minor fine to medium gravel, grey. Gravel: rounded. [FILL] 0.50m: brick fragments.				D				25 50 75	
	LACUSTRINE?		ML	SILT, some clay, grey, homogenous, very soft to soft, high plasticity [LACUSTRINE?]				M	Very Soft to Soft				

End of Hole Depth: 0.9 m
Termination: Target depth



Groundwater not encountered.

Water Level | Date : Time | Hole Depth
1)
2)
3)
4)



LOG OF BORING HS-ENG23-BH6

29 Hamilton Road
29 Hamilton Road Gore
21517

Client : Kainga Ora
Date : 15/2/2023
Hole Depth : 0.9 m
Drilling Method : Sonic
Drilling Contractor : Speight

Core Diameter : mm
Energy Transfer Ratio : %
Logged By/Reviewed By : JJ/BH /
Latitude : 1287444
Longitude : 4887886

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Installation
0.5	FILL			Silty fine to coarse SAND, minor fine to medium gravel, grey. Gravel: rounded [FILL] 0.50m: brick fragments.				D				25 50 75	
	LACUSTRINE?		ML	SILT, some clay, grey, homogenous, very soft to soft, high plasticity [LACUSTRINE?]				M	Very Soft to Soft				

End of Hole Depth: 0.9 m
Termination: Target depth

ENGEO MACHINE BOREHOLE LOG (SOIL) 21517 - GINT MASTER.GPJ NZ DATA TEMPLATE 2.GDT 21/2/23

Groundwater not encountered.

Water Level | Date : Time | Hole Depth
1)
2)
3)
4)



LOG OF BORING HS-ENG23-BH7

29 Hamilton Road
29 Hamilton Road Gore
21517

Client : Kainga Ora
Date : 15/2/2023
Hole Depth : 0.9 m
Drilling Method : Sonic
Drilling Contractor : Speight

Core Diameter : mm
Energy Transfer Ratio : %
Logged By/Reviewed By : JJ/BH /
Latitude : 1287486
Longitude : 4887899

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Installation
0.5	FILL			Silty fine to coarse SAND, minor fine to medium gravel, grey. Gravel: rounded [FILL]		73		D				25 50 75	

End of Hole Depth: 0.9 m
Termination: Target depth

ENGEO MACHINE BOREHOLE LOG (SOIL) 21517 - GINT MASTER.GPJ NZ DATA TEMPLATE 2.GDT 21/2/23

Groundwater not encountered.

Water Level | Date : Time | Hole Depth
1)
2)
3)
4)



Hand Auger Log

Client: Kainga Ora
Project: 29 Hamilton Road
Location: 29 Hamilton Road Gore
Project Number: 21517

Hole I.D:
HS-ENG23-HA1

Method: Hand Auger
 Contractor: ENGEO
 Operator:
 Equipment: Hand Auger/Shovel
 Hole Size: mm
 Vane Number:

Coordinates E: 1287519 (NZTM) N: 4887917
 Elevation (mRL): 73.8
 Elevation Datum: NZTM

Total Depth: 0.5 m
 Survey Method: Gore 0.5 urban Contours
 Start Date: 14/2/2023
 Finish Date: 14/2/2023
 Logged By: JJ/BH
 Reviewed By:

Elevation (mRL)	Geological Unit	DESCRIPTION <small>SOIL: Classification, colour, consistency / density, moisture, plasticity, additional features (grain size, roundness, composition etc. as applicable)</small>	Depth (m BGL)	Graphic Symbol	Water Level	Moisture Cond.	Consistency/Density	Sample	Testing / Additional Comments	Dynamic Cone Penetrometer												
										Blows per 100mm												
										2	4	6	8	10	12							
73.5	FILL/TOPSOIL	SILT, minor fine sand, minor organics, light brown, non plastic. Organics: rootlets [TOPSOIL]																				
		SILT, some fine to medium gravels, tracel rootlets, brown, non plastic [FILL]				D																
		SILT, minor fine sand, light brown mottled orange, very dense, non plastic [FILL]																				
		End of Hole Depth: 0.5 m Termination Condition: Practical refusal	0.5																			

ENGEO HAND AUGER 21517 - GINT MASTER.GPJ NZ DATA TEMPLATE 2.GDT 21/2/23

Groundwater not encountered.



Hand Auger Log

Client: Kainga Ora
Project: 29 Hamilton Road
Location: 29 Hamilton Road Gore
Project Number: 21517

Hole I.D:
HS-ENG23-HA2

Method: Hand Auger
 Contractor: ENGEO
 Operator:
 Equipment: Hand Auger/Shovel
 Hole Size: mm
 Vane Number:

Coordinates E: 1287556
 (NZTM) N: 4887916
 Elevation (mRL): 73.8
 Elevation Datum: NZTM

Total Depth: 0.5 m
 Survey Method: Gore 0.5 urban Contours
 Start Date: 14/2/2023
 Finish Date: 14/2/2023
 Logged By: JJ/BH
 Reviewed By:

Elevation (mRL)	Geological Unit	DESCRIPTION <small>SOIL: Classification, colour, consistency / density, moisture, plasticity, additional features (grain size, roundness, composition etc. as applicable)</small>	Depth (m BGL)	Graphic Symbol	Water Level	Moisture Cond.	Consistency/Density	Sample	Testing / Additional Comments	Dynamic Cone Penetrometer						
										Blows per 100mm						
										2	4	6	8	10	12	
73.5	TS	SILT, minor fine sand, minor organics, light brown, non plastic. Organics: rootlets [TOPSOIL]														
	PRD	Fine sandy SILT, brown, homogenous, very dense, non plastic [ALLUVIUM]				D	Very Dense									
End of Hole Depth: 0.5 m Termination Condition: Practical refusal			0.5													

ENGEO HAND AUGER 21517 - GINT MASTER.GPJ NZ DATA TEMPLATE 2.GDT 16/2/23

PRD = Pleistocene River Deposits
 Groundwater not encountered.



Hand Auger Log

Client: Kainga Ora
Project: 29 Hamilton Road
Location: 29 Hamilton Road Gore
Project Number: 21517

Hole I.D:
HS-ENG23-HA3

Method: Hand Auger
 Contractor: ENGEO
 Operator:
 Equipment: Hand Auger/Shovel
 Hole Size: mm
 Vane Number:

Coordinates E: 1287531 (NZTM) N: 4887874
 Elevation (mRL): 73
 Elevation Datum: NZTM

Total Depth: 0.5 m
 Survey Method: Gore 0.5 urban Contours
 Start Date: 14/2/2023
 Finish Date: 14/2/2023
 Logged By: JJ/BH
 Reviewed By:

Elevation (mRL)	Geological Unit	DESCRIPTION <small>SOIL: Classification, colour, consistency / density, moisture, plasticity, additional features (grain size, roundness, composition etc. as applicable)</small>	Depth (m BGL)	Graphic Symbol	Water Level	Moisture Cond.	Consistency/Density	Sample	Testing / Additional Comments	Dynamic Cone Penetrometer						
										Blows per 100mm						
										2	4	6	8	10	12	
72.5	FILL/TOPSOIL	SILT, minor fine sand, minor organics, light brown, non plastic. Organics: rootlets [TOPSOIL]														
		Fine sandy SILT, brown, homogenous, non plastic [FILL]				D										
		At 0.45m: brown mottled orange.	0.5													
		End of Hole Depth: 0.5 m Termination Condition:														

No DCP undertaken due to proximity of underground services.
 Groundwater not encountered.

PROJECT:	KO-HAMILTON29			JOB NUMBER:	220222
LOCATION:	See Site Plan	INCLINATION:	Vertical		
EASTING:	1287438 m	EQUIPMENT:	5.5t excavator/450 mm auger	OPERATOR:	Robin
NORTHING:	4887883 m	COORD. SYSTEM:	NZTM2000	COMPANY:	Croydon Contracting
ELEVATION:	73 m	EXCAV. DATUM:	Existing ground level	HOLE STARTED:	29/04/2022
METHOD:	Aerial Photography	ACCURACY:	± 4 m	HOLE FINISHED:	29/04/2022

Soil / Rock Type	Description	Graphic Log	Depth (m)	Groundwater / Seepage	
				Scala Penetrometer (Blows per 100mm)	
				0	5 10 15
FILL	Sandy fine to coarse GRAVEL with trace of cobbles; grey. Dense; dry; well graded; gravel, rounded, slightly weathered greywacke or quartz; sand, fine to coarse; cobbles, rounded. Capped by 20 mm of chip seal.		0.0 0.1 0.2		
FILL	Sandy fine to coarse GRAVEL with some silt; brown. Dense; moist; well graded; gravel, rounded, slightly weathered greywacke or quartz; sand, fine to coarse. Some rubbish including brick and timber fragments, rare coal fragments.		0.3 0.4 0.5 0.6		
FILL	Silty fine to coarse GRAVEL with some sand and minor clay; brown. Medium dense; moist; gravel, rounded, slightly weathered greywacke or quartz; sand, fine to coarse. Some rubbish including brick and timber fragments, rare coal fragments.		0.6 0.7 0.8 0.9		
FILL	SILT with some clay and trace organics; brownish grey. Firm to stiff; moist; non-plastic; organics, fine, rare fibrous wood fragments.		0.9 1.0 1.1		
ALLUVIAL SILT	SILT with minor clay and trace of gravel; bluish grey. Stiff to very stiff; moist; low plasticity; gravel, fine to coarse, rounded. Occasional greenish brown flecks/spots.		1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3		
Total Excavation Depth = 2.3 m					

COMMENT:	Target depth reached. Scala from 500 mm owing to very dense pavement subgrade.	LOGGED BY:	RS
		CHECKED DATE:	13/05/2022
		SHEET:	1 of 1

PROJECT:	KO-HAMILTON29			JOB NUMBER:	220222
LOCATION:	See Site Plan	INCLINATION:	Vertical		
EASTING:	1287455 m	EQUIPMENT:	5.5t excavator/450 mm auger	OPERATOR:	Robin
NORTHING:	4887912 m	COORD. SYSTEM:	NZTM2000	COMPANY:	Croydon Contracting
ELEVATION:	73 m	EXCAV. DATUM:	Existing ground level	HOLE STARTED:	29/04/2022
METHOD:	Aerial Photography	ACCURACY:	± 4 m	HOLE FINISHED:	29/04/2022

Soil / Rock Type	Description	Graphic Log	Depth (m)	Groundwater / Seepage	
				Groundwater / Seepage	Scala Penetrometer (Blows per 100mm)
FILL	Sandy fine to coarse GRAVEL with trace of cobbles; grey. Dense; dry; well graded; gravel, rounded, slightly weathered greywacke or quartz; sand, fine to coarse; cobbles, rounded. Capped by 20 mm of chip seal.		0.0 0.1 0.2 0.3 0.4 0.5		
FILL	Sandy fine to coarse GRAVEL with some silt; brown. Dense; moist; well graded; gravel, rounded, slightly weathered greywacke or quartz; sand, fine to coarse. Some rubbish including brick and timber fragments, rare coal fragments.		0.5 0.6 0.7 0.8		
FILL	Silty fine to coarse GRAVEL with some sand and minor clay; brown. Medium dense; moist; gravel, rounded, slightly weathered greywacke or quartz; sand, fine to coarse. Some rubbish including brick and timber fragments, rare coal fragments.		0.8 0.9 1.0 1.1 1.2		
FILL	SILT with some clay and trace organics; brownish grey. Firm to stiff; moist; non-plastic; organics, fine, rare fibrous wood fragments.		1.2 1.3 1.4		
ALLUVIAL SILT	SILT with minor clay and trace of gravel; bluish grey. Stiff to very stiff; moist; low plasticity; gravel, fine to coarse, rounded. Occasional greenish brown flecks/spots.		1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4		

Total Excavation Depth = 2.4 m

COMMENT:	Target depth reached. Scala from 400 mm owing to very dense pavement subgrade.	LOGGED BY:	RS
		CHECKED DATE:	13/05/2022
		SHEET:	1 of 1

PROJECT:	KO-HAMILTON29			JOB NUMBER:	220222
LOCATION:	See Site Plan	INCLINATION:	Vertical		
EASTING:	1287481 m	EQUIPMENT:	5.5t excavator/450 mm auger	OPERATOR:	Robin
NORTHING:	4887886 m	COORD. SYSTEM:	NZTM2000	COMPANY:	Croydon Contracting
ELEVATION:	73 m	EXCAV. DATUM:	Existing ground level	HOLE STARTED:	29/04/2022
METHOD:	Aerial Photography	ACCURACY:	± 4 m	HOLE FINISHED:	29/04/2022

Soil / Rock Type	Description	Graphic Log	Depth (m)	Groundwater / Seepage	Scala Penetrometer (Blows per 100mm)
FILL	Sandy fine to coarse GRAVEL with trace of cobbles; grey. Dense; dry; well graded; gravel, rounded, slightly weathered greywacke or quartz; sand, fine to coarse; cobbles, rounded. Capped by 20 mm of chip seal.		0.0 0.1 0.2 0.3	NO SEEPAGE	
FILL	Sandy fine to coarse GRAVEL with some silt; brown. Dense; moist; well graded; gravel, rounded, slightly weathered greywacke or quartz; sand, fine to coarse.		0.3m 0.4 0.5 0.6 0.7 0.8 0.9 1.0		
FILL	SILT with some gravel and sand, with trace of organics; brownish and bluish grey. Stiff; moist; low plasticity; organics include timber/wood fragments.		1.0 1.1 1.2 1.3 1.4 1.5 1.6		
FILL	SILT with some clay and trace organics; brownish grey. Firm to stiff; moist; non-plastic; organics, fine, rare fibrous wood fragments.		1.6m 1.7		
ALLUVIAL SILT	SILT with minor clay and trace of gravel; bluish grey. Stiff to very stiff; moist; low plasticity; gravel, fine to coarse, rounded. Occasional greenish brown flecks/spots.		1.7m 1.8 1.9 2.0 2.1 2.2 2.3m		

Total Excavation Depth = 2.3 m

COMMENT:	Target depth reached. Scala from 400 mm owing to very dense pavement subgrade - 2nd attempt.	LOGGED BY:	RS
		CHECKED DATE:	13/05/2022
		SHEET:	1 of 1

PROJECT:	KO-HAMILTON29			JOB NUMBER:	220222
LOCATION:	See Site Plan	INCLINATION:	Vertical		
EASTING:	1287497 m	EQUIPMENT:	5.5t excavator/450 mm auger	OPERATOR:	Robin
NORTHING:	4887912 m	COORD. SYSTEM:	NZTM2000	COMPANY:	Croydon Contracting
ELEVATION:	73 m	EXCAV. DATUM:	Existing ground level	HOLE STARTED:	29/04/2022
METHOD:	Aerial Photography	ACCURACY:	± 4 m	HOLE FINISHED:	29/04/2022

Soil / Rock Type	Description	Graphic Log	Depth (m)	Groundwater / Seepage	Scala Penetrometer (Blows per 100mm)
					0 5 10 15
TOPSOIL/FILL	Organic SILT with trace of sand and gravel; brown. Firm; moist; non-plastic; sand, fine to coarse; gravel, fine to coarse, rounded, slightly weathered greywacke or quartz. Frequent rootlets.		0m		
FILL	Silty GRAVEL with some sand; greyish brown. Medium dense; moist; well graded; sand, fine to coarse; gravel, fine to coarse, rounded, slightly weathered greywacke or quartz.		0.2m		
FILL	Gravelly SILT with minor sand and trace of organics; greyish brown. Firm to stiff; moist; low plasticity; sand, fine to coarse; gravel, fine to coarse, rounded, slightly weathered greywacke or quartz. Organics are fibrous, tend to be found in pockets. Rare rubbish including glass and brick fragments.		0.6m		
ALLUVIAL SILT	Clayey SILT with trace of gravel; bluish grey, becoming mottled light brown. Stiff to very stiff; moist; low plasticity; gravel, fine to coarse, rounded. Occasional greenish brown flecks/spots.		1.2m		
			2.3m	NO SEEPAGE	

Total Excavation Depth = 2.3 m

COMMENT:	Target depth reached.	LOGGED BY:	RS
		CHECKED DATE:	13/05/2022
		SHEET:	1 of 1

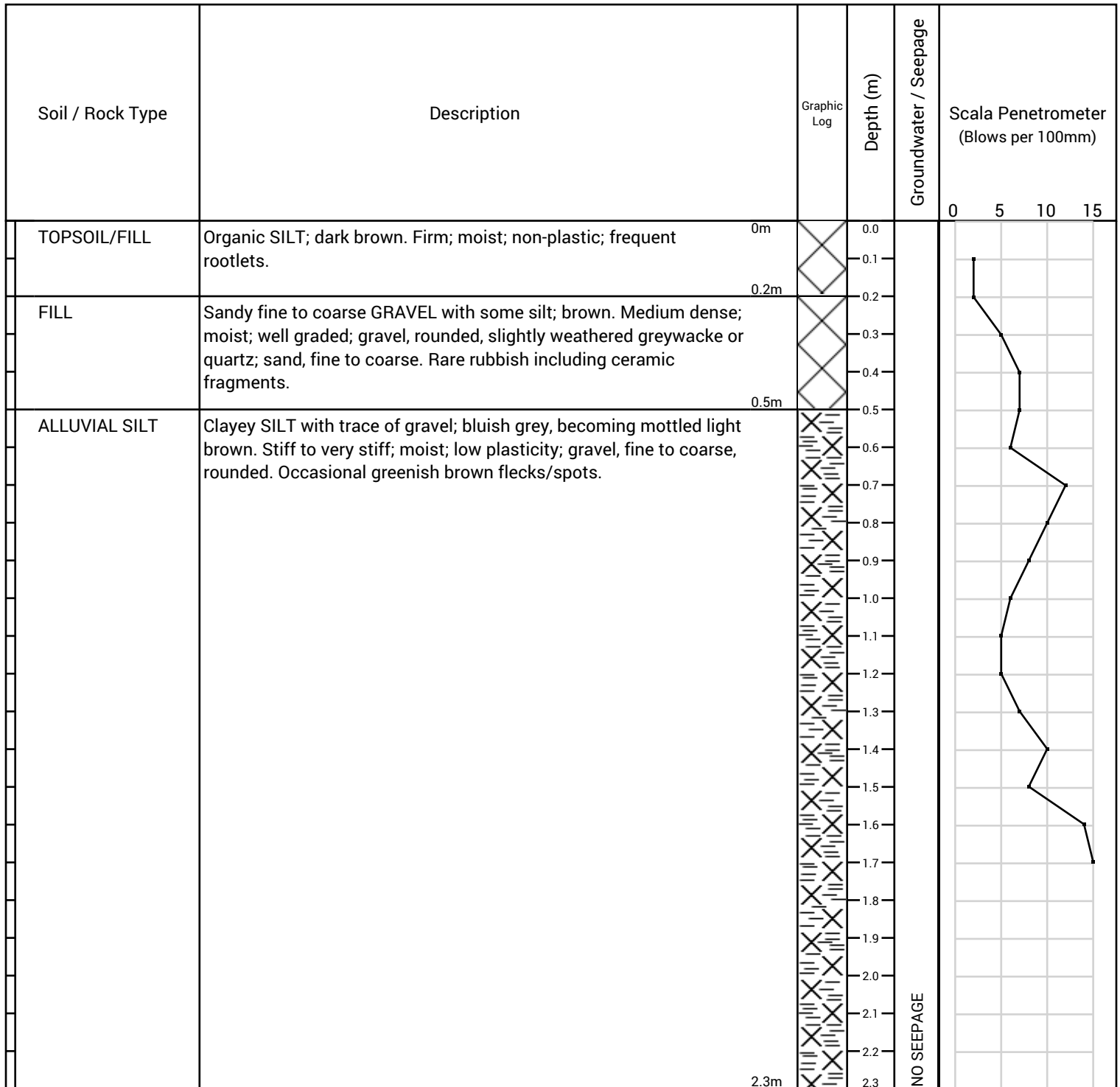
PROJECT:	KO-HAMILTON29			JOB NUMBER:	220222
LOCATION:	See Site Plan	INCLINATION:	Vertical		
EASTING:	1287521 m	EQUIPMENT:	5.5t excavator/450 mm auger	OPERATOR:	Robin
NORTHING:	4887877 m	COORD. SYSTEM:	NZTM2000	COMPANY:	Croydon Contracting
ELEVATION:	73 m	EXCAV. DATUM:	Existing ground level	HOLE STARTED:	29/04/2022
METHOD:	Aerial Photography	ACCURACY:	± 4 m	HOLE FINISHED:	29/04/2022

Soil / Rock Type	Description	Graphic Log	Depth (m)	Groundwater / Seepage	Scala Penetrometer (Blows per 100mm)
TOPSOIL/FILL	Organic SILT; brown. Firm; moist; non-plastic; rare rubbish including brick fragments.		0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7	~1 L/min	
FILL	Silty fine to coarse GRAVEL with some sand and minor clay; bluish grey. Medium dense; moist, wet to saturated in patches; gravel, rounded, slightly weathered greywacke or quartz, tends to be segregated in some zones; sand, fine to coarse. Frequent rubbish including large timber fragments, occasional combustion products.		0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4		
BURIED TOPSOIL	Organic SILT; dark brown. Firm to stiff; moist; non-plastic; organics are fine/fibrous.		1.4 1.5 1.6		
ALLUVIAL SILT	Clayey SILT with trace of gravel; bluish grey. Stiff to very stiff; moist; low plasticity; gravel, fine to coarse, rounded. Occasional greenish brown flecks/spots.		1.6 1.7 1.8 1.9 2.0 2.1 2.2		
-	-		2.2 2.3 2.4		

Total Excavation Depth = 2.2 m

COMMENT:	Target depth reached. Perched groundwater confined to within patches of gravelly fill.	LOGGED BY:	RS
		CHECKED DATE:	13/05/2022
		SHEET:	1 of 1

PROJECT:	KO-HAMILTON29			JOB NUMBER:	220222
LOCATION:	See Site Plan	INCLINATION:	Vertical		
EASTING:	1287552 m	EQUIPMENT:	5.5t excavator/450 mm auger	OPERATOR:	Robin
NORTHING:	4887868 m	COORD. SYSTEM:	NZTM2000	COMPANY:	Croydon Contracting
ELEVATION:	73 m	EXCAV. DATUM:	Existing ground level	HOLE STARTED:	29/04/2022
METHOD:	Aerial Photography	ACCURACY:	± 4 m	HOLE FINISHED:	29/04/2022



Total Excavation Depth = 2.3 m

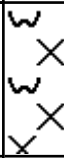
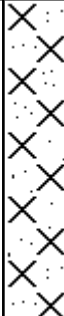
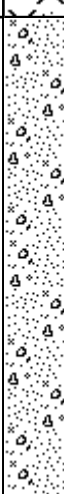


COMMENT:	Target depth reached.	LOGGED BY:	RS
		CHECKED DATE:	13/05/2022
		SHEET:	1 of 1

TEST PIT LOG

EXCAVATION NUMBER:

TP 7

PROJECT:	KO-HAMILTON29			JOB NUMBER:	220222
LOCATION:	See Site Plan	INCLINATION:	Vertical		
EASTING:	1287539 m	EQUIPMENT:	5.5t excavator/450 mm auger	OPERATOR:	Robin
NORTHING:	4887918 m	COORD. SYSTEM:	NZTM2000	COMPANY:	Croydon Contracting
ELEVATION:	74 m	EXCAV. DATUM:	Existing ground level	HOLE STARTED:	29/04/2022
METHOD:	Aerial Photography	ACCURACY:	± 4 m	HOLE FINISHED:	29/04/2022

Soil / Rock Type	Description	Graphic Log	Depth (m)	Groundwater / Seepage	Scala Penetrometer (Blows per 100mm)
TOPSOIL	Organic SILT; dark brown. Firm; moist; non-plastic; rare rubbish including ceramic fragments. Frequent roots and rootlets.		0m 0.1 0.2 0.3m		
ALLUVIAL SILT	Sandy SILT; brown. Firm; moist; non-plastic; sand is fine.		0.3 0.4 0.5 0.6 0.7 0.8 0.9 0.95m		
ALLUVIAL SAND	Gravelly fine to coarse SAND with trace of cobbles; grey and brown. Medium dense; moist; poorly graded; gravel, fine to medium, rarely coarse, rounded, slightly weathered greywacke or quartz; cobbles, rounded.		0.95 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9m		
ALLUVIAL SAND	Gravelly fine to coarse SAND with minor silt and trace of cobbles; grey and brown. Medium dense; moist; poorly graded; gravel, fine to medium, rarely coarse, rounded, slightly weathered greywacke or quartz; cobbles, rounded.		1.9 2.0 2.1 2.2 2.3m		
-	-		2.3 2.4m	NO SEEPAGE	

Total Excavation Depth = 2.3 m

COMMENT:	Target depth reached.	LOGGED BY:	RS
		CHECKED DATE:	13/05/2022
		SHEET:	1 of 1



ATTACHMENT E:

Laboratory Reports and Chain of Custody



Certificate of Analysis

Page 1 of 4

Client:	Engeo Limited	Lab No:	3175136	SPV1
Contact:	Gareth Ward C/- Engeo Limited PO Box 373 Christchurch 8140	Date Received:	16-Feb-2023	
		Date Reported:	22-Feb-2023	
		Quote No:	82742	
		Order No:		
		Client Reference:	21517	
		Submitted By:	Jacob Johnson	

Sample Type: Soil

Sample Name:	BH01 @ 0.1m 14-Feb-2023	BH01 @ 0.3m 14-Feb-2023	BH01 @ 0.5m 14-Feb-2023	BH02 @ 0.1m 14-Feb-2023	BH03 @ 0.1m 14-Feb-2023
Lab Number:	3175136.1	3175136.2	3175136.3	3175136.4	3175136.5

Heavy Metals, Screen Level

	mg/kg dry wt	5	6	4	5	2
Total Recoverable Arsenic	mg/kg dry wt	5	6	4	5	2
Total Recoverable Cadmium	mg/kg dry wt	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	10	12	11	24	8
Total Recoverable Copper	mg/kg dry wt	10	12	9	10	6
Total Recoverable Lead	mg/kg dry wt	76	72	25	76	4.8
Total Recoverable Nickel	mg/kg dry wt	7	8	8	8	5
Total Recoverable Zinc	mg/kg dry wt	60	69	39	39	23

Sample Name:	BH03 @ 0.5m 14-Feb-2023	BH04 @ 0.1m 14-Feb-2023	BH04 @ 0.3m 14-Feb-2023	BH04 @ 0.5m 14-Feb-2023	ENV1 - @ 0.1m 14-Feb-2023
Lab Number:	3175136.6	3175136.7	3175136.8	3175136.9	3175136.10

Individual Tests

Dry Matter	g/100g as rcvd	-	-	-	-	96
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Heavy Metals, Screen Level

	mg/kg dry wt	5	2	3	3	2
Total Recoverable Arsenic	mg/kg dry wt	5	2	3	3	2
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	11	12	12	12
Total Recoverable Copper	mg/kg dry wt	11	8	9	8	9
Total Recoverable Lead	mg/kg dry wt	11.1	6.8	8.7	5.9	9.7
Total Recoverable Nickel	mg/kg dry wt	8	7	7	7	8
Total Recoverable Zinc	mg/kg dry wt	39	26	34	25	31

Organochlorine Pesticides Screening in Soil

Aldrin	mg/kg dry wt	-	-	-	-	< 0.010
alpha-BHC	mg/kg dry wt	-	-	-	-	< 0.010
beta-BHC	mg/kg dry wt	-	-	-	-	< 0.010
delta-BHC	mg/kg dry wt	-	-	-	-	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	-	-	-	-	< 0.010
cis-Chlordane	mg/kg dry wt	-	-	-	-	< 0.010
trans-Chlordane	mg/kg dry wt	-	-	-	-	< 0.010
2,4'-DDD	mg/kg dry wt	-	-	-	-	< 0.010
4,4'-DDD	mg/kg dry wt	-	-	-	-	< 0.010
2,4'-DDE	mg/kg dry wt	-	-	-	-	< 0.010
4,4'-DDE	mg/kg dry wt	-	-	-	-	< 0.010
2,4'-DDT	mg/kg dry wt	-	-	-	-	< 0.010
4,4'-DDT	mg/kg dry wt	-	-	-	-	< 0.010
Total DDT Isomers	mg/kg dry wt	-	-	-	-	< 0.06
Dieldrin	mg/kg dry wt	-	-	-	-	< 0.010
Endosulfan I	mg/kg dry wt	-	-	-	-	< 0.010



This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.

The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Soil						
Sample Name:	BH03 @ 0.5m 14-Feb-2023	BH04 @ 0.1m 14-Feb-2023	BH04 @ 0.3m 14-Feb-2023	BH04 @ 0.5m 14-Feb-2023	ENV1 - @ 0.1m 14-Feb-2023	
Lab Number:	3175136.6	3175136.7	3175136.8	3175136.9	3175136.10	
Organochlorine Pesticides Screening in Soil						
Endosulfan II	mg/kg dry wt	-	-	-	-	< 0.010
Endosulfan sulphate	mg/kg dry wt	-	-	-	-	< 0.010
Endrin	mg/kg dry wt	-	-	-	-	< 0.010
Endrin aldehyde	mg/kg dry wt	-	-	-	-	< 0.010
Endrin ketone	mg/kg dry wt	-	-	-	-	< 0.010
Heptachlor	mg/kg dry wt	-	-	-	-	< 0.010
Heptachlor epoxide	mg/kg dry wt	-	-	-	-	< 0.010
Hexachlorobenzene	mg/kg dry wt	-	-	-	-	< 0.010
Methoxychlor	mg/kg dry wt	-	-	-	-	< 0.010
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	-	-	-	-	0.6
1-Methylnaphthalene	mg/kg dry wt	-	-	-	-	< 0.010
2-Methylnaphthalene	mg/kg dry wt	-	-	-	-	< 0.010
Acenaphthylene	mg/kg dry wt	-	-	-	-	< 0.010
Acenaphthene	mg/kg dry wt	-	-	-	-	< 0.010
Anthracene	mg/kg dry wt	-	-	-	-	< 0.010
Benzo[a]anthracene	mg/kg dry wt	-	-	-	-	0.019
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	-	0.079
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	-	-	-	-	0.110
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	-	-	-	-	0.110
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	-	-	0.068
Benzo[e]pyrene	mg/kg dry wt	-	-	-	-	0.050
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	-	0.053
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	-	0.025
Chrysene	mg/kg dry wt	-	-	-	-	0.021
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	-	0.014
Fluoranthene	mg/kg dry wt	-	-	-	-	0.048
Fluorene	mg/kg dry wt	-	-	-	-	< 0.010
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	-	0.052
Naphthalene	mg/kg dry wt	-	-	-	-	< 0.05
Perylene	mg/kg dry wt	-	-	-	-	0.018
Phenanthrene	mg/kg dry wt	-	-	-	-	0.012
Pyrene	mg/kg dry wt	-	-	-	-	0.132
Sample Name:	ENV1 @ 0.3m 14-Feb-2023	ENV1 @ 0.5m 14-Feb-2023	ENV1 @ 0.9m 14-Feb-2023	ENV2 @ 0.1m 14-Feb-2023	ENV2 @ 0.3m 14-Feb-2023	
Lab Number:	3175136.11	3175136.12	3175136.13	3175136.14	3175136.15	
Individual Tests						
Dry Matter	g/100g as rcvd	97	86	89	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	2	4	3	2	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	13	15	13	11	12
Total Recoverable Copper	mg/kg dry wt	9	10	10	8	9
Total Recoverable Lead	mg/kg dry wt	7.9	11.8	8.5	8.0	76
Total Recoverable Nickel	mg/kg dry wt	7	8	8	7	6
Total Recoverable Zinc	mg/kg dry wt	30	41	33	30	84
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	0.3	0.7	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.012	< 0.011	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.012	< 0.011	-	-
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.012	< 0.011	-	-
Acenaphthene	mg/kg dry wt	< 0.011	< 0.012	< 0.011	-	-

Sample Type: Soil						
Sample Name:	ENV1 @ 0.3m 14-Feb-2023	ENV1 @ 0.5m 14-Feb-2023	ENV1 @ 0.9m 14-Feb-2023	ENV2 @ 0.1m 14-Feb-2023	ENV2 @ 0.3m 14-Feb-2023	
Lab Number:	3175136.11	3175136.12	3175136.13	3175136.14	3175136.15	
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Anthracene	mg/kg dry wt	< 0.011	< 0.012	< 0.011	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.011	0.020	0.030	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.014	0.033	0.067	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.025	0.055	0.086	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.025	0.055	0.085	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.012	0.045	0.073	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.011	0.019	0.050	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.011	0.026	0.059	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	0.016	0.025	-	-
Chrysene	mg/kg dry wt	< 0.011	0.018	0.036	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.012	< 0.011	-	-
Fluoranthene	mg/kg dry wt	0.010	0.036	0.067	-	-
Fluorene	mg/kg dry wt	< 0.011	< 0.012	< 0.011	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.011	0.030	0.051	-	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	-	-
Perylene	mg/kg dry wt	< 0.011	0.014	0.018	-	-
Phenanthrene	mg/kg dry wt	< 0.011	0.023	0.035	-	-
Pyrene	mg/kg dry wt	0.028	0.034	0.137	-	-
Sample Name:	ENV2 @ 0.5m 14-Feb-2023	ENV2 @ 0.9m 14-Feb-2023	ENV3 @ 0.1m 14-Feb-2023	ENV3 @ 0.3m 14-Feb-2023	ENV3 @ 0.5m 14-Feb-2023	
Lab Number:	3175136.16	3175136.17	3175136.18	3175136.19	3175136.20	
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	2	4	2	4	2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.22	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	15	11	12	10
Total Recoverable Copper	mg/kg dry wt	8	11	8	10	7
Total Recoverable Lead	mg/kg dry wt	12.6	37	8.3	240	16.0
Total Recoverable Nickel	mg/kg dry wt	7	9	7	6	7
Total Recoverable Zinc	mg/kg dry wt	34	76	29	126	36
Sample Name:	ENV3 @ 0.9m 14-Feb-2023	HA04 @ 0.5m 14-Feb-2023	BH02 @ 0.3m 14-Feb-2023	BH02 @ 0.5m 14-Feb-2023	BH04 @ 1.0m	
Lab Number:	3175136.21	3175136.22	3175136.23	3175136.24	3175136.25	
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	4	4	4	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	15	14	12	12	10
Total Recoverable Copper	mg/kg dry wt	13	10	10	11	8
Total Recoverable Lead	mg/kg dry wt	36	10.8	15.8	16.4	5.9
Total Recoverable Nickel	mg/kg dry wt	10	8	9	7	6
Total Recoverable Zinc	mg/kg dry wt	71	48	40	44	24
Sample Name:	BH03 @ 0.3m 14-Feb-2023	HA02 @ 0.1m 14-Feb-2023	HA02 @ 0.3m 14-Feb-2023	HA02 @ 0.5m 14-Feb-2023	HA03 @ 0.1m 14-Feb-2023	
Lab Number:	3175136.26	3175136.27	3175136.28	3175136.29	3175136.30	
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	8	5	4	3	5
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	0.11
Total Recoverable Chromium	mg/kg dry wt	10	13	11	13	12
Total Recoverable Copper	mg/kg dry wt	8	11	10	9	12
Total Recoverable Lead	mg/kg dry wt	14.8	31	18.3	14.7	20
Total Recoverable Nickel	mg/kg dry wt	6	9	7	7	8
Total Recoverable Zinc	mg/kg dry wt	37	54	46	47	64

Sample Type: Soil				
Sample Name:	HA03 @ 0.3m 14-Feb-2023	HA03 @ 0.5m 14-Feb-2023	HA04 @ 0.1m 14-Feb-2023	HA04 @ 0.3m 14-Feb-2023
Lab Number:	3175136.31	3175136.32	3175136.33	3175136.34
Heavy Metals, Screen Level				
Total Recoverable Arsenic	mg/kg dry wt	5	4	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	0.13
Total Recoverable Chromium	mg/kg dry wt	13	13	13
Total Recoverable Copper	mg/kg dry wt	12	12	9
Total Recoverable Lead	mg/kg dry wt	18.0	12.3	16.8
Total Recoverable Nickel	mg/kg dry wt	9	9	8
Total Recoverable Zinc	mg/kg dry wt	61	45	55

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 simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-34
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	10-13
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	1-34
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD analysis. Tested on as received sample. In-house based on US EPA 8081.	0.010 - 0.06 mg/kg dry wt	10
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.010 - 0.05 mg/kg dry wt	10-13
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	10-13
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.	0.024 mg/kg dry wt	10-13
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).	0.024 mg/kg dry wt	10-13

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

Testing was completed between 16-Feb-2023 and 21-Feb-2023. 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.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental



ANALYSIS REQUEST

Quote No _____

Primary Contact Gareth Ward

Submitted By Jake Johson

Client Name ENGEO Ltd

Address 1st Floor 24 Rees Street, Queenstown

Postcode 9300

Phone _____ **Mobile** 0226572009

Email gward@engeo.co.nz

Charge To ENGEO Ltd

Client Reference 21517

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 _____

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

Job No: _____ Date Recv: 16-Feb-23 11:33

317 5136

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

Received by: Nathaniel Sue



CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories **Date & Time:** 15-02-2023

Name: _____

Tick if you require COC to be emailed back **Signature:** _____

Received at Hill Laboratories **Date & Time:** _____

Name: _____

Signature: _____

Condition **Temp:**

Room Temp Chilled Frozen 20.9

Dates of testing are not routinely included in the Certificates of Analysis. Please inform the Laboratory if you would like this information reported.

ADDITIONAL INFORMATION / KNOWN HAZARDS

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	BH01 @ 0.1m	14/02/23		Soil	Heavy Metals
2	BH01 @ 0.3m	14/02/23		Soil	Heavy Metals
3	BH01 @ 0.5m	14/02/23		Soil	Heavy Metals
4	BH02 @ 0.1m	14/02/23		Soil	Heavy Metals
5	BH02 @ 0.2m	14/02/23		Soil	Heavy Metals
6	BH02 @ 0.3m	14/02/23		Soil	Heavy Metals
7	BH03 @ 0.1m	14/02/23		Soil	Heavy Metals
8	BH03 @ 0.3m	14/02/23		Soil	Heavy Metals
9	BH03 @ 0.5m	14/02/23		Soil	Heavy Metals
10	BH04 @ 0.1m	14/02/23		Soil	Heavy Metals
11	BH04 @ 0.3m	14/02/23		Soil	Heavy Metals
12	BH04 @ 0.5m	14/02/23		Soil	Heavy Metals

Continued on next page

No.	Sample Name	Sample Date	Sample Time	Sample Type	Tests Required (if not as per Quote)
13	ENV 1 - @0.1m	14/02/23		Soil	Heavy Metals, OCP, PAH
14	ENV 1 @0.3m	14/02/23		Soil	Heavy Metals, TAH
15	ENV 1 @0.5m	14/02/23		Soil	Heavy Metals, TAH
16	ENV 1 @0.9m	14/02/23		Soil	Heavy Metals, TAH
17	ENV 2 @0.1m	14/02/23		Soil	Heavy Metals
18	ENV 2 @0.3m	14/02/23		Soil	Heavy Metals
19	ENV 2 @0.5m	14/02/23		Soil	Heavy Metals
20	ENV 2 @0.9m	14/02/23		Soil	Heavy Metals
21	ENV 3 @0.1m	14/02/23		Soil	Heavy Metals
22	ENV 3 @0.3m	14/02/23		Soil	Heavy Metals
23	ENV 3 @0.5m	14/02/23		Soil	Heavy Metals
24	ENV 3 @0.9m	14/02/23		Soil	Heavy Metals
25	HA02 @0.1m	14/02/23		Soil	Heavy Metals
26	HA02 @0.3m	14/02/23		Soil	Heavy Metals
27	HA02 @0.5m	14/02/23		Soil	Heavy Metals
28	HA03 @0.1m	14/02/23		Soil	Heavy Metals
29	HA03 @0.3m	14/02/23		Soil	Heavy Metals
30	HA03 @0.5m	14/02/23		Soil	Heavy Metals
31	HA04 @0.1m	14/02/23		Soil	Heavy Metals
32	HA04 @0.3m	14/02/23		Soil	Heavy Metals
33	HA04 @0.5m	14/02/23		Soil	Heavy Metals
34				Soil	Heavy Metals
35				Soil	Heavy Metals
36				Soil	Heavy Metals
37				Soil	Heavy Metals
38				Soil	Heavy Metals
39				Soil	Heavy Metals
40				Soil	Heavy Metals



Certificate of Analysis

Client: Engeo Limited	Lab No: 3222174	SPV1
Contact: Gareth Ward	Date Received: 30-Mar-2023	
C/- Engeo Limited	Date Reported: 04-Apr-2023	
PO Box 373	Quote No: 82742	
Christchurch 8140	Order No:	
	Client Reference: 21517 - Delineation	
	Submitted By: Gareth Ward	

Sample Type: Soil

Sample Name:	HS-ENG23-DL01(e) 0.3	HS-ENG23-DL02(s) 0.3	HS-ENG23-DL03(w) 0.3	HS-ENG23-DL04(n) 0.3	HS-ENG23-DL05(s) 0.3
Lab Number:	3222174.1	3222174.4	3222174.7	3222174.10	3222174.13
Heavy Metals, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt	< 2	4	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.12	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	9	12	11	10
Total Recoverable Copper	mg/kg dry wt	8	11	8	9
Total Recoverable Lead	mg/kg dry wt	8.1	70	27	37
Total Recoverable Nickel	mg/kg dry wt	6	7	7	7
Total Recoverable Zinc	mg/kg dry wt	30	116	56	62

Sample Name:	HS-ENG23-DL06(w) 0.3	HS-ENG23-DL07(n) 0.3	HS-ENG23-DL08(w) 0.3	HS-ENG23-DL09(n) 0.3	HS-ENG23-DL10(w) 0.3
Lab Number:	3222174.16	3222174.19	3222174.22	3222174.25	3222174.28
Heavy Metals, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt	< 2	3	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	9	11	9	8
Total Recoverable Copper	mg/kg dry wt	7	8	7	6
Total Recoverable Lead	mg/kg dry wt	9.2	10.8	10.4	4.2
Total Recoverable Nickel	mg/kg dry wt	6	7	6	5
Total Recoverable Zinc	mg/kg dry wt	30	30	30	19

Sample Name:	HS-ENG23-DL11(n) 0.3	HS-ENG23-DL13(n) 0.3
Lab Number:	3222174.31	3222174.34
Heavy Metals, Screen Level		
Total Recoverable Arsenic	mg/kg dry wt	2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10
Total Recoverable Chromium	mg/kg dry wt	9
Total Recoverable Copper	mg/kg dry wt	7
Total Recoverable Lead	mg/kg dry wt	5.2
Total Recoverable Nickel	mg/kg dry wt	6
Total Recoverable Zinc	mg/kg dry wt	25

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.

Test	Method Description	Default Detection Limit	Sample No
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This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.

The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Soil			
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, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34
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, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34

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

Testing was completed between 03-Apr-2023 and 04-Apr-2023. 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.

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Kim Harrison MSc
Client Services Manager - Environmental

Sample ^A	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	DDT ^B	BAP _{eq} ^C
Composite samples:									
HA1, HA2 & HA3 (0-0.15m)	7	0.13	13	13	26	8	74	0.36	-
HB1, HB2 & HB3 (0-0.15m)	6	0.14	12	15	43	9	94	< 0.08	-
HC1, HC2 & HC3 (0-0.15m)	8	0.17	11	14	27	8	80	< 0.08	-
HE1, HE2 & HE3 (0-0.15m)	5	0.19	14	16	32	9	66	-	-
HA4 (0-0.15m), HB4 & HC4 (0-0.1m)	22	0.17	45	56	31	7	125	-	-
<i>Average</i>	10	0.16	19	23	32	8	88	-	-
<i>RSD</i>	73%	15%	77%	82%	21%	10%	26%	-	-
<i>UCL</i>	29	0.18	47	59	38	9	110	-	-
Individual samples:									
HA4 (0-0.15m)	8	0.14	10	81	23	8	96	-	-
HB4 (0-0.1m)	17	0.19	34	47	26	7	113	-	-
HC4 (0-0.1m)	12	0.15	14	40	38	8	197	-	-
HD (0-0.15m)	6	0.1	16	17	38	9	81	-	< 0.04
HM1 (0.5-0.8 m)	4	0.43	11	19	400	7	390	-	0.08
HM1 (1.1m)	5	< 0.10	14	11	26	10	73	-	-
HM2 (0-0.3m)	2	< 0.10	9	8	6.2	6	23	-	< 0.03
HM2 (0.4-0.8m)	7	< 0.10	10	12	90	6	73	-	0.25
HM3 (0-0.2m)	< 2	< 0.10	9	7	6.3	6	27	-	< 0.03
HM3 (1.2m)	5	< 0.10	10	10	17.3	6	41	-	< 0.04
HM4 (0.2-0.4m)	5	< 0.10	9	11	12.5	8	42	-	0.03
HM4 (0.6-1.0m)	3	< 0.10	15	12	10.9	9	42	-	0.44
HM5 (0.7-1.3m)	3	< 0.10	11	9	11.4	7	38	-	< 0.03
HM6 (0.2-0.5m)	4	< 0.10	11	14	11.3	9	37	-	< 0.03
HM7 (0.4-0.6m)	3	< 0.10	11	8	7.5	7	31	-	< 0.03
HM7 (1.4-1.6m)	2	< 0.10	11	7	4.8	6	23	-	< 0.03
<i>Average</i>	6	< 0.13	13	20	46	7	83	-	< 0.09
<i>RSD</i>	73%	63%	47%	102%	212%	18%	113%	-	144%
<i>UCL</i>	8	0.17	15	41	151	8	130	-	0.25
Soil Acceptance Criteria (Human Health - Residential)									
NES ^D SCS	20	3	460	>10,000	210	-	-	70	10
NEPM ^E SGV	-	-	-	-	-	400	7,400	-	-
Soil Quality Guidelines (Environmental Health – Residential/Parkland)									
CCME ^F	17	10	64	63	300	45	250	0.7	20
Landfill Screening Acceptance Criteria^G									
Class A	100	20	100	100	100	200	200	500	300
Class B	10	2	10	10	10	20	20	50	30
Burnside	100	20	400	400	400	200	800	500	300
Predicted Background^H									
Median	2.88	0.066	16.56	10	12.2	7.98	44.06	0.024	0.052
95 th Quantile	12.06	0.34	80.15	42.85	44.34	44.96	182.8	0.245	0.64

^A Results for total concentration analysis, average, 95% upper confidence limit (UCL) and SCS/SGVs in mg/kg dry weight; relative standard deviation (RSD) in %. Sample numbers are as marked in Figure 4. Cells highlighted yellow exceed the predicted background concentration. Cells highlighted red exceed human health standards SCS/SGV.

^B The total DDT isomers is reported.

^C The benzo(a)pyrene equivalent (BAP_{eq}) is calculated as the sum of each of the detected concentrations of nine carcinogenic PAHs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and indeno(1,2,3-cd) pyrene), multiplied by their respective potency equivalency factors from Table 40 in the *Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health* (Ministry for the Environment, 2011. Wellington).

^D Ministry for the Environment, 2012. *Users' Guide, National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*. Wellington. Cr SCS is reported as Cr(VI). Residential scenario applied.

^E National Environment Protection Council (Australia), 2013. *National Environment Protection (Assessment of Site Contamination) Measure 1999*. The values applied represent a Health Investigation Level (HIL) for Low Density Residential land use (HIL A).

^F Canadian Council of Ministers of the Environment, 2021. *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health*. Soil quality guideline for environmental health for Residential/parkland land use quoted. Orange cells indicate the site average exceeds the guideline.

^G Ministry for the Environment, 2004. *Module 2: Hazardous Waste Guidelines - Landfill Waste Acceptance Criteria and Landfill Classification*. And RM17.198.01.V2. Blue cells indicate Landfill Acceptance Criteria that are likely exceeded by the average.

^H Landcare Research, 2015. *Background soil concentrations of selected trace elements and organic contaminants in New Zealand*. Predicted median and 95th Quantile reported for gravel. Also refer: <https://iris.scinfo.org.nz/layer/48470-pbc-predicted-background-soil-concentrations-new-zealand/>. DDT and BAP_{eq} for provincial New Zealand shown.



Certificate of Analysis

Page 1 of 4

Client:	Environmental Consultants Otago Limited	Lab No:	2968027	SPV5
Contact:	Ciaran Keogh	Date Received:	27-Apr-2022	
	C/- Environmental Consultants Otago Limited	Date Reported:	17-May-2022	(Amended)
	PO Box 5522	Quote No:	86979	
	Dunedin 9058	Order No:		
		Client Reference:	Hamilton	
		Submitted By:	Bernice Chapman	

Sample Type: Soil

Sample Name:	HA4 0-0.15m 26-Apr-2022 1:57 pm	HB4 0-0.1m 26-Apr-2022 2:20 pm	HC4 0-0.1m 26-Apr-2022 2:40 pm	HD 0-0.15m 26-Apr-2022 2:15 pm	Composite of HA1 0-0.15m, HA2 0-0.15m & HA3 0-0.15m
Lab Number:	2968027.4	2968027.8	2968027.12	2968027.13	2968027.17

Individual Tests

Test	Unit	HA4 0-0.15m 26-Apr-2022 1:57 pm	HB4 0-0.1m 26-Apr-2022 2:20 pm	HC4 0-0.1m 26-Apr-2022 2:40 pm	HD 0-0.15m 26-Apr-2022 2:15 pm	Composite of HA1 0-0.15m, HA2 0-0.15m & HA3 0-0.15m
Dry Matter	g/100g as rcvd	-	-	-	77	76
Total Recoverable Arsenic	mg/kg dry wt	8	17	12	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.14	0.19	0.15	-	-
Total Recoverable Chromium	mg/kg dry wt	10	34	14	-	-
Total Recoverable Copper	mg/kg dry wt	81	47	40	-	-
Total Recoverable Lead	mg/kg dry wt	23	26	38	-	-
Total Recoverable Nickel	mg/kg dry wt	8	7	8	-	-
Total Recoverable Zinc	mg/kg dry wt	96	113	197	-	-

Heavy Metals, Screen Level

Total Recoverable Arsenic	mg/kg dry wt	-	-	-	6	7
Total Recoverable Cadmium	mg/kg dry wt	-	-	-	0.10	0.13
Total Recoverable Chromium	mg/kg dry wt	-	-	-	16	13
Total Recoverable Copper	mg/kg dry wt	-	-	-	17	13
Total Recoverable Lead	mg/kg dry wt	-	-	-	38	26
Total Recoverable Nickel	mg/kg dry wt	-	-	-	9	8
Total Recoverable Zinc	mg/kg dry wt	-	-	-	81	74

Organochlorine Pesticides Screening in Soil

Aldrin	mg/kg dry wt	-	-	-	-	< 0.013
alpha-BHC	mg/kg dry wt	-	-	-	-	< 0.013
beta-BHC	mg/kg dry wt	-	-	-	-	< 0.013
delta-BHC	mg/kg dry wt	-	-	-	-	< 0.013
gamma-BHC (Lindane)	mg/kg dry wt	-	-	-	-	< 0.013
cis-Chlordane	mg/kg dry wt	-	-	-	-	< 0.013
trans-Chlordane	mg/kg dry wt	-	-	-	-	< 0.013
2,4'-DDD	mg/kg dry wt	-	-	-	-	< 0.013
4,4'-DDD	mg/kg dry wt	-	-	-	-	< 0.013
2,4'-DDE	mg/kg dry wt	-	-	-	-	< 0.013
4,4'-DDE	mg/kg dry wt	-	-	-	-	0.22
2,4'-DDT	mg/kg dry wt	-	-	-	-	0.018
4,4'-DDT	mg/kg dry wt	-	-	-	-	0.109
Total DDT Isomers	mg/kg dry wt	-	-	-	-	0.36
Dieldrin	mg/kg dry wt	-	-	-	-	< 0.013
Endosulfan I	mg/kg dry wt	-	-	-	-	< 0.013
Endosulfan II	mg/kg dry wt	-	-	-	-	< 0.013
Endosulfan sulphate	mg/kg dry wt	-	-	-	-	< 0.013
Endrin	mg/kg dry wt	-	-	-	-	< 0.013



This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.

The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Soil						
Sample Name:	HA4 0-0.15m 26-Apr-2022 1:57 pm	HB4 0-0.1m 26-Apr-2022 2:20 pm	HC4 0-0.1m 26-Apr-2022 2:40 pm	HD 0-0.15m 26-Apr-2022 2:15 pm	Composite of HA1 0-0.15m, HA2 0-0.15m & HA3 0-0.15m	
Lab Number:	2968027.4	2968027.8	2968027.12	2968027.13	2968027.17	
Organochlorine Pesticides Screening in Soil						
Endrin aldehyde	mg/kg dry wt	-	-	-	-	< 0.013
Endrin ketone	mg/kg dry wt	-	-	-	-	< 0.013
Heptachlor	mg/kg dry wt	-	-	-	-	< 0.013
Heptachlor epoxide	mg/kg dry wt	-	-	-	-	< 0.013
Hexachlorobenzene	mg/kg dry wt	-	-	-	-	< 0.013
Methoxychlor	mg/kg dry wt	-	-	-	-	< 0.013
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	-	-	-	< 0.3	-
1-Methylnaphthalene	mg/kg dry wt	-	-	-	< 0.013	-
2-Methylnaphthalene	mg/kg dry wt	-	-	-	< 0.013	-
Acenaphthylene	mg/kg dry wt	-	-	-	< 0.013	-
Acenaphthene	mg/kg dry wt	-	-	-	< 0.013	-
Anthracene	mg/kg dry wt	-	-	-	< 0.013	-
Benzo[a]anthracene	mg/kg dry wt	-	-	-	< 0.013	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	< 0.013	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	-	-	-	< 0.04	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	-	-	-	< 0.04	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	-	< 0.013	-
Benzo[e]pyrene	mg/kg dry wt	-	-	-	< 0.013	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	< 0.013	-
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	< 0.013	-
Chrysene	mg/kg dry wt	-	-	-	< 0.013	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	< 0.013	-
Fluoranthene	mg/kg dry wt	-	-	-	< 0.013	-
Fluorene	mg/kg dry wt	-	-	-	< 0.013	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	< 0.013	-
Naphthalene	mg/kg dry wt	-	-	-	< 0.07	-
Perylene	mg/kg dry wt	-	-	-	< 0.013	-
Phenanthrene	mg/kg dry wt	-	-	-	< 0.013	-
Pyrene	mg/kg dry wt	-	-	-	< 0.013	-
Sample Name:	Composite of HB1 0-0.15m, HB2 0-0.15m & HB3 0-0.15m	Composite of HC1 0-0.15m, HC2 0-0.15m & HC3 0-0.15m	Composite of HE1 0-0.15m, HE2 0-0.15m & HE3 0-0.15m	Composite of HA4 0-0.15m, HB4 0-0.1m & HC4 0-0.1m		
Lab Number:	2968027.18	2968027.19	2968027.20	2968027.21		
Individual Tests						
Dry Matter	g/100g as rcvd	74	74	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	8	5	22	-
Total Recoverable Cadmium	mg/kg dry wt	0.14	0.17	0.19	0.17	-
Total Recoverable Chromium	mg/kg dry wt	12	11	14	45	-
Total Recoverable Copper	mg/kg dry wt	15	14	16	56	-
Total Recoverable Lead	mg/kg dry wt	43	27	32	31	-
Total Recoverable Nickel	mg/kg dry wt	9	8	9	7	-
Total Recoverable Zinc	mg/kg dry wt	94	80	66	125	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.014	< 0.013	-	-	-
alpha-BHC	mg/kg dry wt	< 0.014	< 0.013	-	-	-
beta-BHC	mg/kg dry wt	< 0.014	< 0.013	-	-	-
delta-BHC	mg/kg dry wt	< 0.014	< 0.013	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.014	< 0.013	-	-	-

Sample Type: Soil

Sample Name:	Composite of HB1 0-0.15m, HB2 0-0.15m & HB3 0-0.15m	Composite of HC1 0-0.15m, HC2 0-0.15m & HC3 0-0.15m	Composite of HE1 0-0.15m, HE2 0-0.15m & HE3 0-0.15m	Composite of HA4 0-0.15m, HB4 0-0.1m & HC4 0-0.1m	
Lab Number:	2968027.18	2968027.19	2968027.20	2968027.21	
Organochlorine Pesticides Screening in Soil					
cis-Chlordane	mg/kg dry wt	< 0.014	< 0.013	-	-
trans-Chlordane	mg/kg dry wt	< 0.014	< 0.013	-	-
2,4'-DDD	mg/kg dry wt	< 0.014	< 0.013	-	-
4,4'-DDD	mg/kg dry wt	< 0.014	< 0.013	-	-
2,4'-DDE	mg/kg dry wt	< 0.014	< 0.013	-	-
4,4'-DDE	mg/kg dry wt	< 0.014	0.031	-	-
2,4'-DDT	mg/kg dry wt	< 0.014	< 0.013	-	-
4,4'-DDT	mg/kg dry wt	< 0.014	0.014	-	-
Total DDT Isomers	mg/kg dry wt	< 0.08	< 0.08	-	-
Dieldrin	mg/kg dry wt	< 0.014	< 0.013	-	-
Endosulfan I	mg/kg dry wt	< 0.014	< 0.013	-	-
Endosulfan II	mg/kg dry wt	< 0.014	< 0.013	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.014	< 0.013	-	-
Endrin	mg/kg dry wt	< 0.014	< 0.013	-	-
Endrin aldehyde	mg/kg dry wt	< 0.014	< 0.013	-	-
Endrin ketone	mg/kg dry wt	< 0.014	< 0.013	-	-
Heptachlor	mg/kg dry wt	< 0.014	< 0.013	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.014	< 0.013	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.014	< 0.013	-	-
Methoxychlor	mg/kg dry wt	< 0.014	< 0.013	-	-

Analyst's Comments

Amended Report: This certificate of analysis replaces report '2968027-SPv4' issued on 11-May-2022 at 12:17 pm. Reason for amendment: Additional heavy metals have been added to 2968027.4, .8 & 12.

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%.	-	4, 8, 12-13, 17-21
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	4, 8, 12
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	13
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	13, 17-21
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD analysis. Tested on as received sample. In-house based on US EPA 8081.	0.010 - 0.06 mg/kg dry wt	17-19
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.002 - 0.05 mg/kg dry wt	13
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 rcvcd	13, 17-19
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	4, 8, 12
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	4, 8, 12
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	4, 8, 12

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Total Recoverable Cadmium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.10 mg/kg dry wt	4, 8, 12
Total Recoverable Chromium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	4, 8, 12
Total Recoverable Copper	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	4, 8, 12
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	4, 8, 12
Total Recoverable Nickel	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	4, 8, 12
Total Recoverable Zinc	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	4 mg/kg dry wt	4, 8, 12
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	13
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; 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	13

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

Testing was completed between 29-Apr-2022 and 17-May-2022. 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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental



Certificate of Analysis

Client:	Environmental Consultants Otago Limited	Lab No:	2969427	A2Pv1
Contact:	Ciaran Keogh C/- Environmental Consultants Otago Limited PO Box 5522 Dunedin 9058	Date Received:	28-Apr-2022	
		Date Reported:	02-May-2022	
		Quote No:	86979	
		Order No:		
		Client Reference:	Hamilton	
		Submitted By:	Bernice Chapman	

Sample Type: Soil

Sample Name:	HA4 ASB 26-Apr-2022 1:55 pm	HB4 ASB 26-Apr-2022 2:20 pm	HC4 ASB 26-Apr-2022 2:40 pm		
Lab Number:	2969427.1	2969427.2	2969427.3		
Asbestos Presence / Absence	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	-	-
Description of Asbestos Form	-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	-	-
As Received Weight	g 623.7	g 572.4	g 619.7	-	-
Dry Weight	g 425.7	g 490.1	g 511.7	-	-
Moisture	% 32	% 14	% 17	-	-
Sample Fraction >10mm	g dry wt 2.9	g dry wt 77.9	g dry wt 56.3	-	-
Sample Fraction <10mm to >2mm	g dry wt 97.7	g dry wt 112.2	g dry wt 136.4	-	-
Sample Fraction <2mm	g dry wt 324.0	g dry wt 299.4	g dry wt 317.4	-	-
<2mm Subsample Weight	g dry wt 58.7	g dry wt 56.8	g dry wt 56.7	-	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001	-	-



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Glossary of Terms

- Loose fibres (Minor) - One or two fibres/fibre bundles identified during analysis by stereo microscope/PLM.
 - Loose fibres (Major) - Three or more fibres/fibre bundles identified during analysis by stereo microscope/PLM.
 - ACM Debris (Minor) - One or two small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
 - ACM Debris (Major) - Large (>2mm) piece, or more than three small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
 - Unknown Mineral Fibres - Mineral fibres of unknown type detected by polarised light microscopy including dispersion staining. The fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required.
 - Trace - Trace levels of asbestos, as defined by AS4964-2004.
- For further details, please contact the Asbestos Team.

Please refer to the **BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil.**

<https://www.branz.co.nz/asbestos>

The following assumptions have been made:

1. Asbestos Fines in the <2mm fraction, after homogenisation, is evenly distributed throughout the fraction
2. The weight of asbestos in the sample is unaffected by the ashing process.

Results are representative of the sample provided to Hill Laboratories only.

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
Individual Tests			
Weight of Asbestos as Asbestos Fines in <10mm >2mm Fraction*	Measurement on analytical balance, from the <10mm >2mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g dry wt	1-3
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-3
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-3
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1-3
Sample Fraction >10mm	Sample dried at 100 to 105°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-3
Sample Fraction <10mm to >2mm	Sample dried at 100 to 105°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-3
Sample Fraction <2mm	Sample dried at 100 to 105°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-3
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1-3
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-3
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-3
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-3
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-3
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-3
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-3

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-3
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-3

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

Testing was completed on 02-May-2022. 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.

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John Keneth Paglingayen BApSc
Laboratory Technician - Asbestos



Certificate of Analysis

Page 1 of 2

Client:	Environmental Consultants Otago Limited	Lab No:	2969455	A2Pv1
Contact:	Ciaran Keogh	Date Received:	28-Apr-2022	
	C/- Environmental Consultants Otago Limited	Date Reported:	03-May-2022	
	PO Box 5522	Quote No:	86979	
	Dunedin 9058	Order No:		
		Client Reference:	Hamilton	
		Add. Client Ref:	Sampled: 20/04/22	
		Submitted By:	Bernice Chapman	

Sample Type: Building Material

Sample Name	Lab Number	Sample Category	Sample Weight on receipt (g)	Asbestos Presence / Absence	Description of Asbestos in Non Homogeneous Samples
HA4 Sheet (Fascia)	2969455.1	Fibre Cement	3.93	Asbestos NOT detected. Organic fibres detected.	N/A

Glossary of Terms

- Loose fibres (Minor) - One or two fibres/fibre bundles identified during analysis by stereo microscope/PLM.
- Loose fibres (Major) - Three or more fibres/fibre bundles identified during analysis by stereo microscope/PLM.
- ACM Debris (Minor) - One or two small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
- ACM Debris (Major) - Large (>2mm) piece, or more than three small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
- Unknown Mineral Fibres - Mineral fibres of unknown type detected by polarised light microscopy including dispersion staining. The fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required.
- Trace - Trace levels of asbestos, as defined by AS4964-2004.

For further details, please contact the Asbestos Team.

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: Building Material

Test	Method Description	Default Detection Limit	Sample No
Asbestos in Bulk Material			
Sample Category	Assessment of sample type. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	-	1
Sample Weight on receipt	Sample weight. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.01 g	1
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1
Description of Asbestos in Non Homogeneous Samples	Form, dimensions and/or weight of asbestos fibres present. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1



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

Testing was completed between 29-Apr-2022 and 03-May-2022. 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.

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Mahaleel (May) Alfante BSc, PGDipSci
Laboratory Technician - Asbestos



Certificate of Analysis

Client:	Environmental Consultants Otago Limited	Lab No:	2975969	SPV1
Contact:	Ciaran Keogh C/- Environmental Consultants Otago Limited PO Box 5522 Dunedin 9058	Date Received:	04-May-2022	
		Date Reported:	10-May-2022	
		Quote No:	86979	
		Order No:		
		Client Reference:	HAMILTON	
		Submitted By:	Bernice Chapman	

Sample Type: Soil

Sample Name:	HM1 0.5-0.8 29-Apr-2022 10:40 am	HM1 1.1m 29-Apr-2022 10:50 am	HM2 0-0.3m 29-Apr-2022 11:30 am	HM2 0.4-0.8m 29-Apr-2022 11:45 am	HM3 0-0.2m 29-Apr-2022 12:20 pm
Lab Number:	2975969.1	2975969.2	2975969.5	2975969.6	2975969.9

Individual Tests

Dry Matter	g/100g as rcvd	75	-	96	80	96
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Heavy Metals, Screen Level

Total Recoverable Arsenic	mg/kg dry wt	4	5	2	7	< 2
Total Recoverable Cadmium	mg/kg dry wt	0.43	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	14	9	10	9
Total Recoverable Copper	mg/kg dry wt	19	11	8	12	7
Total Recoverable Lead	mg/kg dry wt	400	26	6.2	90	6.3
Total Recoverable Nickel	mg/kg dry wt	7	10	6	6	6
Total Recoverable Zinc	mg/kg dry wt	390	73	23	73	27

Polycyclic Aromatic Hydrocarbons Screening in Soil*

Total of Reported PAHs in Soil	mg/kg dry wt	0.6	-	< 0.3	2.0	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.013	-	< 0.010	0.019	< 0.010
2-Methylnaphthalene	mg/kg dry wt	< 0.013	-	< 0.010	0.018	< 0.010
Acenaphthylene	mg/kg dry wt	< 0.013	-	< 0.010	0.023	< 0.010
Acenaphthene	mg/kg dry wt	< 0.013	-	< 0.010	0.037	< 0.010
Anthracene	mg/kg dry wt	< 0.013	-	< 0.010	0.055	< 0.010
Benzo[a]anthracene	mg/kg dry wt	0.038	-	< 0.010	0.114	< 0.010
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.051	-	< 0.010	0.169	< 0.010
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.08	-	< 0.03	0.25	< 0.03
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.08	-	< 0.03	0.24	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.063	-	< 0.010	0.188	< 0.010
Benzo[e]pyrene	mg/kg dry wt	0.039	-	< 0.010	0.105	< 0.010
Benzo[g,h,i]perylene	mg/kg dry wt	0.041	-	< 0.010	0.125	< 0.010
Benzo[k]fluoranthene	mg/kg dry wt	0.024	-	< 0.010	0.077	< 0.010
Chrysene	mg/kg dry wt	0.041	-	< 0.010	0.103	< 0.010
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.013	-	< 0.010	0.024	< 0.010
Fluoranthene	mg/kg dry wt	0.089	-	< 0.010	0.23	< 0.010
Fluorene	mg/kg dry wt	< 0.013	-	< 0.010	0.069	< 0.010
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.038	-	< 0.010	0.120	< 0.010
Naphthalene	mg/kg dry wt	< 0.07	-	< 0.05	< 0.07	< 0.05
Perylene	mg/kg dry wt	0.013	-	< 0.010	0.048	< 0.010
Phenanthrene	mg/kg dry wt	0.040	-	< 0.010	0.21	< 0.010
Pyrene	mg/kg dry wt	0.081	-	< 0.010	0.23	< 0.010



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Sample Type: Soil						
Sample Name:	HM3 1.2m 29-Apr-2022 12:46 pm	HM4 0.2-0.4m 29-Apr-2022 2:00 pm	HM4 0.6-1.0m 29-Apr-2022 2:05 pm	HM5 0.7-1.3m 29-Apr-2022 2:40 pm	HM6 0.2-0.5m 29-Apr-2022 3:15 pm	
Lab Number:	2975969.10	2975969.12	2975969.13	2975969.15	2975969.16	
Individual Tests						
Dry Matter	g/100g as rcvd	79	88	80	82	90
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	5	3	3	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	10	9	15	11	11
Total Recoverable Copper	mg/kg dry wt	10	11	12	9	14
Total Recoverable Lead	mg/kg dry wt	17.3	12.5	10.9	11.4	11.3
Total Recoverable Nickel	mg/kg dry wt	6	8	9	7	9
Total Recoverable Zinc	mg/kg dry wt	41	42	42	38	37
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.3	3.7	< 0.3	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.012	0.026	< 0.012	< 0.011
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.012	0.040	< 0.012	< 0.011
Acenaphthylene	mg/kg dry wt	< 0.013	< 0.012	0.057	< 0.012	< 0.011
Acenaphthene	mg/kg dry wt	< 0.013	< 0.012	0.073	< 0.012	< 0.011
Anthracene	mg/kg dry wt	< 0.013	< 0.012	0.148	< 0.012	< 0.011
Benzo[a]anthracene	mg/kg dry wt	< 0.013	0.018	0.29	< 0.012	< 0.011
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.013	0.022	0.31	< 0.012	< 0.011
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.04	0.03	0.44	< 0.03	< 0.03
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	0.03	0.43	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.013	0.023	0.32	< 0.012	< 0.011
Benzo[e]pyrene	mg/kg dry wt	< 0.015 #1	0.013	0.138	< 0.012	< 0.011
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.013	0.015	0.169	< 0.012	< 0.011
Benzo[k]fluoranthene	mg/kg dry wt	< 0.013	< 0.012	0.141	< 0.012	< 0.011
Chrysene	mg/kg dry wt	< 0.013	0.019	0.29	< 0.012	< 0.011
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.013	< 0.012	0.034	< 0.012	< 0.011
Fluoranthene	mg/kg dry wt	< 0.013	0.037	0.39	< 0.012	< 0.011
Fluorene	mg/kg dry wt	< 0.013	< 0.012	0.160	< 0.012	< 0.011
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.013	0.015	0.182	< 0.012	< 0.011
Naphthalene	mg/kg dry wt	< 0.07	< 0.06	< 0.06	< 0.06	< 0.06
Perylene	mg/kg dry wt	< 0.013	< 0.012	0.080	< 0.012	< 0.011
Phenanthrene	mg/kg dry wt	< 0.013	< 0.012	0.51	< 0.012	< 0.011
Pyrene	mg/kg dry wt	< 0.013	0.034	0.38	< 0.012	< 0.011
Sample Name:	HM7 0.4-0.6m 29-Apr-2022 4:00 pm	HM7 1.4-1.6m 29-Apr-2022 4:00 pm				
Lab Number:	2975969.18	2975969.19				
Individual Tests						
Dry Matter	g/100g as rcvd	92	97	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	2	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt	11	11	-	-	-
Total Recoverable Copper	mg/kg dry wt	8	7	-	-	-
Total Recoverable Lead	mg/kg dry wt	7.5	4.8	-	-	-
Total Recoverable Nickel	mg/kg dry wt	7	6	-	-	-
Total Recoverable Zinc	mg/kg dry wt	31	23	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.010	-	-	-

Sample Type: Soil

Sample Name:	HM7 0.4-0.6m 29-Apr-2022 4:00 pm	HM7 1.4-1.6m 29-Apr-2022 4:00 pm			
Lab Number:	2975969.18	2975969.19			

Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Acenaphthene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Anthracene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Chrysene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Fluoranthene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Fluorene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.05	-	-	-
Perylene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Phenanthrene	mg/kg dry wt	< 0.011	< 0.010	-	-	-
Pyrene	mg/kg dry wt	< 0.011	< 0.010	-	-	-

Sample Type: Roading material with dark colour

Sample Name:	HM1 Tar 29-Apr-2022 11:19 am				
Lab Number:	2975969.4				

Polycyclic Aromatic Hydrocarbons Screening in Rock*						
1-Methylnaphthalene*	mg/kg as rcvd	< 0.10	-	-	-	-
2-Methylnaphthalene*	mg/kg as rcvd	< 0.10	-	-	-	-
Acenaphthylene*	mg/kg as rcvd	< 0.10	-	-	-	-
Acenaphthene*	mg/kg as rcvd	< 0.10	-	-	-	-
Anthracene*	mg/kg as rcvd	< 0.10	-	-	-	-
Benzo[a]anthracene*	mg/kg as rcvd	< 0.10	-	-	-	-
Benzo[a]pyrene (BAP)*	mg/kg as rcvd	< 0.10	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg as rcvd	< 0.3	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg as rcvd	< 0.3	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene*	mg/kg as rcvd	< 0.10	-	-	-	-
Benzo[e]pyrene*	mg/kg as rcvd	< 0.10	-	-	-	-
Benzo[g,h,i]perylene*	mg/kg as rcvd	< 0.10	-	-	-	-
Benzo[k]fluoranthene*	mg/kg as rcvd	< 0.10	-	-	-	-
Chrysene*	mg/kg as rcvd	< 0.10	-	-	-	-
Dibenzo[a,h]anthracene*	mg/kg as rcvd	< 0.10	-	-	-	-
Fluoranthene*	mg/kg as rcvd	< 0.10	-	-	-	-
Fluorene*	mg/kg as rcvd	< 0.10	-	-	-	-
Indeno(1,2,3-c,d)pyrene*	mg/kg as rcvd	< 0.10	-	-	-	-
Naphthalene*	mg/kg as rcvd	< 0.5	-	-	-	-
Perylene*	mg/kg as rcvd	< 0.10	-	-	-	-
Phenanthrene*	mg/kg as rcvd	< 0.10	-	-	-	-
Pyrene*	mg/kg as rcvd	< 0.10	-	-	-	-
Total of Reported PAHs	mg/kg as rcvd	< 3	-	-	-	-

Analyst's Comments

#1 Due to some interference found in the chromatography, the detection limit was raised. Hence the higher detection limit reported.

Summary of Methods

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

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-2, 5-6, 9-10, 12-13, 15-16, 18-19
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1, 5-6, 9-10, 12-13, 15-16, 18-19
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	1-2, 5-6, 9-10, 12-13, 15-16, 18-19
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.002 - 0.05 mg/kg dry wt	1, 5-6, 9-10, 12-13, 15-16, 18-19
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1, 5-6, 9-10, 12-13, 15-16, 18-19
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, 5-6, 9-10, 12-13, 15-16, 18-19
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, 5-6, 9-10, 12-13, 15-16, 18-19

Sample Type: Roading material with dark colour			
Test	Method Description	Default Detection Limit	Sample No
SHOC Macro Extraction 10x Dilution*		-	4
Polycyclic Aromatic Hydrocarbons Screening in Rock*	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.002 - 0.3 mg/kg as rcvd	4

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

Testing was completed between 06-May-2022 and 10-May-2022. 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.

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



ATTACHMENT F:
Remedial Action Plan

1 Remediation Action Plan

The information and recommendations provided herein are to augment the processes on-site and are not intended to relieve any contractor or the controller of the place of work of their responsibility for the health and safety of their workers and contractors. Nor is it intended to relieve contractors undertaking work on the site of their responsibilities under the Health and Safety at Work Act 2015 (Ministry of Business, Innovation, and Employment, 2015) and subsequent amendments. The contractor shall develop a site-specific health and safety plan to complement this document, and to address other health and safety requirements that may be applicable to their site works.

Based on available data, lead concentrations (above the human health criteria) have been detected in one sample. Due to exceedances of the predicted background concentrations ('cleanfill criteria'), the recommendations for health and safety procedures and protection of the environment are relevant to soil disturbance in controlled fill (contaminated soil and managed fill) and remedial areas (as shown in Figure 3). Following remedial works, if sampling demonstrates that the concentration of contaminants in soil does not exceed the natural background ranges, controls can be reduced to those appropriate for similar earthworks activities on an uncontaminated site.

If contamination is found that varies significantly from what has been assumed in preparing this document, an update may be required to account for the changed site understanding.

The provisions of this document should be communicated and understood by all site workers. An example Agreement and Acknowledgement Sheet is appended to this document.

Note: Soil within the building footprints and halos will be managed under the 'General Kāinga Ora Contaminated Site Management Plan (Kāinga Ora, July 2022). The Contaminated Site Management Plan should be read in conjunction with this document.

Table 1: Assigned Responsibilities for Site Work

Role	Responsibility
Site Owner Kāinga Ora	To distribute this document and be responsible for ensuring that the site works are undertaken in accordance with this document and any revisions to this document.
Site Contractor <i>to be confirmed</i>	<p>To distribute this document to employees and subcontractors, including updated versions, and to ensure that the correct copy is on-site at all times.</p> <p>To provide control and oversee the redevelopment works. It is recommended that a designated, suitability trained Site Supervisor is present to oversee the works. The Site Supervisor would address changes to site procedures, as necessary, should unanticipated conditions arise. It is anticipated that this Site Supervisor would represent the main site contractor.</p> <p>The contractor involved in the asbestos-related works area should receive non-certified training in asbestos identification, safe handling and suitable controls. A copy of the training shall be kept on record.</p> <p>During the works, earthworks contractors will provide site photographs of remedial works to confirm that the works are being performed in accordance with this RAP.</p>
Contaminated Land Specialist (SQEP) ENGEO	<p>A SQEP, as defined in the NES, shall be appointed to liaise with the contractor during the course of the works, as requested, and to report on the remedial earthworks following completion.</p> <p>The SQEP shall be contacted if any areas of potential contamination are discovered during works.</p>

2 Remediation Methodology and Objective

The most appropriate form of remediation to excavate and remove from the site the fill material above the human health SCS for the proposed residential land use. Due to the presence of uncontrolled material within the site the fill is not considered suitable as engineered fill for construction on-site and analysis results above predicted background levels meant the fill cannot be considered cleanfill for use on other sites. Fill material excavated from the site will require disposal off site at a suitably licenced landfill. This would likely require consent for the disturbance of the 'contaminated site' during remediation.

The delineation testing has identified an impacted area of:

- 4 m north of HM1;
- 2 m east of HM1;
- 2 m south of HM1; and
- 2 m west of HM1.

The required remediation is to a depth of 0.8 m bgl.

If removal off-site was the preferred option this would require the excavation, removal and disposal of an area of soil approximately 24 m² to a depth of 0.8 m bgl. The volume of soil requiring removal in this scenario is approximately 19.2 m³.

Currently the estimated fee for the disposal of 19.2m³ of contaminated fill material is between \$5,891 and \$7,703 (excluding TCLP testing, permitting, excavation and cartage). Costing for the disposal of this material is based on information provided at the time of writing with an average disposal fee of \$236 / tonne (AB Lime, Winton February 2023), an *in situ* bulk density of 1.3 to 1.7 tonnes / m³. The Remedial Action Plan (Attachment F) has been written for this scenario.

Following the excavation and removal of the fill material around HM1, validation sampling will be required to confirm the remaining fill in the identified area of lead contamination is below the Residential SCS.

An estimate of the known contaminated soils that require management during earthworks (based on the existing contaminant distribution data and conceptual site model) has been made and is provided in Table 2. Additional delineation of the remedial area may be completed prior to initiating remedial works to further delineate the extent of impacted soil.

Table 2: Remedial Volume Estimation

Site Area	Sample Exceeding Human Health Criteria	Exceedance	Estimated Area of Impact (m ²)	Estimated Depth of Remedial Excavation (m bgl)	Estimated Soil Volume Exceeding Remedial Goal to be Removed (m ³)
Lead contamination area	HM1 /ENV3	Residential 10% SCS	24	0.8	19.2

1. Estimate based on available data. Actual volume is reliant on results of validation sampling works.

3 Remedial Criteria

The Soil Contaminant Standard (SCS) for residential 10% produce land use was selected.

Table 3: Adopted Remedial Criteria

Contaminant of Concern	Remedial Goals	Remedial Goal Source
Lead	< 210 mg/kg	Human Health criterion

If additional unexpected contamination is encountered during the works, remedial goals shall be referenced from the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES), (Parliamentary Counsel Office, 2011) and following the MfE Contaminated Land Management Guidelines No. 2, (Ministry for the Environment, Revised 2011).

4 Assessment of Environmental Effects

Based on the requirements of Section 88 of the Resource Management Act (RMA) (updated 2022), and the framework set out in the Fourth Schedule of the RMA, the actual and potential environmental effects related to on-site contamination that may arise during site redevelopment activities include:

- Groundwater, stormwater, and sediment discharges – Groundwater encountered during intrusive works or rainwater falling on the site prior to building construction have the potential to come into contact with contaminated material and become contaminated.
- Dust – Dust generated during trenching, drilling and fill placement activities has the potential to contain contaminants.
- Tracking of contaminated soil off-site.
- Odours and vapours – Volatile chemical contamination is not anticipated to be of concern at the site; however, this RAP includes procedures to be implemented if odourous soil is encountered.

The measures that will be implemented to avoid, remedy or mitigate the identified adverse effects are summarised in Section 6 and Table 5 attached. Through implementation of these measures, it is concluded that the potential environmental effects associated with the proposed programme of remedial works will be less than minor.

The risks to environmental receptors are considered likely to be mitigated if the risks to human health are managed.

5 Contractor Record Keeping

Table 4 presents additional information on the controls which are anticipated to be managed by the Site Supervisor and provided to the SQEP.

Table 4: Contractor Documentation

Importation of Material	Any fill imported to the site shall meet the WASTEMINZ, (Waste Management Institute New Zealand (WasteMINZ), 2018) definition of cleanfill. Evidence of the type and quantity of imported fill shall be recorded.
Off-site Disposal	Any excess soil and fill material from the site, as well as used disposable PPE, shall be transported to an appropriate disposal site. Landfill weighbridge receipts shall be obtained as evidence of disposal.
Record Keeping	Information relating to any incidents or complaints and how these were managed shall be recorded. During the works, earthworks contractors will provide site photographs of remedial works to confirm that the works are being performed in accordance with this RAP. Site photographs shall also be provided which demonstrate that works were undertaken in accordance this document (e.g. boundary controls, PPE etc.).

6 Soil Disposal and Site Management Practices

Table 5 presents site management practices during earthwork activities at the site. The relevance and effectiveness of these protocols shall be reviewed by the Site Supervisor (Table 1) on a daily basis.

The receiving facilities shall be contacted to confirm their acceptance of excess material from these areas prior to receipt.

7 Completion Reporting

Following remedial earthworks, validation sampling of subsurface materials within the remediation area (identified on Figure 3) will be required to confirm the extent of contamination and that the area has been sufficiently remediated.

Validation samples shall be collected by the SQEP from the base and sidewalls of the remedial excavation areas. Samples will be analysed for heavy metals. If the validation results show that further contamination is present at the site, additional remediation will be required.

During the works, earthworks contractors will provide site photographs of remedial works to confirm that the works are being performed in accordance with this RAP.

A Site Validation Report shall be prepared following site development activities. This report shall include the following information:

- Summary of the remedial works undertaken.
- Documentation relating to the disposal of contaminated soil / fill and used PPE.
- Documentation relating to the importation of cleanfill.
- Results of validation samples.

If the validation results show that further contamination is present at the site, additional remediation will be required.



Attachments

Soil Management Summary: (29 Hamilton Street, Gore)

Table 5: Soil Disposal Summary

Soil Management Zones	CONTROLLED MATERIAL (CONTAMINATED SOIL & MANAGED FILL) <i>Soil shown on Figure 3 (appended to ENGEO report) is not suitable to remain on-site. Other fill material due for excavation prior to construction is suitable to remain on-site however contaminant concentrations for disposal purposes exceed cleanfill criteria</i>	CLEANFILL <i>Contaminant concentrations are above background levels.</i>
Key Contaminant	Heavy metals	Due to the elevated concentrations of heavy metals in the fill material this material cannot be considered Cleanfill. Confirmation of the acceptance criteria for fill material by a licenced landfill facility should be sought prior to excavation.
Assessment Criteria Exceedance	Predicted regional background concentrations.	Predicted regional background concentrations.
Estimated Area	24 m ²	>2,000 m ³
Estimated Depth	0.0m to 0.8 m bgl	0.0 m to 1.4 m bgl
Soil Disposal <i>General procedures to be followed when transporting material off-site</i>	Trucks shall be loaded within the site where runoff and possible spills during loading will be controlled and contained. Loads must be securely covered during off-site transport.	
PPE Disposal	PPE, shall be transported to an appropriate disposal site.	
Disposal Documentation	Version	1.0
	Date	April 23

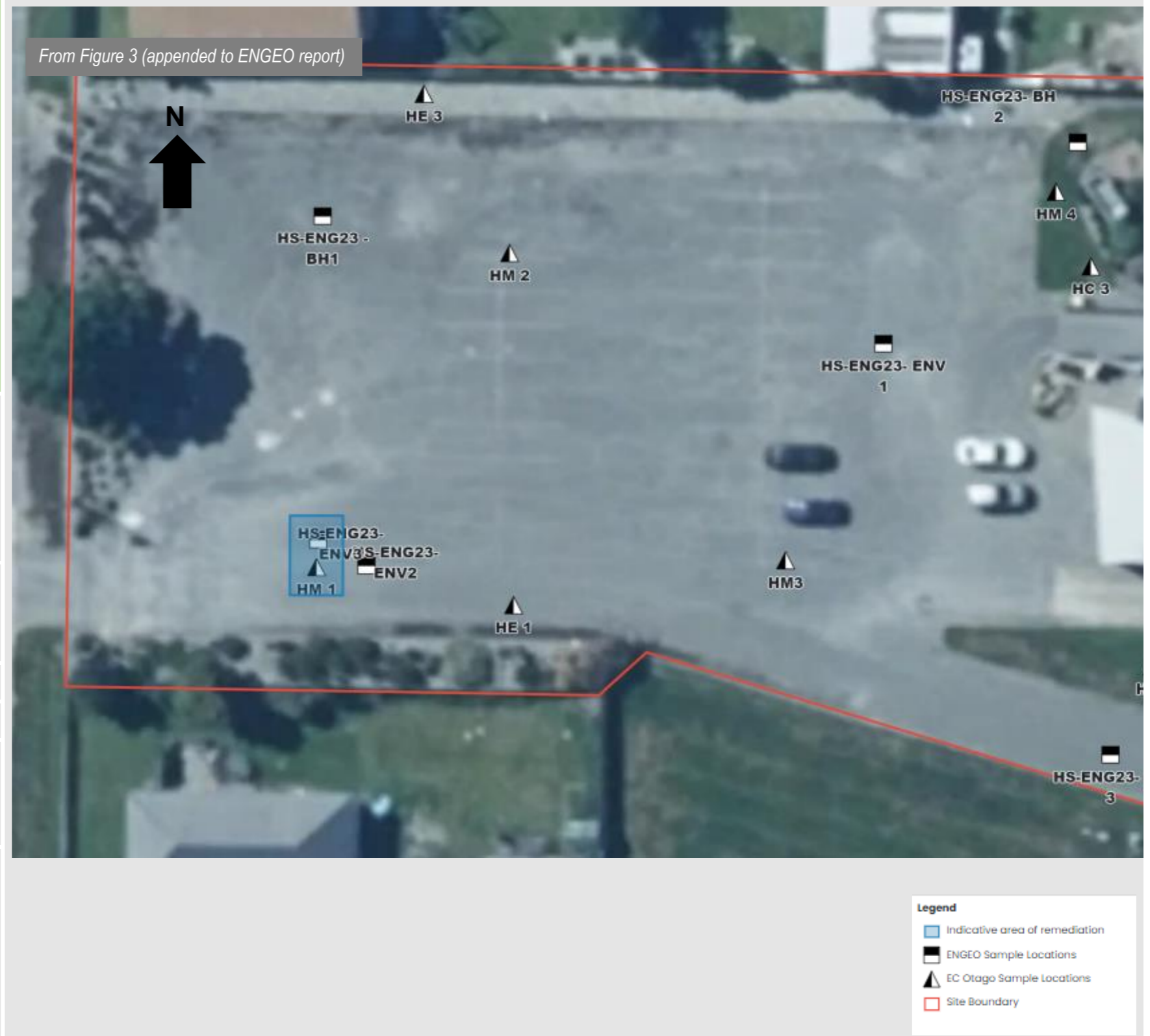


Table 5.2: Site Protocols

 <p>HEALTH & SAFETY</p>	 <p>BOUNDARY CONTROL</p>	 <p>SITE CONTROLS</p>	 <p>UNANTICIPATED CONTAMINATION</p>	 <p>ADDITIONAL CONSULTING</p>
<p>KEY CONTAMINATION RISKS</p> <p>Heavy Metals (arsenic, lead and zinc) in site soil above residential human health criteria and predicted background levels. The controlling pathway for heavy metals in soil are produce consumption and soil ingestion.</p> <p>Contractor staff, subcontractors and visitors shall be inducted before entering or commencing work to ensure they are aware of the potential hazards relating to contaminated soil at the site.</p> <p>The following general safety procedures shall be followed by all staff entering or working in the immediate area of the earthworks:</p> <ul style="list-style-type: none"> Site workers shall avoid unnecessary contact with site soils. Hands are to be washed in a dedicated area prior to eating, drinking or smoking. <p>All incidents shall be reported to the main contractor's health and safety advisor, or equivalent responsible person on-site.</p> <p>Contractors shall undertake non-certified training in suitable controls.</p> <p>PERSONAL PROTECTIVE EQUIPMENT (PPE) to <i>minimise the effects of potential contamination exposure via incidental ingestion of soil, skin contact with soil or inhalation of dust.</i> Along with standard PPE requirements for construction sites (e.g. safety boots) the following should be undertaken:</p> <ul style="list-style-type: none"> P2 Dust Mask Coveralls (if contact with soil is unavoidable) Gloves (if contact with soil is unavoidable) Gumboots or Boot Covers 	<p>Security fencing and appropriate warning signs erected around earthworks areas to prevent unauthorised access.</p> <p>Appropriate sediment control measures shall be implemented to minimise sediment runoff from the site. Minimum controls shall include:</p> <ul style="list-style-type: none"> Stabilised site entrance to minimise the movement of soil off-site. Suitable sediment controls (e.g. silt fencing) shall be placed around the perimeter of the works area and stormwater drains where there is a potential for runoff. <p>Set up of clean and dirty areas to prevent tracking potentially impacted soils around the site and off-site.</p> <ul style="list-style-type: none"> Any machinery used on-site shall be cleaned of loose soil in a designated 'wash down' area (e.g. paved area or area of imported rock / soil) prior to leaving site. Once loose soil has been removed, the cleaned item can be moved to the clean area. Any wastewater generated should not be discharged off-site and should be allowed to drain back into the site. Imported rock / soil utilised in the 'wash down' area should be considered potentially contaminated, and shall be managed / disposed of appropriately. <p>ASBESTOS WORKS AREA NA</p>	<p>DUST Dust shall be managed in accordance with consent requirements and relevant regulations. The contractor shall consider:</p> <ul style="list-style-type: none"> Limit vehicle access onto the excavated areas. Dampen surface soil using a water truck or portable water sprays. Ensure that the volume of water used does not induce soil erosion, or cause surface ponding or runoff, that could discharge into natural water bodies or stormwater drains. Use wind screens or avoid work during windy conditions. Consider use of surfactants or polymers where a reliable source of water is not available. <p>ODOUR If excavated material is odorous, odour control measures shall be put in place. This could include covering the material with cleanfill, a polythene cover or instituting a deodoriser system.</p> <p>GROUNDWATER + STORMWATER Any groundwater, or surface water encountered within the excavation that may have contacted contaminated soils shall be assumed contaminated until tested.</p> <p>Water used for cleaning asbestos-contaminated equipment shall be placed into a plastic lined drum or skip, and disposed of at an appropriately licensed facility.</p> <p>STOCKPILING If temporary stockpiling of material is necessary, dust shall be controlled through wetting during the workday. If left overnight, the material shall be covered (e.g. with plastic) and protected by erosion / sediment controls (e.g. bunded).</p> <p>Stockpiles shall be located on an impermeable surface. If this is not possible, the underlying material should considered potentially contaminated, and shall be managed / disposed of appropriately.</p> <p>Stockpiling of asbestos contaminated material shall be avoided</p>	<p>Examples of the typical indicators of contamination are provided below. Works shall temporarily stop and the SQEP contacted should any areas of potential contamination be discovered during works.</p> <p>Uncontrolled Filling <i>May be mixed with imported gravels. Staining of surrounding soil.</i></p>  <p>Asbestos Containing Material <i>Intact sheets or broken into smaller pieces, may be mixed with other material.</i></p>  <p>Hydrocarbon Staining <i>Odorous, visible sheen on water.</i></p> 	<p>FURTHER TESTING</p> <ul style="list-style-type: none"> Imported fill material (if applicable). Any fill imported to the site shall meet the AUP definition of clean-fill. Soil and / or water requiring off-site disposal (if applicable). Additional testing prior to, or as part of, redevelopment works to assess additional cleanfill areas. Validation soil sampling following remediation. <p>ASBESTOS WORKS AREA NA</p> <p>Contaminated Land Specialist (SQEP) ENGEO (03) 328 9102</p>