Detailed Site Investigation

Stormwater and Process Water Management Project at Ravensdown, Napier

Prepared for Ravensdown Limited
Prepared by Beca Limited

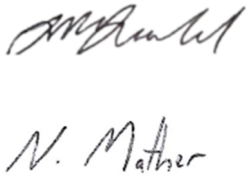
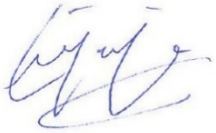
18 November 2021

Creative people together transforming our world

Revision History

Revision Nº	Prepared By	Description	Date
1	Alex McDonald and Nikki Mather	Draft with preliminary results	12 October 2021
2	Alex McDonald and Nikki Mather	Final report for client issue	22 October 2021
3	Nikki Mather	Amendments to executive summary format	11 November 2021
4	Mia Uys	Update proposed works	18 November 2021

Document Acceptance

Action	Name	Signed	Date
Prepared by	Alex McDonald and Nikki Mather		18 November 2021
Reviewed by	Mia Uys and Emma Lewis		18 November 2021
Approved by	Emma Lewis		18 November 2021
on behalf of	Beca Limited		

Contents

Appendices

Executive Summary

Potential Effects Covered

This Detailed Site Investigation (DSI) was prepared by Beca Limited for Ravensdown Limited (Ravensdown) to investigate the presence and extent of potential contamination of soils to be disturbed during the proposed stormwater and process water management system upgrades. In this report, reference to "*the wider Ravensdown site*" constitutes the wider Ravensdown facility situated at 90 Waitangi Road, Awatoto, Napier. Reference to "*the site*" constitutes areas within the wider Ravensdown site proposed for soil disturbance as part of the Stormwater and Process Water Management Project development.

Assessments Undertaken

A Preliminary Site Investigation (PSI)[1] (desktop study) was undertaken as the first stage to the investigation for the wider Ravensdown site, and the findings of this assessment were used to generate a soil sampling methodology specific to the stormwater and process water system management system upgrades.

The following Hazardous Activities and Industries List (HAIL) activities were identified during the PSI on or within the vicinity of the site:

- A6: Fertiliser manufacture or bulk storage
- B2: Electrical transformers
- E1: Sites with buildings containing asbestos products known to be in a deteriorated condition
- G5: Waste disposal to land

Identified contaminants of concern on-site included heavy metals, polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbon (TPH), fluoride, polychlorinated biphenyls (PCBs), asbestos and pH (screening for fertiliser by-products) in soils.

The DSI undertook systematic soil sampling from targeted areas likely to undergo soil disturbance as part of the proposed development. Soil samples were collected at varying depths from test pit excavations and submitted for laboratory analysis targeting identified contaminants of concern.

Results of Assessments

- Encountered ground conditions generally comprised grass cover and topsoil (to approximately 0.2m bgl) underlain by sands and gravels (to between approximately 0.7m and 1.75m bgl), which in turn was underlain by clays to at least the final depths targeted in this investigation (3.2 m bgl).
- Fill containing man-made materials was observed in the north-east of the proposed holding pond, near the pipeline south of the small car wash, and in all test pits undertaken within the southern portion of the site to a maximum depth of 1.75m bgl.
- The fill was generally described as sands and gravels containing traces of concrete, painted concrete, clay red pipe, timber, glass, fabric, rope, cloth, fertiliser bags, metal, plastic, bitumen, assumed fertiliser, rubber pipes and metal cylinders.
- No buried asbestos containing materials (ACM) were visually identified at the time of undertaking the fieldwork, even though buried plastic wrapping was encountered within 7 test pits on the southern portion of the site.

[1] Site-Wide Preliminary Site Investigation (Contamination) Report by Beca Limited for Ravensdown Limited dated 6 August 2021

- Yellow powdered deposits (likely buried elemental sulphur) were encountered within the top 1m of test pits undertaken in the southern portion of the site. White deposits (likely buried fertiliser) were also noted in this area (between approximately 0.1m and 1.6m bgl).
- Although likely to be tidally influenced, groundwater was generally encountered at between 0.9m and 1.6m bgl in the north of the site and between 2m and 2.6m in the south of the site.
- 60 samples (including 4 quality samples) were collected from 28 test pits across the site and screened for heavy metals, TPH, PAH and pH. 43 soil samples were also analysed for asbestos, 5 were analysed for fluoride and 2 for PCBs.
  - 3 soil samples collected from between 0.5m and 0.85m bgl within the fill material on-site exceeded environmental risk threshold values for heavy metals but did not exceed the adopted guideline values for human health risk.
  - 3 soil samples collected from between 0.5m and 1.5m bgl within the fill material on-site contained asbestos; however, these levels were below the adopted human health guideline levels.
  - 4 of the 5 soil samples analysed for fluoride exceeded environmental risk threshold values but did not exceed the adopted guideline values for human health risk.
  - The 2 soil samples analysed for PCBs returned results below the laboratory levels of detection.
  - All TPH and PAH results were below the adopted environmental and human health guideline values.
  - 22 of the 56 samples analysed had pH levels below 6 which may be indicative of acid generation or fertiliser leachate.

The following exposure pathways are considered to be potentially complete:

- **Construction Workers**: Although concentrations of contaminants of concern were all found to be below the criteria for the protection of outdoor workers, a Contaminated Soils Management Plan (CSMP) is recommended with adequate procedures to control potential exposure during development works.
- **Groundwater Resources**: Various Water Permits for groundwater use for drinking water purposes are recorded within the surrounding area. Potential impacts on groundwater were not assessed in this investigation and cannot be ruled out. The proposed works will be carried out in shallower soils and perched groundwater. Impacts on groundwater should be considered and managed through implementation of controls set out in a management plan.
- **Surface Water**: Surface water features are present within the area. The exposure pathway can be managed through implementation of suitable design and management controls.

Suggested Approach for Effects Identified

Shallow groundwater and evidence of impacted soil that pose a risk to the environment was noted, mainly in the southern portion of the site. The impacts on the northern portion cannot be ruled out without further groundwater testing. A groundwater assessment is required to determine the effects of the fertiliser-related buried waste to the groundwater (outside of the scope for this report).

A CSMP is recommended to control identified exposure pathways during the proposed development works. The CSMP shall align with the proposed design where materials are kept in situ or reused.

It is possible for buried wrapped asbestos to be present within the south of the site. If encountered, further work will be required and may cause delays. The removal of any discovered asbestos may require licenced removal. This can be managed through incorporating contingency procedures in the CSMP to anticipate the management of such material.

Management controls and design considerations should be in place where any impacted material is planned to be reused on site. These can be set out in a CSMP. The proposed water holding infrastructure should be designed to avoid the water interacting with potentially impacted groundwater.

Consent Requirements:

Areas on-site where HAIL activities are more likely than not to have occurred are considered to be a "*piece of land*" under the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NESCS). Based on the extent of the proposed works, the soil disturbance activities are not likely to meet the Permitted Activity criteria under Section 8 in the NESCS. As the identified contaminants of concern analysed in this investigation did not exceed any of the adopted human health risk criteria, the proposed works will require a **Controlled Activity consent** under Section 9 of the NESCS.

Soil Disposal:

- Site soil with the presence of hydrocarbons and metal concentrations above the regional background concentrations does not meet the definition of cleanfill but suitable for reuse.
- The reuse of any contaminated material (where contaminants of concern exceeds the environmental risk criteria) within the site should be adequately managed and considered in the design to minimise the potential environmental effects at the site and groundwater.
- In the event buried suspected asbestos is encountered during earthworks, further assessment may be required. The handling / removal of the material will likely be considered as licensed asbestos removal work.
- Where off-site soil removal is required, this should be agreed with the acceptor of the material since the level of contamination may restrict the disposal at local landfills. Additional soil analysis, and quantities of soil to be disposed, may be required to determine its acceptance.

1 Introduction

Beca Limited (Beca) has been commissioned by Ravensdown Limited (Ravensdown) to undertake a Detailed Site Investigation (DSI) for the proposed stormwater and process water management system upgrades at the Ravensdown facility in Napier located at 90 Waitangi Road, Awatoto. In this report, reference to "*the wider Ravensdown site*" constitutes the wider Ravensdown facility situated at 90 Waitangi Road, Awatoto, Napier. Reference to "*the site*" constitutes areas within the wider Ravensdown site proposed for soil disturbance as part of the Stormwater and Process Water Management Project development

1.1 Purpose and Scope

The purpose of the site investigation was the following:

- Characterise potential contaminants in soils within the development area as a result of current or historical activities.
- Assessment of laboratory results against appropriate criteria.
- Confirm contaminated land consent requirements for the proposed works under the following legislation:
  - Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NESCS).
  - Hawke's Bay Regional Resource Management Plan (2006).
  - Health and Safety at Work (Asbestos) Regulations 2016.
- Identify areas of soil contamination which may require management with respects to risks to human health and the environment.
- Provide advice regarding material handling and management.

The scope of works comprised:

- Summarising the desk based reviewed information as set out in the Preliminary Site Investigation (PSI) undertaken by Beca of the wider Ravensdown site (including the subject site) in August 2021.
- Undertaking a ground investigation that comprise of the excavation of 28 test pits up to a maximum depth of 3.2m below ground level, logging observations and collecting soil samples for laboratory analysis.
- The preparation of this report to present and assess the results of the investigation.
- It is understood that groundwater investigations have been undertaken separately and is excluded from this scope or works.

This assessment has been undertaken and reported in general accordance with the *Ministry for the Environment* (MfE) *Contaminated Land Management Guidelines No. 1 – Reporting on Contaminated Sites in New Zealand* (2021) *and MfE Contaminated Land Management Guidelines No. 5 – Site Investigation and Analysis* (2021). New Zealand Guidelines for Assessing and Managing Asbestos in Soil (2017) referred to in this report as the 'GAMAS' and Worksafe Approved Code of Practice for Management and Removal of Asbestos (2016) also known as the 'ACOP'.

2 Site Description

2.1 Site Location and Area

The wider Ravensdown site (on which the site is located) is situated at 90 Waitangi Road, Awatoto, Napier, approximately 6km to the south of Napier city centre (outlined in yellow in **Figure 1**).

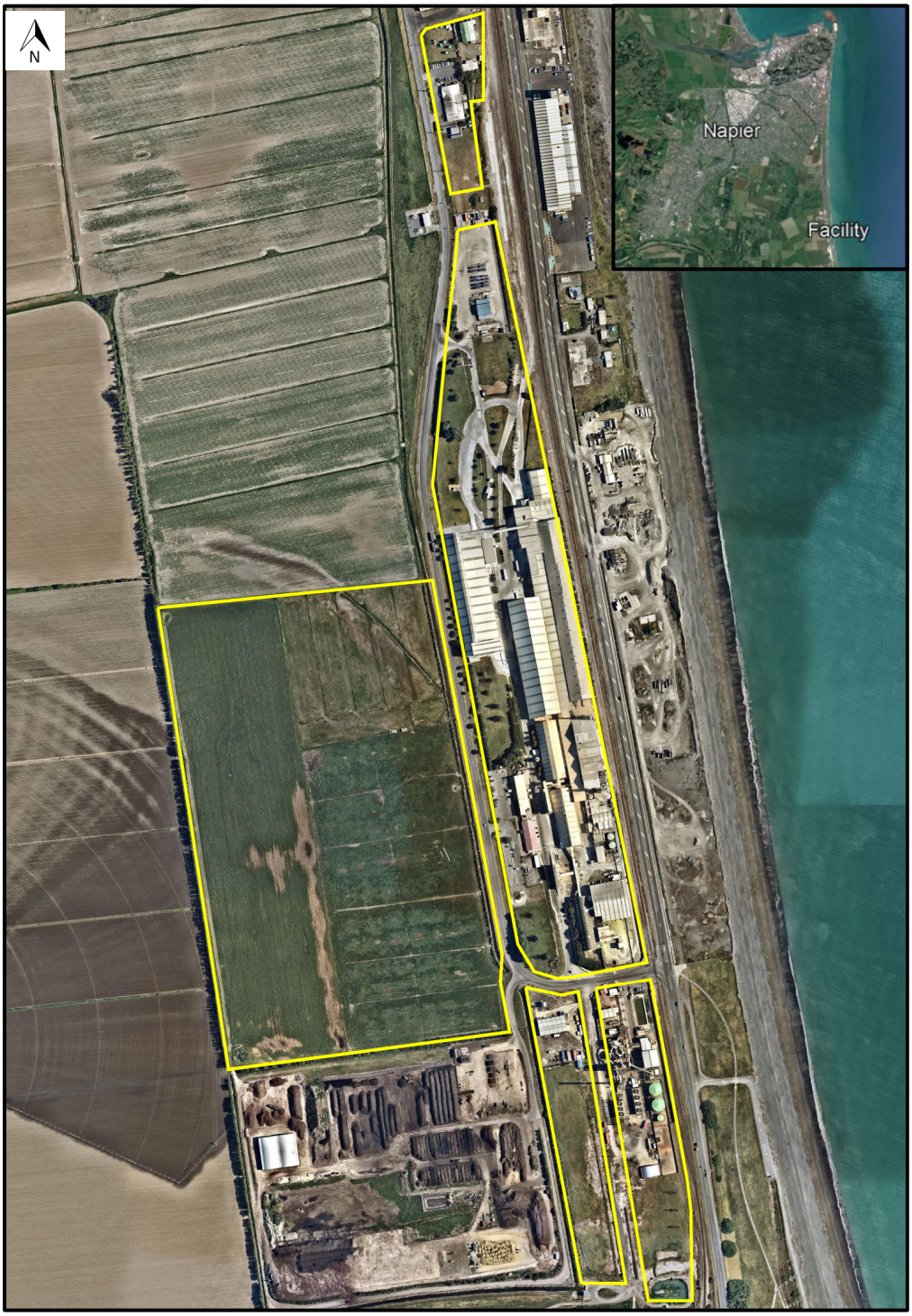


Figure 1: Wider Ravensdown Site (Image Sourced from Nearmap December 2020 and Google Earth Pro March 2018)

In this report, reference to “the site” constitutes areas proposed for soil disturbance as part of the Stormwater and Process Water Management Project development (outlined in red in Figure 3**Figure 2**). As no soil disturbance is proposed within the preferential discharge to land (spray irrigation) area and as no HAIL activities were identified within this area of the site during the PSI, this area has been excluded from this DSI.

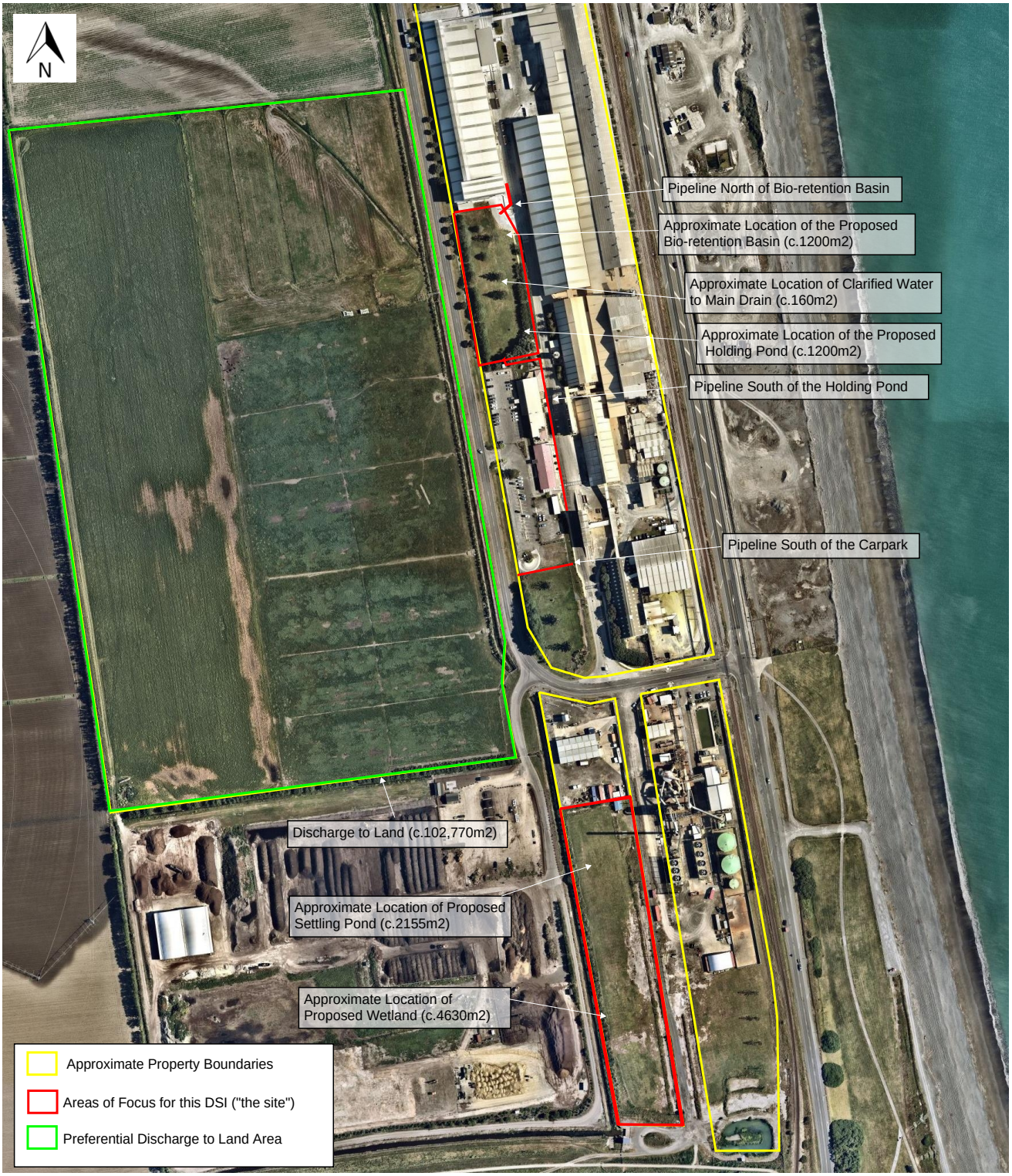


Figure 2: “The site” (Image Sourced from Nearmap December 2020)

2.2 Proposed Works

A Project Description Memorandum prepared by Aurecon[2] outlines the proposed stormwater and process water management system upgrades, the first stage of which involves the installation of bioretention basin and holding pond prior to being treated by a clarifier (see **Figure 3**)..

During this stage of works it is proposed to maintain the existing settling pond in its current physical layout, however modifications will be made to the discharge pump to limit discharge to the estuary and allow for discharge to land via spray irrigation.

Stage 2 introduces a settling pond with a minimum storage volume of 2,090 m^3 that will discharge to a 2,120 m^2 constructed wetland to be located within a southern portion of the facility (see **Figure 4**).

The final soil disturbance volume and earthworks depths have not been confirmed at this stage but is estimated to disturb material up to at least 2m bgl for the purpose of this assessment.

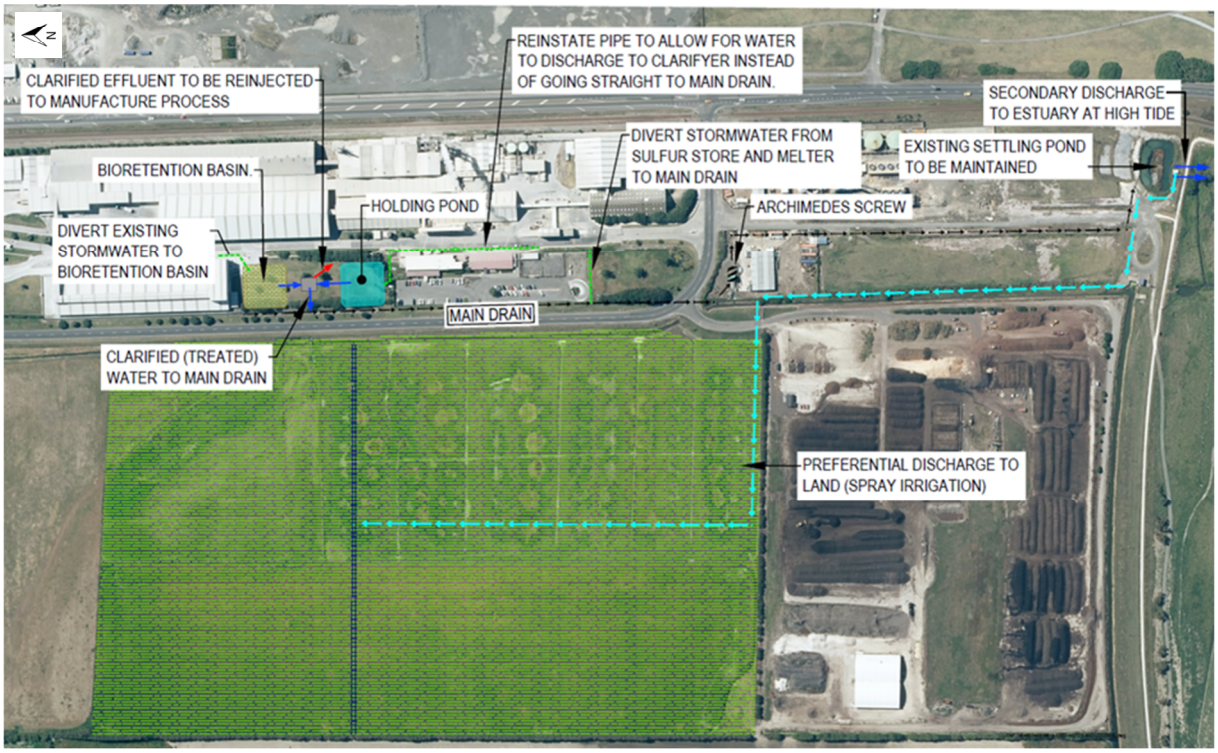


Figure 3: Stage 1 Improvements (Image Sourced from Aurecon Project Description Memorandum)

[2] Memorandum, Ravensdown – Project description-Ravensdown Napier stormwater and process water management prepared by Aurecon dated 17 November 2021 (ref.: 509619).

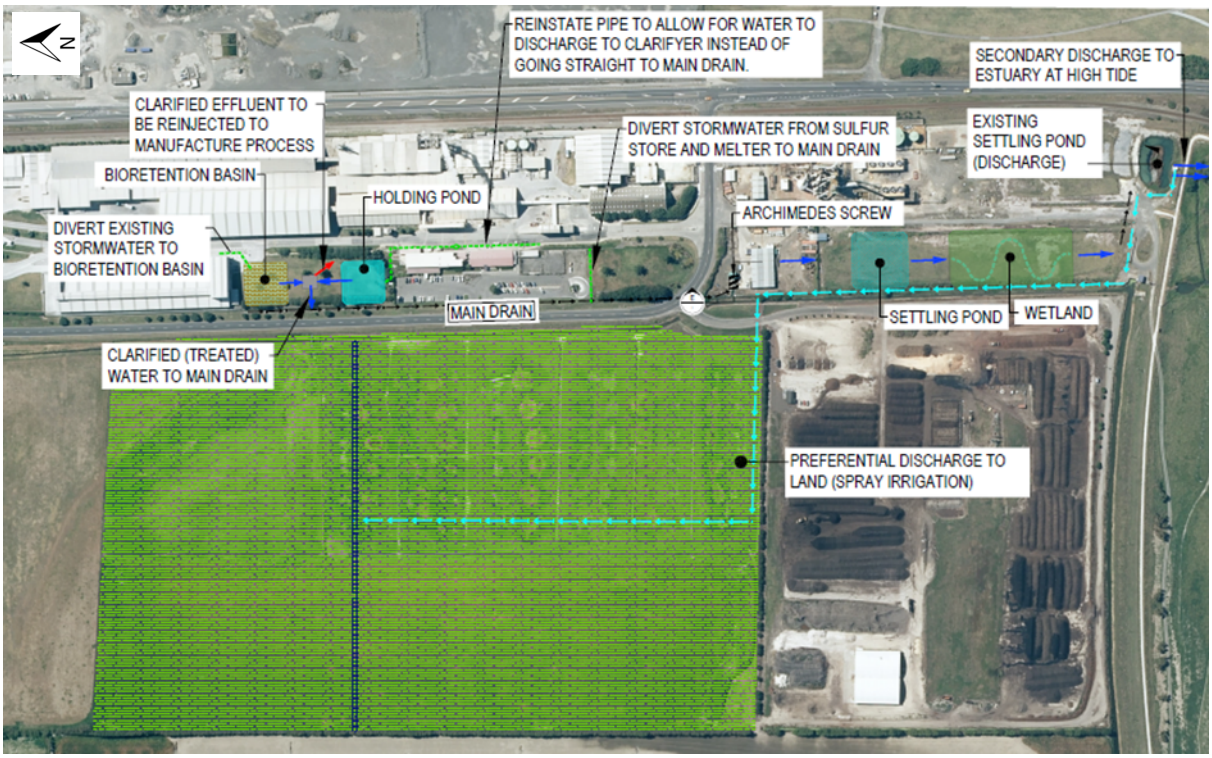


Figure 4: Stage 2 Improvements (Image Sourced from Aurecon Project Description Memorandum)

3 Environmental Setting

The environmental setting described in this section relates to the wider Ravensdown site on which the subject site is located.

3.1 Current Land Use

The wider Ravensdown site is currently owned by Ravensdown and predominantly supports a fertiliser manufacturing facility.

For further details, please see the 2021 Beca PSI issued under separate cover in August 2021.

3.2 Surrounding Land Use

The Ravensdown Facility is located within a predominantly agricultural and commercial area. Numerous commercial/industrial properties are located to the north. Railway lines and State Highway 2 are located from adjacent to the east, beyond which various commercial/industrial properties, rural-residential properties, a quarry/gravel pit and a grass-covered reserve are located on a coastal strip. The sea shore is located approximately 150m to the east of the facility. Undeveloped land, a drain and a section of the Tutaekuri River (on the wider Model Flying Hawkes Bay property) are located from adjacent to the south. A compost manufacturing facility operated by BioRich Compost is located from adjacent to the south-west of the facility. Grazing land is located from adjacent to the west and north-west.

3.3 Topography

The topography of the Ravensdown Facility is reasonably flat, with a gentle fall towards Waitangi Road in the west (around 11m above ordnance datum (AOD) as recorded on the NCC map viewer) and rise towards the railway and SH2 to the east. On the eastern side of SH2, there is a narrow plateau, ranging between 14m and 15.5m AOD, before the ground slopes downwards to the east to the beach and the sea.

3.4 Geology and Hydrogeology

The Geological & Nuclear Sciences (GNS) 1:250 000 Geological Map of New Zealand indicates that the site is underlain by Holocene aged shoreline deposits, described as "*unconsolidated marine gravel, sand and mud on modern beaches*." This is recorded to be underlain by a clastic sandstone and mudstone (Heron, D.W. (custodian) 2018: Geological Map of New Zealand 1:250 000 (2nd ed.)

A geotechnical investigation report by Resource Development Consultants Ltd (RDCL) dated July 2014 (reviewed within the 2021 Beca PSI) recorded granular fill extending to approximately 1m bgl underlain by sands and gravels, locally with some organic clay extending to the base of physical investigations (3m bgl).

Unconfined groundwater with strong hydraulic connectivity to the sea is anticipated to be present at shallow depths within the soils beneath the facility.

Groundwater is recorded in a bore approximately 225m to the north of the facility, with water recorded at a depth of 59m during the most recent quarterly monitoring round conducted by the Regional Council in June 2018 (accessed via the Hawke's Bay Regional Council map viewer). A review of the NZ Geotechnical Database[3] indicates that bores in the vicinity of the facility note groundwater at a similar level. These bores are anticipated to be within the Heretaunga aquifer, which is a confined aquifer beneath the site.

[3] https://www.nzgd.org.nz/ARCGISMapViewer/mapviewer.aspx

3.5 Sensitive Receptors and Hydrology

The Ravensdown Facility is located approximately 150m to the west of the eastern coastline and approximately 200m to the north of the Tutaekuri River. A drain is located approximately 35m south of the facility, which flows into the Tutaekuri River. The Tutaekuri River demarks the northern edge of the Waitangi Estuary, which is identified as a Significant Conservation Area in the Proposed Regional Coastal Environment Plan. The confluence of the Ngaruroro, Tutaekuri and Clive rivers is located approximately 850m to the south of the facility. Residential properties within 500m of the site are limited to a handful of dwelling situated from approximately 50m east of the facility (on the coastal strip located on the opposite side of the railway lines and State Highway).

Asbestos presents a risk to human health through the inhalation pathway. Those at risk from airborne asbestos (if present) include construction workers involved directly with the works and workers on the wider site within the vicinity.

4 Summary of Preliminary Site Investigation Report

A Preliminary Site Investigation (PSI) was prepared by Beca for the wider Ravensdown site on 6 August 2021.

Based on the information reviewed, the property predominantly comprised undeveloped assumed grazing land until approximately 1953. By 1953, the majority of the property had been developed for use as a fertiliser manufacturing facility. Old site plans also referred to various structures associated with the facility including but not limited to a weighbridge, workshops, garages, and a laboratory. Dwellings were historically located in the far north-west of the property from at least 1962 until pre-2003. A truck shed was erected in the far north-east of the property in pre-1982. This structure was subsequently utilised as a tannery and is currently utilised as an engineering workshop. A laboratory has been located in the north of the property since at least 2003.

4.1 Identified Potential HAIL Activities

The PSI identified a number of activities listed on the Ministry for the Environment (MfE) Hazardous Activities and Industries List (HAIL) as having been undertaken on the wider Ravensdown site. Those HAIL activities identified on or within the vicinity or the subject site included (as shown in **Figure 5**):

- HAIL A6 - fertiliser manufacture or bulk storage.
  - On or in the vicinity of the settling Pond and Wetland
  - On or in the vicinity of the pipelines
  - Adjacent to the Bioretention Basin, Clarified Water to Main Drain and Holding Pond
- HAIL B2 - electrical transformers.
  - On or in the vicinity of pipelines south of the Holding Pond
  - Adjacent to the Bioretention Basin
- HAIL G5 - waste disposal to land.
  - On or in the vicinity of the proposed Settling Pond and Wetland (former stockpiling activities as well as potential buried wrapped asbestos).
  - Adjacent or in the vicinity to the pipelines south of the small car wash (suspected buried demolition waste and nearby former settling pond)
- HAIL E1 – asbestos products known to be in a deteriorated condition.
  - On or in the vicinity of the proposed Settling Pond and Wetland (potential buried wrapped asbestos).
  - Adjacent or in the vicinity of the pipelines
  - Nearby to the proposed Bioretention Basin, Clarified Water to Main Drain and Holding Pond

For all HAIL activities identified on the wider Ravensdown site, refer to the 2021 Beca PSI issued under separate cover.

Figure 5: HAIL Activities Identified During the PSI on/in the Vicinity of the Site

4.2 Additional Information Provided

Since the completion of the PSI, fluoride was subsequently identified as an additional potential source of contamination in the vicinity of the former settling pond situated towards the centre of the site, as well as in the vicinity of a small existing pond in the south of the site (see **Figure 6**).

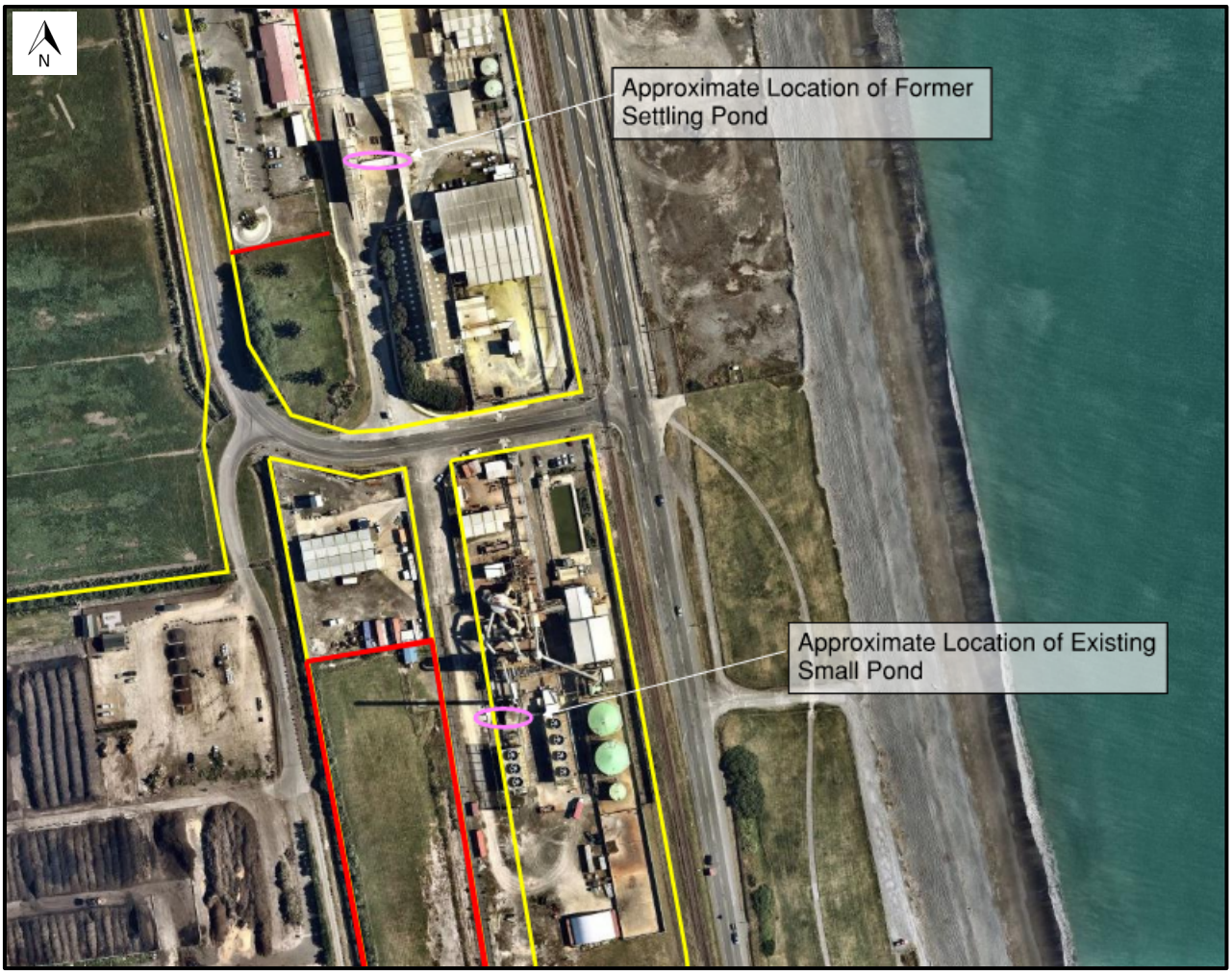


Figure 6: Approximate Locations of Potential Fluoride Sources

5 Site Investigation Scope and Rationale

This section refers to soil sampling investigation at the site area for enabling the proposed earthworks set out in **Section 2.2**, relating to the Stormwater and Process Water Management Project.

5.1 Potential Contaminants of Concern

The 2021 Beca PSI identified land use activities on or within the vicinity of the site which may have resulted in soil contamination. Potential contaminants of concern associated with these activities have also been identified and are summarised in **Table 1**.

Table 1. Potential Contaminants of Concern

Activity	HAIL Code	Potential Contaminants of Concern
Fertiliser production (including bulk storage of associated chemicals	A6: Fertiliser manufacture or bulk storage	Calcium, phosphate, calcium sulphate, copper chloride, sulphur, sulphuric and phosphoric acid, molybdenum, selenium, iron, cadmium, nitrates, and ammonia
Electrical transformers	B2: Electrical transformers	Polychlorinated biphenyls (PCBs), hydrocarbons, copper, tin, lead, and mercury
Asbestos in a deteriorated condition	E1: Sites with buildings containing asbestos products known to be in a deteriorated condition	Asbestos
Waste disposal to land	G5: Waste disposal to land	Dependent upon type of fill material but can include: ▪Heavy metals including arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc ▪Hydrocarbons ▪Asbestos

5.2 Investigation Rationale

A summary of the investigation design and sampling rationale is included in **Table 2**. Sample locations were selected from areas likely to undergo soil disturbance as part of the proposed development.

As no soil disturbance is proposed within the preferential discharge to land (spray irrigation) area and as no HAIL activities were identified within this area of the site during the PSI, this area has been excluded from this DSI.

Soil samples were collected from each sampling location at regular intervals based on visual observations and significant geological changes. See **Figure 7** for soil sampling locations.

Table 2: Investigation Rationale

Site Area	Potential Contamination Source	Investigation Approach/ Rationale
Bioretention Basin located to the south of No 2 Dispatch (approximately 1,200m^2) Assumed Pipeline as referred to as "Clarified Water to Main Drain" located west of No 3 Rock Store (approximately 160m^2) Holding Pond located west of No. 2 Rock Store (approximately 1,200m^2)	• Fertiliser manufacture or bulk storage • Electrical transformers • Asbestos products known to be in a deteriorated condition	• Test pits were proposed to target the areas where the Bioretention Basin, Clarified Water to main drain pipe, and Holding Pond is proposed to be located. The test pits were distributed to generally cover a 20m grid within the proposed earthworks areas. • The test pits were targeting material to a maximum depth of 3.5m but were terminated at shallower depths when intercepting the naturally occurring stiff clays. • Underground service clearance and hydro vacuum excavation was used to clear for services prior to undertaking the test pitting with an excavator. • Where services were encountered, the corresponding sample locations were offset accordingly. • Test pits were chosen to allow for better visual observations for potential buried waste or ACM. • Surface and shallow surface soil samples were collected at all test pit locations to target the long-term fertiliser manufacture and bulk storage at or in the vicinity or this portion of the site. • Nearby structures known or suspected to contain asbestos (past or present) that may also have impacted the shallower soils. Asbestos does not mobilise in soil and therefore, any asbestos from building structures is typically localised within the shallower surface soils. • The laboratory analysis screening suite included testing for semi-quantitative asbestos, heavy metals (including mercury), TPH, PAH, and pH (screening indicative of fertliser generated acids). • Sample location TP101 was situated adjacent to an electrical transformer. Even though no vegetation dieback, staining or odours were noted, the samples were conservatively screened for PCBs.
Pipelines North-East of the Bio-Retention Basin and South of the Holding Pond. The assessment conservatively	• Fertiliser manufacture or bulk storage • Electrical transformers • Asbestos products known to be in a deteriorated condition • Former settling pond	• 4 sample locations were advanced to a maximum depth of 1.5m bgl, generally equally spaced along the pipelines (TP110 – TP113). The depth at these locations was limited due to encountering groundwater and the pit walls collapsing.

Site Area	Potential Contamination Source	Investigation Approach/ Rationale
targeted the pipelines as the proposed works within these areas is still to be confirmed.		• Underground service clearance and concrete cutting was undertaken prior to using hydro vacuum excavation for sampling. This sampling technique avoids significant soil disturbance but still enable sampling where existing underground services limits the suitable sampling options. • Where services were encountered, the corresponding sample locations were offset accordingly. • Near surface soil samples (below the base course) were collected at each location. • Laboratory analysis targeted compounds likely related to the long-term fertiliser manufacture and bulk storage use in the vicinity, as well as nearby structures known or suspected to contain asbestos (past or present). • The laboratory analysis screening suite included testing for semi-quantitative asbestos, heavy metals (including mercury), TPH, PAH, and pH (screening indicative of fertliser generated acids). • Sample location TP112 was situated adjacent to an electrical transformer. Even though no staining or odours were noted, the samples were conservatively screened for PCBs. • As sample location TP113 was situated near to the former settling pond containing high levels of fluoride, soil from this location was analysed for fluoride.
Pipeline located south of the carwash and carpark. The assessment conservatively targeted the pipelines as the proposed works within these areas is still to be confirmed.	• Fertiliser manufacture or bulk storage • Asbestos products known to be in a deteriorated condition • Former settling pond (likely to have contained water with high fluoride concentrations). • Suspected buried demolition waste	• 2 sample locations were advanced to a maximum depth of 2.2m bgl, approximately 20m apart (TP114 – TP115) along the length of the pipeline. • Underground service clearance and hydro vacuum excavation was used to clear for services prior to undertaking the test pitting using an excavator. • Where services were encountered, the corresponding sample locations were offset accordingly. • Test pits were chosen to allow for better visual observations for potential buried waste or ACM. • Surface/near surface soil samples were collected at each location. • Laboratory analysis targeted compounds likely related to the long-term fertiliser manufacture

Site Area	Potential Contamination Source	Investigation Approach/ Rationale
		and bulk storage, nearby structures known or suspected to contain asbestos (past or present), suspected buried demolition waste and nearby former settling pond. • The laboratory screening suite included testing for semi-quantitative asbestos, heavy metals (including mercury), TPH, PAH, pH (screening indicative of fertliser generated acids), and fluoride.
Settling Pond located south of the Inventory Stores (approximately 2,155m^2) Wetland located south of the Settling Pond (approximately 4,630m^2)	• Fertiliser manufacture or bulk storage • Former stockpiling activities and anecdotal evidence that buried wrapped asbestos may be present • Existing small pond (with fluoride containing wastewater)	• Test pits targeted the areas where earthworks are proposed. The test pits were designed to be evenly distributed within these areas to be considered representative of the material. • Underground service clearance was used to clear for services prior to undertaking the test pitting using an excavator. • Where services were encountered, the corresponding sample locations were offset accordingly. • Test pits were chosen to allow for better visual observations for potential buried waste or ACM. • Surface/near surface soil samples were collected at each location. • Laboratory analysis targeted compounds likely related to the long-term fertiliser manufacture and bulk storage in the vicinity, former stockpiling activities, existing small pond and anecdotal evidence of buried wrapped asbestos. • Laboratory analysis screening suite included testing for semi-quantitative asbestos, heavy metals (including mercury), TPH, PAH, pH (screening indicative of fertliser generated acids) and fluoride.

Figure 7: Approximate Sample Locations (Image source: Nearmap December 2020).

5.3 NESCS Permitted Activity Provisions

Given activities on the MfE HAIL are more likely than not to have been undertaken at the site, the NESCS applies with respect to the soil sampling activities undertaken. The soil sampling was undertaken as a permitted activity in accordance with Regulation 8 (2), as the following requirements were met;

- Measures were in place to minimise human exposure to contaminants before, during, and after the sampling program.
- The sampling locations were immediately restored to an erosion resistant state upon completion of the sampling program.

No soil was removed from the site except for sample analysis.

6 Soil Sampling Methodology

The soil investigation was undertaken from 16 to 24 September 2021. A Beca Environmental Scientist and an Underground Service Surveyor marked out the 28 sample locations prior to excavating. 24 of the 28 locations were excavated using a mechanical digger. Where required, hydro vacuum excavation was undertaken to clear for services prior to test pitting. For the remaining 4 locations, as widespread asphalt was present, the hardstanding was cut as required and hydro vacuum excavation was used to retrieve the required soil samples.

6.1 Soil Sampling Methodology

Soil samples were collected from a range of depths across the soil profile between 0.1 to 3.2 m bgl. Multiple samples were collected at each location- based on visual observations and significant geological changes.

The GAMAS include for the field screening of asbestos by field sieving when assessing the presence of asbestos in soils. Due to the cohesive nature of the encountered soils (clays and silts) sieving was not possible. Visual observations of encountered material were made to provide an indication of the presence of material not consistent with natural onsite materials.

Soil samples were collected directly by hand from excavated materials in the centre of the excavator bucket. A clean pair of nitrile gloves was worn for each sample to prevent cross-contamination. Samples were placed in laboratory supplied plastic or glass jars as appropriate and chilled prior to dispatch to R J Hill Laboratories Ltd (Hill Laboratories).

The soil profile was logged for each location and the logs are provided in **Appendix A**.

All sampling equipment was decontaminated between sampling locations using DECON 90.

Field sampling and relevant sampling management procedures were undertaken in general accordance with the MfE *Contaminated Land Management Guidelines No.5 – Site Investigation and Analysis (2021).*

Due to the potential risk of asbestos at the site, a Safe Work Method Statement (SWMS) was prepared and all fieldwork was carried out in accordance with the SWMS. Refer to **Appendix B** for a copy of the SWMS.

The Environmental Scientist undertaking the sampling was wearing suitable Personal Protective Equipment (PPE) when working in these areas of concern. The PPE included disposable suits and gloves, and Respiratory Protective Equipment (RPE) comprising a P2 mask or half face respirator.

6.2 Soil Laboratory Analysis

Samples were placed in laboratory supplied plastic or glass jars as appropriate and chilled prior to dispatch to R J Hill Laboratories Ltd (Hill Laboratories) for undertaking the chemical analysis.

Copies of the Hill Laboratories results certificates are included in **Appendix C** All samples were accompanied with a Chain of Custody form which detail the required handling and testing instructions.

Soil samples were selected for analysis based visual observations and changes in lithology. A range of soil samples from across the soil profile were analysed to provide an understanding of the potential vertical extent of any contamination (if present). Soil samples not selected for analysis were held cold at the laboratory. A data summary sheet of the results is presented in **Appendix D.**

Groundwater sampling and analysis was not undertaken as a part of this investigation, as it is understood that this has been carried out by other parties.

6.3 Laboratory Results Assessment Criteria

6.3.1 Assessment of Human Health Risk

The adopted assessment criteria for the investigation have been selected in accordance with the hierarchy defined by *Ministry for the Environment* (MfE) *Contaminated Land Management Guidelines No.*2 (MfE, 2002) and are summarised below. Assessment criteria for a commercial/industrial scenario have been adopted.

- *Resource Management (National Environment Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011. Soil Contaminant Standards for a commercial/industrial land use adopted.*
- *Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999). Values applicable to commercial/industrial use.*
- *Regional Screening Levels, US Environmental Protection Agency (USEPA, 2012). Values applicable to industrial soil adopted.*
- *BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil (2017) (GAMAS).*

6.3.2 Assessment of Environmental Risk

- The risk posed by contaminants in soil to ecological receptors has been assessed against the following standards:
- *Landcare Research (2016). User Guide: Background soil concentrations and soil guideline values for the protection of ecological receptors (Eco-SGVs) – Consultation draft. Table 5, 6 and 7.*
- *Canadian Council of Ministers of the Environment (2015). Canadian Environmental Quality Guidelines - Soil Quality Guidelines for the Protection of Environmental and Human Health.*

6.3.3 Background Concentrations

The NESCS defines background as “natural background” levels. Background levels are particularly relevant when considering whether soils can be considered cleanfill. Results have been assessed against the following standards:

- *Predicted Background Soil Concentrations, Land Research Limited. 95th Percentile Background Concentration for Pakihi Sandstone and Pakihi Mudstone adopted.*

7 Site Observations and Summary of Soil Analytical Results

7.1 Fieldwork Observations

The fieldwork was undertaken from 16 – 24 October 2021. Weather and wind conditions varied between rain with low to moderate winds to calm full sun conditions.

The following observations were made during the fieldwork investigation.

- TP110 – TP113 were located in areas of widespread hardstanding. The remainder of the sample locations were not sealed at surface.
- Generally, encountered ground conditions comprised sands and gravels (including some areas of fill) to at least 1.4 m bgl, underlain by clay.
- The encountered fill material (described as concrete, painted concrete, clay red pipe, timber, glass, fabric, rope, cloth, fertiliser bags, metal, plastic, bitumen, assumed fertiliser, rubber pipes, metal cylinders) was identified in the north-east of the proposed holding pond (sample location TP107 from 0.4m to 1m bgl), near the pipeline south of the small car wash (TP114 0.5m – 1m and TP115 0.1m – 0.7m), as well as in all test pits undertaken within the south of the site (TP116 – TP128, with fill encountered to a maximum depth of 1.75m.
- An organic odour was noted during the excavation of both TP121 and TP124. An oily sheen was also observed on top of pooling groundwater at 1.0m bgl within the pit of TP125, along with a diesel-like odour.
- TP101, TP102, TP104, TP107, TP109, TP111, TP112, TP113, TP114, TP120, TP123 and TP126 terminated due to obstructions/refusal and groundwater accumulation. TP125 was terminated due to encountering plastic wrapping at 0.8m that the excavator was unable to remove. All other test pits in this area of the site terminated due to reaching the desired strata (clay).
- Generally, groundwater (likely tidally influenced) was encountered at between 0.9m and 1.6m bgl in the north of the site and between 1.0m and 2.1m in the south of the site.

A summary of the test pit logs and sample depths at each location are provided in **Appendix A**

7.2 Soil Analytical Results

7.2.1 Metals

56 soil samples were analysed for metals. In summary:

- The adopted assessment criteria for human health risk were not exceeded in any of the analysed samples.
- Concentrations of cadmium, chromium, copper, lead, nickel and/or zinc were above published background concentrations in 45 of the 56 soil samples analysed. The site straddles a geological boundary. Results have been compared to values mapped for both Pakihi Mudstone and Pakihi Sandstone. The concentrations identified above background criteria are shown in full in the results table in **Appendix D**.
- Environmental criteria for nickel and/or cadmium were exceeded in 3 samples (**Table 3**). Zinc was identified at (but not above) environmental criteria in one sample (TP123 at 0.85m bgl).

Table 3: Results for Metals in Soil Samples where the Environmental Criteria were Exceeded.

Sample name	Sample Depth (m)	Metal	Measured (mg/kg)	Adopted Environmental Risk Criteria (mg/kg)
TP110	0.6	Nickel	190	89
TP122	0.5	Cadmium	53	40
TP123	0.85	Cadmium	58	40

7.2.2 Total Petroleum Hydrocarbons (TPH)

56 samples were analysed for TPH. In summary:

- 31 samples contained detectable concentrations of TPHs. All detectable concentrations were within the long hydrocarbon chain (C15-C36) range.
- The adopted assessment criteria for human health and environmental risk were not exceeded for any of the analysed samples.

7.2.3 Polycyclic Aromatic Hydrocarbons (PAH)

56 samples were analysed for PAHs. In summary:

- 36 of these samples contained detectable levels of various PAH compounds.
- The environmental risk and human health threshold values adopted for this investigation were not exceeded in any of these samples.

7.2.4 Polychlorinated Biphenyls (PCB)

Samples from 2 test pits (TP101 at 0.1 m bgl and TP112 at 0.4 m bgl) were tested for PCBs. Both samples returned results below the detectable limit (<0.4 mg/kg dry weight), and the adopted guideline values for human health and environmental risk were therefore not exceeded.

7.2.5 Asbestos

43 samples were tested for asbestos. In summary:

- Amosite was detected within TP119 at 0.5m bgl. The concentration was below the laboratory limit of detection for Combined Fibrous Asbestos and Asbestos Fines.
- Chrysotile was detected within TP126 at 1.5m bgl and TP127 0.5m bgl. The concentrations were below the laboratory limit of detection for Combined Fibrous Asbestos and Asbestos Fines.

7.2.6 pH Levels

The pH levels of 56 samples were measured. In summary:

- 22 of the 56 samples analysed had pH levels below 6, and 5 had levels above 8 which may be indicative of acid generation or fertiliser leachate.

7.2.7 Fluoride

5 soil samples were analysed for fluoride. In summary:

- The adopted assessment criteria for human health risk were not exceeded in any of the analysed samples.

- Environmental criteria for fluoride were exceeded in 4 samples (see **Table 4**).

Table 4: Results for Fluoride Concentrations in Soil Samples where the Environmental Criteria were Exceeded.

Sample name	Sample Depth (m)	Measured (mg/kg)	Adopted Environmental Risk Criteria (mg/kg)
TP114	0.1	3,200	290
TP115	0.1	4.900	
TP118	2.0	360	
TP120	1.8	1,550	

7.3 Quality Assurance and Quality Control

4 duplicate soil samples were recovered from 4 different test pits (TP101 at 1m, TP120 at 0.5m, TP118 at 0.1m and TP127 at 0.5m). The duplicate samples were screened for targeted metals and hydrocarbons. The relative percentage difference (RPD) between the primary and duplicate samples has been calculated to determine the deviation between the sample and the duplicate.

The RPD ranges for the various compounds are summarised in **Table 5**.

Table 5: RPD ranges for screened analysis of 4 duplicate samples.

	RPD ranges in all 4 duplicates (in %)	Comment
Heavy Metals	0 - 29.4	Two outliers noted: 37.8% TP120 at 0.5m for Nickel 70.3% TP127 at 0.5m for Mercury
Total Reported PAHs	23.9 - 37.8	-
TPHs	4.5 - 46.6	<10% variation in samples TP120 at 0.5m and TP127 at 0.5m >30 %and<45 % for TP101 at 1m and TP118 at 0.1m

The higher RPDs are likely related to the typical heterogeneity of the fill material sampled and analysed. Nonetheless, the results indicate a moderate to high level of accuracy in the sampling and analytical methods used in this investigation. It is considered that the analytical results are appropriate and suitable for the purpose of this investigation.

Hill Laboratories undertook internal replication of heavy metal analysis for the sample recovered from TP128 at a depth of 2.2 m bgl for internal quality control purposes. It was reported that a greater variation than would normally be expected during replicate analyses were noted for 3 heavy metals. This variance is summarised in **Table 6**.

Table 6: Variance between replicate samples for chromium, nickel and zinc for TP128 at 2.2 m bgl.

	Replicate 1 (mg/kg)	Replicate 2 (mg/kg)	Variance (%)
Chromium	21	16	23.8
Nickel	18	14	22.3
Zinc	78	63	19.2

Although the internal replication showed a higher than acceptable variation for internal laboratory analysis, the measured levels were below background criteria levels and therefore not considered significant.

8 Discussion and Risk Assessment

Generally, encountered ground conditions comprised sands and gravels (including areas of fill) to between approximately 0.7m and 1.75m bgl, underlain by clay (where investigations terminated).

Fill containing man-made materials was observed in the north-east of the proposed holding pond (sample location TP107 from 0.4m to 1m bgl), near the pipeline south of the small car wash and main carpark (TP114 0.5m – 1m and TP115 0.1m – 0.7m) and in all test pits undertaken within the southern portion of the site (TP116 – TP128, with fill encountered to a maximum depth of 1.75m). The fill was described as sands and gravels with traces of concrete, painted concrete, clay red pipe, timber, glass, fabric, rope, cloth, fertiliser bags, metal, plastic, bitumen, assumed fertiliser, rubber pipes, and metal cylinders.

Although likely to be tidally influenced, groundwater was generally encountered at between 0.9m and 1.6m bgl in the north of the site and between 2m and 2.6m in the south of the site.

Surface soil samples were analysed from each of the 28 sample locations to target potential contamination from fertiliser storage and asbestos. Although PAH and TPH were detected, and the majority of these surface/near surface level soil samples contained concentrations of metals above published background levels, none of the contaminants of concern exceeded guidelines for the protection of human health or the environment.

50 soil samples were collected at various depths within the fill, sands and gravels. Asbestos, PAH and TPH were detected, albeit within guidelines for the protection of human health. The majority of these soil samples contained concentrations of metals above published background levels. Concentrations of nickel and/or cadmium exceeded the targeted environmental criteria in 3 samples recovered from TP110 at 0.6m bgl, TP123 at 0.85m bgl and TP122 at 0.5m bgl (all within the fill material).

Metal concentrations in 3 samples exceeded the environmental risk criteria (nickel in TP110 at 0.6m bgl, and cadmium in TP122 0.5m and TP123 0.85m). The fluoride concentration in 4 of the 5 soil samples analysed contained concentrations above the environmental criteria (in TP114 and TP115 at 0.1m bgl, in TP118 at 2m bgl and in TP120 at 1.8m bgl). The results suggest that the contamination may pose a risk to the environment, particularly shallow groundwater. The fluoride analysis was limited to soil samples in close proximity to a historical and current settling pond where water is known to hold high levels of fluoride. No fluoride results are available for soil recovered from the northern portion of the investigation site. It should be assumed that the soil may contain high fluoride concentrations or analyse additional samples to rule this out. A Contaminated Soils Management Plan (CSMP) is recommended to control exposure pathways and manage environmental risk during development works. The CSMP will have to align with the proposed design where material is kept in situ or be reused. The proposed water holding infrastructure should be designed to avoid the water interacting with potentially impacted soil and groundwater.

Approximately 6 soil samples were collected from within the clay material underlaying the site. TPHs were detected in one sample (TP108 at 1.2m bgl), and some concentrations of metals were above background levels. None of the contaminants of concern exceeded guidelines for the protection of human health or the environment. The clayey material is suitable for reuse on site since it does not pose a risk to the human health or surrounding environment.

Laboratory testing indicated the presence of asbestos in 3 samples recovered from between 0.5m and 1.5m bgl within TP119, TP126 and TP127 at levels below the screening levels adopted for human health.

As reported on within the 2021 Beca PSI, anecdotal information suggested buried wrapped asbestos may be present within the south of the site. Although no buried suspected asbestos containing materials were visually

identified at the time of the soil sampling, plastic wrapping was encountered in at approximately 0.6m bgl in TP116, 0.3m bgl in TP120, 1m bgl in TP122, 0.3m bgl in TP124, 0.8m bgl in TP125, 0.2m in TP126, and 1.1m in TP127. Although this investigation did not identify asbestos above relevant guidelines for the protection of human health, it is possible for buried wrapped asbestos to be present within soils planned to be disturbed.

Some deterioration was also noted in suspected ACM building materials in the buildings near TP101 (see **Figure 8**).

Figure 8: Deterioration of suspected ACM building materials near TP101 in the northern part of the site.

It is possible for buried wrapped asbestos to be present within the south of the site. If encountered, further work will be required and may cause delays of the construction works. The removal of any discovered asbestos may require licenced removalist. The risk for exposing unidentified buried asbestos during soil disturbance can be managed via procedures set out in a CSMP. For the areas where plastic wrapped buried asbestos is probable (in the vicinity of TP120, TP122, TP124, TP125, TP126 and TP127, at minimum), the removal and disturbance of such material may require additional investigations and considered specialist licences asbestos removal works.

Yellow powdered deposits, (likely buried elemental sulphur) were noted in the top 1m of TP116-TP128 within the south of the site. While sulphur is not considered as a significant environmental and human health risk, prolonged exposure or inhalation of sulphur dust can cause irritation, which can be managed through the use of PPE during soil disturbance. Sulphur dust suspended in air can ignite easily and cause an explosion in confined area. This may be a risk if bulk quantities of pure, buried sulphur is disturbed during the earthworks. Although not a direct contaminated land related risk, the fire and explosion risk will have to be considered during the proposed earthworks. White deposits that are believed to be fertiliser were also noted in this area.

Screening analysis did not reflect significant contamination, however pH levels of 22 of the analysed samples were below a pH level of 6, which may be indicative of acid generation or fertiliser leachate. The low pH suggests the risk of buried fertiliser related buried waste to have impacted the shallow groundwater.

8.1 Exposure Pathway Assessment

A Conceptual Site Model (CSM) was originally developed during the PSI to describe the relationship between sources of contamination on site, the human and environmental receptors that may be exposed to those contaminants in the context of the use of the site, and the pathways by which those receptors may be exposed. The CSM has been updated to reflect the findings of this DSI (see **Table 7**)

Table 7: Updated Exposure Pathway Assessment.

Source	Receptor	Pathway	Pathway Complete?
Fertiliser manufacture/bulk storage and buried on site Heavy metals Hydrocarbons Asbestos Fluoride	Construction workers	Exposure of workers to contaminants in soils during site redevelopment – dermal contact, ingestion or inhalation of dust/vapours.	**Incomplete Pathway** – Concentrations of contaminants of concern were all below criteria for the protection of human health for on-site workers. A CSMP is recommended to manage the residual risk of unexpected or unidentified contamination that may be encountered during development works.
	Future site users	Exposure of future site users to contaminants in soils - dermal contact, ingestion or inhalation of dust/vapours.	**Incomplete Pathway** – Concentrations of contaminants of concern were found to be within guidelines for the protection of human health for an ongoing commercial/industrial land use scenario. Furthermore, the majority of areas utilised by site users comprise building cover and hardstanding.
	Groundwater resources for public consumption	Leaching and migration of soil contaminants into groundwater	**Potentially Complete Pathway** – Various Water Permits for groundwater use for drinking water purposes are recorded within the surrounding area. Potential impacts on groundwater were not assessed in this investigation and cannot be ruled out. The proposed works will be carried out in shallower soils and perched groundwater. Impacts on groundwater should be considered and managed through implementation of controls set out in a management plan.
	Surface water	Runoff into site stormwater system which may discharge to the marine environment. Lateral migration to marine environment via groundwater.	**Potentially Complete Pathway** – Surface water features are present within the area. The exposure pathway can be managed through implementation of management plan controls.

8.2 Limitations of Site Characterisation

Characterisation of subsurface conditions is dependent on the number of sample locations, methods of sampling and the uniformity of subsurface conditions. The accuracy of this characterisation is therefore limited by the scope of works undertaken.

The GAMAS guidelines recommend that test pits are used for asbestos soil sampling to enable sufficient volume of material to be recovered for field sieving and observations for ACM. The investigation was limited to recovery soil samples from hydro vacuum excavation locations in areas currently sealed or where known services were located. The use of this method limited the opportunity for observation of potential ACM.

In total 28 sampling locations were completed across the site to enable the collection of soil samples as part of this investigation. The GAMAS guidelines indicate that when the presence of asbestos in soils is considered suspected (as detailed in Table 3 of the guidelines), then the sampling density for the area is advised to be followed. Based on anecdotal evidence, plastic wrapped and buried asbestos waste were anticipated in the southern portion of the site although the extent and location of these were unknown. The GAMAS recommends sampling density for the southern area equates to approximately 19 test pit location within the proposed earthworks area based on the assumption that the entire area was used for burying the ACM. For this investigation the number of sampling locations within the targeted areas were reduced to 13 locations but increased sampling at various depts. It is considered that the investigation completed to date is adequate for an initial assessment of the risk to human health and the environment based on the proposed works, including identifying procedures to manage the risk to be included within a CSMP. However, there is the possibility that contamination present on the site has not been described, and unexpected contamination may be identified, which may cause delays to the works.

Whilst contaminant concentrations may be estimated at chosen sample locations, conditions at any location removed from the specific points of sampling can only be inferred on the basis of geological and hydrogeological conditions and the nature and the extent of identified contamination. Subsurface conditions can vary, resulting in uneven distribution of contaminants across a site which cannot be defined by these investigations. In addition, with time, the site conditions and environmental guidelines could change so that the reported assessments and conclusions are no longer valid. The conclusions of this report are made on the basis that the site conditions revealed by the investigation are representative of the actual conditions across the site at the time of sampling.

9 Development Implications

9.1 Consents

9.1.1 National Environmental Standard

The *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NESCS) applies to land as per clause 5(7):

"Land covered:

(7) The piece of land is a piece of land that is described by 1 of the following:
- *a) an activity or industry described in the HAIL is being undertaken on it;*
- *b) an activity or industry described in the HAIL has been undertaken on it;*
- *c) it is more likely than not that an activity or industry described in the HAIL is being or has been undertaken on it."*

The 2021 Beca PSI determined that it was considered more likely than not that the following HAIL activities have been identified on or within the vicinity of the site:

- A6: Fertiliser manufacture or bulk storage
- B2: Electrical transformers
- E1: Sites with buildings containing asbestos products known to be in a deteriorated condition
- G5: Waste disposal to land

These areas are therefore considered to be a "*piece of land*" under the NESCS legislation.

Soil Disturbance

Under Regulation 8(3) of the NESCS, soil disturbance of up to 25m^3 per 500m^2 and disposal of up to 5m^3 per 500m^2 is allowed as a Permitted Activity. The following criteria must also be met in order for the proposed works to be considered a Permitted Activity:

- Appropriate dust, erosion and sediment controls are put in place to limit contaminant mobility for the duration of the works and until the site is in an erosion free state
- The soil is in an erosion free state within 1 month of the completion of works
- Soil for offsite disposal must be taken to an appropriate facility
- Duration of the works must not exceed 2 months
- Onsite containment of contaminants must not be compromised

The proposed works are set out in **Section 2.2** of this report. Based on the extent of works, is not likely to meet the Permitted Activity criteria. As the identified contaminants of concern analysed in this investigation did not exceed any of the adopted human health risk criteria, the proposed works will require a **Controlled Activity** consent under the NESCS.

9.1.2 Hawkes Bay Regional Resource Management Plan - Contaminated Land Rules

Under the Hawkes Bay Regional Plan, 'Contaminated Land' is defined as:

"*land that has a hazardous substance in or on it that –*

(a) Has significant adverse effects on the environment; or

(b) Is reasonably likely to have significant adverse effects on the environment".

Soils where the environmental criteria were exceeded should be reused in a manner that does not pose a future risk to the proposed development or groundwater. However, it is considered that the potential risk to the environment, during earthworks, can be managed through the development of a CSMP.

Although the effects on the groundwater have not been assessed in this investigation, it cannot be ruled out. The Rules set out in the Hawke's Bay Regional Resource Management Plan relating to discharges of contaminants onto or into land, or into water (Rules 48, 49 and 52) needs to be assessed to determine whether any additional discharge consents would be required to enable the earthworks.

9.2 Contaminated Soil Management Plan (CSMP)

The exposure pathway assessment identified potentially complete exposure pathways which could be mitigated and managed through the implementation of specialist controls (via the implementation of management plans) during proposed land disturbance works. Specialist controls can be implemented through the development of a CSMP and include:

- List of responsible parties to the land disposal works.
- Human health controls for health and safety planning/training requirements, personal protective equipment, and personal monitoring.
- Environmental controls for odour, dust, spoil stockpiling, spoil disposal, groundwater handling and disposal.
- Procedures for encountering unknown contamination.
- Procedures for encountering significant quantities of wrapped, buried asbestos.
- Continual monitoring during land disturbance for visual and olfactory signs of additional contamination above the levels characterised during this investigation may be necessary to reduce exposure of those on-site to contamination not identified in this assessment.

9.3 Disposal Options

The following provides definitions of cleanfill, managed fill and contaminated fill, and discusses the disposal options that may be available.

9.3.1 Cleanfill

The Ministry for Environment (MfE) describes cleanfill material as; *'Material that when buried will have no adverse effect on people or the environment. Cleanfill material includes virgin natural materials such as clay, soil and rock, and other inert materials such as concrete or brick that are free of:*

- *combustible, putrescible, degradable or leachable components*
- *hazardous substances*
- *products or materials derived from hazardous waste treatment, hazardous waste stabilisation or hazardous waste disposal practices*
- *materials that may present a risk to human or animal health such as medical and veterinary waste, asbestos or radioactive substances*
- *liquid waste*.'

Essentially, inert soils are suitable as cleanfill if potential contaminants have been determined to be below published background concentrations.

9.3.2 Land Fill

Land Fill is defined in the Hawke's Bay Regional Resource Management Plan as "*A waste disposal site of any size used for the controlled deposit of predominantly solid wastes onto or into land*". Soil disposal at Land Fill would be required for contaminated soil containing concentrations above the maximum acceptance criteria for managed fill at local landfill sites, and below any maximum acceptability thresholds.

9.3.3 Soil Reuse and Disposal Options

Site soil with the presence of hydrocarbons and metal concentrations above the regional background concentrations does not meet the definition of cleanfill however it will be suitable for reuse on site since it does not pose a risk to the human health or surrounding environment.

The reuse of any contaminated material within the site should be adequately managed and considered in the design to minimise the potential environmental effects at the site and shallow groundwater. The proposed water holding infrastructure should be designed to avoid the water interacting with potentially impacted groundwater.

Where the materials are not considered to be suitable for reuse, spoil materials may be disposed of off-site to a facility authorised to accept such materials.

The level of contamination may restrict the disposal at local landfills. The closest landfill to the site is Omarunui Landfill. It is understood that the landfill can accept contaminated material only of Total Concentration Leaching Procedure (TCLP) results meet their internal acceptance. Additional soil analysis and quantities of soil to be disposed may be required to determine its acceptance. It is recommended that a copy of the soil analytical results is provided to the nominated disposal facilities for review.

10 Conclusions

Shallow groundwater and evidence of impacted soil that pose a risk to the environment was noted, mainly in the southern portion of the site however, the impacts on the northern portion cannot be ruled out without further testing. A groundwater assessment to determine the effects of the fertiliser-related buried waste to the groundwater is recommended (outside of the scope for this report).

A CSMP is recommended to control identified exposure pathways during development works. The CSMP shall align with the proposed design where materials are kept in situ or reused.

It is possible for buried wrapped asbestos to be present within the south of the site. If encountered, further work will be required and may cause delays. The removal of any discovered asbestos may require licenced removalist. The CSMP should include contingency procedures to anticipate the management of material.

Management controls and design considerations should be in place where any impacted material is planned to be reused on site. These can be set out in a CSMP. The proposed water holding infrastructure should be designed to avoid the water interacting with potentially impacted groundwater.

In the event where off-site soil removal is required, this should be agreed with the acceptor of the material since the level of contamination may restrict the disposal at local landfills. Additional soil analysis, and quantities of soil to be disposed, may be required to determine its acceptance.

11 Limitations

This report has been prepared by Beca Ltd (Beca) solely for Ravensdown Limited (Client). Beca has been requested by the Client to provide a Detailed Site Investigation at Ravensdown's Napier facility located at 90 Waitangi Road, Awatoto. This report is prepared solely for the purpose of the assessment of potential soil contamination in areas of proposed soil disturbance for stormwater and process water management system improvements (Scope). The contents of this report may not be used by Ravensdown for any purpose other than in accordance with the stated Scope.

This report is confidential and is prepared solely for the Client. Beca accepts no liability to any other person for their use of or reliance on this report, and any such use or reliance will be solely at their own risk.

In preparing this report Beca has relied on key information including the Project Description: Ravensdown Awatoto stormwater and process water management. Prepared by Aurecon, dated 17 November 2021 (ref.: 509619) provided by the Client.

Unless specifically stated otherwise in this report, Beca has relied on the accuracy, completeness, currency and sufficiency of all information provided to it by, or on behalf of, the Client or any third party, including the information listed above, and has not independently verified the information provided. Beca accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the information provided. Publicly available records are frequently inaccurate or incomplete.

The contents of this report are based upon our understanding and interpretation of current legislation and guidelines ("Standards") as consulting professionals, and should not be construed as legal opinions or advice. Unless special arrangements are made, this report will not be updated to take account of subsequent changes to any such Standards.

This report should be read in full, having regard to all stated assumptions, limitations and disclaimers.

A

Appendix A – Test Pit Logs

Test Pit Logs – Ravensdown Napier

TP101

Depth	Description	Sampling depths	Photo
0.0-0.2	Topsoil, sandy silt with some organic (rootlets), trace fine gravel, sand is fine to medium, brown, dry.	0.1 (+QA1)	
0.2-1.1	Sandy gravel (fine to coarse gravel), with minor silt, moist to wet, brown/grey, some cobbles.		
1.1-1.6	Clayey gravel (fine to coarse), minor cobbles, trace sand, wet, grey. Groundwater at 1.5m.	1.3	
1.6-2.0	Clay with some gravel (fine to medium), high plasticity, blue/gray, wet.		
2.0	Terminated due to groundwater.		
General observations: North-western corner of proposed bio-retention basin. Dried grass cover, transformer approximately 5m north of pit. Transformer building clad with suspected ACM cement sheet, cladding slightly chipped in one section, corrugated metal sheet from dispatch building approximately 5m north-west of pit. Some dust from dispatch present (from manufactured fertiliser).			

TP102

Depth	Description	Sampling Depth	Photo
0.0-0.05	Silt (topsoil) with organic (rootlets), some sand, brown, dry-moist.		
0.05-0.2	Silty sand (fine to medium sand), minor organic, trace fine gravel, brown/light brown, moist.	0.1	

0.2-1.0 (est)	Sandy gravel (fine to coarse gravel), trace silt, minor cobbles, brown/grey, wet.	0.5	
1.0-1.5	Clayey gravel (fine to coarse gravel), minor cobbles, moist to wet. Has clay deposits/areas with organic matter (black roots), grey/mottled black. Groundwater at 1.4m.		
1.5-1.6	Clay with some gravel (fine to coarse), some organic matter (black and white roots, grey/blue, moist.		
1.6	Terminated due to groundwater accumulation.		
General observations: North-eastern corner of proposed bio-retention basin. Grass cover. Dust accumulating from dispatch during sampling (manufactured product – fertiliser). Transformer north-west of pit, suspected ACM cement sheet cladding, small section chipped. One water pipe (irrigation) found during hydro vacuum excavation and moved test pit to avoid. Groundwater at 1.4m.			

TP103

Depth	Description	Sampling Depth	Photo
0.0-0.15	Topsoil, silt with some sand, some organic (rootlets), minor gravel, brown, dry to moist. Small piece of glass at 0.1m.	0.1	
0.15-0.3	Sand with minor fine gravel, sand fine to medium, trace silt, light brown, moist.		
0.3-1.0	Sandy gravel (fine to coarse gravel), minor cobbles, moist to wet, brown.	0.5	
1.0-1.6	Clayey gravel (fine to coarse), minor cobbles, minor sand, grey, wet.		

1.6-1.9 (est)	Clayey sand (fine to medium sand), grey, moist, medium plasticity.		
1.9 (est)-2.4	Clay with some organic (black roots), larger root in one area, some sand, grey/blue, moist, high plasticity.		
2.4	Terminated at target depth.		
General observations: South-western corner of proposed bio-retention basin. Grass cover, small trees to east and west. More sandy clay at 1.6 to 2.4m than previous pits. Groundwater not reached (likely tidal influenced).			

TP104

Depth	Description	Sampling Depth	Photo
0.0-0.2	Topsoil, silt with some organic (rootlets), minor sand, brown, moist.	0.1	
0.2-0.4	Sand (fine to medium sand) with some gravel (fine to coarse in places), light brown, moist.		
0.4-0.7	Sand (fine to medium sand), light brown, moist.		
0.7-1.2	Sandy gravel (fine to coarse) some cobbles, brown/grey, moist-wet.	1.1	
1.2-1.4	Gravelly clay (fine to medium gravel), grey, wet.		
1.4-1.6	Clay with some gravel (fine to medium gravel), some organic (black roots), grey/mottled black, high plasticity, moist.		

1.6	Terminated due to groundwater accumulation.		
General observations: South-eastern corner of proposed bio-retention basin. Grass cover. Dust of manufactured product (fertiliser) coming from dispatch.observed.			

TP105

Depth	Description	Sampling Depth	Photo
0.0-0.15	Topsoil, silt with some organic (rootlets), minor sand, moist, brown.	0.1	
0.15-0.2	Sand (fine to medium sand), trace silt, moist, light brown.		
0.2-0.8	Sandy gravel (fine to coarse gravel), minor cobbles present, minor silt, moist, grey/brown.	0.5	
0.8-1.2	Clayey gravel (fine to coarse gravel), minor cobbles, minor silt, moist, grey.		
1.2-1.9	Gravelly clay (fine gravel) with minor sand, grey, wet, low plasticity due to granular content. Groundwater at 1.3m.		
1.9-2.2	Clay with some organic (black and brown roots), minor white shells, minor sand, grey/blue, moist, high plasticity.		
2.2	Terminated at target depth. Groundwater accumulating, minor wall collapse.		
General observations: North-western corner of proposed holding pond. Grass cover, tree to east of test pit.			

TP106

Depth	Description	Sampling Depth	Photo
0.0-0.15	Topsoil, silt with some organic (rootlets), minor sand, moist, brown.	0.1	
0.15-0.4	Sand (fine to medium) with minor silt, light brown, moist.		
0.4-0.8	Sandy gravel with minor silt (fine to coarse gravel), trace clay, wet, grey. Water seeping in at 0.5m from hydro vacuum excavation trench.	0.7	
0.8-1.2	Clayey gravel (fine to coarse gravel), minor organic, grey.		
1.2-2.5	Clay with some organic (black and white rootlets), moist to wet, high plasticity, grey/blue and mottled black.		
2.5-3.2	Clay, moist to wet, grey/blue, soft, high plasticity (“Blue-Pug”)		
3.2	Terminated at target depth, minor wall collapse.		
General observations: Proposed pipeline - clarified water to main drain. Grass cover, trees to west of pit. Water level at 0.5m in hydro vacuum extracted pit prior to excavating. Difficult to determine groundwater level due to accumulated water.			

TP107

Depth	Description	Sampling Depth	Photo
0.0-0.4	Topsoil, silt with some organic (rootlets), trace light brown sand deposits, silt deep brown and moist. Large concrete slab and timber plank at 0.4m.	0.1	
0.4-0.8	Gravelly silt with some clay deposits, gravel fine to coarse, brown, clay	0.5	

Depth	Description	Sampling Depth	Photo
	deposits are grey and mottled orange. Wood fill found at this layer (broken wooden plank).		
0.8-1.5	Silty gravel (fine to coarse), moist, minor cobbles, trace clay, grey.		
1.5-2.1	Clay with some gravel (fine to medium), trace silt, organic black deposits, mottled grey/blue with black areas (organic matter, rootlets), high plasticity ("Blue Pug").		
2.1-2.5	Clay with minor organic (rootlets), grey/blue, high plasticity ("Blue Pug").		
2.5	Terminated due to groundwater.		
General observations: North-eastern corner of proposed holding pond. Grass cover. Two water pipes found by hydro vacuum excavation. Large concrete slab at 0.4m, timber behind concrete slab. Fill from 0.4-1.0m with concrete slab and timber.			

TP108

Depth	Description	Sampling Depth	Photo
0.0-0.15	Topsoil, silt with some fine sand, some organic (rootlets), brown, moist.	0.1	
0.15-0.3	Sandy silt, brown.		
0.3-1.2	Silty gravel with some sand (fine to coarse gravel), minor cobbles, minor clay, brown/grey. Accumulated water from hydro vacuum excavation area seeping in at 0.5m.		
1.2-2.4	Clay with some organic (black rootlets), grey/blue, mottled black, moist to wet,	1.2	

Depth	Description	Sampling Depth	Photo
	high plasticity – mottled orange in certain places (“Blue Pug”).		
2.4-3.2	Clay with minor organic, some shells present, soft, high plasticity, grey/blue, moist. Shells at base of pit (3.2m).		
3.2	Terminated at target depth, minor wall collapse.		
General observations: South-western corner of proposed holding pond. Grass cover, trees to the south. Water at 0.55m in hydro vacuum extraction L-shaped pit (accumulated overnight) prior to excavating test pit. Difficult to determine groundwater level due to accumulated water.			

TP109

Depth	Description	Sampling Depth	Photo
0.0-0.15	Topsoil, silt with some organic (rootlets), minor gravel (fine), deep brown. Timber slab at 0.15m.	0.1	
0.15-0.5	Silt with some gravel (fine to medium), minor rootlets, trace clay, brown.		
0.5-1.2	Clayey gravel (fine to coarse gravel), minor cobbles present, mottled grey/orange, moist to wet, low plasticity due to granular content. Concrete slab at 0.7m.	1.0	
1.2	Terminated due to groundwater and side wall collapsing.		

Depth	Description	Sampling Depth	Photo
General observations: South-eastern corner of proposed holding pond. Grass covered, trees south of test pit. Concrete slab at 0.7m (approximately 25cm wide).			

TP110

Depth	Description	Sampling Depth	Photo
0-0.07	Asphalt.		
0.07-0.5	Gravel (fine to coarse) with minor sand, gravel angular to subrounded, light grey.	0.1	
0.5-0.7	Clay with trace sand, trace fine gravel, high plasticity, grey.	0.6	
0.7-1.0	Gravel with minor sand, fine to coarse gravel, dark grey. Groundwater at 0.8m.		
1.0	Terminated due to groundwater.		
General observations: Pipeline north-east of bio-retention basin. Hydro vacuum excavation used after concrete cutting. Couldn't sample below 0.6m due to groundwater and too granular.			

TP111

Depth	Description	Sampling Depth	Photo
0.0-0.07	Asphalt.		
0.07-0.2	Sandy gravel, highly compacted, grey (basecourse).	0.2	
0.2-0.5	Sand with minor silt, grey.		
0.5-1.0	Sandy gravel with trace silt, gravel fine to medium, grey. Broken shell found at this depth. Groundwater at 0.9m.	0.6	
1.0	Terminated due to groundwater.		
General observations: Pipeline south of holding pond. Hydro vacuum excavation used after concrete cutting.			

TP112

Depth	Description	Sampling Depth	Photo
0.0-0.1	Asphalt.		
0.1-0.3	Sandy gravel, cobbles, fine to medium gravel, grey (basecourse).		
0.3-0.65	Sand with some gravel (fine to medium).	0.4	
0.65-1.1	Sand (fine to medium) with trace silt, trace gravel (fine), grey.		
1.1-unknown	Groundwater at 1.1m. Clay with minor sand, minor organic matter (black), organic odour, grey and mottled black colour.	1.2	

Depth	Description	Sampling Depth	Photo
1.5	Terminated due to groundwater and walls collapsing.		
General observations: Pipeline location south of holding pond. Next to generator (west of pit). Hydro vacuum excavation used after concrete cutting.			

TP113

Depth	Description	Sampling Depth	Photo
0-0.06	Asphalt.		
0.06-0.12	Concrete (required breaking out).		
0.12-0.3	Sandy gravel with trace silt, fine to coarse gravel, grey-mottled light brown (basecourse)		
0.3-1.0	Sand with trace silt, fine to medium sand, grey.	0.35, 0.7	
1.0	Terminated due to groundwater.		
General observations: Proposed pipeline location south of holding pond. Suspected clay under groundwater – unable to recover enough material/volume to confirm. Groundwater at 0.95m, moved up to 0.85m within 5 minutes. Hydro vacuum excavation used after concrete cutting.			

TP114

Depth	Description	Sampling Depth	Photo
0.0-0.15	Topsoil, silt with some organic (rootlets), minor sand, brown, moist.	0.1	
0.15-0.3	Sand with minor silt, light brown, moist, sand is fine to medium.		
0.3-0.75	Silty gravel with some sand, gravel is fine to coarse, with minor cobbles, brown/grey, moist. Red clay pipe remnants at 0.5-0.7m. Red brick found at 0.7m.	0.5	
0.75-1.1	Clayey gravel, gravel medium to coarse, some deposits of pure clay, grey/blue. Concrete found at 0.8m. Groundwater at 0.9m, rising fast. Suspected clay beneath.		
1.1	Terminated due to groundwater and partial wall collapse.		
General observations: Pipeline location – close to western site boundary. Grass cover, garden patch with woodchip to the west of pit. Noticeable fill (clay red pipe, red brick, concrete) from 0.5-1.0m – small to medium pieces.			

TP115

Depth	Description	Sampling Depth	Photo
0.0-0.15	Topsoil (silt), silt with some sand (fine), some organic (rootlets), brown, dry to moist. Some broken wood at 0.0-0.15m.	0.1	
0.15-0.4	Sand, fine to medium sand, some silt, light brown, dry to moist.		
0.4-0.7	Silty gravel with some sand, gravel fine to coarse with some cobbles, brown/grey, moist. Red brick found	0.5	

	around 0.6m. White plastic material also at 0.5-0.6m.		
0.7-0.85 (est)	Clay with some organic (red/brown roots), minor silt, dry to moist, medium plasticity. Red/brown mottled and grey, clay very crumbly. Minor black organic areas.		
0.85(est)-1.3	Clay with some organic (black organic matter), dry to moist, black/grey in colour, black sticky, clay semi crumbly. Groundwater seeping in at 1.25m. Strong unidentified odour.		
1.3-1.8	Clay with some organic (large wood/tree roots), grey/blue, high plasticity, moist, gravelly.		
1.8-2.2	Clay (fine to coarse gravel), grey, wet, minor organic.		
2.2	Terminated due to depth and strata reached.		
General observations: Proposed pipeline – approximately 20 m east of TP114. Asbestos roof on sulphur building approximately 100m east of test pit. Grass cover.			

TP116

Depth	Description	Sampling Depth	Photo
0.0-0.15	Topsoil, silt with some sand, minor gravel (fine to medium), brown, moist, some organic (rootlets).	0.1	
0.15-0.4	Silty sand with minor gravel, sand is fine to medium, brown/beige, discoloured soil in places, beige in colour, suspected limestone. Dry, crumbly beige soil. Yellow staining (likely Sulphur) present.		

Depth	Description	Sampling Depth	Photo
0.4-0.9	Gravelly silt with some sand, gravel is fine to coarse, brown/grey. Clay red pipe material at approximately 0.7m. Plastic wrapper at approximately 0.6m. Piece of broken glass and timber at approximately 0.5m.		
0.9-1.45	Sand (fine to medium), brown, moist, hard/solid, trace gravel (fine). Yellow powder noted around sampling area of stockpile. Large concrete slabs at 1.0m and 1.2m (one painted green). Timber/wood at 1m (one medium, one large piece). Plastic black fabric material at west side of pit wall at 1.1m.	1.0	
1.45-2.1	Clay with trace gravel (fine in places), low-medium plasticity (crumbly), dry to moist, grey/blue mottled orange.		
2.1	Terminated due to strata reached.		
General observations: North of proposed settling pond. Sampling ground elevated above natural ground level at roadside. Fill noted from 0.5-1.2m.			

TP117

Depth	Description	Sampling Depth	Photo
0.0-0.2	Topsoil, silt with some organic, minor gravel (fine to medium), minor sand, brown, dry.	0.1	
0.2-0.5	Sand with minor silt, minor fine to medium gravel, brown, moist. Orange deposits at 0.2m (appears natural). Grey lens around 0.3-0.5m which is more gravelly.		

Depth	Description	Sampling Depth	Photo
0.5-1.0	Gravelly sand, gravel is fine to medium with some coarse, brown, moist trace silt. Large concrete slab at 0.5m. Small timber pieces, yellow deposits and black piece of cloth at 0.5m.	1.0	
1.0-1.4	Sand with some gravel, sand is fine to medium, gravel is fine to medium with some coarse. Medium concrete slabs and small orange/brown timber pieces at 1m. Painted white piece of concrete also in this layer.		
1.4-2.2	Clay with minor organic, trace gravel, high plasticity, grey/blue and mottled black.		
2.2-2.4	Clay with some organic and rounded white pieces (possibly coral), grey/blue, mottled orange, high plasticity, moist.		
2.4	Terminated at desired strata.		
General observations: North-west corner of proposed settling pond. Grass cover, ground elevated above natural level. Fill found at approximately 0.5-1.4m. Yellow stained deposits (likely Sulphur) found near surface and at 0.5m.			

TP118

Depth	Description	Sampling Depth	Photo
0.0-0.1	Topsoil silt with some organic, minor sand, minor gravel (fine to medium), brown dry to moist.	0.1 (QA3)	
0.1-0.3	Gravelly silt with some sand, dry to moist. Concrete slab and green plastic material at 0.1m.		

0.4-0.5	Gravelly sand, fine to coarse gravel, possible concrete debris, beige/brown/grey, dry to moist. Yellow deposit at 0.4m.	0.4	
0.5-1.4	Silt with some clay, minor organic, trace sand, brown, hard, low plasticity (crumbly), moist. Small concrete slabs at 0.5m. Small to medium concrete slab at 0.65m. Red brick debris at 1.0m. More small concrete slabs and small timber piece at approximately 0.8m. 1.2-1.3m beige gravelly lens similar to 0.4-0.5m strata.		
1.4-2.0 (est)	Clay with more pure grey/blue clay at top of strata, then clay with sand at approximately 1.8-2.0m, some organic and white material (possibly coral), grey and mottled orange, moist, high plasticity.		
2.0-2.3	Clay with some gravel (fine to coarse), grey, minor sand, high plasticity. Groundwater at 2.1m, infilling reasonably quickly.		
2.3	Terminated due to groundwater and reaching desired strata.		
General observations: North-east corner of proposed settling pond. Grass cover, surface rubbish (plastic bottle) approximately 2m east of test pit.			

TP119

Depth	Description	Sampling Depth	Photo
0.0-0.1	Topsoil, silt with some organic (rootlets), some sand, minor fine to medium gravel, brown, dry to moist.		
0.1-0.2	Silty sand with minor gravel (fine), brown, dry to moist. Small red brick debris at 0.1m. White cement tile at 0.15m. Red/yellow/green/black	0.1	

Depth	Description	Sampling Depth	Photo
	telephone wires at 0.2m. Large yellow powder deposit.		
0.2-0.9	Sandy gravel (fine to medium) with minor silt, grey, dry (crumbly), contains concrete debris, some white stone shaped deposits (possibly limestone). Concrete slabs, concrete debris, timber, rope material, brown organic cloth fabric noted at 0.3m. Small plastic cylinder-shaped object at 0.5m. Plastic fabric sheet at this layer. White gravelly lens at 0.5-0.6m (possibly limestone).	0.5	
0.9-1.35	Sand with minor gravel (fine), brown, moist, minor light grey clay deposits at this layer – clay is crumbly. Black cloth at 1.1m, red brick at 1.3m.		
1.35-1.9 (est)	Clayey sand (fine to medium sand), grey, hard, low plasticity, some organic content (black and white roots), organic content heavy in places, grey and mottled black.		
1.9-2.3	Clay with minor organic, blue/grey, moist to wet, high plasticity.		
2.3	Terminated due to reaching desired strata.		
General observations: South-west corner of proposed settling pond. Grass cover, elevated ground above natural level. Fill found at 0.1-0.9m. Yellow stained deposits (likely Sulphur) present.			

TP120

Depth	Description	Sampling Depth	Photo
0.0-0.15	Topsoil, silt with some organic, some gravel (fine to medium), minor sand, brown, dry to moist. Yellow powder and concrete slab at 0.1m.	0.1	
0.15-0.3	Silty sand with some gravel (fine to medium) – could also be concrete debris, brown, dry to moist. Massive concrete slab at 0.3-0.6m, plastic wrap at one side but appears to be concrete.		
0.3-0.5	Gravelly silt with minor sand, fine to medium gravel, brown, moist. Concrete slab from previous layer continues. Concrete slabs and wood present.		
0.5-0.8	Sand with minor fine to medium gravel, brown, moist. Concrete slabs present.	0.5 (QA2)	
0.8-1.4 (est)	Gravelly clay with some sand, grey/blue with white gravelly areas (possibly concrete debris). Red brick, plastic pipe and timber present. Concrete slab at 1.3m.		
1.4-1.7 (est)	Clayey sand (fine to medium sand), grey, hard, minor organic, trace gravel. Groundwater at 1.7m.		
1.7-1.9	Clayey gravel, fine to coarse gravel, grey, wet.		
1.9	Terminated due to groundwater accumulation.		
General observations: South-east corner of proposed settling pond. Grass cover, elevated ground. Fill from 0.1-1.3m.			

TP121

Depth	Description	Sampling Depth	Photo
0.0-0.2	Topsoil, silt with some organic, minor sand, trace gravel (fine), brown, moist.	0.1	
0.2-0.5	Sandy silt with some gravel (fine to medium), brown, moist. Small concrete slab at approximately 0.2-0.5m, black plastic sheet material and red brick at approximately 0.5m.		
0.5-0.9	Sandy gravel with minor silt, brown/grey, moist.		
0.9-1.2	Gravel with some clay and minor silt, beige, moist. Green gravelly clay lens, with yellow powder - large deposit at 1.0m. Plastic black sheet at 1.0m. Odour noted at this layer, possible from plant next to site. White deposit at this later, possibly limestone or fertiliser – thought more likely to be limestone.	1.0	
1.2-1.4	Sand with some gravel, minor clay, light brown. Light grey gravelly sand patches, potentially limestone. Yellow deposits noted at this lens.		
1.4-1.7 (est)	Clay with minor sand, blue/grey.		
1.7-2.0	Gravelly clay with minor organic, blue/grey, mottled orange in places.		
2.0	Terminated due to reaching clay strata.		
General observations: South of proposed settling pond. Grass cover. Groundwater noted at 1.5m – seeped into test pit but did not accumulate.			

TP122

Depth	Description	Sampling Depth	Photo
0.0-0.2	Topsoil, silt with some organic, minor sand, trace gravel (fine), brown, moist. Concrete at 0.1m.	0.1	
0.2-0.3	Sandy gravel with trace clay, grey, dry to moist. Concrete and red brick at 0.2m. Timber, black plastic bag and black wire at 0.2-0.5m.		
0.3-0.6	Light brown sand lens, fine to medium sand (pure sand). Yellow stained deposits at 0.5m.	0.5	
0.6-0.8	Sandy gravel (fine to coarse), with trace clay, grey, moist.		
0.8-1.2 (est)	Buried yellow stained deposits with white gravelly rock (possibly limestone or fertiliser). Concrete slabs at 1.0-1.1m. White plastic wrapper at 1.0m.		
1.2-1.5 (est)	Gravelly clay with minor silt, brown/dark grey, moist.		
1.5(est) -2.0	Clay with minor sand and trace gravel (fine to medium) in places, grey/blue, moist.		
2.0-2.4	Clay with some organic (black) and large tree branches/roots, blue/grey, mottled black and mottled orange.		
2.4	Terminated at desired strata.		
General observations: North-west corner of proposed wetland. Grass cover, elevated ground level. Excavator driver suspects white layer at 0.8-1.2m is limestone put down manually as a layer under the yellow stained deposits.			

TP123

Depth	Description	Sampling Depth	Photo
0.0-0.1	Silty clay with some organic, minor sand, high plasticity, dry to moist, brown/grey.	0.1	
0.1-0.4	Sandy gravel (fine to coarse gravel), crumbly with white deposits (suspected fertiliser), light grey, minor clay. Silver steel nail/peg at 0.1m. Yellow stained deposits at 0.1m. Fill (large concrete, hard bitumen, small glass fragments, timber, white deposits and red brick) from 0.1-0.5m. Hard to break through with digger, very gravelly.		
0.4-0.5	Sandy gravel with some clay, black.		
0.5-0.65	Gravelly sand with fine to coarse gravel, orange/brown. Piece of fabric at 0.5m		
0.65-0.85	Yellow stained deposit layer.		
0.85-1.0	Light brown clay, moist, low plasticity (crumbly), hard.	0.85	
1.0-1.2	White limestone/fertiliser layer (likely limestone.		
1.2-1.45	Brown/light brown solid clay layer with white rock deposits, hard, gravel/rock in clay.		
1.45-1.75	Black (suspected) bitumen tar, very solid, difficult for digger to penetrate. Suspected bitumen at top of strata. Clay with mottled black under bitumen, grey/blue.		
1.75	Terminated due to refusal.		
General observations: North-east corner of proposed wetland. Bare cover with some silt, clay, gravel and grass patches in sampling area. Noticeable red brick and timber stuck into surface level in surrounding area. Minor Yellow stained deposits (likely Sulphur) on surface.			

TP124

Depth	Description	Sampling Depth	Photo
0.0-0.05	Silt (topsoil) with some organic, minor sand, deep brown and moist.		
0.05-0.4	Sandy silt with minor gravel (fine to coarse), light brown, moist, more sand at 0.3m. White deposits at 0.3-0.5m (concrete and possibly limestone). Rope at 0.4m. Big concrete slab at 0.45m and water underneath – stuck into western pit wall. Water began to seep in at 0.45m. Timber, plastic wrapping and glass at 0.3-0.6m. Agricultural smell, but possibly from the "Bio Rich" plant to the west of site.	0.1	
0.4-0.65	Gravelly silt with some clay and trace/minor sand, gravel fine to medium, brown, moist.	0.5	
0.65-0.85	Yellow stained deposits layer (bright yellow).		
0.85-1.0 (est)	Clay with some sand, minor fine to medium gravel, low plasticity, hard, blue/grey.		
1.0-1.7 (est)	Clay with minor organic, blue/grey with mottled black, high plasticity and soft but also hard and crumbly in places.		
1.7-2.2	Clay with minor organic but softer and higher plasticity than previous layer, moist, grey/blue. Small amount of water seeped into pit at 1.5m, but groundwater accumulation started at 2.1m.		
2.2	Terminated at desired strata.		
General observations: Western side of proposed wetland – approximately 40 m south of TP122. Grass cover. Reinstated poorly, may have some yellow stained deposits (likely Sulphur) towards 2m and clay at higher level.			

TP125

Depth	Description	Sampling Depth	Photo
0.0-0.15	Sandy silt with some organic and some gravel, brown/grey. Red brick and suspected fertiliser at 0.1m.	0.1	
0.15-0.25	Sand, dry to moist, light brown lens. Large yellow stained deposit in centre of pit at 0.25m.		
0.25-0.4	Yellow stained deposits layer.		
0.5-0.7	Clayey silt with major organic materials (not naturally occurring), organic material is rotted/wet timber/wood, large tree branches. Organic material causing soil colour to be black/deep brown/dark red.		
0.7-1.0	Clay with some gravel (fine to coarse), grey/blue, moist to wet. Large fertiliser bag at 0.8m. Plastic wrapping at approximately 0.8m, unable to lift out with digger but fertiliser bag noted above removed. Groundwater entering at 1.0m. Groundwater has an oily sheen. Diesel/methane odour at 0.7m. Plastic red pipe and black wire rods at 0.7-0.8m. Wrappings from 0.8 to 1.0m, possibly present below extent of digging. Groundwater fast-rising.	0.8	
1.0	Terminated due to groundwater and to avoid disturbing thick wrapping.		
General observations: Eastern side of proposed wetland – approximately 40 m south of TP123. Bare cover with grass patches.			

TP126

Depth	Description	Sampling Depth	Photo
0.0-0.05	Topsoil, silt with some organic, trace sand, dry to moist, deep brown.		
0.05-0.35	Sandy silt with some gravel (fine to coarse), light brown, dry, crumbly. Some organic towards the top of strata (0.05-0.15m). Red brick at 0.1m, organic fabric and plastic wrapper at 0.2m, metal rod at approximately 0.3m.	0.1	
0.35-0.5	Silty sand with some clay, moist to wet, brown/grey. Organic fabric material at approximately 0.3-0.6m.		
0.5-0.7	Sandy clay with minor silt and minor fine to medium gravel. Grey, wet, high plasticity when wet. Organic fabric at approximately 0.3-0.6m.		
0.7-0.9	Sand (fine to coarse) with trace silt, light brown.		
0.9-1.1	Bright yellow powder layer. Black rubber pipes, metal cylinders, long thin metal sheets from approximately 0.8-1.2m. Large rubber pipes causing difficulties for digger.		
1.1-1.2 (est)	Clayey tar layer, black. Suspected bitumen.		
1.2-1.5	Sand, fine to coarse, moist to wet, black in colour. Red clay pipe remnants at approximately 1.2-1.5m. Groundwater at 1.5m. Wet sample taken at 1.5m but metal sheets and pipes causing difficulties for digger to retrieve material. Metal sheet, pipes and wood/timber at 1.5m.	1.5	

1.6	Terminated due to refusal and groundwater accumulation.		
General observations: South-west corner of proposed wetland. Grass cover/dried out grass areas.			

TP127

Depth	Description	Sampling Depth	Photo
0.0-0.05	Silt with some organic, some sand, minor fine gravel, deep brown and moist.		
0.05-0.45	Gravelly sand with minor/trace clay. Gravel is fine to coarse. White deposits (possibly fertiliser), moist and beige/white. Large white rock (possibly fertiliser) at 0.1-0.3m, white with rock deposits. Yellow deposit at 0.1-0.3m.	0.1	
0.45-0.55	Gravelly sand with fine to coarse gravel, moist to wet, brown. Concrete at this layer. Black metal wire 0.5-0.6m.	0.5 (QA4)	
0.55-0.6	Sand lens, light brown. Rotten egg odour, possibly from pit at this depth.		
0.6-0.85	Clayey sand with minor gravel (fine to medium), low plasticity, brown with some pure clay deposits (grey and hard). More concrete, black piece of tar (possibly bitumen) and plastic cylinder object at this layer.		
0.85-1.3	Sand (fine to coarse) with minor fine to coarse gravel, dark brown/black/grey, moist. Organic matter (black timber/wood, tree branches) noted here. Red brick pieces at approximately 1m. Plastic wrapping in north and east pit walls at 1.1m.		
1.3-1.7 (est)	Clay with some sand, grey/blue, low plasticity.		

Depth	Description	Sampling Depth	Photo
1.7(est)-2.1	Clay with trace sand, grey/blue mottled black. Groundwater at 2.0m.		
2.1	Terminated due to reaching desired strata.		
General observations: South-east corner of proposed wetland. Grass cover with some bare areas. Slightly less elevated than previous sampling areas. A stream runs parallel to southern sampling area to the east.			

TP128

Depth	Description	Sampling Depth	Photo
0.0-0.05	Topsoil, silt with some organic, trace sand, deep brown, dry to moist.		
0.05-0.2	Gravelly sand, fine to medium gravel, light brown to beige/light grey, gravel causing colour.	0.1	
0.2-0.5	Sand (fine to coarse), light brown, moist. Small concrete and yellow powder at 0.3m.		
0.5-0.6	Bright yellow powder with a lot of thick concrete. Red brick and concrete. Difficult for digger to break through thick concrete layer. Water seeping in briefly at 0.5m but not accumulating.		
0.6-1.0	Gravelly sand with a lot of concrete and red brick. Colour is light brown/grey, likely due to amount of fill present. Noticeable water seeping in at 0.75m. Thickest layer of fill noted across all test pits. A lot of broken concrete at 0.7m.		

Depth	Description	Sampling Depth	Photo
1.0-1.3 (est)	Clayey sand with some gravel (fine to medium). Towards top of strata one large section of black organic roots. Also noted black clayey deposit (suspected bitumen). Colour grey with section of mottled black and mottled orange. Hard and crumbly, low plasticity. Organic brown cloth fabric at approximately 1.2m.		
1.3-1.5	Gravelly sand, fine to coarse gravel, moist to wet, brown/red tinge to colour, low plasticity. Some organic fabric noted around sampling area.		
1.5-1.6	Unsure of layer composition, light grey/white, hard crumbly dry sand with some gravel. Also white deposits and sheen (likely due to sand particles). Unable to sample due to lack of clean material.		
1.6-2.4	Clay, soft, blue/grey in colour, mottled orange, some red wood present. Small volume of water accumulating slightly at 2.2m. Some areas of strata have minor fine gravel and minor sand making clay crumbly. Moist. Sample at 2.2m soft, high plasticity, blue/grey clay with minor organic.	2.2	
2.4	Terminated due to reaching desired strata.		
General observations: South of proposed wetland. Grass cover with some dried grass areas. Slightly less elevated than previous test pits but still above natural ground level. Difficulties for excavator to get through concrete.			

B

Appendix B – Safe Work Method Statement

Safe Works Method Statement

Contaminated Land Detailed Site Investigation - Stormwater and Process Water Management Project

Prepared for Ravensdown Limited
Prepared by Beca Limited

13 September 2021

Revision History

Revision Nº	Prepared By	Description	Date
1	Nikki Mather	Draft	13/09/21

Document Acceptance

Action	Name	Signed	Date
Prepared by	Nikki Mather		10/09/21
Reviewed by	Vicky Kennaugh		10/09/21
Approved by	Emma Lewis		13/09/21
on behalf of	Beca Limited		

Contents

Appendices

1 Introduction

This Safe Work Method Statement (SWMS) has been prepared solely to focus on managing the potential soil contamination risk associated with contaminated land investigations (including hydro vacuum excavation, test pitting and soil sampling) into potentially contaminated sub-surface materials at the Ravensdown site located at 90 Waitangi Road, Awatoto, Napier. The investigation works are being undertaken as part of the proposed Detailed Site Investigation (DSI) associated with the stormwater and process plant management project at Ravensdown Napier Works.

As per the draft Project Description provided by the Client[1], it is understood that the proposed development shall include a bio-retention basin, a holding pond, a settling pond, a wetland area, and a discharge to land area (herein referred to as the 'Areas of Focus').

This SWMS has been prepared by Beca Limited (Beca) for Ravensdown Limited to provide appropriate controls for the works proposed to be carried out by:

- Beca Limited (Beca) Environmental staff
- Appointed Underground Service Clearance Surveyor
- Appointed Concrete Cutter Contractor
- Appointed hydro vacuum excavator
- Appointed Excavator Contractor

All third-party contractors remain responsible for assessing and managing all of their own health and safety obligations onsite including for asbestos. It is intended that this document is provided to these contractors to assist them with hazard identification and establishing the minimum level of mitigation measures required.

1.1 Background and Contamination Status

A Preliminary Site Investigation (PSI) was completed by Beca on 6 August 2021, which identified a number of activities listed on the Ministry for the Environment (MfE) Hazardous Activities and Industries List (HAIL) as having been undertaken within the vicinity or at these Areas of Focus (see Figure 1). These activities included:

- HAIL A6 - fertiliser manufacture or bulk storage.
  - On or in the vicinity of the settling Pond and Wetland
  - On or in the vicinity of the Proposed Pipelines south of the Holding Pond
  - Adjacent to the Bioretention Basin, Clarified Water to Main Drain and Holding Pond
- HAIL B2 - electrical transformers.
  - On or in the vicinity of proposed pipelines south of the Holding Pond
  - Adjacent to the Bioretention Basin
- HAIL G5 - waste disposal to land.
  - On or in the vicinity of the Settling Pond and Wetland (former stockpiling activities as well as potential buried wrapped asbestos).
  - Adjacent or in the vicinity to the proposed pipelines south of the Holding Pond (suspected buried demolition waste and nearby former settling pond)
- HAIL E1 – asbestos products known to be in a deteriorated condition.
  - On or in the vicinity of the Settling Pond and Wetland (potential buried wrapped asbestos).

[1] Memorandum, Ravensdown – Draft Project Description, Stormwater and Process Water Management prepared by Aurecon dated 27 August 2021 (ref.: 509619).

- Adjacent or in the vicinity of the proposed pipelines south of the Holding Pond
- Nearby to the Bioretention Basin, Clarified Water to Main Drain and Holding Pond

Figure 1: Areas of Focus (outlined in red) in Relation to Identified HAILs (image source: NearMap)

From the findings of the PSI, the risk of encountering contamination (including asbestos containing material (ACM)) is considered to be 'suspected'. Therefore, until such time that a targeted contaminated land investigation has been undertaken, the exposure risks cannot be excluded. As such, this SWMS is intended to provide controls and management considered appropriate at this time.

1.2 Proposed Investigation

The proposed investigation comprises soil sampling at 28 locations across the Areas of Focus, as shown in Figure 2, to inform the presence of contamination.

Figure 2: Indicative Sample Location Plan (Image Source: NearMap)

The investigation will comprise:

- Service clearance survey.
- Completion of up to 28 test pits to recover samples up to a maximum depth of 3.5 m bgl across the Areas of Focus.
- Soil sampling and logging.

If test pitting is not possible at a proposed sample location (e.g. due to uncertainty of service locations and/or due to the presence of hardstanding):

- Following undertaking a service clearance survey, a third-party contractor shall undertake surface cover breakout (if required) to allow access for hydro vacuum extraction.
- Hydro vacuum excavation to 2m.
- A hand auger shall then be used to recover samples up to a maximum depth of 2 m bgl at these locations.

2 Approach to SWMS Preparation

2.1 SWMS Approach

The purpose of this SWMS is to provide appropriate management controls and procedures to mitigate the exposure pathway between potentially contaminated material and staff involved in the intrusive contaminated land investigation, and surrounding site users.

Factors considered in developing the SWMS include:

- Occupational measures to be implemented for the safety of personnel on-site during the site investigation work only.
- Non-occupational measures to be implemented for the safety of the surrounding site users.
- Sampling, handling, and disposal processes.
- Procedures to ensure no residual contaminated material has been left on the surface.
- Procedures to ensure no uncontrolled release of spoil that can spread contamination.

This SWMS was produced under the guidance of a Suitably Qualified and Experience Person (SQEP). For the purpose of this investigation the SQEP will be Emma Lewis (Beca - Senior Associate Environments). Vicky Kennaugh (Beca – Senior Environmental Scientist) and Anne Bennett (Environmental Scientist) will be the on-site contaminated land specialists.

This SWMS was developed using the following regulations and guidelines:

- Health and Safety at Work (Asbestos) Regulations, 2016
- The New Zealand Guidelines for Assessing and Managing Asbestos in Soil, 2017
- Approved Code of Practice: Management and Removal of Asbestos, 2016
- Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations, revised 2021

2.2 SWMS Applicability

This SWMS is applicable to the proposed contaminated land investigations only.

Groundwater management procedures are excluded from this SWMS.

This SWMS has been prepared for the health and safety of staff involved on-site with respect to contaminated land and does not consider any potential environmental impacts or discharges.

This SWMS does not consider other health and safety considerations that will need to be addressed prior to undertaking the works (see **Section 3** for clarification of roles and responsibilities).

3 Roles and Responsibilities

This SWMS has been prepared to undertake work at Ravensdown Napier to provide the appointed contractors (underground services locator, concrete cutter, hydro vacuum excavator and excavator operator) and Beca staff with appropriate management procedures to undertake intrusive investigations safely in relation to the potentially contaminated subsurface material located at the project areas on-site.

Each Person Conducting a Business or Undertaking (PCBU) (i.e. Ravensdown, Beca, the appointed underground services locator, concrete cutter, hydro vacuum excavator and excavator operator) have specific duties and where those duties overlap (as in this scenario), each PCBU must consult, cooperate, and coordinate our activities to meet our respective health and safety responsibilities to our workers and others that could be affected. Table 1 below outlines roles and responsibilities with respect to the implementation of this SWMS.

It should be noted that in addition to the below, there are requirements from each PCBU outside of the scope of this SWMS that will need to be addressed for the works, including, but not limited to:

- Beca, the appointed underground services locator, concrete cutter, hydro vacuum excavator and excavator operator internal health and safety documentation, such as Job Safety Analysis that cover the entirety of the work (i.e. out of office/site work, fatigue, safe driving, working around moving machinery etc.) and COVID-19 requirements.
- Any site induction requirements and permit to dig.
- Personal Protective Equipment (PPE) not specific to contaminated land required for the site investigation.

Table 1: Roles and responsibilities for the implementation of this SWMS

PCBU	Involvement in Works	Responsibilities
Ravensdown Limited	Client / Lead PCBU	• Monitoring compliance with SWMS • Facilitate site inductions. • Openly communicating and collaborating with all other PCBUs involved, particularly where they are best placed to manage risks.
The appointed underground services locator, concrete cutter, hydro vacuum excavator and excavator operator	Underground services survey, concrete cutting, hydro excavations and test pitting	• Comply with controls and procedures outlined in the SWMS. • Openly communicating and collaborating with all other PCBUs involved, particularly where they are best placed to manage risks.
Beca	Consultant undertaking investigation on site (i.e. observations, logging of soil, hand augering if needed etc).	• Comply with controls and procedures outlined in the SWMS. • Providing contaminated land specific information as appropriate and required (i.e. Suitably Qualified and Experienced Practitioner (SQEP) to be first point of contact if unexpected conditions are encountered during the works). • Openly communicating and collaborating with all other PCBUs involved, particularly where they are best placed to manage risks.

4 Hazard Identification

4.1 Contaminants of Concern

Contaminants of Concern (CoC) identified include:

- Heavy metals including arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc
- Asbestos
- Hydrocarbons
- Polychlorinated biphenyls (PCBs)
- Fluoride

The contamination status is not yet fully understood. However, based on the available information reviewed, we identified the potential contaminations of concern as set out in **Table 2** to be considered during the investigation.

Table 2: Summary of Potential Contamination

Site Area	Activity	Potential Contaminants of Concern
Bioretention Basin, Clarified Water to Main Drain and Holding Pond	• Adjacent transformer (HAIL B2) • Adjacent fertiliser manufacture operations and associated activities (HAIL A6) • Nearby known or suspected asbestos (past or present, potential HAIL E1)	• Heavy metals • Total petroleum hydrocarbons (TPH) • Polycyclic Aromatic Hydrocarbons (PAH) • Polychlorinated biphenyls (PCBs) • Fluoride • Asbestos
Pipelines South of the Holding Pond	• Transformer (HAIL B2) • Fertiliser manufacture operations and associated activities (HAIL A6) • Adjacent known or suspected asbestos (past or present, potential HAIL E1) • Adjacent suspected buried demolition waste (potential for HAIL G5) • Nearby former settling pond (assumed infilled, potential HAIL G5)	• Heavy metals • Total petroleum hydrocarbons (TPH) • Polycyclic Aromatic Hydrocarbons (PAH) • Polychlorinated biphenyls (PCBs) • Fluoride • Asbestos
Settling Pond and Wetland	• Former stockpiling of phosphate rock (HAIL A6) • Former stockpiling activities as well as potential buried wrapped asbestos (potential for HAIL G5/E1)	• Heavy metals • Total petroleum hydrocarbons (TPH) • Polycyclic Aromatic Hydrocarbons (PAH) • Fluoride • Asbestos

4.2 Hazard Exposure Pathway

The Conceptual Site Model (CSM) (**Table 3**) was developed to describe the relationship between sources of potential contamination on site, the human and environmental receptors that may be exposed to those contaminants in the context of the site investigation, and the pathways by which those receptors may be exposed.

Table 3. Conceptual Site Model

Source	Receptor	Pathway	Pathway Complete?
• Heavy metals • Asbestos • Hydrocarbons • PCBs • Fluoride	Persons undertaking the site investigation	Exposure of workers to contaminants in soils and groundwater during site investigation – dermal contact, ingestion or inhalation of dust/vapours.	**Potentially Complete Pathway** – In the event where contaminants of concern are present at significant concentrations in the areas where works are proposed to be undertaken, the exposure pathway will have to be managed via implementation of the controls set out in this document
	Other site users	Exposure of other site users to contaminants in soils during site investigation – dermal contact, ingestion or inhalation of dust/vapours.	**Potentially Complete Pathway** – Access to the investigation areas will be managed via implementation of the controls in this document. Significant dust generation is unlikely based on the proposed investigation methods.
	General public	Exposure of general public to contaminants in soils– dermal contact, ingestion or inhalation of dust/vapours.	**Potentially Complete Pathway – General public have limited access and will be excluded from the investigation areas via implementation of the controls in this document. Significant dust generation is unlikely based on the proposed investigation methods and likely ground conditions.

4.3 Risk Rating Matrix

The CSM shows that personnel directly involved with the investigations could be at risk during investigation activities at this Site. A Risk Assessment (**Table 4**) has been prepared to assess this risk and appropriate controls to put in place. The risk assessment definitions and matrix are included in **Appendix A**.

4.4 Hazard Management Requirements

Based on the Risk Assessment (**Table 4**) for the works to be undertaken during investigations at the Site, the greatest risk to human health receptors is to personnel working on the site via airborne asbestos fibres. Elimination or substitution for these activities is not possible for this nature of work, so appropriate procedures and protocols will be required to minimise the risk. Appropriate management controls have been outlined in **Section 5**.

Table 4. Risk Assessment for Site Works during the Investigation

Activity	Potential Human Hazard Exposure Scenario	Pre-Control Risk	Control Measures	Residual Risk
Disturbance of soil potentially containing: • Asbestos • Heavy Metals • Hydrocarbons • PCBs • Fluoride	Inhalation of airborne asbestos fibres, or dermal contact / ingestion of other soil contaminants by: • Beca Environmental Scientists. • Subcontractors engaged for the purpose of this investigation. • Other site users.	High	• Use of exclusion zones. • Use of appropriate Personal Protective Equipment (PPE) and Respiratory Protective Equipment (RPE). • Dust suppression as required.	Moderate

5 Management of Contaminated Soil including Asbestos

The following management procedures are recommended to be adhered to when disturbing soil during the proposed investigation. The procedures should also be in place during the concrete cutting activities.

5.1 Tool-Box Talks

The beginning of each day shall start with a toolbox talk in which the day's activities will be discussed, and the health and safety requirements of the works area are checked. Relevant sections of this document shall be reviewed to ensure all appropriate controls are in place and responsible parties are aware of their roles prior to works commencing.

Personnel involved in the investigation should have an appropriate level of awareness and competence with regards to asbestos. This may be gained through attendance to an asbestos awareness training session or similar. If personnel change during the day or between days of work, an additional toolbox talk is required at that time to bring all personnel on site up to speed with the current hazards and management procedures in place.

All PCBUs on site shall participate in and facilitate the toolbox talk to effectively collaborate and co-operate with respect to fulfilling their health and safety obligations.

5.2 Site Access and Setup

Prior to works commencing, Ravensdown Limited will communicate with the wider site users to inform that investigations will be undertaken within the relevant areas of the site.

Prior to works commencing, all contractors shall ensure that measures are in place to aid in the management aspects of site safety and environmental compliance where exposure risks are considered possible. These may include:

- Signage, including works information and health and safety requirements; and
- Cones or barriers, where required, to exclude entry by the personnel not involved in the investigation works.

5.3 Exclusion Zones

Whilst the investigation works are being undertaken, signs and barriers must be erected around the area of works to warn of the danger and to prevent unauthorised entry. An exclusion zone should be set up with safety tape or construction fencing, and signage placed a minimum of 5 metres from the works area where practicable. All barriers and warning signs shall remain in place until the investigation is completed. In the event that anyone not involved in the works approach this area, the works should be stopped.

5.4 General Soil Excavation / Disturbance Procedures

The majority of the excavation works will occur via test pitting however in some areas, hydro excavation and sample recovery via hand auger will be required due to the presence of underground services and / or site constraints preventing large excavations. Prior to any excavation:

- Service clearance survey should be undertaken at each location.
- Access to the area must be restricted.
- The surface cover (concrete/ asphalt) will be cut by the contractor (if required).

5.4.1 Hydro Excavation and Hand Augering

- Selected sample locations will be advanced via hydro-excavation.
- At required depths (as specified by the Environmental Scientist) the hydro-excavation will cease and a representative sample recovered by hand from the sides of the hole (up to 0.5 m bgl) or using a hand auger from the base of the hole (at greater depths).
- Hydro-excavation will then continue to the next required sample depth.
- Hydro-excavation holes will be suitably backfilled.

5.4.2 Test Pitting

- Material will be excavated in gradual layers and placed adjacent to the pit. If the excavated material is dry, it may be necessary to wet it down with water (by sprinkler, spray canister, or the like). Avoid excessive watering as this will result in run-off which will need to be contained.
- At the completion of works, all excavated material must be placed back in the excavation. The excavations should be undertaken in stages and in-filling of the excavation should be completed in reverse, i.e., the material from the bottom of the excavation should be returned to the bottom of the excavation.
- If any of the material cannot be returned to the excavation (for example, if there is no room), it will be left in a designated space on site (to be confirmed by Ravensdown) or disposed of as asbestos containing waste as outlined below.
- Compaction of the reinstated materials shall occur in lifts of a maximum 300mm or as otherwise directed by the Beca onsite representative. Compaction shall be done using the excavator bucket.

5.5 Air Monitoring

According to the New Zealand Guidelines for Assessing and Managing Asbestos in Soil (2017) air monitoring is not required for investigation works unless there is reason to believe that the investigation works will cause the trace level of airborne asbestos fibres (defined by WorkSafe as 0.01 fibres/mL of air in taken) to be exceeded.

Based on the limited size of excavations and the proposed use of general dust suppression practices, it is unlikely that airborne asbestos fibres above trace level will be generated. Further the setting up exclusion zones and the wearing of appropriate PPE/ RPE as outlined below when undertaking the works will also minimise the risk of airborne fibres to personnel inside and outside of the exclusion zone. Air monitoring during soil disturbance is not required.

Should there be an unexpected discovery of large quantities of ACMs and/or friable asbestos, works should stop, and the SQEP contacted regarding the requirements for air monitoring.

5.6 Dust Control Procedures

Dust mitigations procedures and good on-site housekeeping and mitigation measures during the investigation should include:

- Limiting access to the working area to essential vehicles and personnel only.
- It is recommended that a water source is identified and available to use should dust be generated when the excavator tracks over the hardstand. Excessive wetting causing run-off or ponding of water should be avoided.
- Minimise the time soil is exposed by backfilling or cover exposed soil.
- Localised wetting of soils.
- The Contractor should at all times control any dust from the site in accordance with the Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions, MfE (2001).

5.7 Personal Control Measures

Personal protective equipment (PPE) and Respiratory Protective Equipment (RPE) is to be organised and provided by each PCBU individually for their own staff. PPE and RPE for the investigation shall include but not be limited to the following, based on an assessment of the level of risk of exposure to asbestos fibres:

- Safety boots and boot covers.
- Disposable coveralls (Type 5).
- Protective gloves (i.e. Nitrile) for any personnel handling soil.
- Safety glasses.
- Minimum of a disposable P2 mask.

For personnel that may come in contact with potentially contaminated soil (asbestos, metals, PCBs, and hydrocarbons etc), the following procedures should be adhered to:

- Wash hands regularly throughout the investigation and especially prior to eating, drinking, or smoking
- If personnel handling the soil is required, this should be done while wearing nitrile gloves
- No eating, drinking, or smoking within the investigation area
- The investigation area is to be kept tidy (i.e. excess spoil maintained) as to not unnecessarily expose staff in the area to potentially contaminated soil.

5.8 Water and Saturated Soil Control Procedures

The investigation should not be undertaken in heavy rain to prevent surface water runoff.

5.9 Excess Spoil and Asbestos Containing Waste

Apart from the material to be removed by the hydro vacuum excavator, it is not expected that there will be any waste soil generated as part of the works. Waste materials such as used PPE/consumables and excess spoil are to be the responsibility of the respective contractors/owners.

In the event that excess soil is generated, it will have to be disposed appropriately (likely as managed or contaminated fill) to a facility licensed to accept such material.

Material that may require disposal includes, but is not limited to:

- Excess spoil generated observed to contain construction or landfill related waste
- Used PPE/RPE and other disposable equipment
- Plastic sheeting used during the investigation

Waste generated throughout this investigation should be treated as asbestos containing waste and be placed in (and double bagged in) specific asbestos waste bags (i.e. 200µm thick plastic). These bags must be gooseneck tied and sealed with PVC tape prior to transporting waste to the disposal location.

Prior to the investigation commencing, it is recommended that discussions are undertaken around what facility will accept waste materials for off-site disposal (landfills or other approved locations).

5.10 Decontamination

Decontaminating the work area, workers, PPE, and tools used in asbestos related work is vital to eliminate or minimise exposure to airborne asbestos fibres.

5.10.1 Personal Decontamination and Hygiene

Prior to work commencing, a decontamination area will be identified up-wind of the investigation area (to be undertaken by the Beca staff). Items available in this area should include but not be limited to:

- Labelled asbestos waste bags (200 µm)
- Water spray bottle
- Baby wipes
- Alcohol wipes
- Spare masks and/or respirators, suits, booties, and gloves

All involved parties that will carry out the works, must put on appropriate PPE and RPE in the decontamination area. The Beca Environmental Scientist will support all relevant parties in undertaking this action.

Once the asbestos related site work is complete, workers must return to the decontamination area.

Before stepping into the decontamination area, workers must spray water over coveralls (where used), head, face, hands, and feet to adhere any loose asbestos fibres to the PPE. Workers must then wipe any exposed areas of skin and the externals of the mask down with baby wipes (around eyes and hands).

Workers must then put used baby wipes into the labelled asbestos waste bag available.

To remove coveralls, fold back the hood onto itself, and continue this rolling method from top to bottom, until the suit has been rolled inside of itself. Sleeves should be pulled inside out and rolled into the body of the suit. The aim of this is to contain the surface of the suit, that may have asbestos fibres attached, inside itself and avoid transference to other surfaces. Wrap gloves into the folds of the suit and flip the booties inside out (these must be rolled into the suit as well). Place the rolled bundle into the labelled asbestos waste bag.

Wipe down hands, face, and all surfaces and edges of RPE with baby wipes a second time before turning upwind and removing RPE. If a disposable respirator was used, workers must place this in the asbestos waste bag. If a re-usable respirator was used, wipe down the inside with alcohol wipes to prevent mould, and place in its designated carry case.

Once all asbestos containing waste is placed in the bag, it should be goose neck tied closed for transport. If the asbestos waste bag is full and ready for disposal it should be double bagged in 200 µm plastic, each bag individually goose-necked and sealed with PVC tape. This bag should be placed in the designated asbestos storage area for disposal at an appropriate waste facility.

5.10.2 Decontamination of Equipment

All tools and equipment should be decontaminated by wiping down with wet wipes. Any tools or equipment that cannot be decontaminated must be placed in a sealed and labelled container or 200 µm thick plastic bag.

5.10.3 Decontamination of Vehicles and Machinery

For vehicles and machinery used during the investigation, a thorough visual inspection would be undertaken and controlled removal of visible debris and soil should take place. Attention should be taken to the tracks and buckets of excavators.

If large volumes of visible ACM are encountered, surface tests to identify possible asbestos fibres on machinery and vehicles are recommended to accompany the visual inspection. Surface tests should be analysed by an IANZ accredited laboratory.

5.11 Unexpected Contamination Discovery

The procedures outlined below provide the staff undertaking the intrusive investigation with protocols to identify potential contamination if suspected contaminated soils or hazardous materials (other than the hazards identified in this SWMS) are discovered during the works.

These protocols will enable the appropriate action to avoid exposure of contaminants to site workers or the dispersion of contaminants into the surrounding environment.

Contamination indicators or hazardous materials may include but are not limited to the following:

- Suspected Asbestos Containing Material (ACM)
- Unusual odours
- Discoloured or stained water seeps and soils
- Petroleum hydrocarbon contaminated soil and/or free product
- Liquid waste, putrescible waste, household refuse, and any material that normally would be sent to a licensed landfill
- Intact or broken drums and containers.

During the investigation, the staff undertaking the investigation shall actively monitor for the conditions/materials specified above. In the event that one of these is identified, the staff should take the following actions:

- Stop all investigation works within a 5 m radius of the area where the suspected material/emission/discharge has been recorded
- Immediately notify the SQEP who will provide advice on next steps and whether works may resume.
- Cordon off the area as practicable with a suitable barrier.

If large quantities of suspected ACM and / or friable asbestos is identified, the following should occur:

- Stop work
- Restrict all access to the area
- Erect signage at every entry to the suspected contamination area. Signage needs to indicate potential presence of ACM contamination and that access is restricted to personnel wearing appropriate RPE and PPE
- Notify management team and SQEP as soon as practically possible
- Management controls to minimise asbestos fibre release:
  - Dust suppression
  - Cover damaged/identified material with polythene
- Establish course of action with guidance of SQEP for reoccupation
- Any removal is to be performed by appropriately licenced asbestos removal company
- Reoccupation authorised by an appropriately experienced person (SQEP/ competent person/ Asbestos Assessor) following suitable inspection and clearance testing procedures
- Records of any contamination, testing, and removal to be kept and asbestos register updated where necessary.

6 Limitations

This report has been prepared by Beca Ltd solely for Ravensdown Limited. Beca has been requested by the Client to provide a Safe Work Method Statement for contaminated land investigations as part of the DSI at Ravensdown, Napier. This report is prepared solely for the use of Beca Limited and subcontractors for the purpose of managing the risks associated with contaminated soil investigations at the Site as shown in Figure 1. The contents of this report may not be used by Ravensdown Limited for any purpose other than in accordance with the stated Scope.

This report is confidential and is prepared solely for the Client. Beca accepts no liability to any other person for their use of or reliance on this report, and any such use or reliance will be solely at their own risk. Unless specifically stated otherwise in this report, Beca has relied on the accuracy, completeness, currency and sufficiency of all information provided to it by, or on behalf of, the Client or any third party, including the information listed above, and has not independently verified the information provided. Beca accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the information provided. Publicly available records are often inaccurate or incomplete.

The contents of this report are based upon our understanding and interpretation of current legislation and guidelines as consulting professionals, and should not be construed as legal opinions or advice. Unless special arrangements are made, this report will not be updated to take account of subsequent changes to any such Standards.

This report should be read in full, having regard to all stated assumptions, limitations, and disclaimers.

A

Appendix A – Risk Matrix

Table A1 - Risk Rating Matrix

Probability (Likelihood)	Consequence				
	1 Low	2 Minor	3 Moderate	4 Major	5 Critical
1 Rare	Low	Low	Moderate	Moderate	High
2 Unlikely	Low	Low	Moderate	High	High
3 Possible	Low	Moderate	High	High	Extreme
4 Likely	Moderate	Moderate	High	Extreme	Extreme
5 Almost Certain	Moderate	High	High	Extreme	Extreme

Rare	Less than once per 10 years
Unlikely	Once per 6 - 10 years.
Possible	Once per 2 - 6 years.
Likely	Once per 1 - 2 years.
Almost Certain	Greater than once a year

Table A2- Explanation of Risk Rating Scores

Consequence	Health and Safety	Environmental	Reputation
Low	Recoverable injuries or illnesses with no treatment.	Incident resulting in no or insignificant environmental impact and no action from regulator.	No media coverage. Issues managed directly with individual stakeholder and client with minimal impact on Beca brand.
Minor	Recoverable injuries or illness manageable with in-situ first aid treatment or requiring non-prescriptive or diagnostic medical treatment. No absence from work beyond time taken for treatment.	Incident resulting in possible short-term irreversible damage taking up to 1 week to restore. Regional concern. Verbal warning from regulator.	Adverse local media coverage. Dissatisfaction to community groups, lobby group, local stakeholders and clients. Damage to Beca brand up to 1 month.
Moderate	Recoverable injuries or illness requiring professional medical treatment and/or temporary absence from normal work activity (alternative duties Incident).	Incident resulting in environmental impact taking between 1 week and 1 month to restore. Regional concern. Regulator enforcement action (minor fine).	Adverse regional media coverage. Significant dissatisfaction to key regional stakeholders and clients. Damage to Beca brand between 1 and 3 months.
Major	Recoverable injuries resulting in admittance to hospital for treatment as an in-patient for more than 24 hours or Lost Time. Non-permanent impact on health.	Incident resulting in an environmental impact taking up to 1 to 6 months to restore. National concern. Regulator enforcement action (clean up notice/injunction).	Adverse national media coverage. Significant dissatisfaction to key stakeholders and clients. Damage to Beca brand up to 3 months.
Critical	Single fatality or injury leading to permanent disability or impact on health.	Incident resulting in an environmental impact taking >6 months to restore. International concern. Environmental prosecution.	Adverse international media coverage. Significant and irrevocable damage to Beca brand and relationship with key stakeholders and clients.

www.beca.com

www.beca.com

www.beca.com

No.	Revision	By	Chk	Appd	Date

Drawing Originator: Beca

Original Scale (A1)

Reduced Scale (A3)

Design			
Drawn			
Dsg Verifier			
Dwg Check			

* Refer to Revision 1 for Original Signature

Client: Ravensdown Limited

Project: Detailed Site Investigation – Stormwater and Process Water Treatment Upgrades Project

Title: Sample Location Plan

Discipline

Drawing No.

Rev.

BLUEBEAM

DO NOT SCALE

IF IN DOUBT ASK.

C

Appendix C – Hills Laboratory Certificates

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2708251 SPv2
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	18-Sep-2021
		Date Reported:	27-Sep-2021
		Quote No:	113742
		Order No:	21:136
		Client Reference:	4210205/002/DA
		Submitted By:	Nikki Mather

Sample Type: Soil

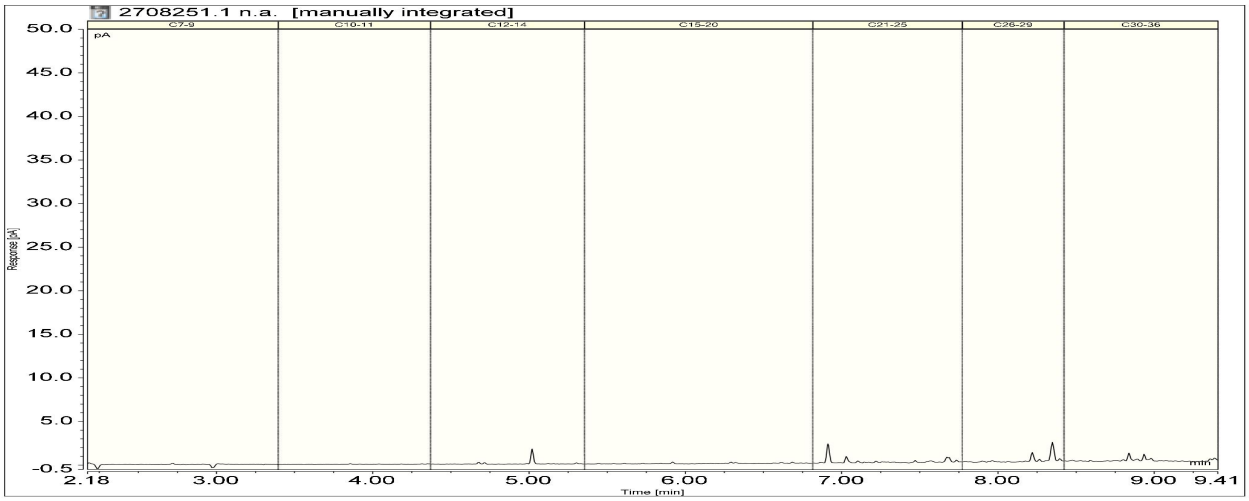
Sample Name:		TP110_0.1 17-Sep-2021	TP110_0.6 17-Sep-2021	TP111_0.2 17-Sep-2021	TP111_0.6 17-Sep-2021	TP113_0.35 17-Sep-2021
Lab Number:		2708251.1	2708251.2	2708251.3	2708251.4	2708251.5
Individual Tests						
Dry Matter	g/100g as rcvd	93	76	81	94	83
pH*	pH Units	7.0	7.5	8.6	8.8	8.2
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	6	3	2	4
Total Recoverable Cadmium	mg/kg dry wt	1.16	16.8	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	15	121	12	9	12
Total Recoverable Copper	mg/kg dry wt	9	51	6	4	6
Total Recoverable Lead	mg/kg dry wt	15.8	32	8.9	7.7	7.9
Total Recoverable Mercury	mg/kg dry wt	< 0.10	0.12	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	14	190	10	7	10
Total Recoverable Zinc	mg/kg dry wt	154	340	41	34	41
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	9.3	0.3	1.1	0.4	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.014	0.013	< 0.011	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.014	0.014	< 0.011	< 0.013
Acenaphthylene	mg/kg dry wt	0.042	< 0.014	< 0.012	< 0.011	< 0.013
Acenaphthene	mg/kg dry wt	0.026	< 0.014	0.054	0.012	0.030
Anthracene	mg/kg dry wt	0.092	< 0.014	0.036	0.014	< 0.013
Benzo[a]anthracene	mg/kg dry wt	0.66	0.019	0.066	0.024	< 0.013
Benzo[a]pyrene (BAP)	mg/kg dry wt	1.07	0.032	0.069	0.027	< 0.013
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	1.53	0.04	0.09	0.04	< 0.03
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	1.52	0.04	0.09	0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	1.13	0.044	0.068	0.026	< 0.013
Benzo[e]pyrene	mg/kg dry wt	0.63	0.026	0.036	0.013	< 0.013
Benzo[g,h,i]perylene	mg/kg dry wt	0.91	0.036	0.039	0.014	< 0.013
Benzo[k]fluoranthene	mg/kg dry wt	0.40	0.014	0.026	< 0.011	< 0.013
Chrysene	mg/kg dry wt	0.53	0.023	0.050	0.018	< 0.013
Dibenzo[a,h]anthracene	mg/kg dry wt	0.150	< 0.014	< 0.012	< 0.011	< 0.013
Fluoranthene	mg/kg dry wt	1.20	0.044	0.195	0.068	< 0.013
Fluorene	mg/kg dry wt	0.018	< 0.014	0.026	0.011	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.82	0.030	0.034	0.014	< 0.013
Naphthalene	mg/kg dry wt	< 0.06	< 0.07	< 0.06	< 0.06	< 0.07
Perylene	mg/kg dry wt	0.34	< 0.014	0.034	0.015	0.019
Phenanthrene	mg/kg dry wt	0.21	0.016	0.135	0.068	< 0.013
Pyrene	mg/kg dry wt	1.03	0.051	0.163	0.056	< 0.013

Sample Type: Soil						
Sample Name:		TP110_0.1 17-Sep-2021	TP110_0.6 17-Sep-2021	TP111_0.2 17-Sep-2021	TP111_0.6 17-Sep-2021	TP113_0.35 17-Sep-2021
Lab Number:		2708251.1	2708251.2	2708251.3	2708251.4	2708251.5
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 30	< 30	< 30	< 30	< 30
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	63	125	< 40	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 90	130	< 90	< 90	< 90

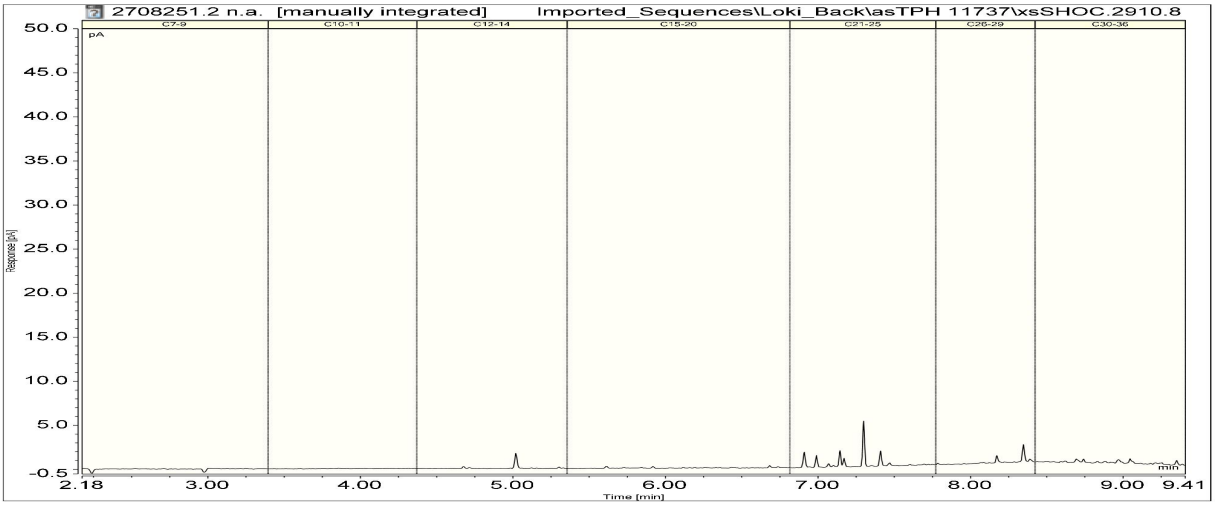
Sample Name:		TP113_0.7 17-Sep-2021	TP112_0.4 17-Sep-2021	TP112_1.2 17-Sep-2021		
Lab Number:		2708251.6	2708251.7	2708251.9		
Individual Tests						
Dry Matter	g/100g as rcvd	82	85	73	-	-
pH*	pH Units	8.2	8.3	8.0	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	5	6	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	11	11	19	-	-
Total Recoverable Copper	mg/kg dry wt	5	7	11	-	-
Total Recoverable Lead	mg/kg dry wt	7.3	7.5	16.7	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Nickel	mg/kg dry wt	9	9	16	-	-
Total Recoverable Zinc	mg/kg dry wt	39	41	67	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	0.6	< 0.4	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
Acenaphthene	mg/kg dry wt	0.037	< 0.012	< 0.014	-	-
Anthracene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.012	0.039	< 0.014	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	0.058	< 0.014	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	0.07	< 0.04	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	0.07	< 0.04	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.012	0.052	< 0.014	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.012	0.032	< 0.014	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	0.032	< 0.014	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	0.019	< 0.014	-	-
Chrysene	mg/kg dry wt	< 0.012	0.042	< 0.014	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
Fluoranthene	mg/kg dry wt	< 0.012	0.079	< 0.014	-	-
Fluorene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	0.031	< 0.014	-	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.07	-	-
Perylene	mg/kg dry wt	0.028	0.045	< 0.014	-	-
Phenanthrene	mg/kg dry wt	< 0.012	0.050	< 0.014	-	-
Pyrene	mg/kg dry wt	< 0.012	0.080	< 0.014	-	-
Polychlorinated Biphenyls Screening in Soil*						
PCB-18	mg/kg dry wt	-	< 0.010	-	-	-
PCB-28	mg/kg dry wt	-	< 0.010	-	-	-
PCB-31	mg/kg dry wt	-	< 0.010	-	-	-
PCB-44	mg/kg dry wt	-	< 0.010	-	-	-
PCB-49	mg/kg dry wt	-	< 0.010	-	-	-
PCB-52	mg/kg dry wt	-	< 0.010	-	-	-
PCB-60	mg/kg dry wt	-	< 0.010	-	-	-
PCB-77	mg/kg dry wt	-	< 0.010	-	-	-

Sample Type: Soil						
Sample Name:		TP113_0.7 17-Sep-2021	TP112_0.4 17-Sep-2021	TP112_1.2 17-Sep-2021		
Lab Number:		2708251.6	2708251.7	2708251.9		
Polychlorinated Biphenyls Screening in Soil*						
PCB-81	mg/kg dry wt	-	< 0.010	-	-	-
PCB-86	mg/kg dry wt	-	< 0.010	-	-	-
PCB-101	mg/kg dry wt	-	< 0.010	-	-	-
PCB-105	mg/kg dry wt	-	< 0.010	-	-	-
PCB-110	mg/kg dry wt	-	< 0.010	-	-	-
PCB-114	mg/kg dry wt	-	< 0.010	-	-	-
PCB-118	mg/kg dry wt	-	< 0.010	-	-	-
PCB-121	mg/kg dry wt	-	< 0.010	-	-	-
PCB-123	mg/kg dry wt	-	< 0.010	-	-	-
PCB-126	mg/kg dry wt	-	< 0.010	-	-	-
PCB-128	mg/kg dry wt	-	< 0.010	-	-	-
PCB-138	mg/kg dry wt	-	< 0.010	-	-	-
PCB-141	mg/kg dry wt	-	< 0.010	-	-	-
PCB-149	mg/kg dry wt	-	< 0.010	-	-	-
PCB-151	mg/kg dry wt	-	< 0.010	-	-	-
PCB-153	mg/kg dry wt	-	< 0.010	-	-	-
PCB-156	mg/kg dry wt	-	< 0.010	-	-	-
PCB-157	mg/kg dry wt	-	< 0.010	-	-	-
PCB-159	mg/kg dry wt	-	< 0.010	-	-	-
PCB-167	mg/kg dry wt	-	< 0.010	-	-	-
PCB-169	mg/kg dry wt	-	< 0.010	-	-	-
PCB-170	mg/kg dry wt	-	< 0.010	-	-	-
PCB-180	mg/kg dry wt	-	< 0.010	-	-	-
PCB-189	mg/kg dry wt	-	< 0.010	-	-	-
PCB-194	mg/kg dry wt	-	< 0.010	-	-	-
PCB-206	mg/kg dry wt	-	< 0.010	-	-	-
PCB-209	mg/kg dry wt	-	< 0.010	-	-	-
Mono-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	-	< 0.000003	-	-	-
Non-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	-	< 0.0014	-	-	-
Total PCB (Sum of 35 congeners)	mg/kg dry wt	-	< 0.4	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 30	< 30	< 30	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 90	< 90	< 90	-	-

2708251.1
TP110_0.1 17-Sep-2021
Client Chromatogram for TPH by FID



2708251.2
TP110_0.6 17-Sep-2021
Client Chromatogram for TPH by FID



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			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-7, 9
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-7, 9
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-7, 9
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-7, 9
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-7, 9

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-7, 9
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-7, 9
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-7, 9
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-7, 9
Polychlorinated Biphenyls Screening in Soil*	Sonication extraction, GC-MS analysis. Tested on dried sample. In-house based on US EPA 8270.	0.00000020 - 0.2 mg/kg dry wt	7
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1-2
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1-7, 9
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-7, 9
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-7, 9
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-7, 9

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

Testing was completed between 22-Sep-2021 and 27-Sep-2021. 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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
101C Waterloo Road
Hornby
Christchurch 8042 New Zealand

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2709699	A2Pv1
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	20-Sep-2021	
		Date Reported:	22-Sep-2021	
		Quote No:	113742	
		Order No:	21:136	
		Client Reference:	4210205/002	
		Submitted By:	Nikki Mather	

Sample Type: Soil

Sample Name:		TP110_0.1 17-Sep-2021	TP111_0.2 17-Sep-2021	TP113_0.1 17-Sep-2021	TP112_0.4 17-Sep-2021	
Lab Number:		2709699.1	2709699.3	2709699.5	2709699.7	
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
As Received Weight	g	1,031.7	834.5	780.5	936.2	-
Dry Weight	g	981.5	687.2	646.3	804.2	-
Moisture	%	5	18	17	14	-
Sample Fraction >10mm	g dry wt	476.0	50.4	108.4	171.3	-
Sample Fraction <10mm to >2mm	g dry wt	397.3	69.4	97.9	159.2	-
Sample Fraction <2mm	g dry wt	106.9	565.8	438.7	472.7	-
<2mm Subsample Weight	g dry wt	59.7	55.4	53.6	58.3	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-

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			
Wgt 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, 5, 7
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, 5, 7
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, 5, 7
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1, 3, 5, 7
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, 5, 7
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, 5, 7
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, 5, 7
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, 5, 7
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1, 3, 5, 7
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, 5, 7
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, 5, 7
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, 5, 7
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, 5, 7
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, 5, 7
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, 5, 7
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, 5, 7

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

Testing was completed on 22-Sep-2021. 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.

Rhodri Williams BSc (Hons)
Technical Manager - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2709924 SPv1
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	21-Sep-2021
		Date Reported:	24-Sep-2021
		Quote No:	113742
		Order No:	21:136
		Client Reference:	4210205/002/DA
		Submitted By:	Nikki Mather

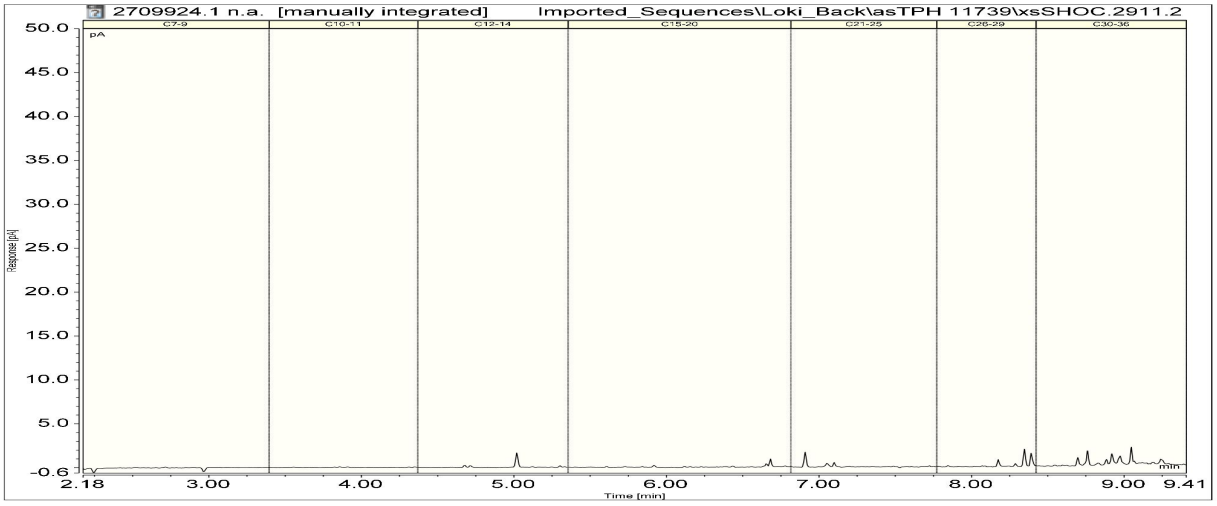
Sample Type: Soil

Sample Name:		TP109_0.1 20-Sep-2021	TP109_1.0 20-Sep-2021	TP107_0.1 20-Sep-2021	TP107_0.5 20-Sep-2021	TP108_0.1 20-Sep-2021
Lab Number:		2709924.1	2709924.3	2709924.5	2709924.6	2709924.10
Individual Tests						
Dry Matter	g/100g as rcvd	73	91	75	87	76
pH*	pH Units	6.6	7.2	6.9	7.6	6.2
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	5	5	5	4
Total Recoverable Cadmium	mg/kg dry wt	1.13	0.76	0.86	0.33	1.91
Total Recoverable Chromium	mg/kg dry wt	14	15	13	17	17
Total Recoverable Copper	mg/kg dry wt	9	10	11	11	8
Total Recoverable Lead	mg/kg dry wt	12.8	14.5	22	16.4	10.3
Total Recoverable Mercury	mg/kg dry wt	< 0.10	0.11	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	8	13	9	14	10
Total Recoverable Zinc	mg/kg dry wt	52	62	65	64	68
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.3	0.5	< 0.3	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.011	< 0.013	< 0.012	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.011	< 0.013	< 0.012	< 0.013
Acenaphthylene	mg/kg dry wt	< 0.014	< 0.011	< 0.013	< 0.012	< 0.013
Acenaphthene	mg/kg dry wt	< 0.014	< 0.011	< 0.013	< 0.012	< 0.013
Anthracene	mg/kg dry wt	< 0.014	< 0.011	< 0.013	< 0.012	< 0.013
Benzo[a]anthracene	mg/kg dry wt	0.014	< 0.011	0.036	< 0.012	< 0.013
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.021	< 0.011	0.054	< 0.012	< 0.013
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.04	< 0.03	0.07	< 0.03	< 0.04
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.04	< 0.03	0.07	< 0.03	< 0.04
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.028	< 0.011	0.054	< 0.012	< 0.013
Benzo[e]pyrene	mg/kg dry wt	0.016	< 0.011	0.033	< 0.012	< 0.013
Benzo[g,h,i]perylene	mg/kg dry wt	0.019	< 0.011	0.038	< 0.012	< 0.013
Benzo[k]fluoranthene	mg/kg dry wt	< 0.014	< 0.011	0.027	< 0.012	< 0.013
Chrysene	mg/kg dry wt	0.016	< 0.011	0.041	< 0.012	< 0.013
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.014	< 0.011	< 0.013	< 0.012	< 0.013
Fluoranthene	mg/kg dry wt	< 0.014	< 0.011	0.061	< 0.012	< 0.013
Fluorene	mg/kg dry wt	< 0.014	< 0.011	< 0.013	< 0.012	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.016	< 0.011	0.029	< 0.012	< 0.013
Naphthalene	mg/kg dry wt	< 0.07	< 0.06	< 0.07	< 0.06	< 0.07
Perylene	mg/kg dry wt	< 0.014	< 0.011	< 0.013	< 0.012	< 0.013
Phenanthrene	mg/kg dry wt	< 0.014	< 0.011	0.018	< 0.012	< 0.013
Pyrene	mg/kg dry wt	0.019	< 0.011	0.065	< 0.012	< 0.013

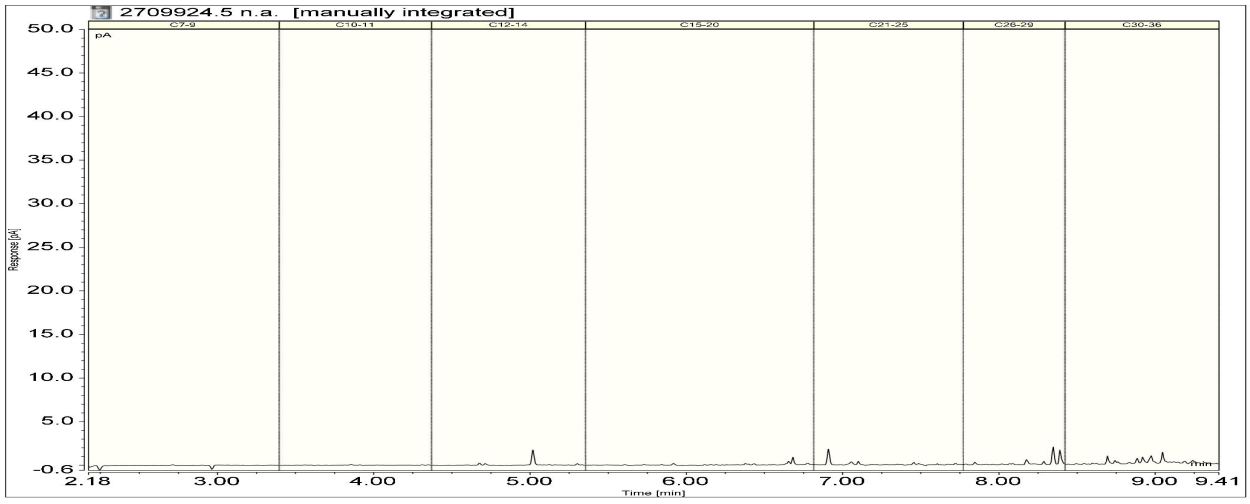
Sample Type: Soil						
Sample Name:		TP109_0.1 20-Sep-2021	TP109_1.0 20-Sep-2021	TP107_0.1 20-Sep-2021	TP107_0.5 20-Sep-2021	TP108_0.1 20-Sep-2021
Lab Number:		2709924.1	2709924.3	2709924.5	2709924.6	2709924.10
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	63	< 40	46	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 80	< 80	< 80	< 80	< 80

Sample Name:		TP108_1.2 20-Sep-2021	TP106_0.1 20-Sep-2021	TP106_0.7 20-Sep-2021		
Lab Number:		2709924.12	2709924.15	2709924.17		
Individual Tests						
Dry Matter	g/100g as rcvd	70	72	85	-	-
pH*	pH Units	7.9	6.4	7.9	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	10	3	3	-	-
Total Recoverable Cadmium	mg/kg dry wt	16.8	1.15	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	71	14	10	-	-
Total Recoverable Copper	mg/kg dry wt	46	7	6	-	-
Total Recoverable Lead	mg/kg dry wt	41	8.1	8.5	-	-
Total Recoverable Mercury	mg/kg dry wt	0.71	< 0.10	< 0.10	-	-
Total Recoverable Nickel	mg/kg dry wt	60	9	8	-	-
Total Recoverable Zinc	mg/kg dry wt	360	58	37	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.4	< 0.3	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Acenaphthylene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Acenaphthene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Anthracene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.04	< 0.04	< 0.03	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.04	< 0.04	< 0.03	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Chrysene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Fluoranthene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Fluorene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Naphthalene	mg/kg dry wt	< 0.08	< 0.07	< 0.06	-	-
Perylene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Phenanthrene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Pyrene	mg/kg dry wt	< 0.015	< 0.014	< 0.012	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	< 20	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	73	43	< 40	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 80	< 80	< 80	-	-

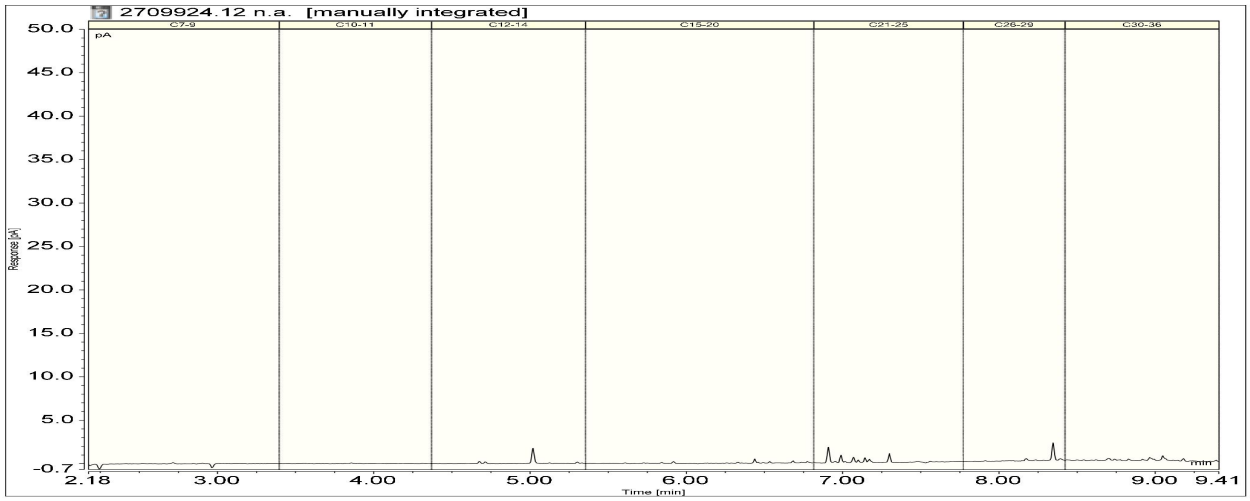
2709924.1
TP109_0.1 20-Sep-2021
Client Chromatogram for TPH by FID



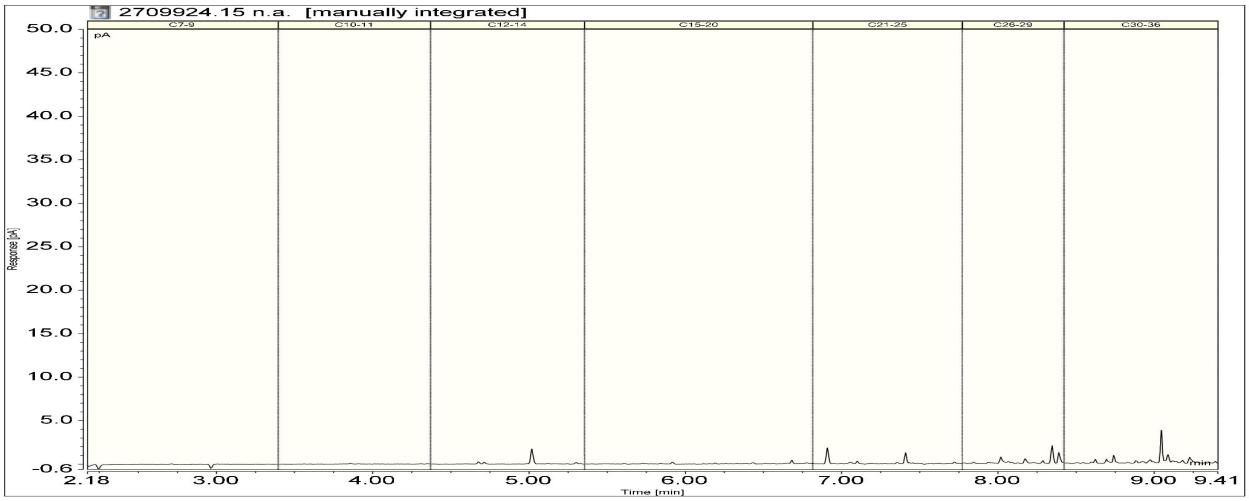
2709924.5
TP107_0.1 20-Sep-2021
Client Chromatogram for TPH by FID



2709924.12
TP108_1.2 20-Sep-2021
Client Chromatogram for TPH by FID



2709924.15
TP106_0.1 20-Sep-2021
Client Chromatogram for TPH by FID



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			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1, 3, 5-6, 10, 12, 15, 17
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1, 3, 5-6, 10, 12, 15, 17
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, 3, 5-6, 10, 12, 15, 17
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1, 3, 5-6, 10, 12, 15, 17
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1, 3, 5-6, 10, 12, 15, 17
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1, 3, 5-6, 10, 12, 15, 17
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1, 3, 5-6, 10, 12, 15, 17
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1, 3, 5-6, 10, 12, 15, 17
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1, 3, 5-6, 10, 12, 15, 17
Total Petroleum Hydrocarbons in Soil			

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1, 5, 12, 15
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1, 3, 5-6, 10, 12, 15, 17
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1, 3, 5-6, 10, 12, 15, 17
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1, 3, 5-6, 10, 12, 15, 17
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1, 3, 5-6, 10, 12, 15, 17

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

Testing was completed between 22-Sep-2021 and 23-Sep-2021. For completion dates of individual analyses please contact the laboratory.

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

Martin Cowell - BSc
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
101C Waterloo Road
Hornby
Christchurch 8042 New Zealand

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2710990	A2Pv1
Contact:	Nikki Mather	**Date Received:**	21-Sep-2021	
	C/- Beca Limited	**Date Reported:**	23-Sep-2021	
	PO Box 6345	**Quote No:**	113742	
	Wellesley Street	**Order No:**	21:136	
	Auckland 1141	**Client Reference:**	4210205/002/DA	
		Submitted By:	Nikki Mather	

Sample Type: Soil

Sample Name:		TP109_0.1 20-Sep-2021	TP107_0.1 20-Sep-2021	TP108_0.1 20-Sep-2021	TP106_0.1 20-Sep-2021	
Lab Number:		2710990.1	2710990.5	2710990.10	2710990.15	
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
As Received Weight	g	737.0	722.8	596.9	630.5	-
Dry Weight	g	565.3	573.5	449.5	440.7	-
Moisture	%	23	21	25	30	-
Sample Fraction >10mm	g dry wt	10.0	28.8	2.3	< 0.1	-
Sample Fraction <10mm to >2mm	g dry wt	79.8	122.8	4.0	< 0.1	-
Sample Fraction <2mm	g dry wt	474.6	421.4	442.9	440.2	-
<2mm Subsample Weight	g dry wt	57.4	52.0	51.6	53.3	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-

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			
Wgt 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, 5, 10, 15
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, 5, 10, 15
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, 5, 10, 15
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1, 5, 10, 15
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, 5, 10, 15
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, 5, 10, 15
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, 5, 10, 15
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, 5, 10, 15
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1, 5, 10, 15
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, 5, 10, 15
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, 5, 10, 15
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, 5, 10, 15
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, 5, 10, 15
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, 5, 10, 15
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, 5, 10, 15
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, 5, 10, 15

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

Testing was completed on 23-Sep-2021. 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.

Rhodri Williams BSc (Hons)
Technical Manager - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2711251	SPv1
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	22-Sep-2021	
		Date Reported:	27-Sep-2021	
		Quote No:	113742	
		Order No:	21:136	
		Client Reference:	4210205/002/DA	
		Submitted By:	Anne Bennett	

Sample Type: Soil

Sample Name:		TP105_0.1 21-Sep-2021	TP105_0.5 21-Sep-2021	TP103_0.1 21-Sep-2021	TP103_0.5 21-Sep-2021	TP101_1.3 21-Sep-2021
Lab Number:		2711251.1	2711251.2	2711251.5	2711251.6	2711251.10
Individual Tests						
Dry Matter	g/100g as rcvd	75	95	73	95	83
pH*	pH Units	6.3	7.3	4.7	4.1	7.4
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	3	4
Total Recoverable Cadmium	mg/kg dry wt	1.24	< 0.10	1.11	< 0.10	0.37
Total Recoverable Chromium	mg/kg dry wt	16	11	14	9	12
Total Recoverable Copper	mg/kg dry wt	7	7	6	7	8
Total Recoverable Lead	mg/kg dry wt	9.6	9.7	9.1	9.2	14.5
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	10	10	9	8	12
Total Recoverable Zinc	mg/kg dry wt	61	41	57	39	51
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Acenaphthylene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Acenaphthene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Anthracene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Benzo[a]anthracene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.04	< 0.03	< 0.04	< 0.03	< 0.03
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.04	< 0.03	< 0.04	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Benzo[e]pyrene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Benzo[k]fluoranthene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Chrysene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Fluoranthene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Fluorene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Naphthalene	mg/kg dry wt	< 0.07	< 0.06	< 0.07	< 0.06	< 0.06
Perylene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Phenanthrene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012
Pyrene	mg/kg dry wt	< 0.013	< 0.011	< 0.014	< 0.011	< 0.012

Sample Type: Soil						
Sample Name:		TP105_0.1 21-Sep-2021	TP105_0.5 21-Sep-2021	TP103_0.1 21-Sep-2021	TP103_0.5 21-Sep-2021	TP101_1.3 21-Sep-2021
Lab Number:		2711251.1	2711251.2	2711251.5	2711251.6	2711251.10
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	< 40	51	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 80	< 80	< 80	< 80	< 80

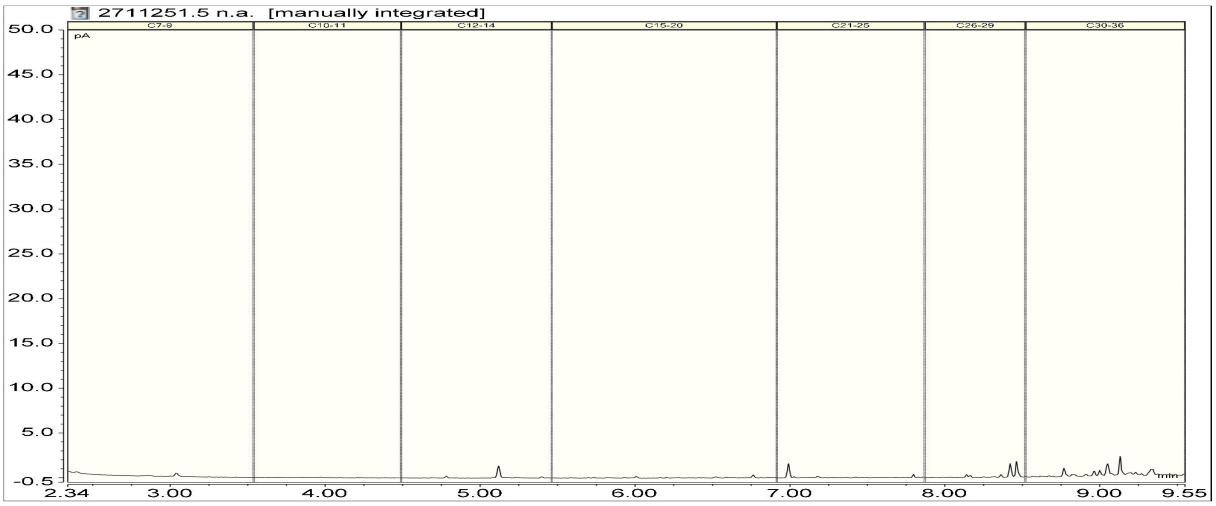
Sample Name:		TP102_0.1 21-Sep-2021	TP102_0.5 21-Sep-2021	QA1 21-Sep-2021	TP104_0.1 21-Sep-2021	TP104_1.1 21-Sep-2021
Lab Number:		2711251.12	2711251.13	2711251.16	2711251.17	2711251.19
Individual Tests						
Dry Matter	g/100g as rcvd	80	95	76	70	90
pH*	pH Units	5.1	5.2	5.2	6.5	7.8
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	3	3	5	3
Total Recoverable Cadmium	mg/kg dry wt	3.3	0.31	2.2	1.41	0.26
Total Recoverable Chromium	mg/kg dry wt	23	10	18	17	11
Total Recoverable Copper	mg/kg dry wt	9	7	8	35	7
Total Recoverable Lead	mg/kg dry wt	8.7	8.9	8.9	21	8.2
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	9	8	12	12	8
Total Recoverable Zinc	mg/kg dry wt	90	41	87	94	38
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	< 0.4	< 0.4	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	< 0.014	< 0.011
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	< 0.014	< 0.011
Acenaphthylene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	< 0.014	< 0.011
Acenaphthene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	< 0.014	< 0.011
Anthracene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	< 0.014	< 0.011
Benzo[a]anthracene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	0.020	< 0.011
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.013	< 0.011	< 0.013	0.032	< 0.011
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	< 0.03	< 0.04	0.04	< 0.03
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	< 0.03	< 0.04	0.04	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	0.040	< 0.011
Benzo[e]pyrene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	0.021	< 0.011
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	0.025	< 0.011
Benzo[k]fluoranthene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	0.016	< 0.011
Chrysene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	0.023	< 0.011
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	< 0.014	< 0.011
Fluoranthene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	0.040	< 0.011
Fluorene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	< 0.014	< 0.011
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	0.023	< 0.011
Naphthalene	mg/kg dry wt	< 0.07	< 0.06	< 0.07	< 0.07	< 0.06
Perylene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	< 0.014	< 0.011
Phenanthrene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	< 0.014	< 0.011
Pyrene	mg/kg dry wt	< 0.013	< 0.011	< 0.013	0.040	< 0.011
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	< 40	68	45	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 80	< 80	< 80	< 80	< 80

Sample Name:		TP101_0.1 21-Sep-2021				
Lab Number:		2711251.21				

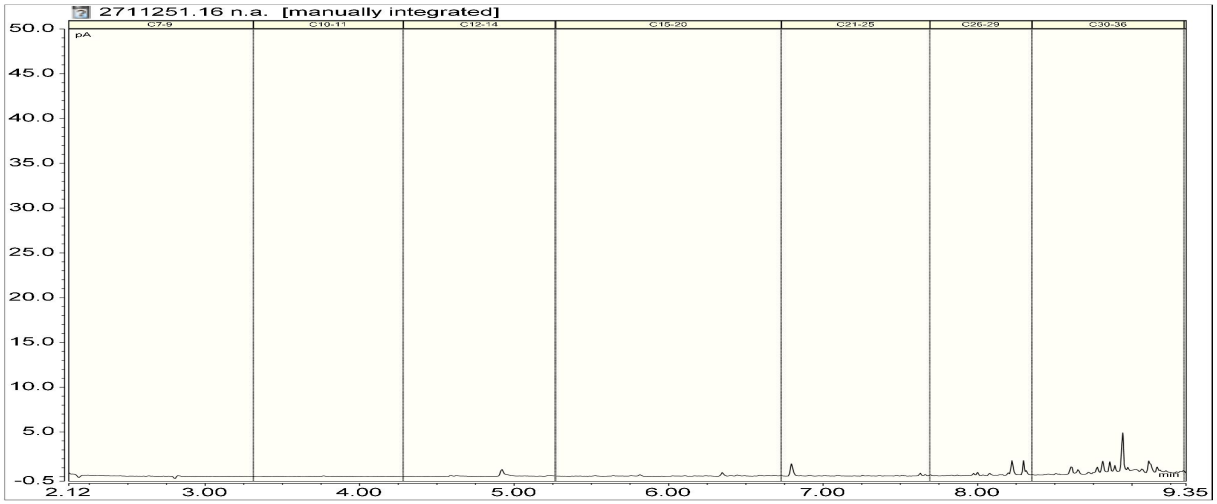
Sample Type: Soil						
Sample Name:		TP101_0.1 21-Sep-2021				
Lab Number:		2711251.21				
Individual Tests						
Dry Matter	g/100g as rcvd	76	-	-	-	-
pH*	pH Units	5.2	-	-	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	1.70	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	16	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	6	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	8.4	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	9	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	67	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	-	-	-	-
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	-	-	-	-
Polychlorinated Biphenyls Screening in Soil*						
PCB-18	mg/kg dry wt	< 0.010	-	-	-	-
PCB-28	mg/kg dry wt	< 0.010	-	-	-	-
PCB-31	mg/kg dry wt	< 0.010	-	-	-	-
PCB-44	mg/kg dry wt	< 0.010	-	-	-	-
PCB-49	mg/kg dry wt	< 0.010	-	-	-	-
PCB-52	mg/kg dry wt	< 0.010	-	-	-	-
PCB-60	mg/kg dry wt	< 0.010	-	-	-	-
PCB-77	mg/kg dry wt	< 0.010	-	-	-	-
PCB-81	mg/kg dry wt	< 0.010	-	-	-	-
PCB-86	mg/kg dry wt	< 0.010	-	-	-	-
PCB-101	mg/kg dry wt	< 0.010	-	-	-	-
PCB-105	mg/kg dry wt	< 0.010	-	-	-	-
PCB-110	mg/kg dry wt	< 0.010	-	-	-	-
PCB-114	mg/kg dry wt	< 0.010	-	-	-	-
PCB-118	mg/kg dry wt	< 0.010	-	-	-	-
PCB-121	mg/kg dry wt	< 0.010	-	-	-	-

Sample Type: Soil						
Sample Name:		TP101_0.1 21-Sep-2021				
Lab Number:		2711251.21				
Polychlorinated Biphenyls Screening in Soil*						
PCB-123	mg/kg dry wt	< 0.010	-	-	-	-
PCB-126	mg/kg dry wt	< 0.010	-	-	-	-
PCB-128	mg/kg dry wt	< 0.010	-	-	-	-
PCB-138	mg/kg dry wt	< 0.010	-	-	-	-
PCB-141	mg/kg dry wt	< 0.010	-	-	-	-
PCB-149	mg/kg dry wt	< 0.010	-	-	-	-
PCB-151	mg/kg dry wt	< 0.010	-	-	-	-
PCB-153	mg/kg dry wt	< 0.010	-	-	-	-
PCB-156	mg/kg dry wt	< 0.010	-	-	-	-
PCB-157	mg/kg dry wt	< 0.010	-	-	-	-
PCB-159	mg/kg dry wt	< 0.010	-	-	-	-
PCB-167	mg/kg dry wt	< 0.010	-	-	-	-
PCB-169	mg/kg dry wt	< 0.010	-	-	-	-
PCB-170	mg/kg dry wt	< 0.010	-	-	-	-
PCB-180	mg/kg dry wt	< 0.010	-	-	-	-
PCB-189	mg/kg dry wt	< 0.010	-	-	-	-
PCB-194	mg/kg dry wt	< 0.010	-	-	-	-
PCB-206	mg/kg dry wt	< 0.010	-	-	-	-
PCB-209	mg/kg dry wt	< 0.010	-	-	-	-
Mono-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.000003	-	-	-	-
Non-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.0014	-	-	-	-
Total PCB (Sum of 35 congeners)	mg/kg dry wt	< 0.4	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	-	-	-	-
C10 - C14	mg/kg dry wt	< 20	-	-	-	-
C15 - C36	mg/kg dry wt	50	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 80	-	-	-	-

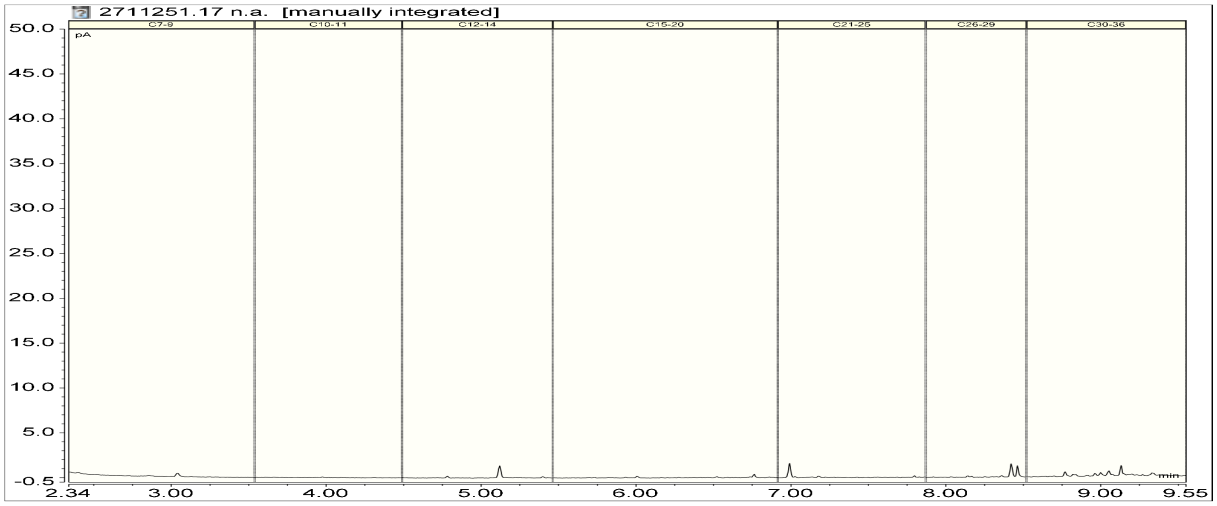
2711251.5
TP103_0.1 21-Sep-2021
Client Chromatogram for TPH by FID



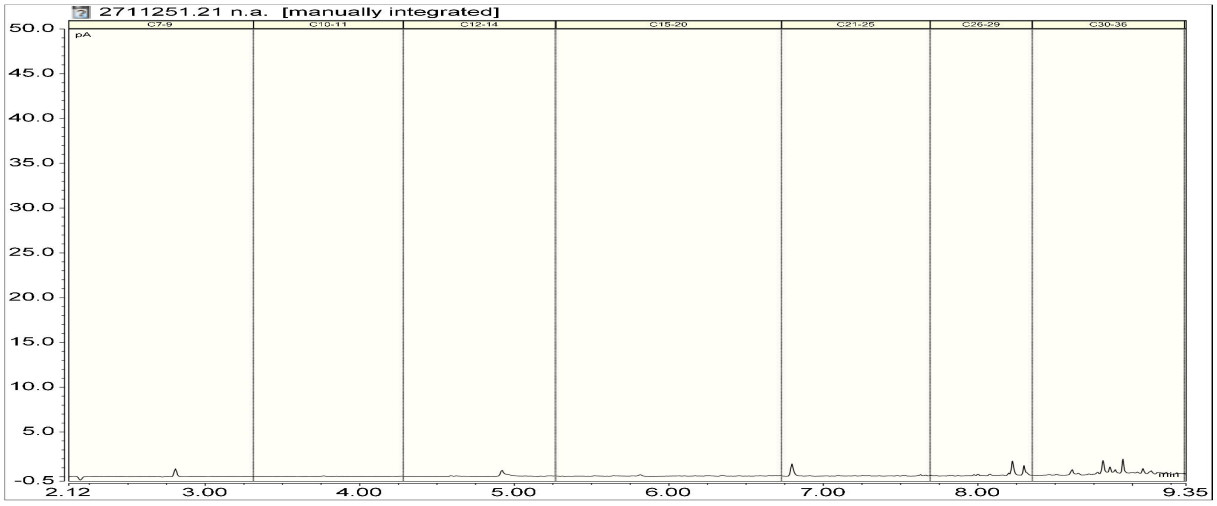
2711251.16
QA1 21-Sep-2021
Client Chromatogram for TPH by FID



2711251.17
TP104_0.1 21-Sep-2021
Client Chromatogram for TPH by FID



2711251.21
TP101_0.1 21-Sep-2021
Client Chromatogram for TPH by FID



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			
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, 10, 12-13, 16-17, 19, 21
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-2, 5-6, 10, 12-13, 16-17, 19, 21
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-2, 5-6, 10, 12-13, 16-17, 19, 21
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	1-2, 5-6, 10, 12-13, 16-17, 19, 21
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-2, 5-6, 10, 12-13, 16-17, 19, 21
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	1-2, 5-6, 10, 12-13, 16-17, 19, 21
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	1-2, 5-6, 10, 12-13, 16-17, 19, 21
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-2, 5-6, 10, 12-13, 16-17, 19, 21
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-2, 5-6, 10, 12-13, 16-17, 19, 21
Polychlorinated Biphenyls Screening in Soil*	Sonication extraction, GC-MS analysis. Tested on dried sample. In-house based on US EPA 8270.	0.00000020 - 0.2 mg/kg dry wt	21
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	5, 16-17, 21
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5-6, 10, 12-13, 16-17, 19, 21
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5-6, 10, 12-13, 16-17, 19, 21
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-2, 5-6, 10, 12-13, 16-17, 19, 21
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-2, 5-6, 10, 12-13, 16-17, 19, 21

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

Testing was completed between 23-Sep-2021 and 27-Sep-2021. 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.

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

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
101C Waterloo Road
Hornby
Christchurch 8042 New Zealand

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2711652 A2Pv1
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	22-Sep-2021
		Date Reported:	24-Sep-2021
		Quote No:	113742
		Order No:	21:136
		Client Reference:	4210205/002/DA
		Submitted By:	Anne Bennett

Sample Type: Soil

Sample Name:		TP105_0.1 21-Sep-2021	TP103_0.1 21-Sep-2021	TP101_0.1 21-Sep-2021	TP102_0.1 21-Sep-2021	TP104_0.1 21-Sep-2021
Lab Number:		2711652.1	2711652.5	2711652.9	2711652.11	2711652.15
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
As Received Weight	g	642.4	657.9	531.8	592.6	597.2
Dry Weight	g	467.8	509.5	379.2	450.2	407.3
Moisture	%	27	23	29	24	32
Sample Fraction >10mm	g dry wt	< 0.1	37.1	< 0.1	< 0.1	5.8
Sample Fraction <10mm to >2mm	g dry wt	< 0.1	79.3	7.9	7.5	106.2
Sample Fraction <2mm	g dry wt	466.5	392.2	370.8	441.7	294.0
<2mm Subsample Weight	g dry wt	55.7	53.8	50.2	55.3	53.4
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001

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			
Wgt 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, 5, 9, 11, 15
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, 5, 9, 11, 15
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, 5, 9, 11, 15
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1, 5, 9, 11, 15
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, 5, 9, 11, 15
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, 5, 9, 11, 15
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, 5, 9, 11, 15
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, 5, 9, 11, 15
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1, 5, 9, 11, 15
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, 5, 9, 11, 15
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, 5, 9, 11, 15
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, 5, 9, 11, 15
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, 5, 9, 11, 15
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, 5, 9, 11, 15
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, 5, 9, 11, 15
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, 5, 9, 11, 15

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

Testing was completed on 24-Sep-2021. 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.

Rhodri Williams BSc (Hons)
Technical Manager - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
101C Waterloo Road
Hornby
Christchurch 8042 New Zealand

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2712871	A2Pv1
Contact:	Nikki Mather	**Date Received:**	23-Sep-2021	
	C/- Beca Limited	**Date Reported:**	28-Sep-2021	
	PO Box 6345	**Quote No:**	113742	
	Wellesley Street	**Order No:**	21:136	
	Auckland 1141	**Client Reference:**	4210205/002/DA	
		Submitted By:	Nikki Mather	

Sample Type: Soil

Sample Name:		TP116_0.1 22-Sep-2021	TP116_1.0 22-Sep-2021	TP117_0.1 22-Sep-2021	TP117_1.0 22-Sep-2021	
Lab Number:		2712871.1	2712871.4	2712871.6	2712871.8	
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
As Received Weight	g	663.8	827.7	678.4	813.5	-
Dry Weight	g	581.0	712.7	566.8	697.4	-
Moisture	%	12	14	16	14	-
Sample Fraction >10mm	g dry wt	100.3	42.5	87.9	109.8	-
Sample Fraction <10mm to >2mm	g dry wt	165.6	43.8	156.0	206.9	-
Sample Fraction <2mm	g dry wt	314.0	625.2	321.7	379.6	-
<2mm Subsample Weight	g dry wt	56.7	59.1	59.6	59.1	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-

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

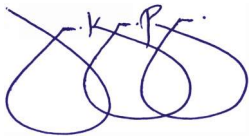
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Wgt of Asbestos as Asbestos Fines in <10mm >2mm Fraction*	Measurement on analytical balance, from the <10mm >2mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g dry wt	1, 4, 6, 8
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, 4, 6, 8
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, 4, 6, 8
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1, 4, 6, 8
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, 4, 6, 8
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, 4, 6, 8
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, 4, 6, 8
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, 4, 6, 8
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1, 4, 6, 8
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, 4, 6, 8
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, 4, 6, 8
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, 4, 6, 8
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, 4, 6, 8
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, 4, 6, 8
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, 4, 6, 8
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, 4, 6, 8

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

Testing was completed on 27-Sep-2021. 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.



John Keneth Paglingayen BApSc
Laboratory Technician - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

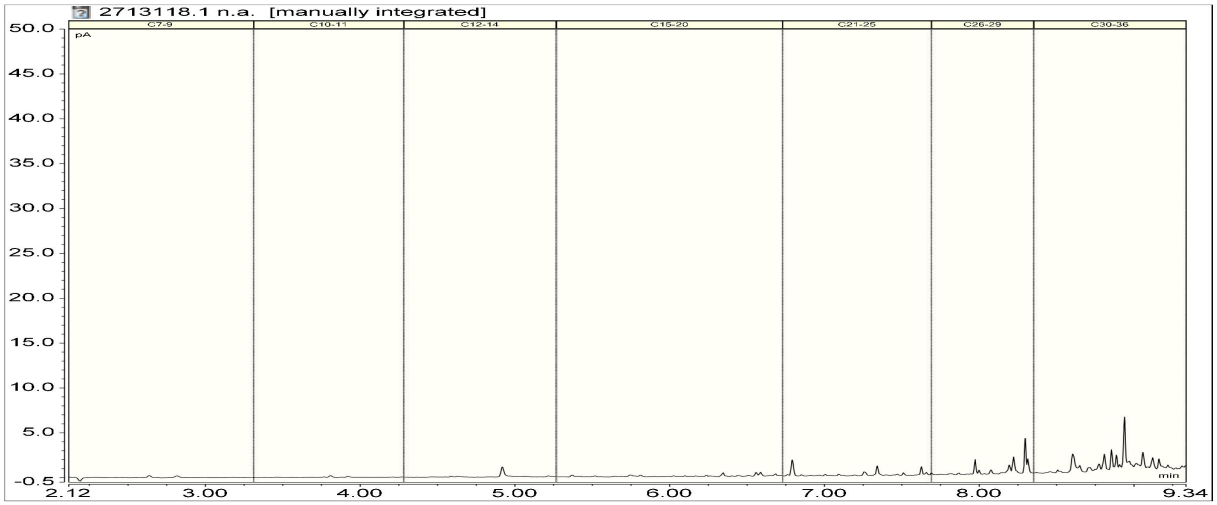
Client:	Beca Limited	**Lab No:**	2713118	SPv1
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	23-Sep-2021	
		Date Reported:	27-Sep-2021	
		Quote No:	113742	
		Order No:	21:136	
		Client Reference:	4210205/002/DA	
		Submitted By:	Nikki Mather	

Sample Type: Soil

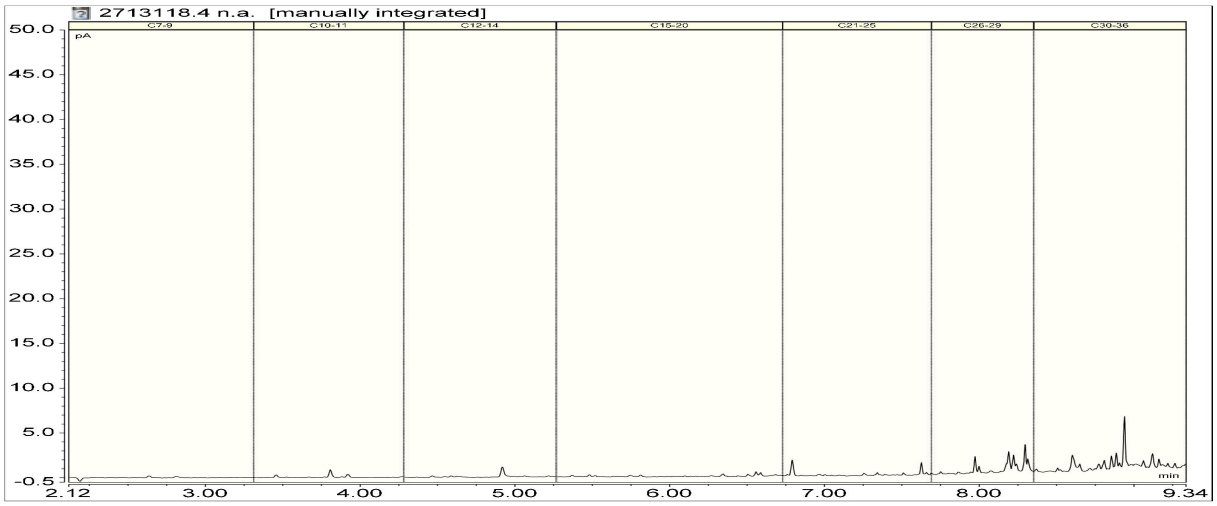
Sample Name:		TP115_0.1 22-Sep-2021	TP115_0.5 22-Sep-2021	TP114_0.1 22-Sep-2021	TP114_0.5 22-Sep-2021	
Lab Number:		2713118.1	2713118.2	2713118.4	2713118.5	
Individual Tests						
Dry Matter	g/100g as rcvd	75	95	67	95	-
pH*	pH Units	5.8	6.0	6.6	6.9	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	4	4	4	-
Total Recoverable Cadmium	mg/kg dry wt	1.04	0.69	1.53	0.40	-
Total Recoverable Chromium	mg/kg dry wt	20	11	18	12	-
Total Recoverable Copper	mg/kg dry wt	20	8	12	9	-
Total Recoverable Lead	mg/kg dry wt	25	10.5	119	18.8	-
Total Recoverable Mercury	mg/kg dry wt	0.11	0.11	< 0.10	0.15	-
Total Recoverable Nickel	mg/kg dry wt	9	11	9	12	-
Total Recoverable Zinc	mg/kg dry wt	81	58	73	50	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.3	< 0.4	2.5	-
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	< 0.011	-
2-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	< 0.011	-
Acenaphthylene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.014	-
Acenaphthene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.016	-
Anthracene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.042	-
Benzo[a]anthracene	mg/kg dry wt	0.016	< 0.011	< 0.015	0.169	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.013	< 0.011	< 0.015	0.28	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.41	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.41	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.016	< 0.011	0.018	0.29	-
Benzo[e]pyrene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.175	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.014	0.012	0.019	0.30	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.111	-
Chrysene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.124	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.053	-
Fluoranthene	mg/kg dry wt	0.014	< 0.011	< 0.015	0.24	-
Fluorene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.013	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.014	< 0.011	0.015	0.25	-
Naphthalene	mg/kg dry wt	< 0.07	< 0.06	< 0.08	< 0.06	-
Perylene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.099	-
Phenanthrene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.115	-
Pyrene	mg/kg dry wt	0.022	< 0.011	0.018	0.25	-

Sample Type: Soil						
Sample Name:		TP115_0.1 22-Sep-2021	TP115_0.5 22-Sep-2021	TP114_0.1 22-Sep-2021	TP114_0.5 22-Sep-2021	
Lab Number:		2713118.1	2713118.2	2713118.4	2713118.5	
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	< 30	< 20	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	-
C15 - C36	mg/kg dry wt	167	< 40	210	< 40	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	173	< 80	220	< 80	-

2713118.1
TP115_0.1 22-Sep-2021
Client Chromatogram for TPH by FID



2713118.4
TP114_0.1 22-Sep-2021
Client Chromatogram for TPH by FID



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			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-2, 4-5
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-2, 4-5

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-2, 4-5
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	1-2, 4-5
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-2, 4-5
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	1-2, 4-5
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	1-2, 4-5
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-2, 4-5
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-2, 4-5
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1, 4
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 4-5
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 4-5
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-2, 4-5
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-2, 4-5

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

Testing was completed between 24-Sep-2021 and 27-Sep-2021. 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.

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

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
101C Waterloo Road
Hornby
Christchurch 8042 New Zealand

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2713416	A2Pv1
Contact:	Nikki Mather	**Date Received:**	23-Sep-2021	
	C/- Beca Limited	**Date Reported:**	28-Sep-2021	
	PO Box 6345	**Quote No:**	113742	
	Wellesley Street	**Order No:**	21:136	
	Auckland 1141	**Client Reference:**	4210205/002/DA	
		Submitted By:	Nikki Mather	

Sample Type: Soil

Sample Name:		TP115_0.1 22-Sep-2021	TP115_0.5 22-Sep-2021	TP114_0.1 22-Sep-2021	TP114_0.5 22-Sep-2021	
Lab Number:		2713416.1	2713416.2	2713416.4	2713416.5	
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
As Received Weight	g	500.5	995.2	476.1	1,024.1	-
Dry Weight	g	377.5	940.3	354.6	989.9	-
Moisture	%	25	6	26	3	-
Sample Fraction >10mm	g dry wt	1.9	331.3	20.3	372.6	-
Sample Fraction <10mm to >2mm	g dry wt	21.2	395.5	29.7	426.2	-
Sample Fraction <2mm	g dry wt	353.1	212.4	303.2	190.2	-
<2mm Subsample Weight	g dry wt	55.3	59.3	55.2	56.9	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-

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.

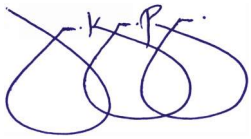
Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Wgt 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	1-2, 4-5
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	1-2, 4-5
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-2, 4-5
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1-2, 4-5
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	1-2, 4-5
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	1-2, 4-5
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	1-2, 4-5
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%	1-2, 4-5
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-2, 4-5
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	1-2, 4-5
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	1-2, 4-5
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	1-2, 4-5
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	1-2, 4-5
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	1-2, 4-5
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	1-2, 4-5
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	1-2, 4-5

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

Testing was completed on 27-Sep-2021. 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.



John Keneth Paglingayen BApSc
Laboratory Technician - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2714105 SPv1
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	24-Sep-2021
		Date Reported:	29-Sep-2021
		Quote No:	113742
		Order No:	21:136
		Client Reference:	4210205/002/DA
		Submitted By:	Nikki Mather

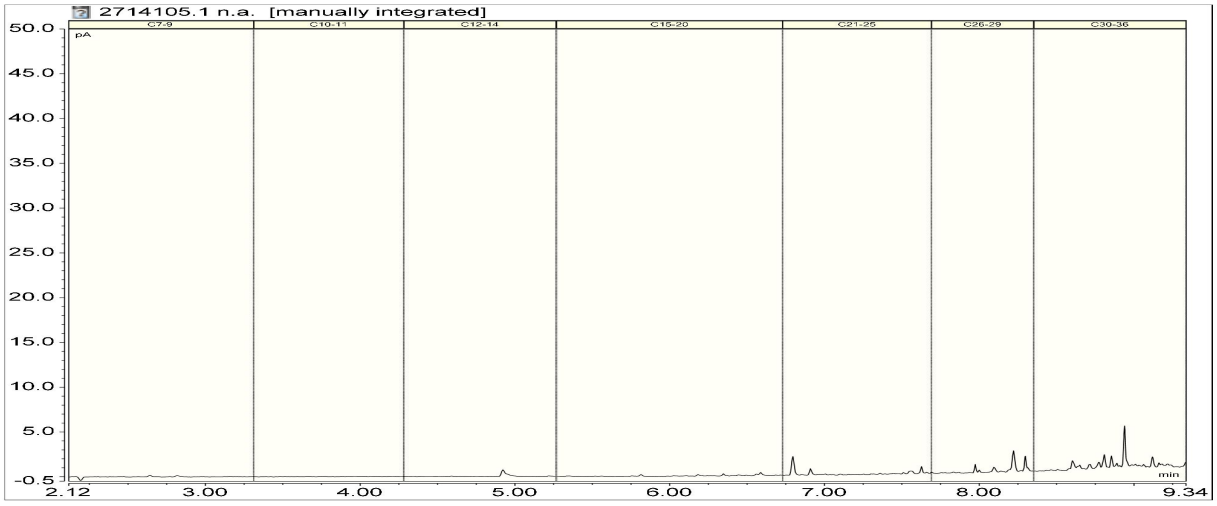
Sample Type: Soil

Sample Name:		TP122_0.1 23-Sep-2021	TP122_0.5 23-Sep-2021	TP123_0.1 23-Sep-2021	TP123_0.85 23-Sep-2021	TP125_0.1 23-Sep-2021
Lab Number:		2714105.1	2714105.2	2714105.5	2714105.7	2714105.10
Individual Tests						
Dry Matter	g/100g as rcvd	79	81	73	66	74
pH*	pH Units	6.8	4.4	3.1	5.2	4.6
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	7	21	5	3	15
Total Recoverable Cadmium	mg/kg dry wt	2.6	53	1.21	58	17.6
Total Recoverable Chromium	mg/kg dry wt	25	123	30	122	72
Total Recoverable Copper	mg/kg dry wt	23	41	35	21	57
Total Recoverable Lead	mg/kg dry wt	56	7.9	19.8	5.0	24
Total Recoverable Mercury	mg/kg dry wt	0.32	0.11	0.52	0.97	1.28
Total Recoverable Nickel	mg/kg dry wt	12	26	3	4	15
Total Recoverable Zinc	mg/kg dry wt	173	290	21	480	148
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	6.0	< 0.3	0.3	< 0.4	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.013	< 0.014	< 0.015	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.013	< 0.014	< 0.015	< 0.013
Acenaphthylene	mg/kg dry wt	0.074	< 0.013	< 0.014	< 0.015	< 0.013
Acenaphthene	mg/kg dry wt	< 0.013	< 0.013	< 0.014	< 0.015	< 0.013
Anthracene	mg/kg dry wt	0.075	< 0.013	< 0.014	< 0.015	< 0.013
Benzo[a]anthracene	mg/kg dry wt	0.38	< 0.013	0.028	< 0.015	0.021
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.58	< 0.013	0.035	< 0.015	0.028
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.82	< 0.03	0.05	< 0.04	0.04
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.81	< 0.03	0.05	< 0.04	0.04
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.61	< 0.013	0.042	< 0.015	0.033
Benzo[e]pyrene	mg/kg dry wt	0.36	< 0.013	0.025	< 0.015	0.019
Benzo[g,h,i]perylene	mg/kg dry wt	0.46	< 0.013	0.025	< 0.015	0.021
Benzo[k]fluoranthene	mg/kg dry wt	0.27	< 0.013	0.019	< 0.015	0.015
Chrysene	mg/kg dry wt	0.40	< 0.013	0.031	< 0.015	0.020
Dibenzo[a,h]anthracene	mg/kg dry wt	0.058	< 0.013	< 0.014	< 0.015	< 0.013
Fluoranthene	mg/kg dry wt	0.82	< 0.013	0.047	< 0.015	0.031
Fluorene	mg/kg dry wt	0.017	< 0.013	< 0.014	< 0.015	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.40	< 0.013	0.017	< 0.015	0.017
Naphthalene	mg/kg dry wt	< 0.07	< 0.07	< 0.07	< 0.08	< 0.07
Perylene	mg/kg dry wt	0.146	< 0.013	< 0.014	< 0.015	< 0.013
Phenanthrene	mg/kg dry wt	0.35	< 0.013	< 0.014	< 0.015	< 0.013
Pyrene	mg/kg dry wt	0.94	0.015	0.043	< 0.015	0.034

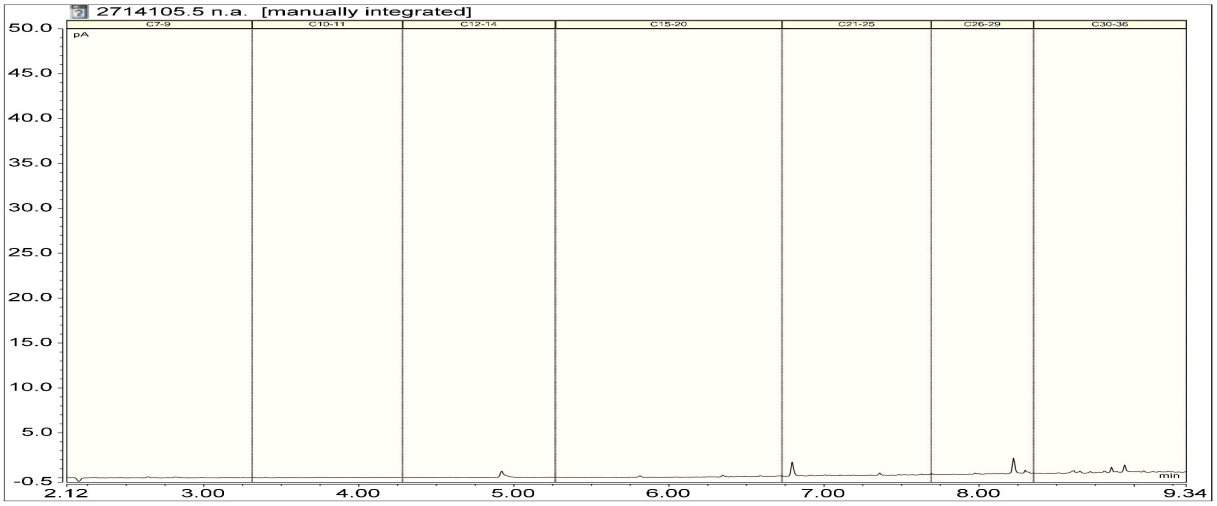
Sample Type: Soil						
Sample Name:		TP122_0.1 23-Sep-2021	TP122_0.5 23-Sep-2021	TP123_0.1 23-Sep-2021	TP123_0.85 23-Sep-2021	TP125_0.1 23-Sep-2021
Lab Number:		2714105.1	2714105.2	2714105.5	2714105.7	2714105.10
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	< 20	< 30	< 20
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	155	< 40	104	< 40	93
Total hydrocarbons (C7 - C36)	mg/kg dry wt	158	< 80	107	< 90	95

Sample Name:		TP125_0.8 23-Sep-2021				
Lab Number:		2714105.12				
Individual Tests						
Dry Matter	g/100g as rcvd	67	-	-	-	-
pH*	pH Units	7.1	-	-	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	7	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	7.3	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	33	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	16	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	32	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	0.40	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	16	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	200	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	-	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.015	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.015	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.015	-	-	-	-
Acenaphthene	mg/kg dry wt	< 0.015	-	-	-	-
Anthracene	mg/kg dry wt	< 0.015	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.015	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.015	-	-	-	-
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	< 0.015	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.015	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.015	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.015	-	-	-	-
Chrysene	mg/kg dry wt	< 0.015	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.015	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.015	-	-	-	-
Fluorene	mg/kg dry wt	< 0.015	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.015	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.08	-	-	-	-
Perylene	mg/kg dry wt	< 0.015	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.015	-	-	-	-
Pyrene	mg/kg dry wt	< 0.015	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 30	-	-	-	-
C10 - C14	mg/kg dry wt	< 20	-	-	-	-
C15 - C36	mg/kg dry wt	60	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 90	-	-	-	-

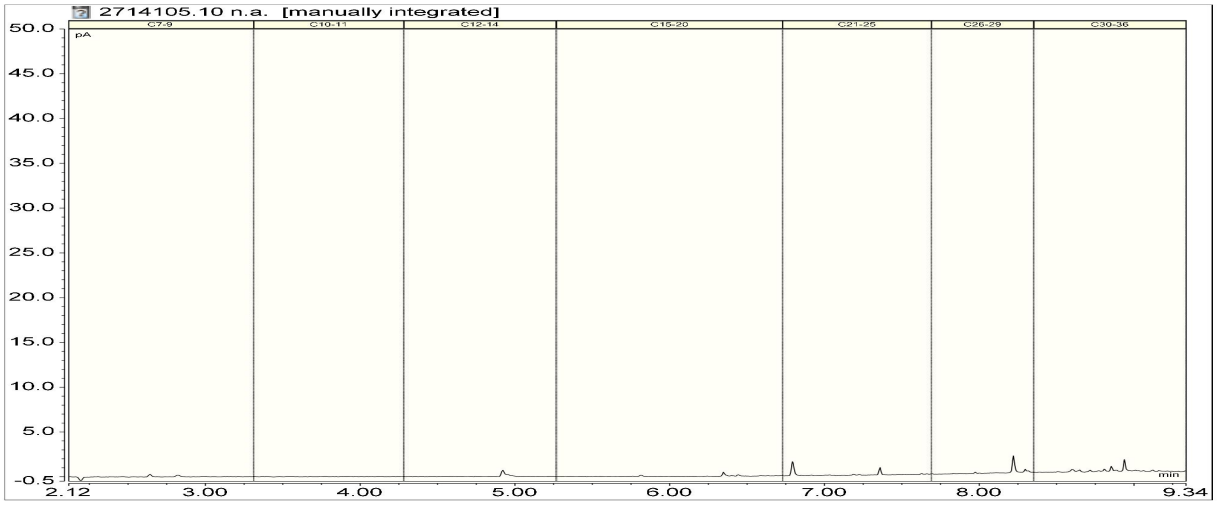
2714105.1
TP122_0.1 23-Sep-2021
Client Chromatogram for TPH by FID



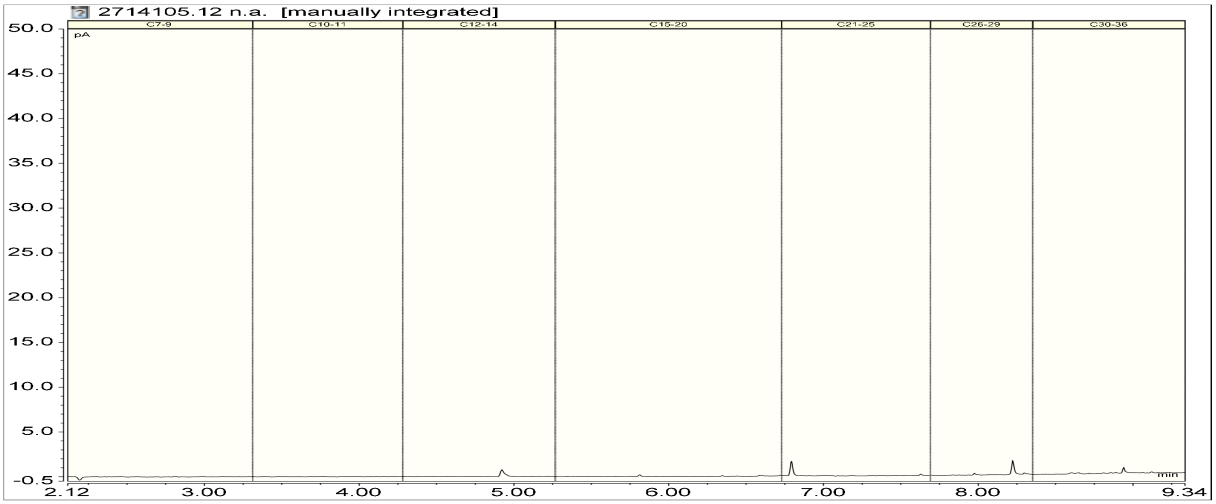
2714105.5
TP123_0.1 23-Sep-2021
Client Chromatogram for TPH by FID



2714105.10
TP125_0.1 23-Sep-2021
Client Chromatogram for TPH by FID



2714105.12
TP125_0.8 23-Sep-2021
Client Chromatogram for TPH by FID



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			
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, 7, 10, 12
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-2, 5, 7, 10, 12
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-2, 5, 7, 10, 12
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-2, 5, 7, 10, 12
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-2, 5, 7, 10, 12
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1, 5, 10, 12

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5, 7, 10, 12
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5, 7, 10, 12
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-2, 5, 7, 10, 12
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-2, 5, 7, 10, 12

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

Testing was completed between 28-Sep-2021 and 29-Sep-2021. 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.

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

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
101C Waterloo Road
Hornby
Christchurch 8042 New Zealand

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2714491	A2Pv1
Contact:	Nikki Mather	**Date Received:**	24-Sep-2021	
	C/- Beca Limited	**Date Reported:**	28-Sep-2021	
	PO Box 6345	**Quote No:**	113742	
	Wellesley Street	**Order No:**	21:136	
	Auckland 1141	**Client Reference:**	4210205/002/DA	
		Submitted By:	Nikki Mather	

Sample Type: Soil

Sample Name:		TP122_0.1 23-Sep-2021	TP122_0.5 23-Sep-2021	TP123_0.1 23-Sep-2021	TP123_0.85 23-Sep-2021	TP125_0.1 23-Sep-2021
Lab Number:		2714491.1	2714491.2	2714491.5	2714491.7	2714491.10
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
As Received Weight	g	703.6	762.5	661.8	563.1	662.4
Dry Weight	g	575.1	615.8	533.1	408.4	505.4
Moisture	%	18	19	19	27	24
Sample Fraction >10mm	g dry wt	133.0	< 0.1	77.0	< 0.1	32.3
Sample Fraction <10mm to >2mm	g dry wt	168.0	25.4	171.7	3.1	141.5
Sample Fraction <2mm	g dry wt	273.2	588.7	283.3	404.6	330.8
<2mm Subsample Weight	g dry wt	53.0	58.2	57.8	59.4	55.0
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Sample Name:		TP125_0.8 23-Sep-2021				
Lab Number:		2714491.12				
Asbestos Presence / Absence		Asbestos NOT detected.	-	-	-	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
As Received Weight	g	1,000.4	-	-	-	-
Dry Weight	g	692.8	-	-	-	-
Moisture	%	31	-	-	-	-

Sample Type: Soil						
Sample Name:		TP125_0.8 23-Sep-2021				
Lab Number:		2714491.12				
Sample Fraction >10mm	g dry wt	57.8	-	-	-	-
Sample Fraction <10mm to >2mm	g dry wt	178.7	-	-	-	-
Sample Fraction <2mm	g dry wt	454.9	-	-	-	-
<2mm Subsample Weight	g dry wt	57.3	-	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	-	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	-	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	-	-	-	-

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			
Wgt 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	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-2, 5, 7, 10, 12
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12
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%	1-2, 5, 7, 10, 12
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-2, 5, 7, 10, 12

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
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	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12
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	1-2, 5, 7, 10, 12

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

Testing was completed on 28-Sep-2021. 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.

Rhodri Williams BSc (Hons)
Technical Manager - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2716253 SPv1
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	27-Sep-2021
		Date Reported:	04-Oct-2021
		Quote No:	113742
		Order No:	21:132
		Client Reference:	4210205/002/DA
		Submitted By:	Nikki Mather

Interim Report

This is an interim report, prepared before all test results are completed. As all final Q.C. checks may not have been possible, it is not regarded as an official certificate of analysis. The final, official report will be issued upon completion of all tests.

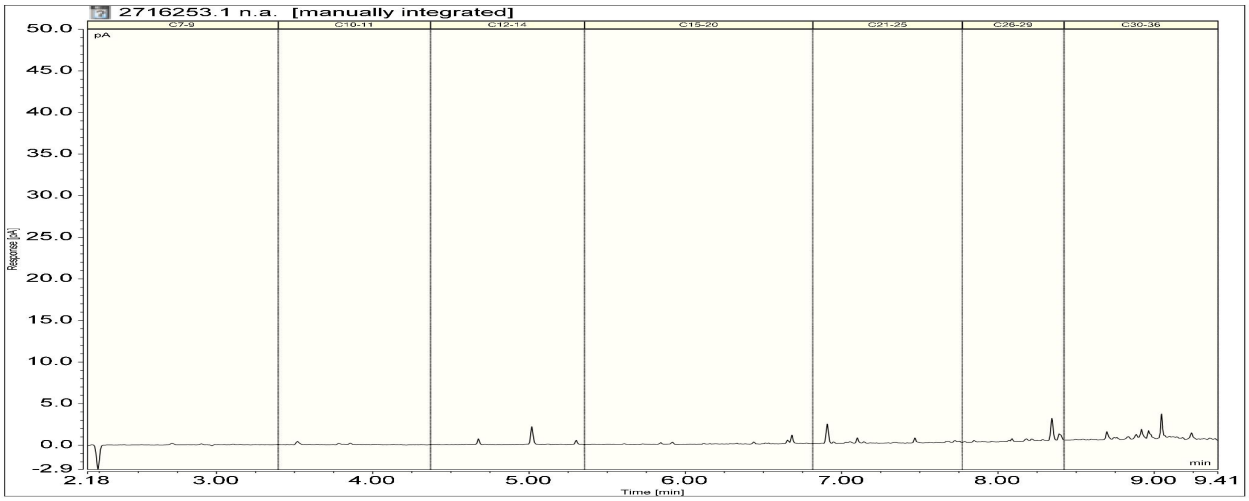
Sample Type: Soil

Sample Name:		TP118_0.1 23-Sep-2021	TP118_0.4 23-Sep-2021	TP118_2.0 23-Sep-2021	TP120_0.1 23-Sep-2021	TP120_0.5 23-Sep-2021
Lab Number:		2716253.1	2716253.2	2716253.4	2716253.5	2716253.6
Individual Tests						
Dry Matter	g/100g as rcvd	83	83	-	80	80
Fluoride	mg/kg dry wt	-	-	In Progress	-	-
pH	pH Units	6.2	4.8	-	5.9	5.6
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	8	5	-	11	7
Total Recoverable Cadmium	mg/kg dry wt	8.7	17.5	-	8.1	12.1
Total Recoverable Chromium	mg/kg dry wt	34	49	-	41	53
Total Recoverable Copper	mg/kg dry wt	20	32	-	31	34
Total Recoverable Lead	mg/kg dry wt	21	26	-	28	29
Total Recoverable Mercury	mg/kg dry wt	0.53	0.42	-	0.43	0.50
Total Recoverable Nickel	mg/kg dry wt	14	7	-	13	22
Total Recoverable Zinc	mg/kg dry wt	122	193	-	146	162
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	1.5	0.6	-	2.8	6.1
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.012	-	< 0.012	< 0.012
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.012	-	< 0.012	< 0.012
Acenaphthylene	mg/kg dry wt	0.012	< 0.012	-	0.035	0.041
Acenaphthene	mg/kg dry wt	< 0.012	< 0.012	-	< 0.012	0.014
Anthracene	mg/kg dry wt	< 0.012	< 0.012	-	0.028	0.055
Benzo[a]anthracene	mg/kg dry wt	0.095	0.028	-	0.172	0.34
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.169	0.064	-	0.31	0.88
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.24	0.10	-	0.44	1.20
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.24	0.10	-	0.44	1.19
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.198	0.086	-	0.34	0.93
Benzo[e]pyrene	mg/kg dry wt	0.131	0.061	-	0.22	0.57
Benzo[g,h,i]perylene	mg/kg dry wt	0.168	0.061	-	0.28	0.62
Benzo[k]fluoranthene	mg/kg dry wt	0.077	0.044	-	0.134	0.34
Chrysene	mg/kg dry wt	0.080	0.031	-	0.154	0.30
Dibenzo[a,h]anthracene	mg/kg dry wt	0.021	< 0.012	-	0.036	0.089
Fluoranthene	mg/kg dry wt	0.153	0.051	-	0.32	0.55
Fluorene	mg/kg dry wt	< 0.012	< 0.012	-	< 0.012	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.136	0.052	-	0.24	0.55
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	-	< 0.06	< 0.06
Perylene	mg/kg dry wt	0.049	0.016	-	0.083	0.22
Phenanthrene	mg/kg dry wt	0.036	0.016	-	0.078	0.098
Pyrene	mg/kg dry wt	0.128	0.045	-	0.30	0.49

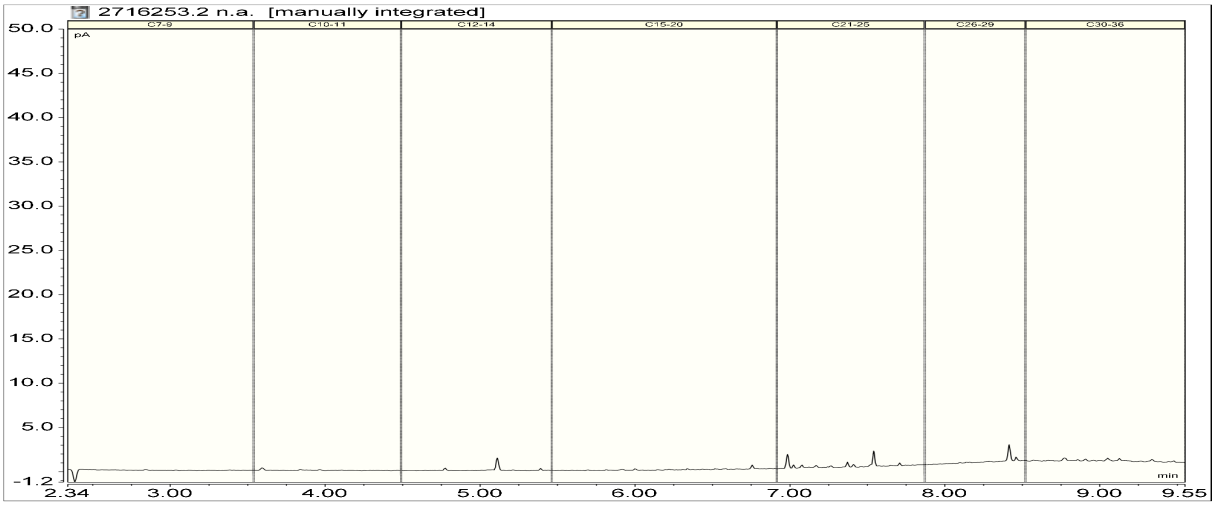
Sample Type: Soil						
Sample Name:		TP118_0.1 23-Sep-2021	TP118_0.4 23-Sep-2021	TP118_2.0 23-Sep-2021	TP120_0.1 23-Sep-2021	TP120_0.5 23-Sep-2021
Lab Number:		2716253.1	2716253.2	2716253.4	2716253.5	2716253.6
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	-	< 20	< 20
C10 - C14	mg/kg dry wt	< 20	< 20	-	< 20	< 20
C15 - C36	mg/kg dry wt	97	190	-	85	153
Total hydrocarbons (C7 - C36)	mg/kg dry wt	107	191	-	96	156

Sample Name:		TP120_1.8 23-Sep-2021	TP121_0.1 23-Sep-2021	TP121_1.0 23-Sep-2021	QA2 23-Sep-2021	QA3 23-Sep-2021
Lab Number:		2716253.8	2716253.9	2716253.11	2716253.13	2716253.14
Individual Tests						
Dry Matter	g/100g as rcvd	-	83	69	82	80
Fluoride	mg/kg dry wt	In Progress	-	-	-	-
pH	pH Units	-	6.1	4.6	5.5	5.8
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	19	20	8	10
Total Recoverable Cadmium	mg/kg dry wt	-	4.7	17.1	9.0	7.6
Total Recoverable Chromium	mg/kg dry wt	-	61	106	44	40
Total Recoverable Copper	mg/kg dry wt	-	44	52	32	25
Total Recoverable Lead	mg/kg dry wt	-	35	18.6	30	25
Total Recoverable Mercury	mg/kg dry wt	-	0.29	4.0	0.5	0.42
Total Recoverable Nickel	mg/kg dry wt	-	18	24	15	11
Total Recoverable Zinc	mg/kg dry wt	-	220	156	139	114
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	-	1.8	< 0.4	4.8	2.2
1-Methylnaphthalene	mg/kg dry wt	-	< 0.012	< 0.015	< 0.012	< 0.013
2-Methylnaphthalene	mg/kg dry wt	-	< 0.012	< 0.015	< 0.012	< 0.013
Acenaphthylene	mg/kg dry wt	-	0.024	< 0.015	0.041	0.020
Acenaphthene	mg/kg dry wt	-	< 0.012	< 0.015	0.013	< 0.013
Anthracene	mg/kg dry wt	-	0.016	< 0.015	0.078	0.028
Benzo[a]anthracene	mg/kg dry wt	-	0.118	0.025	0.24	0.123
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	0.192	0.036	0.66	0.24
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	-	0.26	0.05	0.89	0.34
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	-	0.26	0.05	0.89	0.34
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	0.191	0.035	0.65	0.28
Benzo[e]pyrene	mg/kg dry wt	-	0.124	0.020	0.45	0.195
Benzo[g,h,i]perylene	mg/kg dry wt	-	0.143	0.022	0.49	0.25
Benzo[k]fluoranthene	mg/kg dry wt	-	0.070	< 0.015	0.24	0.100
Chrysene	mg/kg dry wt	-	0.109	0.024	0.21	0.105
Dibenzo[a,h]anthracene	mg/kg dry wt	-	0.019	< 0.015	0.070	0.031
Fluoranthene	mg/kg dry wt	-	0.26	0.040	0.46	0.22
Fluorene	mg/kg dry wt	-	< 0.012	< 0.015	< 0.012	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	0.113	0.022	0.44	0.21
Naphthalene	mg/kg dry wt	-	< 0.06	< 0.08	< 0.06	< 0.07
Perylene	mg/kg dry wt	-	0.048	< 0.015	0.171	0.070
Phenanthrene	mg/kg dry wt	-	0.075	0.023	0.154	0.092
Pyrene	mg/kg dry wt	-	0.24	0.038	0.38	0.174
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	< 20	< 20	< 20	< 20
C10 - C14	mg/kg dry wt	-	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	-	75	153	160	156
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	85	166	168	169

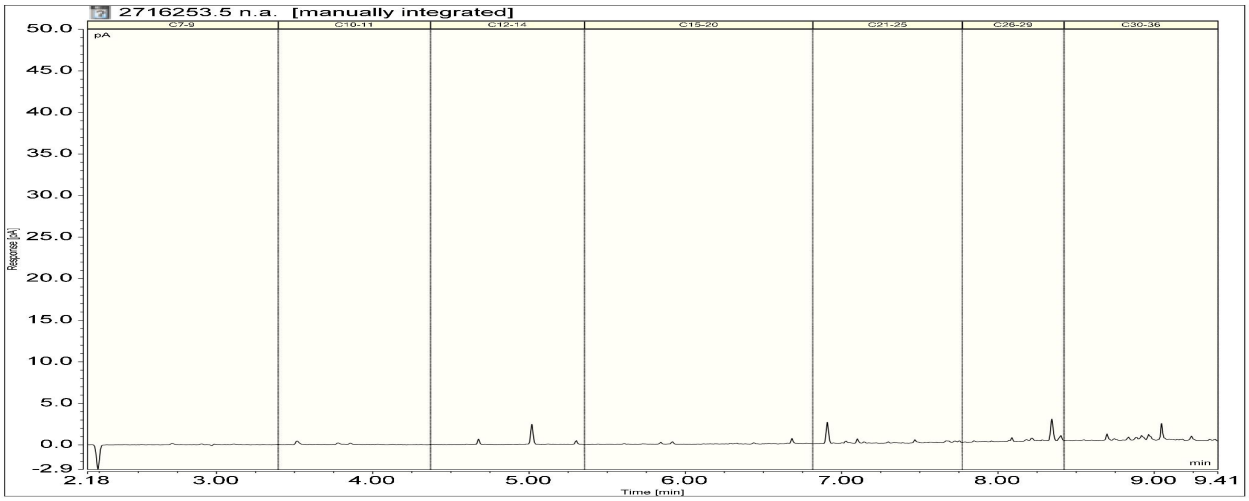
2716253.1
TP118_0.1 23-Sep-2021
Client Chromatogram for TPH by FID



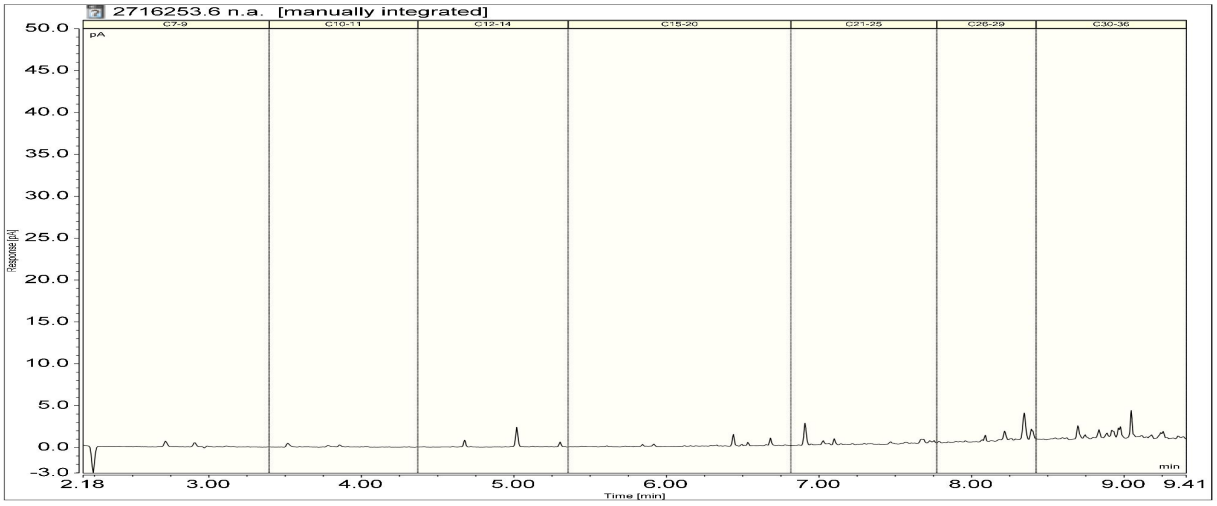
2716253.2
TP118_0.4 23-Sep-2021
Client Chromatogram for TPH by FID



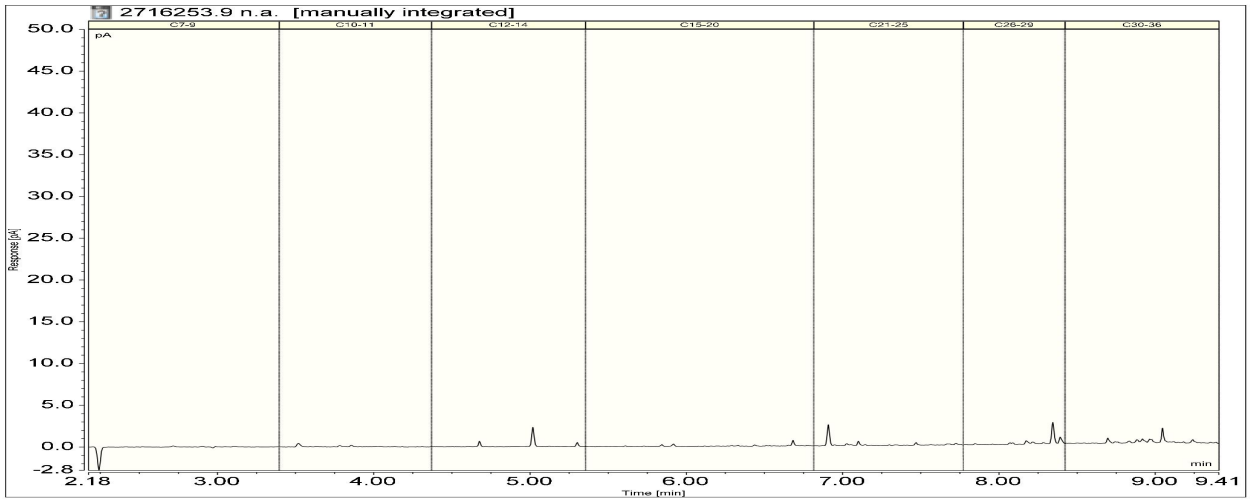
2716253.5
TP120_0.1 23-Sep-2021
Client Chromatogram for TPH by FID



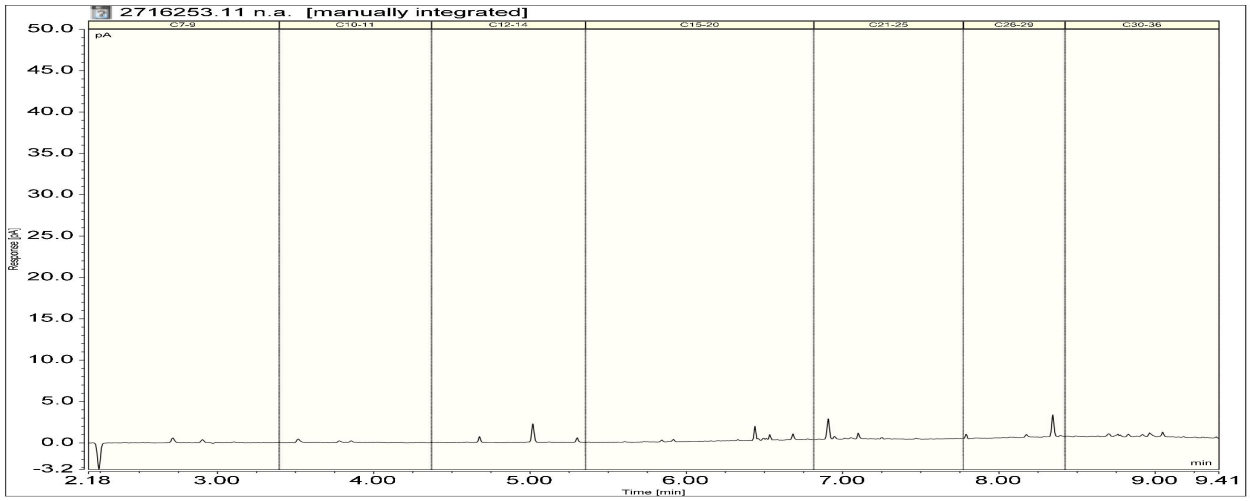
2716253.6
TP120_0.5 23-Sep-2021
Client Chromatogram for TPH by FID



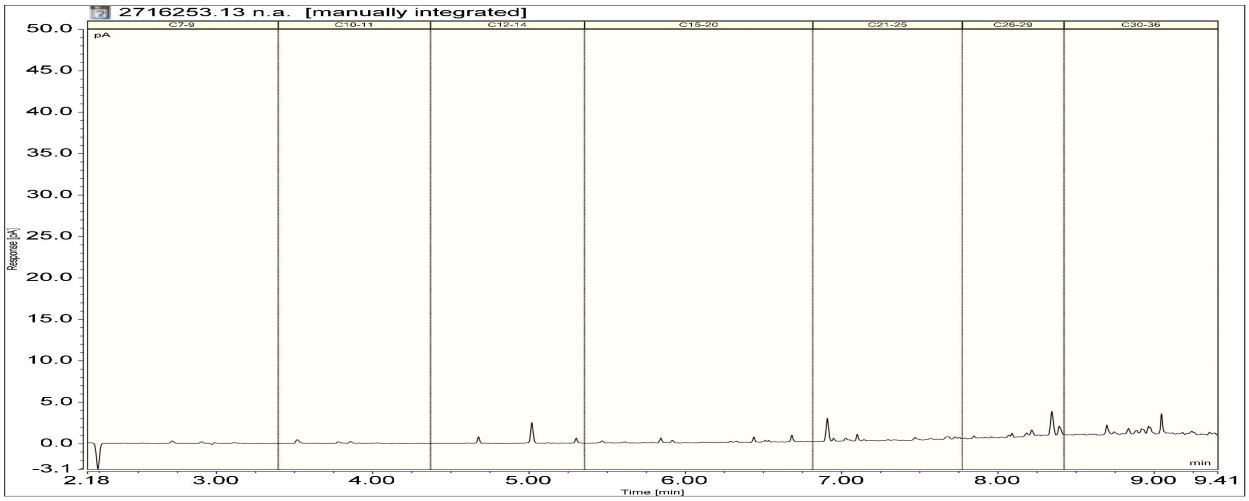
2716253.9
TP121_0.1 23-Sep-2021
Client Chromatogram for TPH by FID



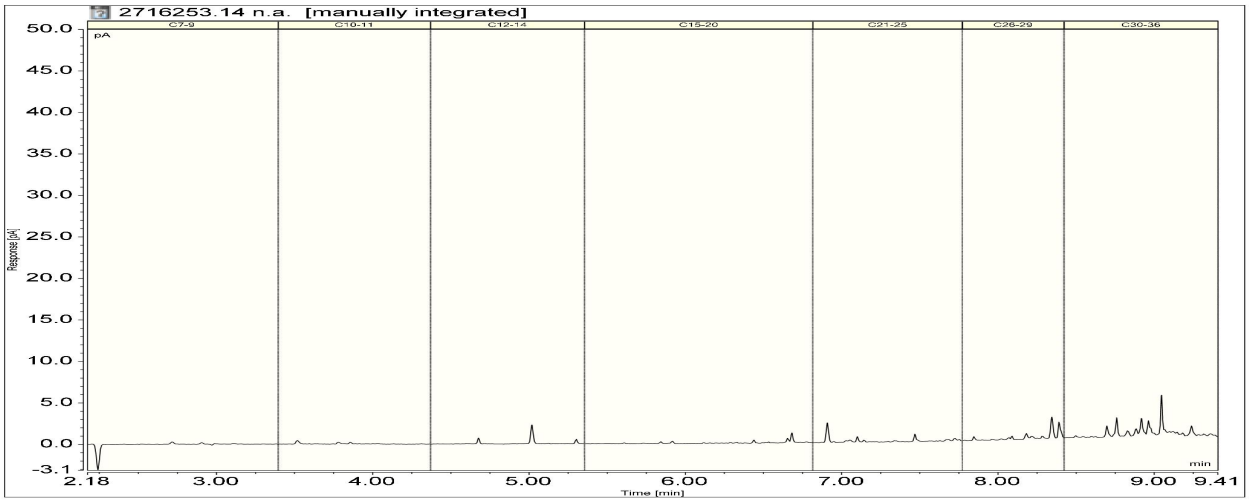
2716253.11
TP121_1.0 23-Sep-2021
Client Chromatogram for TPH by FID



2716253.13
QA2 23-Sep-2021
Client Chromatogram for TPH by FID



2716253.14
QA3 23-Sep-2021
Client Chromatogram for TPH by FID



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			
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, 11, 13-14
Non-Routine Environmental Solids Sample Drying	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	4, 8
Non-Routine sample preparation. Air drying and 180 um sieving.	Air dried and sieved, <180 um fraction. Used for sample preparation.	-	4, 8
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-2, 5-6, 9, 11, 13-14
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
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	1-2, 5-6, 9, 11, 13-14

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Fluoride in solids alkaline fusion	Alkaline fusion of sample. Methods of Soil Analysis 2nd Edition, Pt2, 26-4.3.3.	-	4, 8
Total Fluoride in Solids	Ion selective electrode. Methods of Soil Analysis 2nd Edition, Pt2, 26-4.3.3. (modified).	20 mg/kg dry wt	4, 8
pH	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-2, 5-6, 9, 11, 13-14
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	1-2, 5-6, 9, 11, 13-14
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	1-2, 5-6, 9, 11, 13-14
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1-2, 5-6, 9, 11, 13-14
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14

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

Testing was completed between 29-Sep-2021 and 04-Oct-2021. 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.

Kim Harrison MSc
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2716254 SPv1
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	27-Sep-2021
		Date Reported:	01-Oct-2021
		Quote No:	113742
		Order No:	21:136
		Client Reference:	4210205/002/DA
		Submitted By:	Nikki Mather

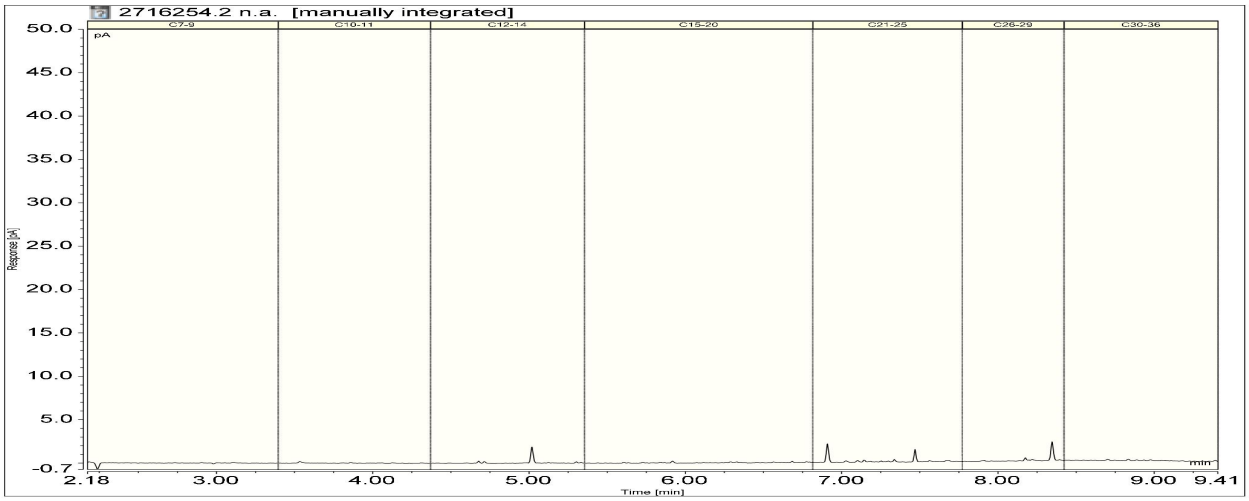
Sample Type: Soil

Sample Name:		TP127_0.1 24-Sep-2021	TP127_0.5 24-Sep-2021	QA4 24-Sep-2021	TP124_0.1 24-Sep-2021	TP124_0.5 24-Sep-2021
Lab Number:		2716254.1	2716254.2	2716254.5	2716254.6	2716254.7
Individual Tests						
Dry Matter	g/100g as rcvd	70	83	81	75	72
pH*	pH Units	3.3	7.4	7.1	4.9	4.6
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	6	7	8	11
Total Recoverable Cadmium	mg/kg dry wt	0.84	5.2	6.3	14.6	10.9
Total Recoverable Chromium	mg/kg dry wt	18	30	33	54	58
Total Recoverable Copper	mg/kg dry wt	7	22	22	33	39
Total Recoverable Lead	mg/kg dry wt	12.9	22	20	17.4	17.8
Total Recoverable Mercury	mg/kg dry wt	0.43	0.12	0.25	1.53	1.26
Total Recoverable Nickel	mg/kg dry wt	< 2	57	56	16	14
Total Recoverable Zinc	mg/kg dry wt	8	141	139	220	184
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	1.5	2.0	< 0.4	< 0.4
1-Methylnaphthalene	mg/kg dry wt	< 0.015	< 0.012	< 0.013	< 0.014	< 0.014
2-Methylnaphthalene	mg/kg dry wt	< 0.015	< 0.012	< 0.013	< 0.014	< 0.014
Acenaphthylene	mg/kg dry wt	< 0.015	0.038	0.016	< 0.014	< 0.014
Acenaphthene	mg/kg dry wt	< 0.015	< 0.012	< 0.013	< 0.014	< 0.014
Anthracene	mg/kg dry wt	< 0.015	0.044	< 0.013	< 0.014	< 0.014
Benzo[a]anthracene	mg/kg dry wt	0.021	0.143	0.174	0.014	0.015
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.026	0.153	0.26	0.026	0.025
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.04	0.21	0.35	0.03	< 0.04
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.04	0.21	0.35	0.03	< 0.04
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.028	0.140	0.26	0.028	0.031
Benzo[e]pyrene	mg/kg dry wt	0.017	0.087	0.149	0.021	0.019
Benzo[g,h,i]perylene	mg/kg dry wt	0.019	0.076	0.148	0.022	0.022
Benzo[k]fluoranthene	mg/kg dry wt	< 0.015	0.063	0.113	< 0.014	< 0.014
Chrysene	mg/kg dry wt	0.020	0.108	0.133	< 0.014	< 0.014
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.015	0.015	0.022	< 0.014	< 0.014
Fluoranthene	mg/kg dry wt	0.052	0.22	0.28	0.013	0.018
Fluorene	mg/kg dry wt	< 0.015	< 0.012	< 0.013	< 0.014	< 0.014
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.017	0.066	0.125	0.016	0.018
Naphthalene	mg/kg dry wt	< 0.08	< 0.06	< 0.07	< 0.07	< 0.07
Perylene	mg/kg dry wt	< 0.015	0.030	0.063	< 0.014	< 0.014
Phenanthrene	mg/kg dry wt	< 0.015	0.121	0.028	< 0.014	< 0.014
Pyrene	mg/kg dry wt	0.046	0.21	0.24	0.018	0.020

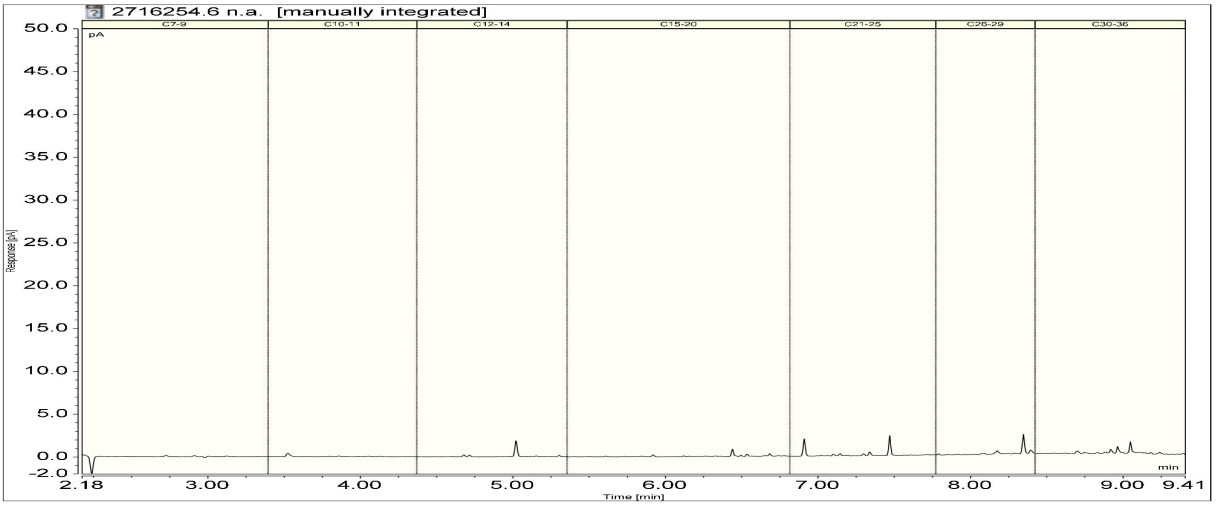
Sample Type: Soil						
Sample Name:		TP127_0.1 24-Sep-2021	TP127_0.5 24-Sep-2021	QA4 24-Sep-2021	TP124_0.1 24-Sep-2021	TP124_0.5 24-Sep-2021
Lab Number:		2716254.1	2716254.2	2716254.5	2716254.6	2716254.7
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	42	< 40	58	90
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 80	< 80	< 80	< 80	93

Sample Name:		TP126_0.1 24-Sep-2021	TP126_1.5 24-Sep-2021			
Lab Number:		2716254.10	2716254.13			
Individual Tests						
Dry Matter	g/100g as rcvd	85	79	-	-	-
pH*	pH Units	4.4	6.4	-	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	9	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	4.8	4.3	-	-	-
Total Recoverable Chromium	mg/kg dry wt	32	41	-	-	-
Total Recoverable Copper	mg/kg dry wt	20	32	-	-	-
Total Recoverable Lead	mg/kg dry wt	19.8	78	-	-	-
Total Recoverable Mercury	mg/kg dry wt	0.40	0.26	-	-	-
Total Recoverable Nickel	mg/kg dry wt	4	21	-	-	-
Total Recoverable Zinc	mg/kg dry wt	55	450	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	0.4	1.2	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.013	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.013	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.013	-	-	-
Acenaphthene	mg/kg dry wt	< 0.012	0.028	-	-	-
Anthracene	mg/kg dry wt	< 0.012	< 0.013	-	-	-
Benzo[a]anthracene	mg/kg dry wt	0.030	0.076	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.051	0.103	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.07	0.15	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.07	0.15	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.070	0.132	-	-	-
Benzo[e]pyrene	mg/kg dry wt	0.042	0.082	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.041	0.086	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	0.027	0.054	-	-	-
Chrysene	mg/kg dry wt	0.033	0.081	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	0.013	-	-	-
Fluoranthene	mg/kg dry wt	0.044	0.195	-	-	-
Fluorene	mg/kg dry wt	< 0.012	0.014	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.033	0.069	-	-	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.07	-	-	-
Perylene	mg/kg dry wt	0.012	0.025	-	-	-
Phenanthrene	mg/kg dry wt	0.013	0.087	-	-	-
Pyrene	mg/kg dry wt	0.037	0.149	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	-	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	-	-	-
C15 - C36	mg/kg dry wt	65	108	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 80	109	-	-	-

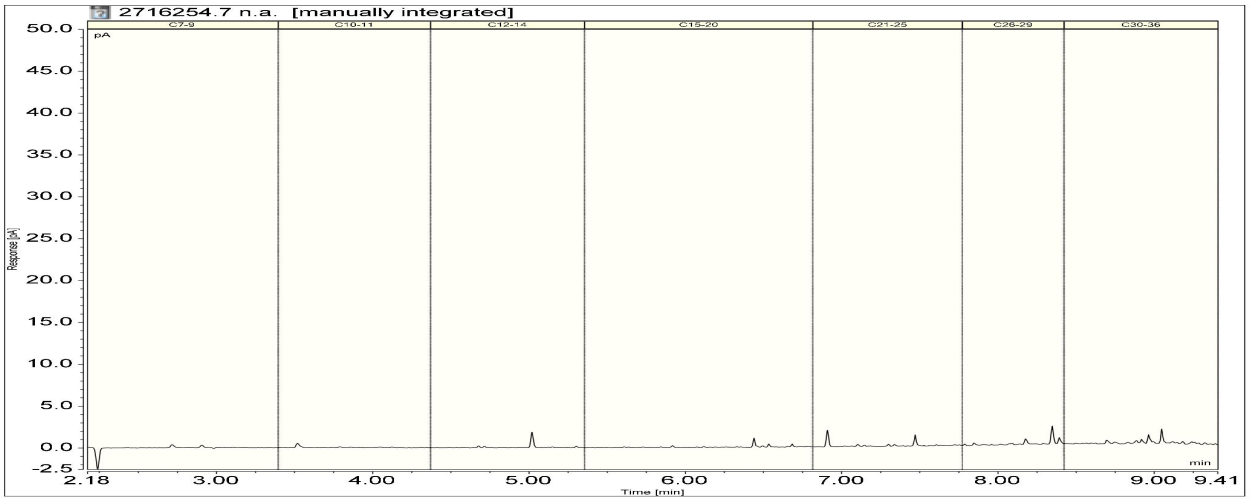
2716254.2
TP127_0.5 24-Sep-2021
Client Chromatogram for TPH by FID



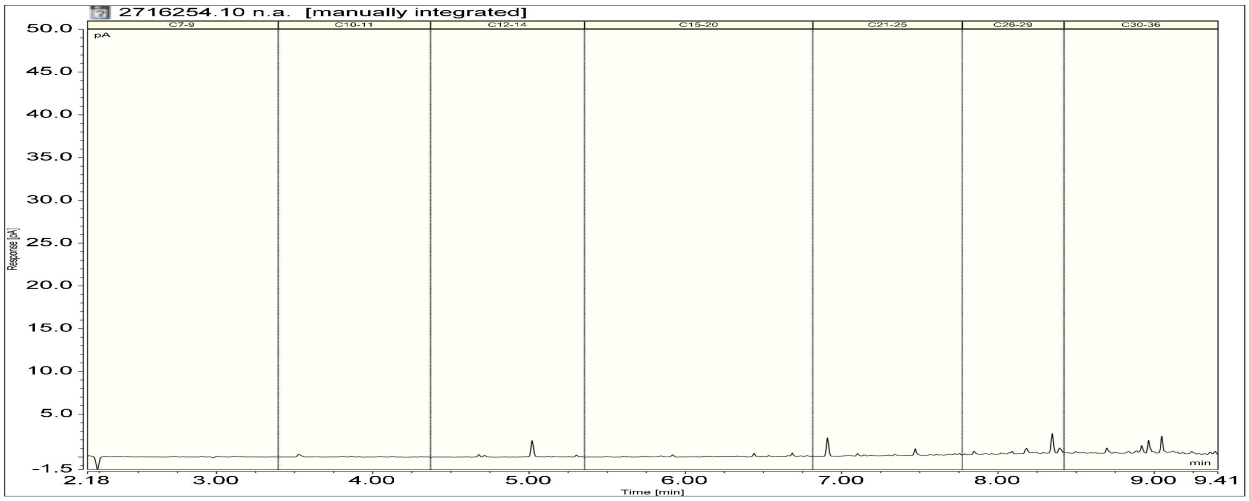
2716254.6
TP124_0.1 24-Sep-2021
Client Chromatogram for TPH by FID



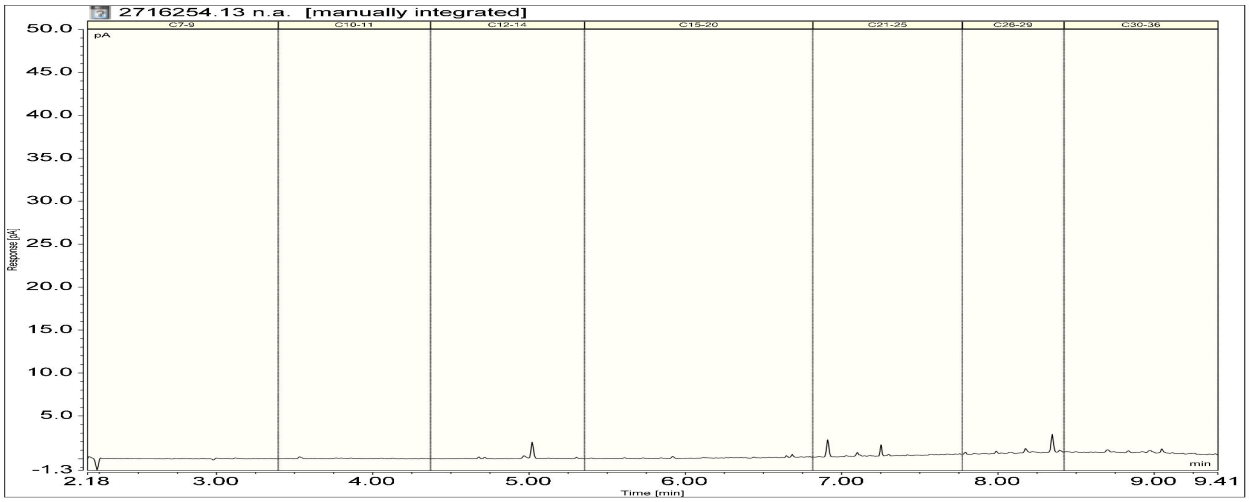
2716254.7
TP124_0.5 24-Sep-2021
Client Chromatogram for TPH by FID



2716254.10
TP126_0.1 24-Sep-2021
Client Chromatogram for TPH by FID



2716254.13
TP126_1.5 24-Sep-2021
Client Chromatogram for TPH by FID



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			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-2, 5-7, 10, 13
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-2, 5-7, 10, 13
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-2, 5-7, 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	1-2, 5-7, 10, 13
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-2, 5-7, 10, 13

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
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	1-2, 5-7, 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).	0.002 mg/kg dry wt	1-2, 5-7, 10, 13
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-2, 5-7, 10, 13
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-2, 5-7, 10, 13
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	2, 6-7, 10, 13
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5-7, 10, 13
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5-7, 10, 13
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-2, 5-7, 10, 13
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-2, 5-7, 10, 13

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

Testing was completed between 29-Sep-2021 and 01-Oct-2021. For completion dates of individual analyses please contact the laboratory.

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

Martin Cowell - BSc
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

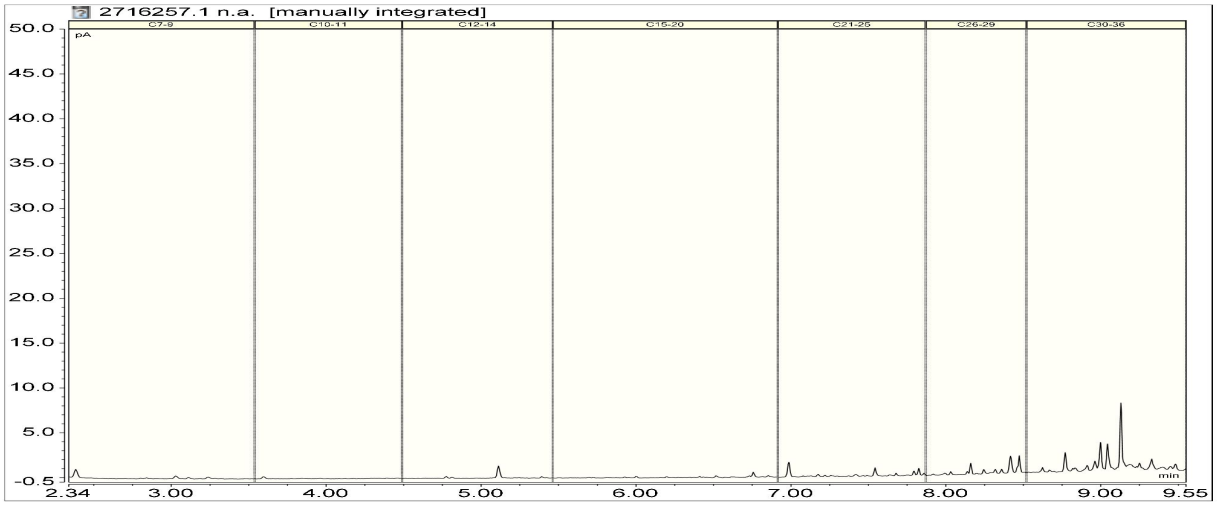
Client:	Beca Limited	**Lab No:**	2716257	SPv1
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:** **Date Reported:** **Quote No:** **Order No:** **Client Reference:** **Submitted By:**	27-Sep-2021 01-Oct-2021 113742 21:136 4210205/002/DA Nikki Mather	

Sample Type: Soil

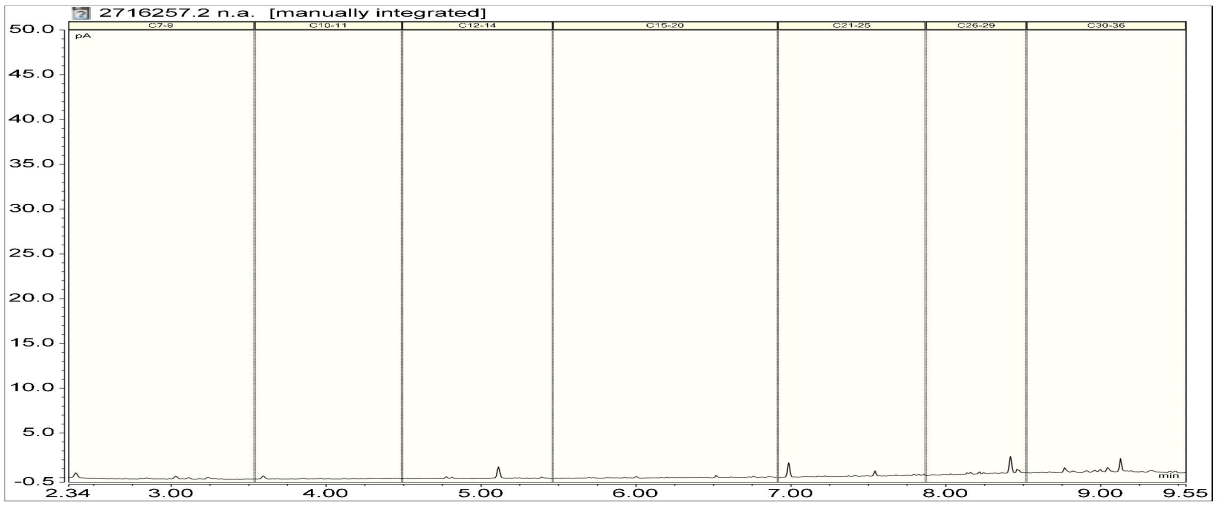
		Sample Name:	TP119_0.1 22-Sep-2021	TP119_0.5 22-Sep-2021	TP128_0.1 24-Sep-2021	TP128_2.2 24-Sep-2021	
		Lab Number:	2716257.1	2716257.2	2716257.5	2716257.9	
Individual Tests							
Dry Matter	g/100g as rcvd		72	81	74	72	-
pH*	pH Units		6.0	4.9	4.2	8.1	-
Heavy Metals with Mercury, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		6	8	13	5	-
Total Recoverable Cadmium	mg/kg dry wt		5.1	7.7	14.0	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt		36	38	55	21 #1	-
Total Recoverable Copper	mg/kg dry wt		29	29	49	11	-
Total Recoverable Lead	mg/kg dry wt		30	21	18.7	19.4	-
Total Recoverable Mercury	mg/kg dry wt		0.73	0.53	1.80	< 0.10	-
Total Recoverable Nickel	mg/kg dry wt		6	8	7	18 #2	-
Total Recoverable Zinc	mg/kg dry wt		82	93	74	78 #3	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*							
Total of Reported PAHs in Soil	mg/kg dry wt		1.0	0.5	0.6	< 0.4	-
1-Methylnaphthalene	mg/kg dry wt		< 0.014	< 0.013	< 0.014	< 0.014	-
2-Methylnaphthalene	mg/kg dry wt		< 0.014	< 0.013	< 0.014	< 0.014	-
Acenaphthylene	mg/kg dry wt		< 0.014	< 0.013	< 0.014	< 0.014	-
Acenaphthene	mg/kg dry wt		< 0.014	< 0.013	< 0.014	< 0.014	-
Anthracene	mg/kg dry wt		< 0.014	< 0.013	< 0.014	< 0.014	-
Benzo[a]anthracene	mg/kg dry wt		0.079	0.035	0.046	< 0.014	-
Benzo[a]pyrene (BAP)	mg/kg dry wt		0.105	0.051	0.066	< 0.014	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt		0.14	0.07	0.09	< 0.04	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt		0.14	0.07	0.09	< 0.04	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt		0.147	0.075	0.072	< 0.014	-
Benzo[e]pyrene	mg/kg dry wt		0.088	0.046	0.042	< 0.014	-
Benzo[g,h,i]perylene	mg/kg dry wt		0.099	0.048	0.047	< 0.014	-
Benzo[k]fluoranthene	mg/kg dry wt		0.055	0.033	0.027	< 0.014	-
Chrysene	mg/kg dry wt		0.074	0.039	0.053	< 0.014	-
Dibenzo[a,h]anthracene	mg/kg dry wt		< 0.014	< 0.013	< 0.014	< 0.014	-
Fluoranthene	mg/kg dry wt		0.109	0.043	0.085	< 0.014	-
Fluorene	mg/kg dry wt		< 0.014	< 0.013	< 0.014	< 0.014	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt		0.083	0.040	0.038	< 0.014	-
Naphthalene	mg/kg dry wt		< 0.07	< 0.07	< 0.07	< 0.07	-
Perylene	mg/kg dry wt		0.026	< 0.013	0.014	< 0.014	-
Phenanthrene	mg/kg dry wt		0.039	0.018	0.028	< 0.014	-
Pyrene	mg/kg dry wt		0.110	0.042	0.104	< 0.014	-

Sample Type: Soil						
Sample Name:		TP119_0.1 22-Sep-2021	TP119_0.5 22-Sep-2021	TP128_0.1 24-Sep-2021	TP128_2.2 24-Sep-2021	
Lab Number:		2716257.1	2716257.2	2716257.5	2716257.9	
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	< 20	< 20	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	-
C15 - C36	mg/kg dry wt	210	142	< 40	< 40	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	210	150	< 80	< 80	-

2716257.1
TP119_0.1 22-Sep-2021
Client Chromatogram for TPH by FID



2716257.2
TP119_0.5 22-Sep-2021
Client Chromatogram for TPH by FID



Analyst's Comments

#1 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. Replicate 1 = 21mg/kg, replicate 2 = 16mg/kg.

#2 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. Replicate 1 = 18mg/kg, replicate 2 = 14mg/kg.

#3 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. Replicate 1 = 78mg/kg, replicate 2 = 63mg/kg.

Summary of Methods

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

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
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, 9
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-2, 5, 9
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-2, 5, 9
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-2, 5, 9
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-2, 5, 9
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	1-2, 5, 9
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	1-2, 5, 9
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-2, 5, 9
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-2, 5, 9
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1-2
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5, 9
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5, 9
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-2, 5, 9
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-2, 5, 9

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

Testing was completed between 29-Sep-2021 and 01-Oct-2021. For completion dates of individual analyses please contact the laboratory.

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

Martin Cowell - BSc
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
101C Waterloo Road
Hornby
Christchurch 8042 New Zealand

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2716521 A2Pv1
Contact:	Nikki Mather	**Date Received:**	27-Sep-2021
	C/- Beca Limited	**Date Reported:**	29-Sep-2021
	PO Box 6345	**Quote No:**	113742
	Wellesley Street	**Order No:**	21:136
	Auckland 1141	**Client Reference:**	4210205/002/DA
		Add. Client Ref:	Sampled: 23/09/21
		Submitted By:	Nikki Mather

Sample Type: Soil

Sample Name:		TP118-0.1 23-Sep-2021	TP118-0.4 23-Sep-2021	TP120-0.1 23-Sep-2021	TP120-0.5 23-Sep-2021	TP121-0.1 23-Sep-2021
Lab Number:		2716521.1	2716521.2	2716521.5	2716521.6	2716521.9
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
As Received Weight	g	673.8	680.5	719.7	712.5	644.8
Dry Weight	g	558.4	546.4	599.5	616.3	512.5
Moisture	%	17	20	17	13	21
Sample Fraction >10mm	g dry wt	78.3	51.5	79.8	150.5	78.8
Sample Fraction <10mm to >2mm	g dry wt	187.3	175.7	204.8	210.2	147.4
Sample Fraction <2mm	g dry wt	291.9	318.5	314.5	255.0	285.7
<2mm Subsample Weight	g dry wt	57.4	58.5	56.8	54.5	53.1
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Sample Name:		TP121-1.0 23-Sep-2021				
Lab Number:		2716521.11				
Asbestos Presence / Absence		Asbestos NOT detected.	-	-	-	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
As Received Weight	g	777.6	-	-	-	-
Dry Weight	g	519.4	-	-	-	-
Moisture	%	33	-	-	-	-

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:		TP121-1.0 23-Sep-2021				
Lab Number:		2716521.11				
Sample Fraction >10mm	g dry wt	50.0	-	-	-	-
Sample Fraction <10mm to >2mm	g dry wt	119.7	-	-	-	-
Sample Fraction <2mm	g dry wt	346.6	-	-	-	-
<2mm Subsample Weight	g dry wt	56.2	-	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	-	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	-	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	-	-	-	-

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			
Wgt 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	1-2, 5-6, 9, 11
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	1-2, 5-6, 9, 11
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-2, 5-6, 9, 11
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1-2, 5-6, 9, 11
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	1-2, 5-6, 9, 11
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	1-2, 5-6, 9, 11
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	1-2, 5-6, 9, 11
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%	1-2, 5-6, 9, 11
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-2, 5-6, 9, 11

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
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	1-2, 5-6, 9, 11
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	1-2, 5-6, 9, 11
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	1-2, 5-6, 9, 11
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	1-2, 5-6, 9, 11
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	1-2, 5-6, 9, 11
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	1-2, 5-6, 9, 11
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	1-2, 5-6, 9, 11

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

Testing was completed on 29-Sep-2021. 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.

Rhodri Williams BSc (Hons)
Technical Manager - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
Ground Fl, 28 Heather Street
Parnell
Auckland 1052 New Zealand

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2716616	A2Pv1
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	27-Sep-2021	
		Date Reported:	28-Sep-2021	
		Quote No:	113742	
		Order No:	21:136	
		Client Reference:	4210205/002/DA	
		Add. Client Ref:	Sampled: 24/09/21	
		Submitted By:	Nikki Mather	

Sample Type: Soil

Sample Name:		TP119_0.1	TP119_0.5	TP128_0.1	TP128_2.2	
Lab Number:		2716616.1	2716616.2	2716616.5	2716616.9	
Asbestos Presence / Absence		Asbestos NOT detected.	Amosite (Brown Asbestos) detected.	Asbestos NOT detected.	Asbestos NOT detected.	-
Description of Asbestos Form		-	Loose fibres.	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
As Received Weight	g	521.0	717.6	716.8	704.5	-
Dry Weight	g	408.1	621.6	549.1	511.7	-
Moisture	%	22	13	23	27	-
Sample Fraction >10mm*	g dry wt	48.9	139.5	60.1	< 0.1	-
Sample Fraction <10mm to >2mm*	g dry wt	112.8	198.0	140.3	184.5	-
Sample Fraction <2mm*	g dry wt	245.9	283.0	347.0	326.7	-
<2mm Subsample Weight*	g dry wt	51.0	51.7	50.8	51.6	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Fibrous Asbestos (Friable)*	g dry wt	< 0.00001	0.00064	< 0.00001	< 0.00001	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-

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
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.1 g	1-2, 5, 9
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.1 g	1-2, 5, 9
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1-2, 5, 9
Sample Fraction >10mm*	Sample dried at 100 to 105°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.1 g dry wt	1-2, 5, 9
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; 28 Heather Street, Auckland.	0.1 g dry wt	1-2, 5, 9
Sample Fraction <2mm*	Sample dried at 100 to 105°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.1 g dry wt	1-2, 5, 9
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%	1-2, 5, 9
Description of Asbestos Form	Description of asbestos form and/or shape if present. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	-	1-2, 5, 9
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; 28 Heather Street, Auckland. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-2, 5, 9
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	1-2, 5, 9
Weight of Asbestos as Fibrous Asbestos (Friable)*	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-2, 5, 9
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	1-2, 5, 9
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-2, 5, 9
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	1-2, 5, 9

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
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	1-2, 5, 9

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

Testing was completed on 28-Sep-2021. 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.

Danielle Carter BSc, PGDipSci, MSc
Laboratory Technician - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
Ground Fl, 28 Heather Street
Parnell
Auckland 1052 New Zealand

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2716661	A2Pv1
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	27-Sep-2021	
		Date Reported:	28-Sep-2021	
		Quote No:	113742	
		Order No:	21:136	
		Client Reference:	4210205/002/DA	
		Add. Client Ref:	Sampled: 24/09/21	
		Submitted By:	Nikki Mather	

Sample Type: Soil

Sample Name:		TP127_0.1	TP127_0.5	TP124_0.1	TP124_0.5	TP126_0.1
Lab Number:		2716661.1	2716661.2	2716661.5	2716661.6	2716661.9
Asbestos Presence / Absence		Asbestos NOT detected.	Chrysotile (White Asbestos) detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form		-	Loose fibres	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
As Received Weight	g	656.4	986.9	742.4	807.7	837.0
Dry Weight	g	517.2	846.6	598.3	610.1	683.9
Moisture	%	21	14	19	24	18
Sample Fraction >10mm*	g dry wt	59.7	218.3	70.2	59.7	70.3
Sample Fraction <10mm to >2mm*	g dry wt	189.5	267.0	218.9	195.4	231.1
Sample Fraction <2mm*	g dry wt	266.2	360.6	307.8	353.1	381.5
<2mm Subsample Weight*	g dry wt	50.5	50.9	50.3	50.1	50.2
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)*	g dry wt	< 0.00001	0.00003	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	0.00010	< 0.00001	< 0.00001	< 0.00001

Sample Name:		TP126_1.5				
Lab Number:		2716661.12				
Asbestos Presence / Absence		Chrysotile (White Asbestos) detected.	-	-	-	-
Description of Asbestos Form		Loose fibres	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
As Received Weight	g	1,183.5	-	-	-	-
Dry Weight	g	962.3	-	-	-	-

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:		TP126_1.5				
Lab Number:		2716661.12				
Moisture	%	19	-	-	-	-
Sample Fraction >10mm*	g dry wt	90.6	-	-	-	-
Sample Fraction <10mm to >2mm*	g dry wt	220.5	-	-	-	-
Sample Fraction <2mm*	g dry wt	649.1	-	-	-	-
<2mm Subsample Weight*	g dry wt	50.4	-	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	-	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)*	g dry wt	< 0.00001	-	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	0.00146	-	-	-	-

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**
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.1 g	1-2, 5-6, 9, 12
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.1 g	1-2, 5-6, 9, 12
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1-2, 5-6, 9, 12
Sample Fraction >10mm*	Sample dried at 100 to 105°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.1 g dry wt	1-2, 5-6, 9, 12
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; 28 Heather Street, Auckland.	0.1 g dry wt	1-2, 5-6, 9, 12
Sample Fraction <2mm*	Sample dried at 100 to 105°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.1 g dry wt	1-2, 5-6, 9, 12
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%	1-2, 5-6, 9, 12
Description of Asbestos Form	Description of asbestos form and/or shape if present. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	-	1-2, 5-6, 9, 12

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
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; 28 Heather Street, Auckland. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-2, 5-6, 9, 12
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	1-2, 5-6, 9, 12
Weight of Asbestos as Fibrous Asbestos (Friable)*	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-2, 5-6, 9, 12
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	1-2, 5-6, 9, 12
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-2, 5-6, 9, 12
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	1-2, 5-6, 9, 12
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	1-2, 5-6, 9, 12

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

Testing was completed on 28-Sep-2021. 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.

Danielle Carter BSc, PGDipSci, MSc
Laboratory Technician - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2708251	SPv3
Contact:	Nikki Mather	**Date Received:**	18-Sep-2021	
	C/- Beca Limited	**Date Reported:**	06-Oct-2021	**(Amended)**
	PO Box 6345	**Quote No:**	113742	
	Wellesley Street	**Order No:**	21:132	
	Auckland 1141	**Client Reference:**	4210205/002/DA	
		Submitted By:	Nikki Mather	

Sample Type: Soil

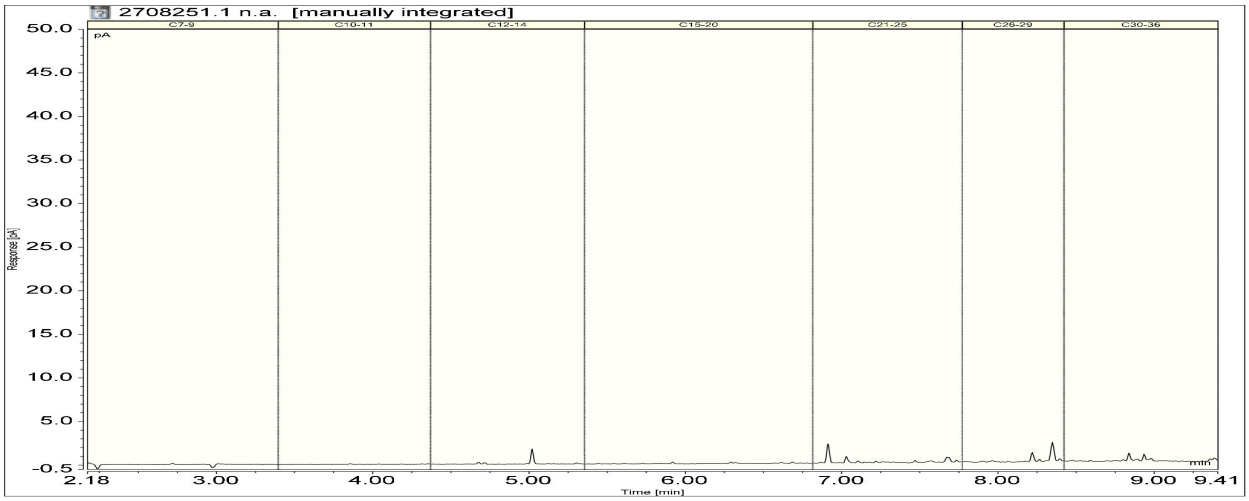
Sample Name:		TP110_0.1 17-Sep-2021	TP110_0.6 17-Sep-2021	TP111_0.2 17-Sep-2021	TP111_0.6 17-Sep-2021	TP113_0.35 17-Sep-2021
Lab Number:		2708251.1	2708251.2	2708251.3	2708251.4	2708251.5
Individual Tests						
Dry Matter	g/100g as rcvd	93	76	81	94	83
Fluoride*	mg/kg dry wt	-	-	-	-	260
pH*	pH Units	7.0	7.5	8.6	8.8	8.2
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	6	3	2	4
Total Recoverable Cadmium	mg/kg dry wt	1.16	16.8	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	15	121	12	9	12
Total Recoverable Copper	mg/kg dry wt	9	51	6	4	6
Total Recoverable Lead	mg/kg dry wt	15.8	32	8.9	7.7	7.9
Total Recoverable Mercury	mg/kg dry wt	< 0.10	0.12	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	14	190	10	7	10
Total Recoverable Zinc	mg/kg dry wt	154	340	41	34	41
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	9.3	0.3	1.1	0.4	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.014	0.013	< 0.011	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.014	0.014	< 0.011	< 0.013
Acenaphthylene	mg/kg dry wt	0.042	< 0.014	< 0.012	< 0.011	< 0.013
Acenaphthene	mg/kg dry wt	0.026	< 0.014	0.054	0.012	0.030
Anthracene	mg/kg dry wt	0.092	< 0.014	0.036	0.014	< 0.013
Benzo[a]anthracene	mg/kg dry wt	0.66	0.019	0.066	0.024	< 0.013
Benzo[a]pyrene (BAP)	mg/kg dry wt	1.07	0.032	0.069	0.027	< 0.013
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	1.53	0.04	0.09	0.04	< 0.03
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	1.52	0.04	0.09	0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	1.13	0.044	0.068	0.026	< 0.013
Benzo[e]pyrene	mg/kg dry wt	0.63	0.026	0.036	0.013	< 0.013
Benzo[g,h,i]perylene	mg/kg dry wt	0.91	0.036	0.039	0.014	< 0.013
Benzo[k]fluoranthene	mg/kg dry wt	0.40	0.014	0.026	< 0.011	< 0.013
Chrysene	mg/kg dry wt	0.53	0.023	0.050	0.018	< 0.013
Dibenzo[a,h]anthracene	mg/kg dry wt	0.150	< 0.014	< 0.012	< 0.011	< 0.013
Fluoranthene	mg/kg dry wt	1.20	0.044	0.195	0.068	< 0.013
Fluorene	mg/kg dry wt	0.018	< 0.014	0.026	0.011	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.82	0.030	0.034	0.014	< 0.013
Naphthalene	mg/kg dry wt	< 0.06	< 0.07	< 0.06	< 0.06	< 0.07
Perylene	mg/kg dry wt	0.34	< 0.014	0.034	0.015	0.019
Phenanthrene	mg/kg dry wt	0.21	0.016	0.135	0.068	< 0.013
Pyrene	mg/kg dry wt	1.03	0.051	0.163	0.056	< 0.013

Sample Type: Soil						
Sample Name:		TP110_0.1 17-Sep-2021	TP110_0.6 17-Sep-2021	TP111_0.2 17-Sep-2021	TP111_0.6 17-Sep-2021	TP113_0.35 17-Sep-2021
Lab Number:		2708251.1	2708251.2	2708251.3	2708251.4	2708251.5
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 30	< 30	< 30	< 30	< 30
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	63	125	< 40	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 90	130	< 90	< 90	< 90

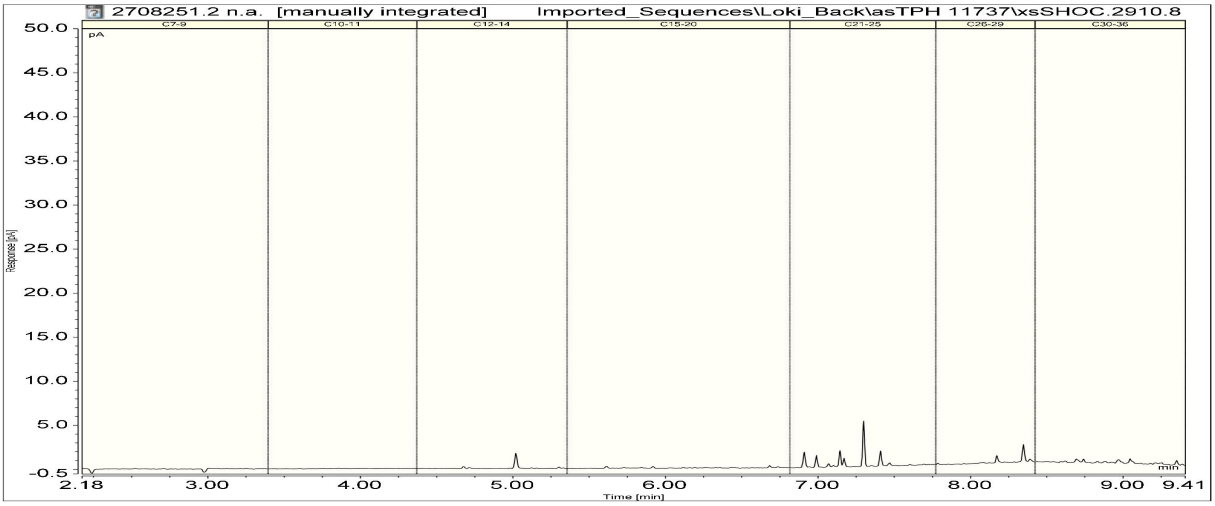
Sample Name:		TP113_0.7 17-Sep-2021	TP112_0.4 17-Sep-2021	TP112_1.2 17-Sep-2021		
Lab Number:		2708251.6	2708251.7	2708251.9		
Individual Tests						
Dry Matter	g/100g as rcvd	82	85	73	-	-
pH*	pH Units	8.2	8.3	8.0	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	5	6	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	11	11	19	-	-
Total Recoverable Copper	mg/kg dry wt	5	7	11	-	-
Total Recoverable Lead	mg/kg dry wt	7.3	7.5	16.7	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Nickel	mg/kg dry wt	9	9	16	-	-
Total Recoverable Zinc	mg/kg dry wt	39	41	67	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	0.6	< 0.4	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
Acenaphthene	mg/kg dry wt	0.037	< 0.012	< 0.014	-	-
Anthracene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.012	0.039	< 0.014	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	0.058	< 0.014	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	0.07	< 0.04	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	0.07	< 0.04	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.012	0.052	< 0.014	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.012	0.032	< 0.014	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	0.032	< 0.014	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	0.019	< 0.014	-	-
Chrysene	mg/kg dry wt	< 0.012	0.042	< 0.014	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
Fluoranthene	mg/kg dry wt	< 0.012	0.079	< 0.014	-	-
Fluorene	mg/kg dry wt	< 0.012	< 0.012	< 0.014	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	0.031	< 0.014	-	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.07	-	-
Perylene	mg/kg dry wt	0.028	0.045	< 0.014	-	-
Phenanthrene	mg/kg dry wt	< 0.012	0.050	< 0.014	-	-
Pyrene	mg/kg dry wt	< 0.012	0.080	< 0.014	-	-
Polychlorinated Biphenyls Screening in Soil*						
PCB-18	mg/kg dry wt	-	< 0.010	-	-	-
PCB-28	mg/kg dry wt	-	< 0.010	-	-	-
PCB-31	mg/kg dry wt	-	< 0.010	-	-	-
PCB-44	mg/kg dry wt	-	< 0.010	-	-	-
PCB-49	mg/kg dry wt	-	< 0.010	-	-	-
PCB-52	mg/kg dry wt	-	< 0.010	-	-	-
PCB-60	mg/kg dry wt	-	< 0.010	-	-	-
PCB-77	mg/kg dry wt	-	< 0.010	-	-	-

Sample Type: Soil						
Sample Name:		TP113_0.7 17-Sep-2021	TP112_0.4 17-Sep-2021	TP112_1.2 17-Sep-2021		
Lab Number:		2708251.6	2708251.7	2708251.9		
Polychlorinated Biphenyls Screening in Soil*						
PCB-81	mg/kg dry wt	-	< 0.010	-	-	-
PCB-86	mg/kg dry wt	-	< 0.010	-	-	-
PCB-101	mg/kg dry wt	-	< 0.010	-	-	-
PCB-105	mg/kg dry wt	-	< 0.010	-	-	-
PCB-110	mg/kg dry wt	-	< 0.010	-	-	-
PCB-114	mg/kg dry wt	-	< 0.010	-	-	-
PCB-118	mg/kg dry wt	-	< 0.010	-	-	-
PCB-121	mg/kg dry wt	-	< 0.010	-	-	-
PCB-123	mg/kg dry wt	-	< 0.010	-	-	-
PCB-126	mg/kg dry wt	-	< 0.010	-	-	-
PCB-128	mg/kg dry wt	-	< 0.010	-	-	-
PCB-138	mg/kg dry wt	-	< 0.010	-	-	-
PCB-141	mg/kg dry wt	-	< 0.010	-	-	-
PCB-149	mg/kg dry wt	-	< 0.010	-	-	-
PCB-151	mg/kg dry wt	-	< 0.010	-	-	-
PCB-153	mg/kg dry wt	-	< 0.010	-	-	-
PCB-156	mg/kg dry wt	-	< 0.010	-	-	-
PCB-157	mg/kg dry wt	-	< 0.010	-	-	-
PCB-159	mg/kg dry wt	-	< 0.010	-	-	-
PCB-167	mg/kg dry wt	-	< 0.010	-	-	-
PCB-169	mg/kg dry wt	-	< 0.010	-	-	-
PCB-170	mg/kg dry wt	-	< 0.010	-	-	-
PCB-180	mg/kg dry wt	-	< 0.010	-	-	-
PCB-189	mg/kg dry wt	-	< 0.010	-	-	-
PCB-194	mg/kg dry wt	-	< 0.010	-	-	-
PCB-206	mg/kg dry wt	-	< 0.010	-	-	-
PCB-209	mg/kg dry wt	-	< 0.010	-	-	-
Mono-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	-	< 0.000003	-	-	-
Non-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	-	< 0.0014	-	-	-
Total PCB (Sum of 35 congeners)	mg/kg dry wt	-	< 0.4	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 30	< 30	< 30	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 90	< 90	< 90	-	-

2708251.1
TP110_0.1 17-Sep-2021
Client Chromatogram for TPH by FID



2708251.2
TP110_0.6 17-Sep-2021
Client Chromatogram for TPH by FID



Analyst's Comments

Amended Report: This certificate of analysis replaces report '2708251-SPv2' issued on 27-Sep-2021 at 11:40 am.
Reason for amendment: Fluoride added to one sample as requested.

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			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-7, 9
Non-Routine sample preparation. Air drying and 180 um sieving.*	Air dried and sieved, <180 um fraction. Used for sample preparation.	-	5
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-7, 9
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-7, 9

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-7, 9
Total Fluoride in solids alkaline fusion*	Alkaline fusion of sample. Methods of Soil Analysis 2nd Edition, Pt2, 26-4.3.3.	-	5
Total Fluoride in Solids*	Ion selective electrode. Methods of Soil Analysis 2nd Edition, Pt2, 26-4.3.3. (modified).	20 mg/kg dry wt	5
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-7, 9
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-7, 9
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-7, 9
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-7, 9
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-7, 9
Polychlorinated Biphenyls Screening in Soil*	Sonication extraction, GC-MS analysis. Tested on dried sample. In-house based on US EPA 8270.	0.00000020 - 0.2 mg/kg dry wt	7
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1-2
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1-7, 9
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-7, 9
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-7, 9
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-7, 9

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

Testing was completed between 22-Sep-2021 and 06-Oct-2021. 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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

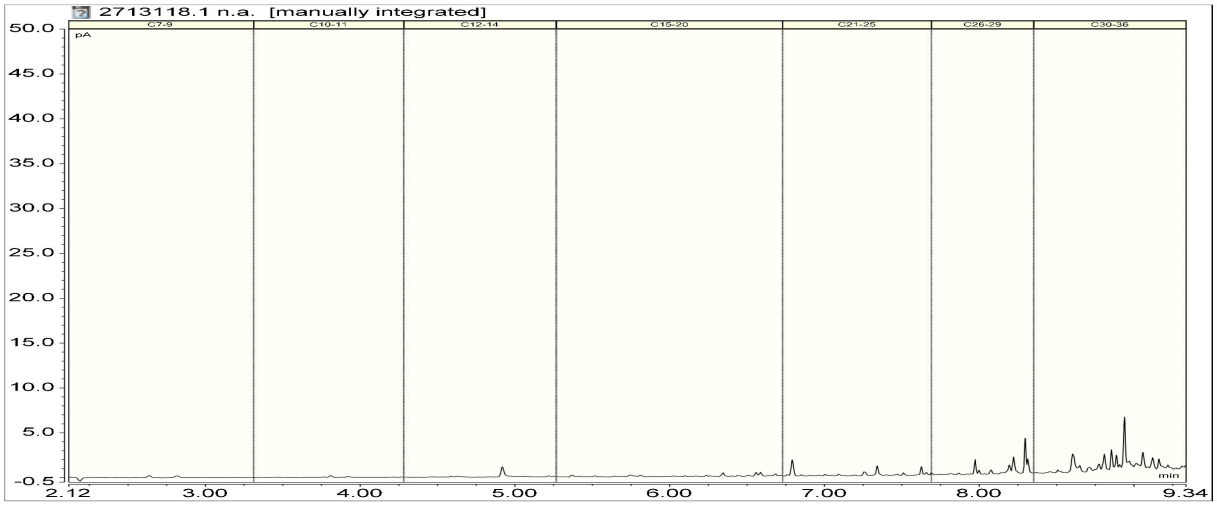
Client:	Beca Limited	**Lab No:**	2713118	SPv2
Contact:	Nikki Mather	**Date Received:**	23-Sep-2021	
	C/- Beca Limited	**Date Reported:**	07-Oct-2021	**(Amended)**
	PO Box 6345	**Quote No:**	113742	
	Wellesley Street	**Order No:**	21:132	
	Auckland 1141	**Client Reference:**	4210205/002/DA	
		Submitted By:	Nikki Mather	

Sample Type: Soil

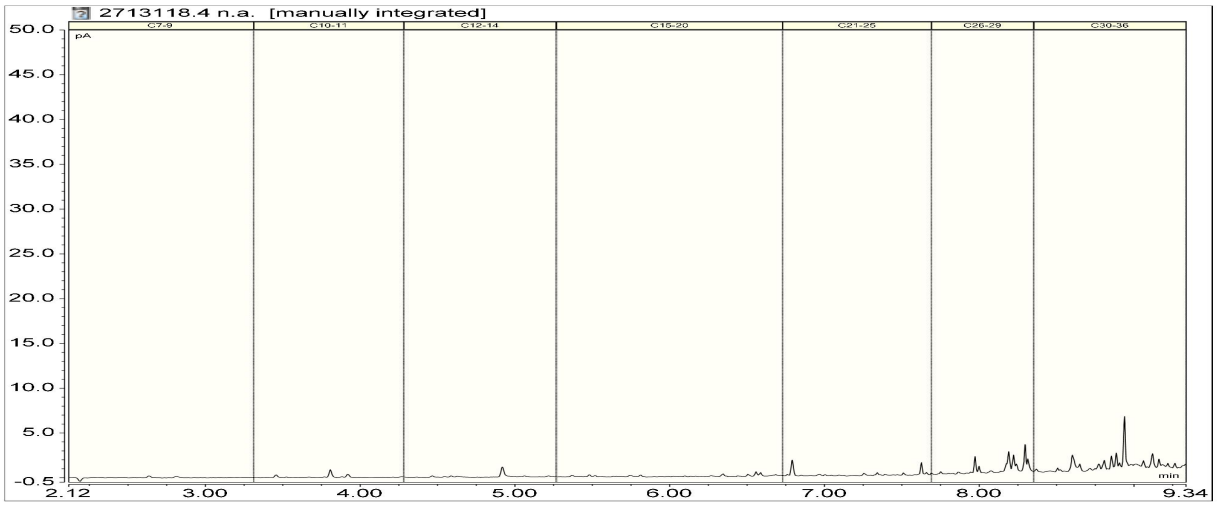
Sample Name:		TP115_0.1 22-Sep-2021	TP115_0.5 22-Sep-2021	TP114_0.1 22-Sep-2021	TP114_0.5 22-Sep-2021	
Lab Number:		2713118.1	2713118.2	2713118.4	2713118.5	
Individual Tests						
Dry Matter	g/100g as rcvd	75	95	67	95	-
Fluoride*	mg/kg dry wt	4,900	-	3,200	-	-
pH*	pH Units	5.8	6.0	6.6	6.9	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	4	4	4	-
Total Recoverable Cadmium	mg/kg dry wt	1.04	0.69	1.53	0.40	-
Total Recoverable Chromium	mg/kg dry wt	20	11	18	12	-
Total Recoverable Copper	mg/kg dry wt	20	8	12	9	-
Total Recoverable Lead	mg/kg dry wt	25	10.5	119	18.8	-
Total Recoverable Mercury	mg/kg dry wt	0.11	0.11	< 0.10	0.15	-
Total Recoverable Nickel	mg/kg dry wt	9	11	9	12	-
Total Recoverable Zinc	mg/kg dry wt	81	58	73	50	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	< 0.3	< 0.4	2.5	-
1-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	< 0.011	-
2-Methylnaphthalene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	< 0.011	-
Acenaphthylene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.014	-
Acenaphthene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.016	-
Anthracene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.042	-
Benzo[a]anthracene	mg/kg dry wt	0.016	< 0.011	< 0.015	0.169	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.013	< 0.011	< 0.015	0.28	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.41	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.41	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.016	< 0.011	0.018	0.29	-
Benzo[e]pyrene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.175	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.014	0.012	0.019	0.30	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.111	-
Chrysene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.124	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.053	-
Fluoranthene	mg/kg dry wt	0.014	< 0.011	< 0.015	0.24	-
Fluorene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.013	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.014	< 0.011	0.015	0.25	-
Naphthalene	mg/kg dry wt	< 0.07	< 0.06	< 0.08	< 0.06	-
Perylene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.099	-
Phenanthrene	mg/kg dry wt	< 0.014	< 0.011	< 0.015	0.115	-
Pyrene	mg/kg dry wt	0.022	< 0.011	0.018	0.25	-

Sample Type: Soil						
Sample Name:		TP115_0.1 22-Sep-2021	TP115_0.5 22-Sep-2021	TP114_0.1 22-Sep-2021	TP114_0.5 22-Sep-2021	
Lab Number:		2713118.1	2713118.2	2713118.4	2713118.5	
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	< 30	< 20	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	-
C15 - C36	mg/kg dry wt	167	< 40	210	< 40	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	173	< 80	220	< 80	-

2713118.1
TP115_0.1 22-Sep-2021
Client Chromatogram for TPH by FID



2713118.4
TP114_0.1 22-Sep-2021
Client Chromatogram for TPH by FID



Analyst's Comments

Amended Report: This certificate of analysis replaces report '2713118-SPv1' issued on 27-Sep-2021 at 2:29 pm.
Reason for amendment: Fluoride added as per request.

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			

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, 4-5
Non-Routine sample preparation. Air drying and 180 um sieving.*	Air dried and sieved, <180 um fraction. Used for sample preparation.	-	1, 4
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-2, 4-5
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-2, 4-5
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	1-2, 4-5
Total Fluoride in solids alkaline fusion*	Alkaline fusion of sample. Methods of Soil Analysis 2nd Edition, Pt2, 26-4.3.3.	-	1, 4
Total Fluoride in Solids*	Ion selective electrode. Methods of Soil Analysis 2nd Edition, Pt2, 26-4.3.3. (modified).	20 mg/kg dry wt	1, 4
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-2, 4-5
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	1-2, 4-5
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	1-2, 4-5
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-2, 4-5
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-2, 4-5
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1, 4
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 4-5
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 4-5
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-2, 4-5
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-2, 4-5

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

Testing was completed between 24-Sep-2021 and 07-Oct-2021. 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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	Beca Limited	**Lab No:**	2716253 SPv2
Contact:	Nikki Mather C/- Beca Limited PO Box 6345 Wellesley Street Auckland 1141	**Date Received:**	27-Sep-2021
		Date Reported:	06-Oct-2021
		Quote No:	113742
		Order No:	21:132
		Client Reference:	4210205/002/DA
		Submitted By:	Nikki Mather

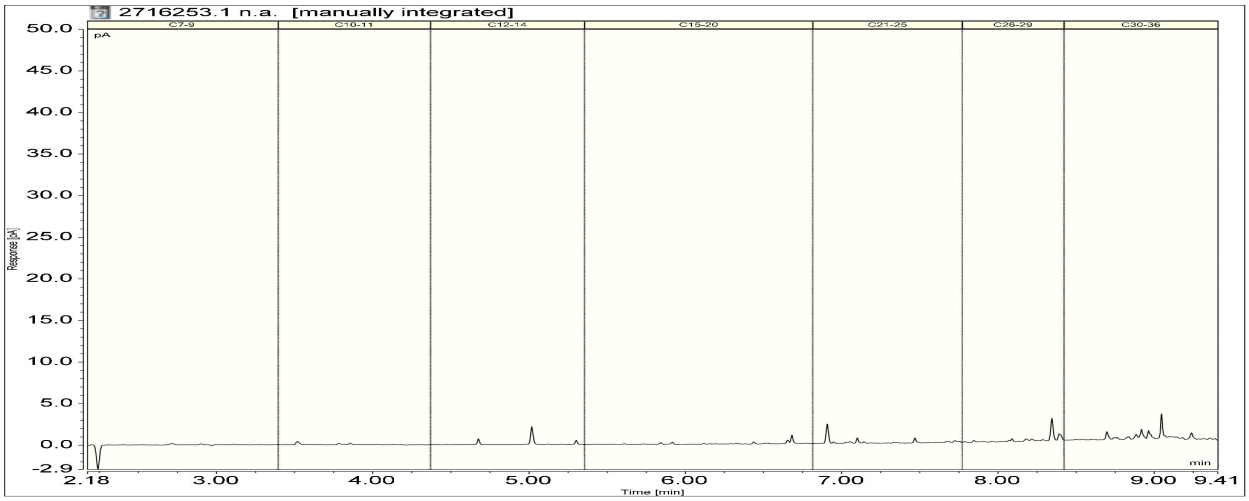
Sample Type: Soil

Sample Name:		TP118_0.1 23-Sep-2021	TP118_0.4 23-Sep-2021	TP118_2.0 23-Sep-2021	TP120_0.1 23-Sep-2021	TP120_0.5 23-Sep-2021
Lab Number:		2716253.1	2716253.2	2716253.4	2716253.5	2716253.6
Individual Tests						
Dry Matter	g/100g as rcvd	83	83	-	80	80
Fluoride*	mg/kg dry wt	-	-	360	-	-
pH*	pH Units	6.2	4.8	-	5.9	5.6
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	8	5	-	11	7
Total Recoverable Cadmium	mg/kg dry wt	8.7	17.5	-	8.1	12.1
Total Recoverable Chromium	mg/kg dry wt	34	49	-	41	53
Total Recoverable Copper	mg/kg dry wt	20	32	-	31	34
Total Recoverable Lead	mg/kg dry wt	21	26	-	28	29
Total Recoverable Mercury	mg/kg dry wt	0.53	0.42	-	0.43	0.50
Total Recoverable Nickel	mg/kg dry wt	14	7	-	13	22
Total Recoverable Zinc	mg/kg dry wt	122	193	-	146	162
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	1.5	0.6	-	2.8	6.1
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.012	-	< 0.012	< 0.012
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.012	-	< 0.012	< 0.012
Acenaphthylene	mg/kg dry wt	0.012	< 0.012	-	0.035	0.041
Acenaphthene	mg/kg dry wt	< 0.012	< 0.012	-	< 0.012	0.014
Anthracene	mg/kg dry wt	< 0.012	< 0.012	-	0.028	0.055
Benzo[a]anthracene	mg/kg dry wt	0.095	0.028	-	0.172	0.34
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.169	0.064	-	0.31	0.88
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.24	0.10	-	0.44	1.20
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.24	0.10	-	0.44	1.19
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.198	0.086	-	0.34	0.93
Benzo[e]pyrene	mg/kg dry wt	0.131	0.061	-	0.22	0.57
Benzo[g,h,i]perylene	mg/kg dry wt	0.168	0.061	-	0.28	0.62
Benzo[k]fluoranthene	mg/kg dry wt	0.077	0.044	-	0.134	0.34
Chrysene	mg/kg dry wt	0.080	0.031	-	0.154	0.30
Dibenzo[a,h]anthracene	mg/kg dry wt	0.021	< 0.012	-	0.036	0.089
Fluoranthene	mg/kg dry wt	0.153	0.051	-	0.32	0.55
Fluorene	mg/kg dry wt	< 0.012	< 0.012	-	< 0.012	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.136	0.052	-	0.24	0.55
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	-	< 0.06	< 0.06
Perylene	mg/kg dry wt	0.049	0.016	-	0.083	0.22
Phenanthrene	mg/kg dry wt	0.036	0.016	-	0.078	0.098
Pyrene	mg/kg dry wt	0.128	0.045	-	0.30	0.49

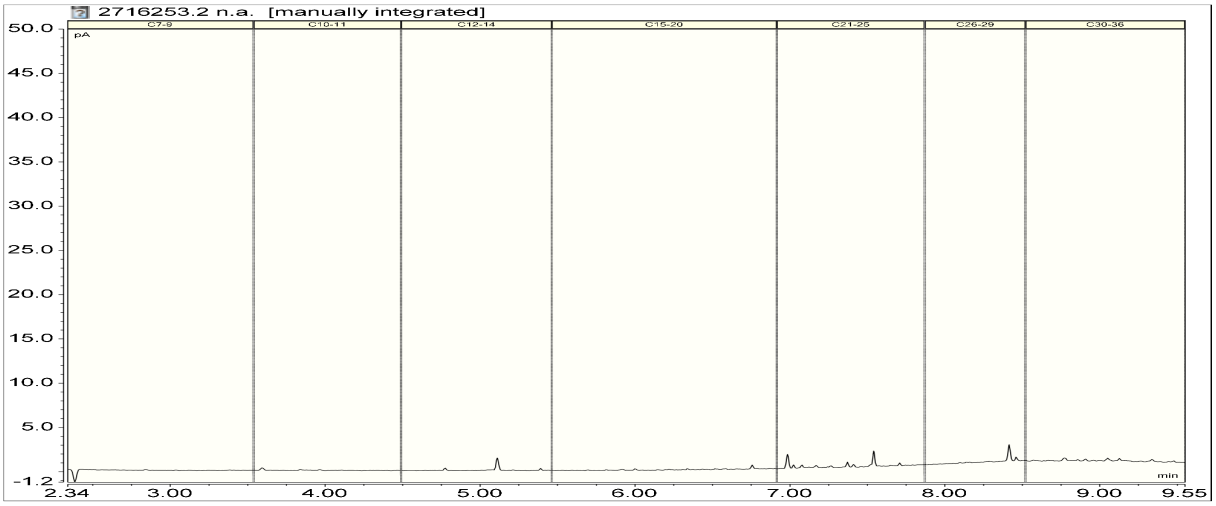
Sample Type: Soil						
Sample Name:		TP118_0.1 23-Sep-2021	TP118_0.4 23-Sep-2021	TP118_2.0 23-Sep-2021	TP120_0.1 23-Sep-2021	TP120_0.5 23-Sep-2021
Lab Number:		2716253.1	2716253.2	2716253.4	2716253.5	2716253.6
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 20	< 20	-	< 20	< 20
C10 - C14	mg/kg dry wt	< 20	< 20	-	< 20	< 20
C15 - C36	mg/kg dry wt	97	190	-	85	153
Total hydrocarbons (C7 - C36)	mg/kg dry wt	107	191	-	96	156

Sample Name:		TP120_1.8 23-Sep-2021	TP121_0.1 23-Sep-2021	TP121_1.0 23-Sep-2021	QA2 23-Sep-2021	QA3 23-Sep-2021
Lab Number:		2716253.8	2716253.9	2716253.11	2716253.13	2716253.14
Individual Tests						
Dry Matter	g/100g as rcvd	-	83	69	82	80
Fluoride*	mg/kg dry wt	1,550	-	-	-	-
pH*	pH Units	-	6.1	4.6	5.5	5.8
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	19	20	8	10
Total Recoverable Cadmium	mg/kg dry wt	-	4.7	17.1	9.0	7.6
Total Recoverable Chromium	mg/kg dry wt	-	61	106	44	40
Total Recoverable Copper	mg/kg dry wt	-	44	52	32	25
Total Recoverable Lead	mg/kg dry wt	-	35	18.6	30	25
Total Recoverable Mercury	mg/kg dry wt	-	0.29	4.0	0.5	0.42
Total Recoverable Nickel	mg/kg dry wt	-	18	24	15	11
Total Recoverable Zinc	mg/kg dry wt	-	220	156	139	114
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	-	1.8	< 0.4	4.8	2.2
1-Methylnaphthalene	mg/kg dry wt	-	< 0.012	< 0.015	< 0.012	< 0.013
2-Methylnaphthalene	mg/kg dry wt	-	< 0.012	< 0.015	< 0.012	< 0.013
Acenaphthylene	mg/kg dry wt	-	0.024	< 0.015	0.041	0.020
Acenaphthene	mg/kg dry wt	-	< 0.012	< 0.015	0.013	< 0.013
Anthracene	mg/kg dry wt	-	0.016	< 0.015	0.078	0.028
Benzo[a]anthracene	mg/kg dry wt	-	0.118	0.025	0.24	0.123
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	0.192	0.036	0.66	0.24
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	-	0.26	0.05	0.89	0.34
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	-	0.26	0.05	0.89	0.34
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	0.191	0.035	0.65	0.28
Benzo[e]pyrene	mg/kg dry wt	-	0.124	0.020	0.45	0.195
Benzo[g,h,i]perylene	mg/kg dry wt	-	0.143	0.022	0.49	0.25
Benzo[k]fluoranthene	mg/kg dry wt	-	0.070	< 0.015	0.24	0.100
Chrysene	mg/kg dry wt	-	0.109	0.024	0.21	0.105
Dibenzo[a,h]anthracene	mg/kg dry wt	-	0.019	< 0.015	0.070	0.031
Fluoranthene	mg/kg dry wt	-	0.26	0.040	0.46	0.22
Fluorene	mg/kg dry wt	-	< 0.012	< 0.015	< 0.012	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	0.113	0.022	0.44	0.21
Naphthalene	mg/kg dry wt	-	< 0.06	< 0.08	< 0.06	< 0.07
Perylene	mg/kg dry wt	-	0.048	< 0.015	0.171	0.070
Phenanthrene	mg/kg dry wt	-	0.075	0.023	0.154	0.092
Pyrene	mg/kg dry wt	-	0.24	0.038	0.38	0.174
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	< 20	< 20	< 20	< 20
C10 - C14	mg/kg dry wt	-	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	-	75	153	160	156
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	85	166	168	169

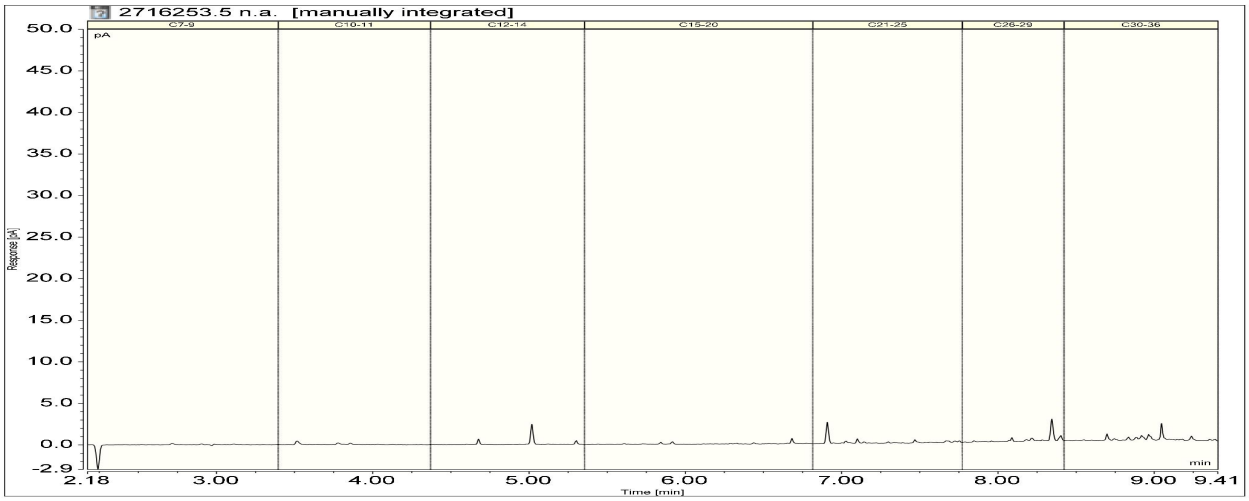
2716253.1
TP118_0.1 23-Sep-2021
Client Chromatogram for TPH by FID



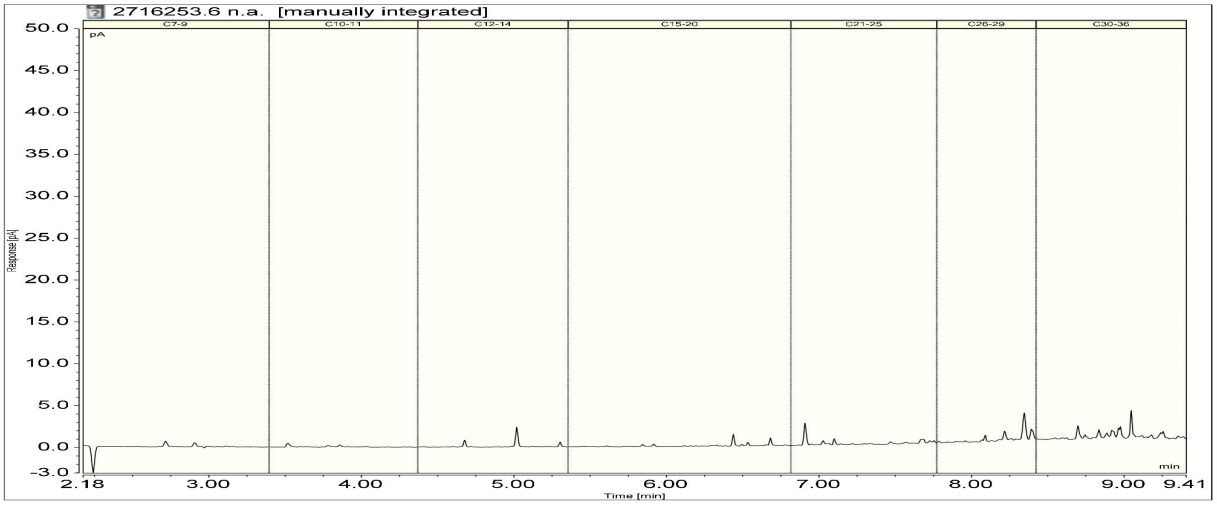
2716253.2
TP118_0.4 23-Sep-2021
Client Chromatogram for TPH by FID



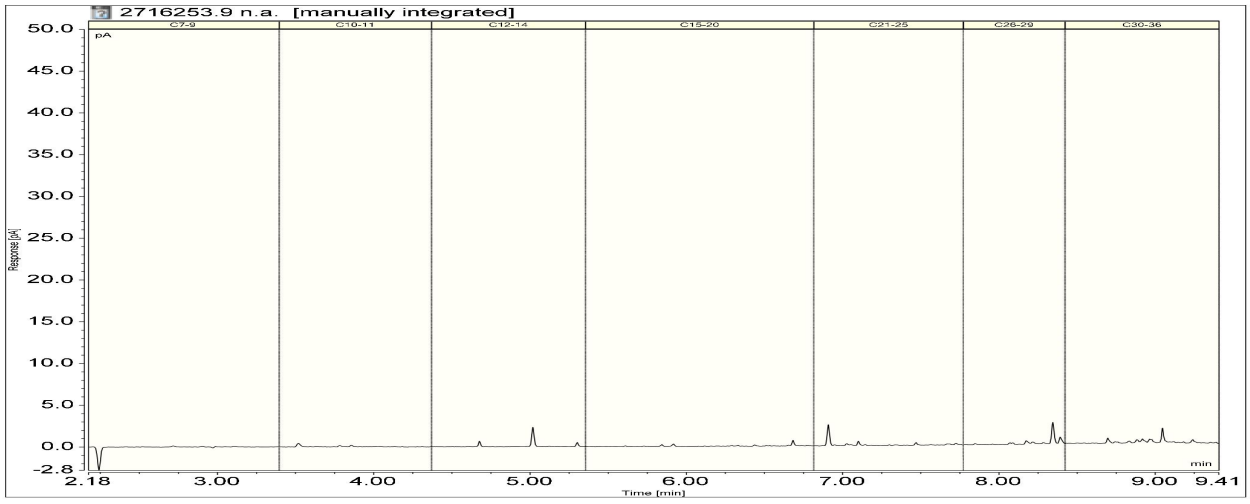
2716253.5
TP120_0.1 23-Sep-2021
Client Chromatogram for TPH by FID



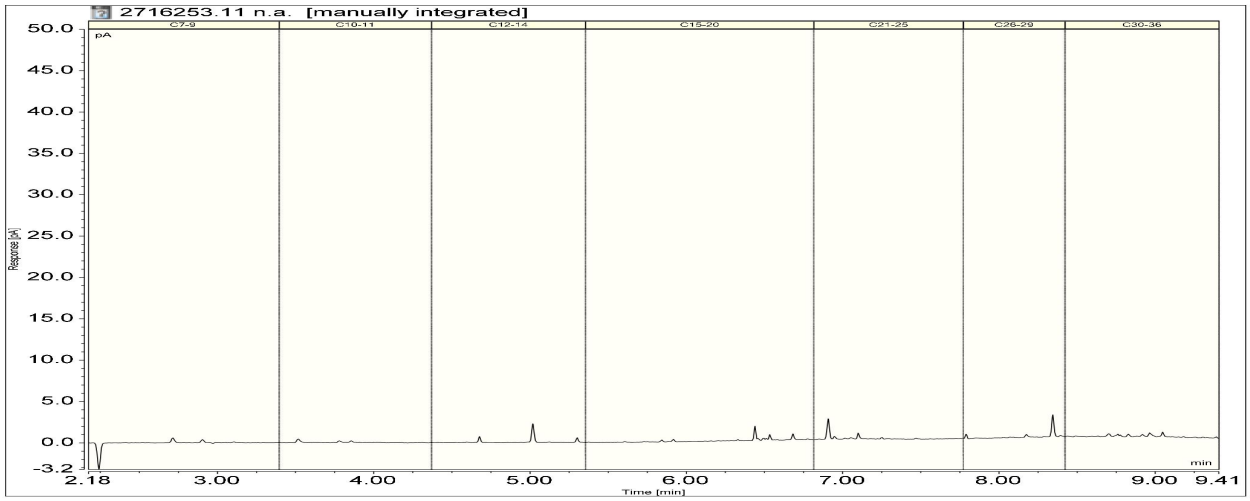
2716253.6
TP120_0.5 23-Sep-2021
Client Chromatogram for TPH by FID



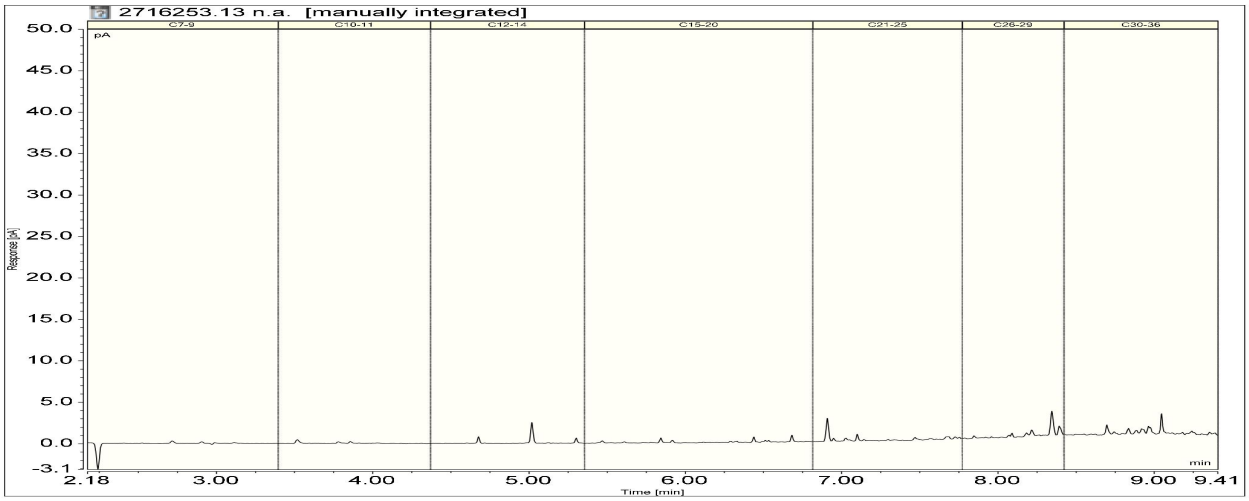
2716253.9
TP121_0.1 23-Sep-2021
Client Chromatogram for TPH by FID



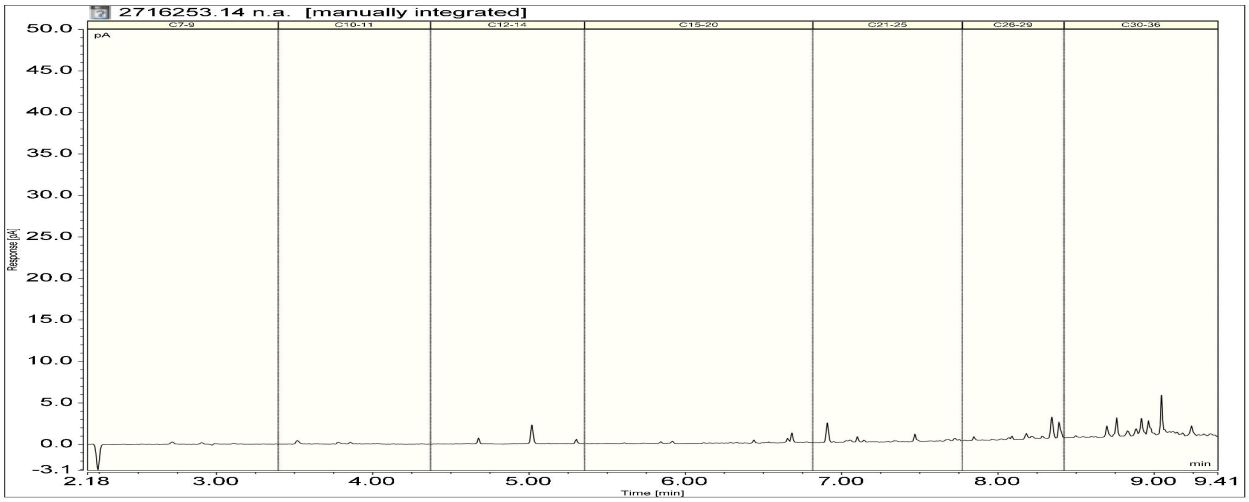
2716253.11
TP121_1.0 23-Sep-2021
Client Chromatogram for TPH by FID



2716253.13
QA2 23-Sep-2021
Client Chromatogram for TPH by FID



2716253.14
QA3 23-Sep-2021
Client Chromatogram for TPH by FID



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			
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, 11, 13-14
Non-Routine Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	4, 8
Non-Routine sample preparation. Air drying and 180 um sieving.*	Air dried and sieved, <180 um fraction. Used for sample preparation.	-	4, 8
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-2, 5-6, 9, 11, 13-14
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
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	1-2, 5-6, 9, 11, 13-14

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Fluoride in solids alkaline fusion*	Alkaline fusion of sample. Methods of Soil Analysis 2nd Edition, Pt2, 26-4.3.3.	-	4, 8
Total Fluoride in Solids*	Ion selective electrode. Methods of Soil Analysis 2nd Edition, Pt2, 26-4.3.3. (modified).	20 mg/kg dry wt	4, 8
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-2, 5-6, 9, 11, 13-14
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	1-2, 5-6, 9, 11, 13-14
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	1-2, 5-6, 9, 11, 13-14
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1-2, 5-6, 9, 11, 13-14
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-2, 5-6, 9, 11, 13-14

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

Testing was completed between 29-Sep-2021 and 06-Oct-2021. 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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

D

Appendix D – Soil Results Screening Table

Soil Analytical Results - Ravensdown Napier DSI															
Sample Name	**TP101_0.1**	**TP101_1.3**	**TP102_0.1**	**TP102_0.5**	**TP103_0.1**	**TP103_0.5**	**TP104_0.1**	**TP104_1.1**	**TP105_0.1**	**TP105_0.5**	**Assessment Criteria**				
Sample Date	21-Sep-21	21-Sep-21	21-Sep-21	21-Sep-21	21-Sep-21		21-Sep-21	21-Sep-21	21-Sep-21	21-Sep-21	Background Criteria		Human Health		Disposal criteria
Sample Depth (m)	0.1	1.3	0.1	0.5	0.1	0.5	0.1	1.1	0.1	0.5					
Lab Number (Chemical Testing)	2711251.21	2711251.1	2711251.12	2711251.13	2711251.5	2711251.6	2711251.17	2711251.19	2711251.1	2711251.2	Sandstone Pakihi [1] (Majority of site)	Mudstone Pakihi [2] (By western bdy)	Commercial / Industrial Worker Scenario[3]	Environmental Risk Threshold [4]	Class A Landfill [7]
Lab Number (Asbestos Testing)	2711652.9	-	2711652.11	-	2711652.5	-	2711652.15	-	2711652.1	-					
pH															
pH Units	5.2	7.4	5.1	5.2	4.7	4.1	6.5	7.8	6.3	7.3	-	-	-	6-8	-
Heavy Metals (mg/kg dry wt)															
Total Recoverable Arsenic	3	4	4	3	3	3	5	3	3	3	12.67	9.97	70 [3]	150	100
Total Recoverable Cadmium	1.7	0.37	3.3	0.31	1.11	< 0.10	1.41	0.26	1.24	< 0.10	0.28	0.33	1,300 [3]	40	20
Total Recoverable Chromium	16	12	23	10	14	9	17	11	16	11	60.50	56.88	6,300 *	650	100
Total Recoverable Copper	6	8	9	7	6	7	35	7	7	7	40.17	48.14	>10,000 [3]	600	100
Total Recoverable Lead	8.4	14.5	8.7	8.9	9.1	9.2	21	8.2	9.6	9.7	30.08	25.83	3300 [3]	3,000	100
Total Recoverable Mercury	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	†	†	4200 [3]	50 [8]	4
Total Recoverable Nickel	9	12	9	8	9	8	12	8	10	10	32.88	35.15	20,000 [4]	89 [8]	200
Total Recoverable Zinc	67	51	90	41	57	39	94	38	61	41	101.8	97.97	35,000 [4]	480	200
Polycyclic Aromatic Hydrocarbons (mg/kg dry wt)															
Total of Reported PAHs in Soil	< 0.4	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3	< 0.4	< 0.3	< 0.4	< 0.3	-	-	-	-	-
1-Methylnaphthalene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	< 0.014	< 0.011	< 0.013	< 0.011	-	-	-	-	-
2-Methylnaphthalene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	< 0.014	< 0.011	< 0.013	< 0.011	-	-	-	-	-
Acenaphthylene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	< 0.014	< 0.011	< 0.013	< 0.011	-	-	-	-	-
Acenaphthene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	< 0.014	< 0.011	< 0.013	< 0.011	-	-	-	-	-
Anthracene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	< 0.014	< 0.011	< 0.013	< 0.011	-	-	-	-	-
Benzo[a]anthracene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	0.02	< 0.011	< 0.013	< 0.011	-	-	21 [4]	-	-
Benzo[a]pyrene (BAP)	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	0.032	< 0.011	< 0.013	< 0.011	-	-	2.1	47	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	< 0.04	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03	0.04	< 0.03	< 0.04	< 0.03	-	-	35	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	< 0.04	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03	0.04	< 0.03	< 0.04	< 0.03	-	-	11 [5]	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	0.04	< 0.011	< 0.013	< 0.011	-	-	-	-	-
Benzo[e]pyrene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	0.021	< 0.011	< 0.013	< 0.011	-	-	-	-	-
Benzo[g,h,i]perylene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	0.025	< 0.011	< 0.013	< 0.011	-	-	-	-	-
Benzo[k]fluoranthene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	0.016	< 0.011	< 0.013	< 0.011	-	-	210 [4]	-	-
Chrysene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	0.023	< 0.011	< 0.013	< 0.011	-	-	2,100 [4]	-	-
Dibenzo[a,h]anthracene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	< 0.014	< 0.011	< 0.013	< 0.011	-	-	2.1 [4]	-	-
Fluoranthene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	0.04	< 0.011	< 0.013	< 0.011	-	-	3,000 [4]	190	-
Fluorene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	< 0.014	< 0.011	< 0.013	< 0.011	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	0.023	< 0.011	< 0.013	< 0.011	-	-	21 [4]	-	-
Naphthalene	< 0.07	< 0.06	< 0.07	< 0.06	< 0.07	< 0.06	< 0.07	< 0.06	< 0.07	< 0.06	-	-	190 / 230	-	-
Perylene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	< 0.014	< 0.011	< 0.013	< 0.011	-	-	-	-	-
Phenanthrene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	< 0.014	< 0.011	< 0.013	< 0.011	-	-	-	-	-
Pyrene	< 0.013	< 0.012	< 0.013	< 0.011	< 0.014	< 0.011	0.04	< 0.011	< 0.013	< 0.011	-	-	2,300 [4]	-	-
Total Petroleum Hydrocarbons (mg/kg dry wt)															
C7 - C9	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	-	-	120 / 120 [5]	170	-
C10 - C14	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	-	-	1,500 / 1,900 [5]	140	-
C15 - C36	50	< 40	< 40	< 40	51	< 40	45	< 40	< 40	< 40	-	-	NA / N/A [5]	1,700	-
Total hydrocarbons (C7 - C36)	< 80	< 80	< 80	< 80	< 80	< 80	< 80	< 80	< 80	< 80	-	-	NA / N/A [5]	-	-
Asbestos															
Presence/Absence	NOT detected	-	NOT detected	-	NOT detected	-	NOT detected	-	NOT detected	-	-	-	-	-	-
Weight of Non-Friable Asbestos in ACM (g dry wt)	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	-	-	-	-	-
Weight of Friable Fibrous Asbestos (g dry wt)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	-	-	-	-	-
Weight of Friable Asbestos Fines (g dry wt))	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	-	-	-	-	-
Asbestos in ACM as % of Total Sample (%w/w)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	-	-	0.05% [9]	-	-
Asbestos as Fibrous Asbestos as % of Total Sample (%w/w)	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	-	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample (%w/w)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	-	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample (%w/w)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	-	-	0.001% [9]	-	-
Polychlorinated Biphenyls (mg/kg dry wt)															
Total PCB (sum of 35 congeners)	<0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Annotations

† Background concentrations are not available for mercury

* No value for total chromium. Adopted value for Chromium VI

1 - Predicted Background Soil Concentrations - PAKIHI SANDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/

2 - Predicted Background Soil Concentrations - PAKIHI MUDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/

3 - Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2012. Values applicable for inorganic and organic substances 'commercial / industrial outdoor worker unpaved' have been selected.

4 United States Environmental Protection Agency (US EPA) Regional Screening Levels. Soil contamination standards for 'industrial' soil have been selected.

5 Ministry for the Environment Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand 1999. Module 4 values applicable to SAND soils <1 m and 1-4 m in depth have been selected for 'commercial/industrial' (Tables 4.11 and 4.14) land use scenarios.

Brackets denote values exceed threshold likley to correspond to formation of residual separate phase hydrocarbons

NA indicates contaminant not limiting as estimated health based crtierion is signficantly higher than that likley to be encountered on site

N/A indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix

6. Landcare Research (2016). User Guide: Background soil concentrations and soil guideline values for the protection of ecological receptors (Eco-SGVs) – Consultation draft. Table 5, 6 and 7. Values applicable to a Commercial/industrial area used. TPH values applicable to 'coarse' grained soils adopted.

7 Ministry for the Environment (2004) Hazardous Waste Guidelines - Landfill Waste Acceptance Criteria and Landfill Classification.

8 Canadian Council of Ministers of the Environment (2015). Canadian Environmental Quality Guidelines - Soil Quality Guidelines for the Protection of Environmental and Human Health. Commercial/industrial land use adopted.

9 BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil - Table 5 Soil Guideline Values for asbestos in NZ

Above Background Concentration

Concentrations above Human Health Criteria

Concentrations above Environmental Discharge Criteria

Soil Analytical Results - Ravensdown Napier DSI															
Sample Name	**TP106_0.1**	**TP106_0.7**	**TP107_0.1**	**TP107_0.5**	**TP108_0.1**	**TP108_1.2**	**TP109_0.1**	**TP109_1.0**	**TP110_0.1**	**TP110_0.6**	**Assessment Criteria**				
Sample Date	20-Sep-21	20-Sep-21	20-Sep-21	20-Sep-21	20-Sep-21	20-Sep-21	20-Sep-21	20-Sep-21	17-Sep-21	17-Sep-21	Background Criteria		Human Health	Environmental	Disposal criteria
Sample Depth (m)	0.1	0.7	0.1	0.5	0.1	1.2	0.1	1	0.1	0.6					
Lab Number (Chemical Testing)	2709924.15	2709924.17	2709924.50	2709924.6	2709924.1	2709924.12	2709924.1	2709924.3	2708251.1	2708251.2	Sandstone Pakihi [1] (Majority of site)	Mudstone Pakihi [2] (By western bdy)	Commercial / Industrial Worker Scenario [3]	Risk Threshold [6]	Class A Landfill [7]
Lab Number (Asbestos Testing)	2710990.15	-	2710990.50	-	2710990.10	-	2710990.10	-	2709699.1	-					
pH															
pH Units	6.4	7.9	6.9	7.6	6.2	7.9	6.6	7.2	7.0	7.5	-	-	-	6-8	-
Heavy Metals (mg/kg dry wt)															
Total Recoverable Arsenic	3	3	5	5	4	10	4	5	3	6	12.67	9.97	70 [3]	150	100
Total Recoverable Cadmium	1.15	< 0.10	0.85	0.33	1.91	16.8	1.13	0.76	1.16	16.8	0.28	0.33	1,300 [3]	40	20
Total Recoverable Chromium	14	10	13.2	17	17	71	14	15	15	121	60.50	56.88	6,300 [4]	650	100
Total Recoverable Copper	7	6	10.6	11	8	46	9	10	9	51	40.17	48.14	>10,000 [3]	600	100
Total Recoverable Lead	8.1	8.5	21.6	16.4	10.3	41	12.8	14.5	15.8	32	30.08	25.83	3300 [3]	3,000	100
Total Recoverable Mercury	< 0.10	< 0.10	<0.10	< 0.10	< 0.10	0.71	< 0.10	0.11	< 0.10	0.12	[1]	[1]	4200 [3]	50 [8]	4
Total Recoverable Nickel	9	8	8.7	14	10	60	8	13	14	190	32.88	35.15	20,000 [4]	89 [8]	200
Total Recoverable Zinc	58	37	65	64	68	360	52	62	154	340	101.8	97.97	35,000 [4]	480	200
Polycyclic Aromatic Hydrocarbons (mg/kg dry wt)															
Total of Reported PAHs in Soil	< 0.4	< 0.3	0.5	< 0.3	< 0.4	< 0.4	< 0.4	< 0.3	9.3	0.3	-	-	-	-	-
1-Methylnaphthalene	< 0.014	< 0.012	<0.013	< 0.012	< 0.013	< 0.015	< 0.014	< 0.011	< 0.011	< 0.014	-	-	-	-	-
2-Methylnaphthalene	< 0.014	< 0.012	<0.013	< 0.012	< 0.013	< 0.015	< 0.014	< 0.011	< 0.011	< 0.014	-	-	-	-	-
Acenaphthylene	< 0.014	< 0.012	<0.013	< 0.012	< 0.013	< 0.015	< 0.014	< 0.011	0.042	< 0.014	-	-	-	-	-
Acenaphthene	< 0.014	< 0.012	<0.013	< 0.012	< 0.013	< 0.015	< 0.014	< 0.011	0.026	< 0.014	-	-	-	-	-
Anthracene	< 0.014	< 0.012	<0.013	< 0.012	< 0.013	< 0.015	< 0.014	< 0.011	0.092	< 0.014	-	-	-	-	-
Benzo[a]anthracene	< 0.014	< 0.012	0.036	< 0.012	< 0.013	< 0.015	0.014	< 0.011	0.66	0.019	-	-	21 [4]	-	-
Benzo[a]pyrene (BAP)	< 0.014	< 0.012	0.0536	< 0.012	< 0.013	< 0.015	0.021	< 0.011	1.07	0.032	-	-	2.1	47	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	< 0.04	< 0.03	0.069	< 0.03	< 0.04	< 0.04	< 0.04	< 0.03	1.53	0.04	-	-	35	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	< 0.04	< 0.03	0.069	< 0.03	< 0.04	< 0.04	< 0.04	< 0.03	1.52	0.04	-	-	11 [5]	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	< 0.014	< 0.012	0.054	< 0.012	< 0.013	< 0.015	0.028	< 0.011	1.13	0.044	-	-	-	-	-
Benzo[e]pyrene	< 0.014	< 0.012	0.0326	< 0.012	< 0.013	< 0.015	0.016	< 0.011	0.63	0.026	-	-	-	-	-
Benzo[g,h,i]perylene	< 0.014	< 0.012	0.0382	< 0.012	< 0.013	< 0.015	0.019	< 0.011	0.91	0.036	-	-	-	-	-
Benzo[k]fluoranthene	< 0.014	< 0.012	0.0269	< 0.012	< 0.013	< 0.015	< 0.014	< 0.011	0.4	0.014	-	-	210 [4]	-	-
Chrysene	< 0.014	< 0.012	0.0412	< 0.012	< 0.013	< 0.015	0.016	< 0.011	0.53	0.023	-	-	2,100 [4]	-	-
Dibenzo[a,h]anthracene	< 0.014	< 0.012	<0.013	< 0.012	< 0.013	< 0.015	< 0.014	< 0.011	0.15	< 0.014	-	-	2.1 [4]	-	-
Fluoranthene	< 0.014	< 0.012	0.0609	< 0.012	< 0.013	< 0.015	< 0.014	< 0.011	1.2	0.044	-	-	3,000 [4]	190	-
Fluorene	< 0.014	< 0.012	<0.013	< 0.012	< 0.013	< 0.015	< 0.014	< 0.011	0.018	< 0.014	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	< 0.014	< 0.012	0.0291	< 0.012	< 0.013	< 0.015	0.016	< 0.011	0.82	0.03	-	-	21 [4]	-	-
Naphthalene	< 0.07	< 0.06	<0.07	< 0.06	< 0.07	< 0.08	< 0.07	< 0.06	< 0.06	< 0.07	-	-	-	-	-
Perylene	< 0.014	< 0.012	<0.013	< 0.012	< 0.013	< 0.015	< 0.014	< 0.011	0.34	< 0.014	-	-	-	-	-
Phenanthrene	< 0.014	< 0.012	0.0182	< 0.012	< 0.013	< 0.015	< 0.014	< 0.011	0.21	0.016	-	-	-	-	-
Pyrene	< 0.014	< 0.012	0.065	< 0.012	< 0.013	< 0.015	0.019	< 0.011	1.03	0.051	-	-	2,300 [4]	-	-
Total Petroleum Hydrocarbons (mg/kg dry wt)															
C7 - C9	< 20	< 20	<20	< 20	< 20	< 20	< 20	< 20	< 30	< 30	-	-	120 / 120 [5]	170	-
C10 - C14	< 20	< 20	<20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	-	-	1,500 / 1,900 [5]	140	-
C15 - C36	43	< 40	46.2	< 40	< 40	73	63	< 40	63	125	-	-	NA / N/A [5]	1,700	-
Total hydrocarbons (C7 - C36)	< 80	< 80	<80	< 80	< 80	< 80	< 80	< 80	< 90	130	-	-	NA / N/A [5]	-	-
Asbestos															
Presence/Absence	NOT detected	-	NOT detected	-	NOT detected	-	NOT detected	-	NOT detected	-	-	-	-	-	-
Weight of Non-Friable Asbestos in ACM (g dry wt)	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	-	-	-	-	-
Weight of Friable Fibrous Asbestos (g dry wt)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	-	-	-	-	-
Weight of Friable Asbestos Fines (g dry wt))	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	-	-	-	-	-
Asbestos in ACM as % of Total Sample (%w/w)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	-	-	0.05% [9]	-	-
Asbestos as Fibrous Asbestos as % of Total Sample (%w/w)	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	-	-	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample (%w/w)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	-	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample (%w/w)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	-	-	0.001% [9]	-	-
Polychlorinated Biphenyls (mg/kg dry wt)															
Total PCB (sum of 35 congeners)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Annotations
1 Background concentrations are not available for mercury
* No value for total chromium. Adopted value for Chromium VI
1 - Predicted Background Soil Concentrations - PAKIHI SANDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/
2 - Predicted Background Soil Concentrations - PAKIHI MUDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/
3 - Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2012. Values applicable for inorganic and organic substances 'commercial / industrial outdoor worker unpaved' have been selected.
4 United States Environmental Protection Agency (US EPA) Regional Screening Levels. Soil contamination standards for 'industrial' soil have been selected.
5 Ministry for the Environment Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand 1999. Module 4 values applicable to SAND soils <1 m and 1-4 m in depth have been selected for 'commercial/industrial' (Tables 4.11 and 4.14) land use scenarios.
Brackets denote values exceed threshold likley to correspond to formation of residual separate phase hydrocarbons
NA indicates contaminant not limiting as estimated health based crtierion is signficantly higher than that likley to be encountered on site
N/A indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix
6. Landcare Research (2016). User Guide: Background soil concentrations and soil guideline values for the protection of ecological receptors (Eco-SGVs) – Consultation draft. Table 5, 6 and 7. Values applicable to a Commercial/industrial area used. TPH values applicable to 'coarse' grained soils adopted.
7 Ministry for the Environment (2004) Hazardous Waste Guidelines - Landfill Waste Acceptance Criteria and Landfill Classification.
8 Canadian Council of Ministers of the Environment (2015). Canadian Environmental Quality Guidelines - Soil Quality Guidelines for the Protection of Environmental and Human Health. Commercial/industrial land use adopted.
9 BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil - Table 5 Soil Guideline Values for asbestos in NZ

Above Background Concentration
Concentrations above Human Health Criteria
Concentrations above Environmental Discharge Criteria

Soil Analytical Results - Ravensdown Napier DSI															
Sample Name	**TP111_0.2**	**TP111_0.6**	**TP112_0.4**	**TP112_1.2**	**TP113_0.35**	**TP113_0.7**	**TP114_0.1**	**TP114_0.5**	**TP115_0.1**	**TP115_0.5**	**Assessment Criteria**				
Sample Date	17-Sep-21	17-Sep-21	17-Sep-21	17-Sep-21	17-Sep-21	17-Sep-21	22-Sep-21	22-Sep-21	22-Sep-21	22-Sep-21	Background Criteria		Human Health		Disposal criteria
Sample Depth (m)	0.2	0.6	0.4	1.2	0.35	0.7	0.1	0.5	0.1	0.5					
Lab Number (Chemical Testing)	2708251.3	2708251.4	2708251.7	2708251.9	2708251.5	2708251.6	2713118.4	2713118.5	2713118.1	2713118.2	Sandstone Pakihi [1] (Majority of site)	Mudstone Pakihi [2] (By western bdy)	Commercial / Industrial Worker Scenario [3]	Environmental Risk Threshold [4]	Class A Landfill [7]
Lab Number (Asbestos Testing)	2709699.30	-	2709699.70	-	2709699.5	-	2713416.4	2713416.5	2713416.1	2713416.20					
pH															
pH Units	8.6	8.8	8.3	8.0	8.2	8.2	6.6	6.9	5.8	6.0	-	-	-	6-8	-
Heavy Metals (mg/kg dry wt)															
Total Recoverable Arsenic	3	2	5	6	4	3	4	4	6	4	12.67	9.97	70 [3]	150	100
Total Recoverable Cadmium	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.53	0.4	1.04	0.69	0.28	0.33	1,300 [3]	40	20
Total Recoverable Chromium	12	9	11	19	12	11	18	12	20	11	60.50	56.88	6,300 *	650	100
Total Recoverable Copper	6	4	7	11	6	5	12	9	20	8	40.17	48.14	>10,000 [3]	600	100
Total Recoverable Lead	8.9	7.7	7.5	16.7	7.9	7.3	119	18.8	25	10.5	30.08	25.83	3300 [3]	3,000	100
Total Recoverable Mercury	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.15	0.11	0.11	!	!	4200 [3]	50 [8]	4
Total Recoverable Nickel	10	7	9	16	10	9	9	12	9	11	32.88	35.15	20,000 [4]	89 [8]	200
Total Recoverable Zinc	41	34	41	67	41	39	73	50	81	58	101.8	97.97	35,000 [4]	480	200
Polycyclic Aromatic Hydrocarbons (mg/kg dry wt)															
Total of Reported PAHs in Soil	1.1	0.4	0.6	< 0.4	< 0.3	< 0.3	< 0.4	2.5	< 0.4	< 0.3	-	-	-	-	-
1-Methylnaphthalene	0.013	< 0.011	< 0.012	< 0.014	< 0.013	< 0.012	< 0.015	< 0.011	< 0.014	< 0.011	-	-	-	-	-
2-Methylnaphthalene	0.014	< 0.011	< 0.012	< 0.014	< 0.013	< 0.012	< 0.015	< 0.011	< 0.014	< 0.011	-	-	-	-	-
Acenaphthylene	< 0.012	< 0.011	< 0.012	< 0.014	< 0.013	< 0.012	< 0.015	0.014	< 0.014	< 0.011	-	-	-	-	-
Acenaphthene	0.054	0.012	< 0.012	< 0.014	0.03	0.037	< 0.015	0.016	< 0.014	< 0.011	-	-	-	-	-
Anthracene	0.036	0.014	< 0.012	< 0.014	< 0.013	< 0.012	< 0.015	0.042	< 0.014	< 0.011	-	-	-	-	-
Benzo[a]anthracene	0.066	0.024	0.039	< 0.014	< 0.013	< 0.012	< 0.015	0.169	0.016	< 0.011	-	-	21 [4]	-	-
Benzo[a]pyrene (BAP)	0.069	0.027	0.058	< 0.014	< 0.013	< 0.012	< 0.015	0.28	0.013	< 0.011	-	-	2.1	47	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	0.09	0.04	0.07	< 0.04	< 0.03	< 0.03	< 0.04	0.41	< 0.04	< 0.03	-	-	35	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	0.09	0.03	0.07	< 0.04	< 0.03	< 0.03	< 0.04	0.41	< 0.04	< 0.03	-	-	11 [5]	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	0.068	0.026	0.052	< 0.014	< 0.013	< 0.012	0.018	0.29	0.016	< 0.011	-	-	-	-	-
Benzo[e]pyrene	0.036	0.013	0.032	< 0.014	< 0.013	< 0.012	< 0.015	0.175	< 0.014	< 0.011	-	-	-	-	-
Benzo[g,h,i]perylene	0.039	0.014	0.032	< 0.014	< 0.013	< 0.012	0.019	0.3	0.014	0.012	-	-	-	-	-
Benzo[k]fluoranthene	0.026	< 0.011	0.019	< 0.014	< 0.013	< 0.012	< 0.015	0.111	< 0.014	< 0.011	-	-	210 [4]	-	-
Chrysene	0.05	0.018	0.042	< 0.014	< 0.013	< 0.012	< 0.015	0.124	< 0.014	< 0.011	-	-	2,100 [4]	-	-
Dibenzo[a,h]anthracene	< 0.012	< 0.011	< 0.012	< 0.014	< 0.013	< 0.012	< 0.015	0.053	< 0.014	< 0.011	-	-	2.1 [4]	-	-
Fluoranthene	0.195	0.068	0.079	< 0.014	< 0.013	< 0.012	< 0.015	0.24	0.014	< 0.011	-	-	3,000 [4]	190	-
Fluorene	0.026	0.011	< 0.012	< 0.014	< 0.013	< 0.012	< 0.015	0.013	< 0.014	< 0.011	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	0.034	0.014	0.031	< 0.014	< 0.013	< 0.012	0.015	0.25	< 0.014	< 0.011	-	-	21 [4]	-	-
Naphthalene	< 0.08	< 0.08	< 0.08	< 0.07	< 0.07	< 0.06	< 0.08	< 0.08	< 0.07	< 0.08	-	-	-	-	-
Perylene	0.034	0.015	0.045	< 0.014	0.019	0.028	< 0.015	0.099	< 0.014	< 0.011	-	-	-	-	-
Phenanthrene	0.135	0.068	0.05	< 0.014	< 0.013	< 0.012	< 0.015	0.115	< 0.014	< 0.011	-	-	-	-	-
Pyrene	0.163	0.056	0.08	< 0.014	< 0.013	< 0.012	0.018	0.25	0.022	< 0.011	-	-	2,300 [4]	-	-
Total Petroleum Hydrocarbons (mg/kg dry wt)															
C7 - C9	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 20	< 20	< 20	-	-	120 / 120 [5]	170	-
C10 - C14	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	-	-	1,500 / 1,900 [5]	140	-
C15 - C36	< 40	< 40	< 40	< 40	< 40	< 40	210	< 40	167	< 40	-	-	NA / N/A [9]	1,700	-
Total hydrocarbons (C7 - C36)	< 90	< 90	< 90	< 90	< 90	< 90	220	< 80	173	< 80	-	-	NA / N/A [9]	-	-
Asbestos															
Presence/Absence	NOT detected	-	NOT detected	-	NOT detected	-	NOT detected	NOT detected	NOT detected	NOT detected	-	-	-	-	-
Weight of Non-Friable Asbestos in ACM (g dry wt)	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-	-	-	-	-
Weight of Firiable Fibrous Asbestos (g dry wt)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	-	-	-	-	-
Weight of Friable Asbestos Fines (g dry wt))	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-	-	-	-	-
Asbestos in ACM as % of Total Sample (%w/w)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	-	-	0.05% [9]	-	-
Asbestos as Fibrous Asbestos as % of Total Sample (%w/w)	< 0.00001	-	< 0.00001	-	< 0.00001	-	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample (%w/w)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	-	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample (%w/w)	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	-	-	0.001% [9]	-	-
Polychlorinated Biphenyls (mg/kg dry wt)															
Total PCB (sum of 35 congeners)	-	-	<0.4	-	-	-	-	-	-	-	-	-	-	-	-

Annotations

! Background concentrations are not available for mercury

* No value for total chromium. Adopted value for Chromium VI

1 - Predicted Background Soil Concentrations - PAKIHI SANDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/

2 - Predicted Background Soil Concentrations - PAKIHI MUDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/

3 - Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2012. Values applicable for inorganic and organic substances 'commercial / industrial outdoor worker unpaved' have been selected.

4 United States Environmental Protection Agency (US EPA) Regional Screening Levels. Soil contamination standards for 'industrial' soil have been selected.

5 Ministry for the Environment Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand 1999. Module 4 values applicable to SAND soils <1 m and 1-4 m in depth have been selected for 'commercial/industrial' (Tables 4.11 and 4.14) land use scenarios.

Brackets denote values exceed threshold likley to correspond to formation of residual separate phase hydrocarbons

NA indicates contaminant not limiting as estimated health based crtierion is signficantly higher than that likley to be encountered on site

N/A indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix

6. Landcare Research (2016). User Guide: Background soil concentrations and soil guideline values for the protection of ecological receptors (Eco-SGVs) – Consultation draft. Table 5, 6 and 7. Values applicable to a Commercial/industrial area used. TPH values applicable to

7 Ministry for the Environment (2004) Hazardous Waste Guidelines - Landfill Waste Acceptance Criteria and Landfill Classification.

8 Canadian Council of Ministers of the Environment (2015). Canadian Environmental Quality Guidelines - Soil Quality Guidelines for the Protection of Environmental and Human Health. Commercial/industrial land use adopted.

9 BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil - Table 5 Soil Guideline Values for asbestos in NZ

Above Background Concentration

Concentrations above Human Health Criteria

Concentrations above Environmental Discharge Criteria

Soil Analytical Results - Ravensdown Napier DSI															
Sample Name	**TP116_0.1**	**TP116_1.0**	**TP117_0.1**	**TP117_1.0**	**TP118_0.1**	**TP118_0.4**	**TP119_0.1**	**TP119_0.5**	**TP120_0.1**	**TP120_0.5**	**Assessment Criteria**				
Sample Date	22-Sep-21	22-Sep-21	22-Sep-21	22-Sep-21	23-Sep-21	23-Sep-21	24-Sep-21	24-Sep-21	23-Sep-21	23-Sep-21	Background Criteria		Human Health		Disposal criteria
Sample Depth (m)	0.1	1	0.1	1	0.1	0.4	0.1	0.5	0.1	0.5					
Lab Number (Chemical Testing)	2712641.1	2712641.4	2712641.6	2712641.8	2716253.1	2716253.2	2716257.1	2716257.2	2716253.5	2716253.6	Sandstone Pakihi [1] (Majority of site)	Mudstone Pakihi [2] (By western bdy)	Commercial / Industrial Worker Scenario [3]	Environmental Risk Threshold [4]	Class A Landfill [7]
Lab Number (Asbestos Testing)	2712871.10	2712871.4	2712871.6	2712871.80	2716521.1	2716521.2	2716616.1	2716616.2	2716521.5	2716521.60					
pH															
pH Units	6.9	5.2	6.6	5.0	6.2	4.8	6.0	4.9	5.9	5.6	-	-	-	6-8	-
Heavy Metals (mg/kg dry wt)															
Total Recoverable Arsenic	35	9	8	8	8	5	6	8	11	7	12.67	9.97	70 [3]	150	100
Total Recoverable Cadmium	3.4	2.9	6.1	12.9	8.7	17.5	5.1	7.7	8.1	12.1	0.28	0.33	1,300 [3]	40	20
Total Recoverable Chromium	30	14	33	36	34	49	36	38	41	53	60.50	56.88	6,300 [4]	650	100
Total Recoverable Copper	15	12	26	28	20	32	29	29	31	34	40.17	48.14	>10,000 [3]	600	100
Total Recoverable Lead	21	8.5	24	29	21	26	30	21	28	29	30.08	25.83	3300 [3]	3,000	100
Total Recoverable Mercury	0.19	< 0.10	0.46	0.67	0.53	0.42	0.73	0.53	0.43	0.5	[1]	[1]	4200 [3]	50 [8]	4
Total Recoverable Nickel	18	9	15	7	14	7	6	8	13	22	32.88	35.15	20,000 [4]	89 [8]	200
Total Recoverable Zinc	75	143	118	135	122	193	82	93	146	162	101.8	97.97	35,000 [4]	480	200
Polycyclic Aromatic Hydrocarbons (mg/kg dry wt)															
Total of Reported PAHs in Soil	< 0.3	< 0.3	4.9	0.5	1.5	0.6	1	0.5	2.8	6.1	-	-	-	-	-
1-Methylnaphthalene	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.014	< 0.013	< 0.012	< 0.012	-	-	-	-	-
2-Methylnaphthalene	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.014	< 0.013	< 0.012	< 0.012	-	-	-	-	-
Acenaphthylene	< 0.012	< 0.012	0.033	< 0.012	0.012	< 0.012	< 0.014	< 0.013	0.035	0.041	-	-	-	-	-
Acenaphthene	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.014	< 0.013	< 0.012	0.014	-	-	-	-	-
Anthracene	< 0.012	< 0.012	0.051	< 0.012	< 0.012	< 0.012	< 0.014	< 0.013	0.028	0.055	-	-	-	-	-
Benzo[a]anthracene	< 0.012	< 0.012	0.42	0.038	0.095	0.028	0.079	0.035	0.172	0.34	-	-	21 [4]	-	-
Benzo[a]pyrene (BAP)	< 0.012	< 0.012	0.56	0.052	0.169	0.064	0.105	0.051	0.31	0.88	-	-	2.1	47	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	< 0.03	< 0.03	0.83	0.08	0.24	0.1	0.14	0.07	0.44	1.2	-	-	35	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	< 0.03	< 0.03	0.83	0.08	0.24	0.1	0.14	0.07	0.44	1.19	-	-	11 [5]	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	0.015	< 0.012	0.61	0.07	0.198	0.086	0.147	0.075	0.34	0.93	-	-	-	-	-
Benzo[e]pyrene	< 0.012	< 0.012	0.37	0.042	0.131	0.061	0.088	0.046	0.22	0.57	-	-	-	-	-
Benzo[g,h,i]perylene	0.016	< 0.012	0.47	0.051	0.168	0.061	0.099	0.048	0.28	0.62	-	-	-	-	-
Benzo[k]fluoranthene	< 0.012	< 0.012	0.23	0.027	0.077	0.044	0.055	0.033	0.134	0.34	-	-	210 [4]	-	-
Chrysene	< 0.012	< 0.012	0.31	0.031	0.08	0.031	0.074	0.039	0.154	0.3	-	-	2,100 [4]	-	-
Dibenzo[a,h]anthracene	< 0.012	< 0.012	0.097	0.012	0.021	< 0.012	< 0.014	< 0.013	0.036	0.089	-	-	2.1 [4]	-	-
Fluoranthene	< 0.012	< 0.012	0.5	0.045	0.153	0.051	0.109	0.043	0.32	0.55	-	-	3,000 [4]	190	-
Fluorene	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.014	< 0.013	< 0.012	< 0.012	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	< 0.012	< 0.012	0.42	0.045	0.136	0.052	0.083	0.04	0.24	0.55	-	-	21 [4]	-	-
Naphthalene	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.07	< 0.07	< 0.06	< 0.06	-	-	-	-	-
Perylene	< 0.012	< 0.012	0.155	0.016	0.049	0.016	0.026	< 0.013	0.083	0.22	-	-	-	-	-
Phenanthrene	< 0.012	< 0.012	0.09	0.021	0.036	0.016	0.039	0.018	0.078	0.098	-	-	-	-	-
Pyrene	0.013	< 0.012	0.57	0.047	0.128	0.045	0.11	0.042	0.3	0.49	-	-	2,300 [4]	-	-
Total Petroleum Hydrocarbons (mg/kg dry wt)															
C7 - C9	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	-	-	120 / 120 [5]	170	-
C10 - C14	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	-	-	1,500 / 1,900 [5]	140	-
C15 - C36	74	< 40	149	87	97	190	210	142	85	153	-	-	NA / N/A [5]	1,700	-
Total hydrocarbons (C7 - C36)	< 80	< 80	152	88	107	191	210	150	96	156	-	-	NA / N/A [5]	-	-
Asbestos															
Presence/Absence	NOT detected	NOT detected	NOT detected	NOT detected	NOT detected	NOT detected	NOT detected	Amosite detected	NOT detected	NOT detected	-	-	-	-	-
Weight of Non-Friable Asbestos in ACM (g dry wt)	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	<0.00001	< 0.00001	< 0.00001	-	-	-	-	-
Weight of Friable Fibrous Asbestos (g dry wt)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.00064	< 0.001	< 0.001	-	-	-	-	-
Weight of Friable Asbestos Fines (g dry wt))	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	<0.00001	< 0.00001	< 0.00001	-	-	-	-	-
Asbestos in ACM as % of Total Sample (%w/w)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	-	-	0.05% [9]	-	-
Asbestos as Fibrous Asbestos as % of Total Sample (%w/w)	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	<0.001	< 0.00001	< 0.00001	-	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample (%w/w)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	-	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample (%w/w)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	-	-	0.001% [9]	-	-
Polychlorinated Biphenyls (mg/kg dry wt)															
Total PCB (sum of 35 congeners)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Annotations

1 Background concentrations are not available for mercury

* No value for total chromium. Adopted value for Chromium VI

1 - Predicted Background Soil Concentrations - PAKIHI SANDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/

2 - Predicted Background Soil Concentrations - PAKIHI MUDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/

3 - Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2012. Values applicable for inorganic and organic substances 'commercial / industrial outdoor worker unpaved' have been selected.

4 United States Environmental Protection Agency (US EPA) Regional Screening Levels. Soil contamination standards for 'industrial' soil have been selected.

5 Ministry for the Environment Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand 1999. Module 4 values applicable to SAND soils <1 m and 1-4 m in depth have been selected for 'commercial/industrial' (Tables 4.11 and 4.14) land use scenarios.

Brackets denote values exceed threshold likley to correspond to formation of residual separate phase hydrocarbons

NA indicates contaminant not limiting as estimated health based crtierion is signficantly higher than that likley to be encountered on site

N/A indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix

6. Landcare Research (2016). User Guide: Background soil concentrations and soil guideline values for the protection of ecological receptors (Eco-SGVs) – Consultation draft. Table 5, 6 and 7. Values applicable to a Commercial/industrial area used. TPH values applicable to 'coarse' grained soils adopted.

7 Ministry for the Environment (2004) Hazardous Waste Guidelines - Landfill Waste Acceptance Criteria and Landfill Classification.

8 Canadian Council of Ministers of the Environment (2015). Canadian Environmental Quality Guidelines - Soil Quality Guidelines for the Protection of Environmental and Human Health. Commercial/industrial land use adopted.

9 BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil - Table 5 Soil Guideline Values for asbestos in NZ

Above Background Concentration
Concentrations above Human Health Criteria
Concentrations above Environmental Discharge Criteria

Soil Analytical Results - Ravensdown Napier DSI															
Sample Name	**TP121_0.1**	**TP121_1.0**	**TP122_0.1**	**TP122_0.5**	**TP123_0.1**	**TP123_0.85**	**TP124_0.1**	**TP124_0.5**	**TP125_0.1**	**TP125_0.8**	**Assessment Criteria**				
Sample Date	23-Sep-21	23-Sep-21	23-Sep-21	23-Sep-21	23-Sep-21	23-Sep-21	24-Sep-21	24-Sep-21	23-Sep-21	23-Sep-21	Background Criteria		Human Health	Environmental	Disposal criteria
Sample Depth (m)	0.1	1.0	0.1	0.5	0.1	0.85	0.1	0.5	0.1	0.8					
Lab Number (Chemical Testing)	2716253.90	2716253.11	2714105.1	2714105.2	2714105.5	2714105.7	2716254.6	2716254.7	2714105.1	2714105.12	Sandstone Pakihi [1] (Majority of site)	Mudstone Pakihi [2] (By western bdy)	Commercial / Industrial Worker Scenario [3]	Risk Threshold [4]	Class A Landfill [7]
Lab Number (Asbestos Testing)	2716521.9	2716521.11	2714491.1	2714491.2	2714491.5	2714491.7	2716661.5	2716661.6	2714491.10	2714491.12					
pH															
pH Units	6.1	4.6	6.8	4.4	3.1	5.2	4.9	4.6	4.6	7.1	-	-	-	6-8	-
Heavy Metals (mg/kg dry wt)															
Total Recoverable Arsenic	19	20	7	21	5	3	8	11	15	7	12.67	9.97	70 [3]	150	100
Total Recoverable Cadmium	4.7	17.1	2.6	53	1.21	58	14.6	10.9	17.6	7.3	0.28	0.33	1,300 [3]	40	20
Total Recoverable Chromium	61	106	25	123	30	122	54	58	72	33	60.50	56.88	6,300 [4]	650	100
Total Recoverable Copper	44	52	23	41	35	21	33	39	57	16	40.17	48.14	>10,000 [3]	600	100
Total Recoverable Lead	35	18.6	56	7.9	19.8	5	17.4	17.8	24	32	30.08	25.83	3300 [3]	3,000	100
Total Recoverable Mercury	0.29	4	0.32	0.11	0.52	0.97	1.53	1.26	1.28	0.4	[1]	[1]	4200 [3]	50 [8]	4
Total Recoverable Nickel	18	24	12	26	3	4	16	14	15	16	32.88	35.15	20,000 [4]	89 [8]	200
Total Recoverable Zinc	220	156	173	290	21	480	220	184	148	200	101.8	97.97	35,000 [4]	480	200
Polycyclic Aromatic Hydrocarbons (mg/kg dry wt)															
Total of Reported PAHs in Soil	1.8	< 0.4	6	< 0.3	0.3	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	-	-	-	-	-
1-Methylnaphthalene	< 0.012	< 0.015	< 0.013	< 0.013	< 0.014	< 0.015	< 0.014	< 0.014	< 0.013	< 0.015	-	-	-	-	-
2-Methylnaphthalene	< 0.012	< 0.015	< 0.013	< 0.013	< 0.014	< 0.015	< 0.014	< 0.014	< 0.013	< 0.015	-	-	-	-	-
Acenaphthylene	0.024	< 0.015	0.074	< 0.013	< 0.014	< 0.015	< 0.014	< 0.014	< 0.013	< 0.015	-	-	-	-	-
Acenaphthene	< 0.012	< 0.015	< 0.013	< 0.013	< 0.014	< 0.015	< 0.014	< 0.014	< 0.013	< 0.015	-	-	-	-	-
Anthracene	0.016	< 0.015	0.075	< 0.013	< 0.014	< 0.015	< 0.014	< 0.014	< 0.013	< 0.015	-	-	-	-	-
Benzo[a]anthracene	0.118	0.025	0.38	< 0.013	0.028	< 0.015	0.014	0.015	0.021	< 0.015	-	-	21 [4]	-	-
Benzo[a]pyrene (BAP)	0.192	0.036	0.58	< 0.013	0.035	< 0.015	0.026	0.025	0.028	< 0.015	-	-	2.1	47	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	0.26	0.05	0.82	< 0.03	0.05	< 0.04	0.03	< 0.04	0.04	< 0.04	-	-	35	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	0.26	0.05	0.81	< 0.03	0.05	< 0.04	0.03	< 0.04	0.04	< 0.04	-	-	11 [5]	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	0.191	0.035	0.61	< 0.013	0.042	< 0.015	0.028	0.031	0.033	< 0.015	-	-	-	-	-
Benzo[e]pyrene	0.124	0.02	0.36	< 0.013	0.025	< 0.015	0.021	0.019	0.019	< 0.015	-	-	-	-	-
Benzo[g,h,i]perylene	0.143	0.022	0.46	< 0.013	0.025	< 0.015	0.022	0.022	0.021	< 0.015	-	-	-	-	-
Benzo[k]fluoranthene	0.07	< 0.015	0.27	< 0.013	0.019	< 0.015	< 0.014	< 0.014	0.015	< 0.015	-	-	210 [4]	-	-
Chrysene	0.109	0.024	0.4	< 0.013	0.031	< 0.015	< 0.014	< 0.014	0.02	< 0.015	-	-	2,100 [4]	-	-
Dibenzo[a,h]anthracene	0.019	< 0.015	0.058	< 0.013	< 0.014	< 0.015	< 0.014	< 0.014	< 0.013	< 0.015	-	-	2.1 [4]	-	-
Fluoranthene	0.26	0.04	0.82	< 0.013	0.047	< 0.015	0.013	0.018	0.031	< 0.015	-	-	3,000 [4]	190	-
Fluorene	< 0.012	< 0.015	0.017	< 0.013	< 0.014	< 0.015	< 0.014	< 0.014	< 0.013	< 0.015	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	0.113	0.022	0.4	< 0.013	0.017	< 0.015	0.016	0.018	0.017	< 0.015	-	-	21 [4]	-	-
Naphthalene	< 0.06	< 0.08	< 0.07	< 0.07	< 0.07	< 0.08	< 0.07	< 0.07	< 0.07	< 0.08	-	-	-	-	-
Perylene	0.048	< 0.015	0.146	< 0.013	< 0.014	< 0.015	< 0.014	< 0.014	< 0.013	< 0.015	-	-	-	-	-
Phenanthrene	0.075	0.023	0.35	< 0.013	< 0.014	< 0.015	< 0.014	< 0.014	< 0.013	< 0.015	-	-	-	-	-
Pyrene	0.24	0.038	0.94	0.015	0.043	< 0.015	0.018	0.02	0.034	< 0.015	-	-	2,300 [4]	-	-
Total Petroleum Hydrocarbons (mg/kg dry wt)															
C7 - C9	< 20	< 20	< 20	< 20	< 20	< 30	< 20	< 20	< 20	< 30	-	-	120 / 120 [5]	170	-
C10 - C14	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	-	-	1,500 / 1,900 [5]	140	-
C15 - C36	75	153	155	< 40	104	< 40	58	90	93	60	-	-	NA / N/A [5]	1,700	-
Total hydrocarbons (C7 - C36)	85	166	158	< 80	107	< 90	< 80	93	95	< 90	-	-	NA / N/A [5]	-	-
Asbestos															
Presence/Absence	NOT detected	NOT detected	NOT detected	NOT detected	NOT detected	NOT detected	NOT detected	NOT detected	NOT detected	NOT detected	-	-	-	-	-
Weight of Non-Friable Asbestos in ACM (g dry wt)	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-	-	-	-	-
Weight of Friable Fibrous Asbestos (g dry wt)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	-	-	-	-
Weight of Friable Asbestos Fines (g dry wt))	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-	-	-	-	-
Asbestos in ACM as % of Total Sample (%w/w)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	-	0.05% [9]	-	-
Asbestos as Fibrous Asbestos as % of Total Sample (%w/w)	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample (%w/w)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample (%w/w)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	-	0.001% [9]	-	-
Polychlorinated Biphenyls (mg/kg dry wt)															
Total PCB (sum of 35 congeners)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Annotations
1 Background concentrations are not available for mercury
* No value for total chromium. Adopted value for Chromium VI
1 - Predicted Background Soil Concentrations - PAKIHI SANDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/
2 - Predicted Background Soil Concentrations - PAKIHI MUDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/
3 - Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2012. Values applicable for inorganic and organic substances 'commercial / industrial outdoor worker unpaved' have been selected.
4 United States Environmental Protection Agency (US EPA) Regional Screening Levels. Soil contamination standards for 'industrial' soil have been selected.
5 Ministry for the Environment Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand 1999. Module 4 values applicable to SAND soils <1 m and 1-4 m in depth have been selected for 'commercial/industrial' (Tables 4.11 and 4.14) land use scenarios.
Brackets denote values exceed threshold likley to correspond to formation of residual separate phase hydrocarbons
NA indicates contaminant not limiting as estimated health based crtierion is signficantly higher than that likley to be encountered on site
N/A indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix
6. Landcare Research (2016). User Guide: Background soil concentrations and soil guideline values for the protection of ecological receptors (Eco-SGVs) – Consultation draft. Table 5, 6 and 7. Values applicable to a Commercial/industrial area used. TPH values applicable to 'coarse' grained soils adopted.
7 Ministry for the Environment (2004) Hazardous Waste Guidelines - Landfill Waste Acceptance Criteria and Landfill Classification.
8 Canadian Council of Ministers of the Environment (2015). Canadian Environmental Quality Guidelines - Soil Quality Guidelines for the Protection of Environmental and Human Health. Commercial/industrial land use adopted.
9 BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil - Table 5 Soil Guideline Values for asbestos in NZ

Above Background Concentration
Concentrations above Human Health Criteria
Concentrations above Environmental Discharge Criteria

Soil Analytical Results - Ravensdown Napier DSI															
Sample Name	**TP126__0.1**	**TP126_1.5**	**TP127_0.1**	**TP127_0.5**	**TP128_0.1**	**TP128_2.2**					**Assessment Criteria**				
Sample Date	24-Sep-21	24-Sep-21	24-Sep-21	24-Sep-21	24-Sep-21	24-Sep-21					Background Criteria		Human Health		Disposal criteria
Sample Depth (m)	0.1	1.5	0.1	0.5	0.1	0.5									
Lab Number (Chemical Testing)	2716254.10	2716254.13	2716254.1	2716254.20	2716257.5	2716257.9					Sandstone Pakihi [1] (Majority of site)	Mudstone Pakihi [2] (By western bdy)	Commercial / Industrial Worker Scenario [4]	Environmental Risk Threshold [8]	Class A Landfill [7]
Lab Number (Asbestos Testing)	2716661.9	2716661.12	2716661.1	2716661.20	2716616.5	2716616.9									
pH															
pH Units	4.4	6.4	3.3	7.4	4.2	8.1					-	-	-	6-8	-
Heavy Metals (mg/kg dry wt)															
Total Recoverable Arsenic	5	9	< 2	6	13	5					12.67	9.97	70 [3]	150	100
Total Recoverable Cadmium	4.8	4.3	0.84	5.2	14	< 0.10					0.28	0.33	1,300 [3]	40	20
Total Recoverable Chromium	32	41	18	30	55	21 #1					60.50	56.88	6,300 [4]	650	100
Total Recoverable Copper	20	32	7	22	49	11					40.17	48.14	>10,000 [3]	600	100
Total Recoverable Lead	19.8	78	12.9	22	18.7	19.4					30.08	25.83	3300 [3]	3,000	100
Total Recoverable Mercury	0.4	0.26	0.43	0.12	1.8	< 0.10					[1]	[1]	4200 [3]	50 [8]	4
Total Recoverable Nickel	4	21	< 2	57	7	18 #2					32.88	35.15	20,000 [4]	89 [8]	200
Total Recoverable Zinc	55	450	8	141	74	78 #3					101.8	97.97	35,000 [4]	480	200
Polycyclic Aromatic Hydrocarbons (mg/kg dry wt)															
Total of Reported PAHs in Soil	0.4	1.2	< 0.4	1.5	0.6	< 0.4					-	-	-	-	-
1-Methylnaphthalene	< 0.012	< 0.013	< 0.015	< 0.012	< 0.014	< 0.014					-	-	-	-	-
2-Methylnaphthalene	< 0.012	< 0.013	< 0.015	< 0.012	< 0.014	< 0.014					-	-	-	-	-
Acenaphthylene	< 0.012	< 0.013	< 0.015	0.038	< 0.014	< 0.014					-	-	-	-	-
Acenaphthene	< 0.012	0.028	< 0.015	< 0.012	< 0.014	< 0.014					-	-	-	-	-
Anthracene	< 0.012	< 0.013	< 0.015	0.044	< 0.014	< 0.014					-	-	-	-	-
Benzo[a]anthracene	0.03	0.076	0.021	0.143	0.046	< 0.014					-	-	21 [4]	-	-
Benzo[a]pyrene (BAP)	0.051	0.103	0.026	0.153	0.066	< 0.014					-	-	2.1	47	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	0.07	0.15	< 0.04	0.21	0.09	< 0.04					-	-	35	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	0.07	0.15	< 0.04	0.21	0.09	< 0.04					-	-	11 [5]	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	0.07	0.132	0.028	0.14	0.072	< 0.014					-	-	-	-	-
Benzo[e]pyrene	0.042	0.082	0.017	0.087	0.042	< 0.014					-	-	-	-	-
Benzo[g,h,i]perylene	0.041	0.086	0.019	0.076	0.047	< 0.014					-	-	-	-	-
Benzo[k]fluoranthene	0.027	0.054	< 0.015	0.063	0.027	< 0.014					-	-	210 [4]	-	-
Chrysene	0.033	0.081	0.02	0.108	0.053	< 0.014					-	-	2,100 [4]	-	-
Dibenzo[a,h]anthracene	< 0.012	0.013	< 0.015	0.015	< 0.014	< 0.014					-	-	2.1 [4]	-	-
Fluoranthene	0.044	0.195	0.052	0.22	0.085	< 0.014					-	-	3,000 [4]	190	-
Fluorene	< 0.012	0.014	< 0.015	< 0.012	< 0.014	< 0.014					-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	0.033	0.069	0.017	0.066	0.038	< 0.014					-	-	21 [4]	-	-
Naphthalene	< 0.06	< 0.07	< 0.08	< 0.06	< 0.07	< 0.07					-	-	-	-	-
Perylene	0.012	0.025	< 0.015	0.03	0.014	< 0.014					-	-	-	-	-
Phenanthrene	0.013	0.087	< 0.015	0.121	0.028	< 0.014					-	-	-	-	-
Pyrene	0.037	0.149	0.046	0.21	0.104	< 0.014					-	-	2,300 [4]	-	-
Total Petroleum Hydrocarbons (mg/kg dry wt)															
C7 - C9	< 20	< 20	< 20	< 20	< 20	< 20					-	-	120 / 120 [5]	170	-
C10 - C14	< 20	< 20	< 20	< 20	< 20	< 20					-	-	1,500 / 1,900 [5]	140	-
C15 - C36	65	108	< 40	42	< 40	< 40					-	-	NA / N/A [5]	1,700	-
Total hydrocarbons (C7 - C36)	< 80	109	< 80	< 80	< 80	< 80					-	-	NA / N/A [5]	-	-
Asbestos															
Presence/Absence	NOT detected	Chrysotile detected	NOT detected	Chrysotile detected	NOT detected	NOT detected					-	-	-	-	-
Weight of Non-Friable Asbestos in ACM (g dry wt)	< 0.00001	<0.00001	< 0.00001	<0.00001	< 0.00001	< 0.00001					-	-	-	-	-
Weight of Friable Fibrous Asbestos (g dry wt)	< 0.001	<0.00001	< 0.001	0.00003	< 0.001	< 0.001					-	-	-	-	-
Weight of Friable Asbestos Fines (g dry wt))	< 0.00001	0.00146	< 0.00001	0.0001	< 0.00001	< 0.00001					-	-	-	-	-
Asbestos in ACM as % of Total Sample (%w/w)	< 0.001	<0.001	< 0.001	<0.001	< 0.001	< 0.001					-	-	0.05% [9]	-	-
Asbestos as Fibrous Asbestos as % of Total Sample (%w/w)	< 0.00001	<0.001	< 0.00001	<0.001	< 0.00001	< 0.00001					-	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample (%w/w)	< 0.001	<0.001	< 0.001	<0.001	< 0.001	< 0.001					-	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample (%w/w)	< 0.001	<0.001	< 0.001	<0.001	< 0.001	< 0.001					-	-	0.001% [9]	-	-
Polychlorinated Biphenyls (mg/kg dry wt)															
Total PCB (sum of 35 congeners)	-	-	-	-	-	-					-	-	-	-	-

Annotations
! Background concentrations are not available for mercury
* No value for total chromium. Adopted value for Chromium VI
1 - Predicted Background Soil Concentrations - PAKIHI SANDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/
2 - Predicted Background Soil Concentrations - PAKIHI MUDSTONE, Land Research Limited. 95th Percentile Background Concentration used. https://lris.scinfo.org.nz/layer/470-pbc-predicted-background-soil-concentrations-new-zealand/
3 - Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2012. Values applicable for inorganic and organic substances 'commercial / industrial outdoor worker unpaved' have been selected.
4 United States Environmental Protection Agency (US EPA) Regional Screening Levels. Soil contamination standards for 'industrial' soil have been selected.
5 Ministry for the Environment Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand 1999. Module 4 values applicable to SAND soils <1 m and 1-4 m in depth have been selected for 'commercial/industrial' (Tables 4.11 and 4.14) land use scenarios.
Brackets denote values exceed threshold likley to correspond to formation of residual separate phase hydrocarbons
NA indicates contaminant not limiting as estimated health based crtierion is signficantly higher than that likley to be encountered on site
N/A indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix
6. Landcare Research (2016). User Guide: Background soil concentrations and soil guideline values for the protection of ecological receptors (Eco-SGVs) – Consultation draft. Table 5, 6 and 7. Values applicable to a Commercial/industrial area used. TPH values applicable to 'coarse' grained soils adopted.
7 Ministry for the Environment (2004) Hazardous Waste Guidelines - Landfill Waste Acceptance Criteria and Landfill Classification.
8 Canadian Council of Ministers of the Environment (2015). Canadian Environmental Quality Guidelines - Soil Quality Guidelines for the Protection of Environmental and Human Health. Commercial/industrial land use adopted.
9 BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil - Table 5 Soil Guideline Values for asbestos in NZ

Above Background Concentration
Concentrations above Human Health Criteria
Concentrations above Environmental Discharge Criteria

Fluoride in Soil Analytical Results - Ravensdown Napier DSI								
Sample Name	**TP113_0.35**	**TP114_0.1**	**TP115_0.1**	**TP118_2.0**	**TP120_1.8**			
Sample Date	17-Sep-21	22-Sep-21	22-Sep-21	23-Sep-21	23-Sep-21	Human Health		Disposal criteria
Sample Depth (m)	0.35	0.1	0.1	2.0	1.8			
Lab Number (Chemical Testing)	2708251.50	2713118.4	2713118.1	2716253.4	2716253.8	Commercial / Industrial Worker Scenario[1]	Environmental Risk Threshold [2]	Class A Landfill [3]
Fluoride (mg/kg dry wt)								
Fluoride	260	**3,200**	**4,900**	**360**	**1,550**	47000	290	4000

1. United States Environmental Protection Agency (US EPA) Regional Screening Levels. Soil contamination standards for 'industrial' soil have been selected.
2. Landcare Research (2016). User Guide: Background soil concentrations and soil guideline values for the protection of ecological receptors (Eco-SGVs) – Consultation draft. Table 5.
3. Ministry for the Environment (2004) Hazardous Waste Guidelines - Landfill Waste Acceptance Criteria and Landfill Classification.

Concentrations above Human Health Criteria
Concentrations above Environmental Discharge Criteria