



# **Southshore and South New Brighton Erosion Protection**

**Detailed Site Investigation**

**IA271200-NG-RPT-0002**

**30 November 2023**

**Christchurch City Council**



## Southshore and South New Brighton Erosion Protection

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Project Manager: Ian Wiseman  
Author: Kate Murray  
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Jacobs New Zealand Limited

Level 2, Wynn Williams Building  
47 Hereford Street  
Christchurch Central 8013  
PO Box 1147  
Christchurch 8140  
New Zealand  
T +64 3 940 4900  
[www.jacobs.com](http://www.jacobs.com)

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## Executive Summary

Jacobs New Zealand Limited (Jacobs) have been commissioned by Christchurch City Council (Council) to develop an integrated coastal erosion protection and flood inundation concept design for the South New Brighton Park (SNBP) and Southshore Estuary Edge in Christchurch ('the project'). The proposed project works cover approximately 2.7 km in length and involves erosion protection upgrades along the estuary edge, and the construction of a new bund.

The purpose of the detailed site investigation (DSI) is to support the Council's existing global land use consent (RMA/2021/2094, CCC Global NESCS Consent) under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations 2011 ('the NESCS') (NESCS, 2011). Additionally, the findings of the investigation are intended to inform the risk classification that applies to the project to determine which Contaminated Soil Management Plan (CSMP) is applicable to the works.

The following observations and findings were made from this investigation:

- A total of 21 testpits within the existing bund and 12 surface samples along the estuary edge were tested, with samples obtained between depths of 0.0 metres below ground level (m bgl) and 0.8 m bgl.
- None of the 33 samples tested for heavy metals / PAH exceeded the human health criteria for recreational land use or commercial / industrial outdoor worker / maintenance.
- Concentrations of asbestos (ACM as % of total sample) were above adopted human health criteria for recreational landuse in the shallow samples obtained from the estuary edge SS-03 and SS-07.
- The identification of asbestos containing material (ACM) on the surface surrounding SS-07 exceeds the adopted human health criteria for both recreational landuse and worker scenario (industrial/commercial).
- None of the samples tested for heavy metals exceeded the Canadian Council of Ministers of the Environment (CCME), 2002 guidelines for the residential / parkland land use scenario.
- All soil within the investigation area does not meet the criteria for cleanfill since contaminant concentrations exceed the adopted background concentrations.
- All soil may be disposed off-site at a licensed solid waste landfill facility (subject to landfill operator approval) as follows:
  - Soil from along the estuary edge (samples SS01 – SS12) may be disposed of to Kate Valley Landfill (or equivalent). Heavy metal analysis could potentially confirm acceptance at Legget Road landfill (or equivalent).
  - Soil within the vicinity of TP-18 may be disposed of to Frews Hororata Landfill (or equivalent) .
  - All remaining soil within the proposed bund location may be disposed of to Legget Road Landfill (or equivalent) .
- Soil within the proposed bund may be reused on site (except in exposed soil areas).
- Due to the large amount of asbestos identified intermittently throughout the length of the estuary edge, it is recommended that soil within this area is not reused on site unless it is encapsulated at depths greater than 0.5 m bgl.
- Excavation and handling of soil within the investigation area surrounding the estuary and SS-03/SS-07 is likely to pose an unacceptable risk to human health and as such, any soil disturbance works completed in these areas shall be conducted under 'asbestos-related work' controls in accordance with the New Zealand Guidelines for Assessing and Managing Asbestos in Soil (NZGAMAS) by a person competent in working with asbestos in soil.
- Due to detections of friable asbestos / asbestos fines (FA/AF) and ACM as % of total sample below landuse criteria at TP05\_0.1-0.3, TP11\_0.5-0.8, any soil disturbance works completed in these areas shall be

conducted under 'unlicensed-asbestos work' controls in accordance with the NZGAMAS by a person competent in working with asbestos.

- Roads are not specifically listed on the HAIL; however, coal tar may have been used in the construction of the roads that the alignment traverses and thus there is the potential for coal tar contamination in these locations.
- Based on the findings of the DSI, Council have assigned the "medium risks" category to the project with risk controls to be implemented through the respective CCC CSMP to support the use of the Council's Global NESCS consent.

Based on the above findings, the following recommendations are made:

- Additional sampling throughout the estuary in areas containing known ACM (including SS03 and SS07) in order to quantify the extent and potentially reduce disposal requirements. It is also recommended that analysis include heavy metals to inform off-site disposal options. Due to the unknown nature of ACM material along the estuary, it is not recommended that soil from this location is reused on-site within the proposed bund works unless it is capped 0.5 m bgl and that the works are completed as per NZGAMAS (2017) *Figure 1. Decision flowchart for work involving asbestos in soil.*
- Where the bund will transect the existing road ends, it is recommended that samples of the excavated material be submitted for PAH analysis during the construction phase to determine whether coal tar is present and inform material handling and disposal requirements.
- In line with the CCC Medium Risk CSMP a Contaminated Land Specialist (CLS) is to be engaged at the beginning of the project with the works to be overseen by a CLS to identify contamination and advise on management, mitigation measures and soil removal.
- Due to detections of FA/AF and ACM as % of total sample below landuse criteria at TP05\_0.1-0.3, TP11\_0.5-0.8, any soil disturbance works completed in these areas shall be conducted under 'unlicensed-asbestos work' controls in accordance with the NZGAMAS by a person competent in working with asbestos.
- In line with the Rule 5.185 of the Canterbury Land and Water Regional Plan, The Council are to provide ECAN with a copy of this site investigation.

## Important note about your report

*The sole purpose of this report prepared by Jacobs New Zealand Limited (Jacobs) is to document the findings of an investigation relating to the potential for shallow soil contamination at some surface locations along the estuary edge and to depths of 0.8 m bgl within the bund that lies between 15 m and 30 m inland of the Avon-Heathcote Ihutai Estuary edge from Ebbtide Street to Tern Street, Southshore, Christchurch. The contents of the report are in accordance with the scope of services detailed in the terms of engagement between Jacobs and Christchurch City Council (the Client).*

*In assessing available information and preparing this report, Jacobs has relied upon and presumed accurate, all information provided by the Client and any third party, including provision of site observations and collection and laboratory submission of soil samples. Unless otherwise stated in this report, Jacobs has not attempted to verify the accuracy or completeness of any such information and Jacobs accepts no liability to the client and/or any third party for any loss and/or damage incurred as a result of any inaccurate or incomplete information.*

*The information in this report is derived from data provided by the client, available desktop information including historical aerial photos and council records.*

*It is imperative to note that the Report only considers the site conditions current at the time of investigation, and to be aware that conditions may have changed due to natural forces and/or operations on or near the site. Any decisions based on the findings of the Report must take into account any subsequent changes in site conditions and/or developments in legislative and regulatory requirements. Jacobs accepts no liability to the Client or any third party for any loss and/or damage incurred as a result of a change in the site conditions and/or regulatory/legislative framework since the date of the Report.*

*Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law. Opinions and judgements expressed in the report are based on Jacobs' understanding and interpretation of current regulatory standards and should not be construed as legal opinions.*

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## Abbreviations

|          |                                                                                                                                                |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------|
| ACM      | Asbestos Containing Material                                                                                                                   |
| CA       | Controlled Activity                                                                                                                            |
| Council  | Christchurch City Council                                                                                                                      |
| CEnvP:SC | Certified Environmental Practitioner in Site Contamination                                                                                     |
| CoPC     | Contaminants of Potential Concern                                                                                                              |
| CLMG     | Contaminated Land Management Guidelines                                                                                                        |
| CLS      | Contaminated Land Specialist                                                                                                                   |
| CRC      | Canterbury Regional Council (ECAN)                                                                                                             |
| CSM      | Conceptual Site Model                                                                                                                          |
| DSI      | Detailed Site Investigation                                                                                                                    |
| ECAN     | Environment Canterbury                                                                                                                         |
| HA       | Hand Auger                                                                                                                                     |
| HAIL     | Hazardous Activities and Industries List                                                                                                       |
| IANZ     | International Accreditation New Zealand                                                                                                        |
| Jacobs   | Jacobs New Zealand Limited                                                                                                                     |
| LLUR     | Listed Land Use Register                                                                                                                       |
| LWRP     | Environment Canterbury Land and Water Regional Plan                                                                                            |
| m asl    | Meters above sea level                                                                                                                         |
| m bgl    | Meters below ground level                                                                                                                      |
| MfE      | Ministry for the Environment                                                                                                                   |
| MFWAC    | Managed Fill Waste Acceptance Criteria                                                                                                         |
| NES-CS   | Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 |
| NZGAMAS  | New Zealand Guidelines for Assessing and Managing Asbestos in Soil                                                                             |
| PA       | Permitted Activity                                                                                                                             |
| PAH      | Polycyclic Aromatic Hydrocarbons                                                                                                               |
| PSI      | Preliminary Site Investigation                                                                                                                 |
| RDA      | Restricted Discretionary Activity                                                                                                              |
| SAQP     | Sampling and Analysis Quality Plan                                                                                                             |
| SCS      | Soil Contaminant Standards                                                                                                                     |
| SMP      | Site Management Plan                                                                                                                           |
| SNBP     | South New Brighton Park                                                                                                                        |
| SQEP     | Suitably Qualified and Experienced Practitioner                                                                                                |
| TPH      | Total Petroleum Hydrocarbons                                                                                                                   |

# 1. Introduction

## 1.1 Overview

Jacobs New Zealand Limited (Jacobs) have been commissioned by Christchurch City Council (Council) to develop design criteria for the Design Basis and Concept Design to develop an integrated coastal erosion protection and flood inundation concept for the South New Brighton Park (SNBP) and Southshore Estuary Edge in Christchurch ('the project'). The proposed project works cover approximately 2.7 km in length and involve:

- erosion protection upgrade along the estuary edge; and
- the construction of a new bund.

Following two previous Preliminary Site Investigations (PSIs) conducted in September 2020 (updated in 2022) (Jacobs, 2022a) and in January 2022 (Jacobs, 2022b), Council requested Jacobs complete a Detailed Site Investigation to confirm the presence/concentration of friable asbestos or asbestos fines in the soil identified in the previous PSIs.

For the purpose of this investigation, Jacobs have combined both the erosion protection upgrade and proposed bund construction into one investigation area. This area is hereafter referred to as 'the site' and north to south from 2 Godwit Street to 170 Rocking Horse Road. The approximate site outline is further displayed in Figure A1, **Appendix A**.

## 1.2 Purpose

The purpose of the DSI is to support the Council's existing global land use consent (RMA/2021/2094, CCC Global NESCS Consent) under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations 2011 ('the NESCS') (NESCS, 2011).

The investigation findings will inform soil contamination risk management strategies that will be communicated in the Contaminated Soil Management Plan (CSMP) for works associated with the improvements to the erosion protection structures and bund.

## 1.3 Background

Residential dwellings previously present on the site were built in the mid-20th century when asbestos-containing materials were commonly used in the construction. Degradation of these materials can result in the migration of asbestos fibers into the soils. It is additionally noted, that in the development of some of the properties in the area, erosion protection was installed by individual landowners at the edge of the estuary. This was either by means of the construction of walls or the installation of informal structures to create a hard edge. It is considered likely that a portion of the land immediately behind these structures was reclaimed/filled by the landowners at that time using a range of materials and there is concern that contamination could exist in this reclaimed/filled land.

Two preliminary site investigations (PSIs) have been undertaken for the site by Jacobs, with the first investigating the Southshore Estuary edge (Jacobs, 2022a) and the second investigating the South New Brighton Park and proposed bund area (Jacobs, 2022b). A summary of the PSI reports is listed below:

- The initial PSI (Jacobs, 2022a) identified one HAIL activity – HAIL I<sup>1</sup> intersecting with the proposed works. During the PSI site walkover and subsequent sampling, nine of the eleven existing erosion protection structures returned positive detections of asbestos containing material (ACM). All structures are located within 20 m adjacent west to the Southshore Bund.

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<sup>1</sup> Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment

- The second PSI (Jacobs, 2022b) identified no current or historical HAIL activity within the proposed Bund location. However, it was noted that there is the potential for HAIL I classification owing to the former demolition of residential buildings and fill associated with these works.
- Both reports recommended:
  - The NESCS will require further consideration for project works within the Southshore Bund area of the site, and further sampling would be required to confirm the presence/concentration of friable asbestos or asbestos fines in the soil.
  - Soil sampling along the proposed bund alignment (100 m intervals) and at locations where asbestos was previously positively identified.
  - The estimated soil disturbance volumes associated with the proposed bund construction and proposed erosion protection upgrade activities exceed the permitted activity volume and therefore a resource consent under the NESCS is required.
  - The NESCS will require further consideration for project works within the Southshore Bund area of the site, and further sampling would be required to confirm the presence/concentration of friable asbestos or asbestos fines in the soil.

Jacobs recommended a soil investigation as a result of the findings, conclusions, and recommendations in the PSI reports.

### 1.4 Proposed Development and Anticipated Excavation Volumes

Council intends to redevelop the erosion protection at the site, including upgrading the erosion protection at the Estuary edge, the removal of the existing bund and the construction of a new bund.

Soil disturbance associated with the works will include that which may be associated with the modification of the existing structures, soft barriers and natural shoreline as well as that associated with the construction of the bund. Topsoil will be stripped from the works area and retained on site for use as landscape fill.

It is envisaged that the soil disturbance will be associated with the following activities:

- Stripping of topsoil;
- Construction (and reinstatement) of a haul road;
- Bank trimming;
- Excavation of estuary bed to design levels;
- Excavation of existing estuary edge to formation levels of approximately 1.6 metres below ground level (m bgl);
- Excavation of existing bund and new bund to formation levels of approximately 0.3 m bgl; and
- Landscaping and planting outside of immediate bund/erosion protection footprint.

According to the latest revision of the design drawings (IA271200-CD-DRG-1003\_B) that are appended to the Southshore Inundation and Erosion Project Assessment of Effects on the Environment, the proposed erosion protection upgrade (revetment) activity covers an area of approximately 12,000 m<sup>2</sup> along Southshore and it is estimated that 10,380 m<sup>3</sup> of soil disturbance would be associated with the works. Of the volume of soil that is estimated to be disturbed, potentially 1,840 m<sup>3</sup> can be reused on site with the remaining 8,540 m<sup>3</sup> likely requiring disposal off site.

The proposed bund construction activity covers an area of approximately 19,000 m<sup>2</sup> along Southshore and it is estimated that 4,900 m<sup>3</sup> of soil disturbance would be associated with the works. It is projected that approximately 4,620 m<sup>3</sup> of the disturbed soil can be reused on site with the remaining 280 m<sup>3</sup> likely requiring disposal.

There is a potential option to fill in the areas between the bund and revetment structures with the remaining cut material instead of disposing off-site. These areas have capacity to accommodate a volume of up to 63,300m<sup>3</sup> which is sufficient to retain all cut material on site, assuming soil conditions are suitable.

These volumes of soil disturbance exceed the permitted activity disturbance volume of 25 m<sup>3</sup> per 500 m<sup>3</sup> and disposal volume of 5 m<sup>3</sup> per 500 m<sup>3</sup> of the piece of land and therefore if the soil were confirmed to be contaminated a resource consent under the NESCS is required.

### 1.5 Objectives

The objectives of the DSI are to:

- Assess potential soil contamination risk to human health and the environment to substantiate the soil management requirements that will apply to the works; and
- Inform soil reuse/disposal options.

### 1.6 Scope of Works

The scope of works for the soil investigation comprised the following:

- Development of a sampling analysis and quality plan (SAQP) that describes:
  - Number, location, and depth of sample locations;
  - Frequency of sample collection at nominated depths;
  - Sample collection procedures; and
  - Analytes to be tested at an International Accredited New Zealand (IANZ) accredited laboratory.
- Supervision of service clearance and excavation of 33 sampling locations;
- Completion of the following test pits:
  - 21 machine-excavated test pits to a maximum depth of 0.8 m bgl along the existing bund.
  - 12 hand-dug test pits to a maximum depth of 0.3 m bgl along the estuary shoreline.
- The collection of 54 soil samples across a range of depths and one potential asbestos-containing material (PACM) sample from 33 locations across the site and selected samples for analysis to an IANZ accredited laboratory.
- Assessment of the soil laboratory test results against the commercial/industrial land use criteria, consistent with the Ministry for the Environment (MfE) *Contaminated Land Management Guidelines (CLMG) 2: Hierarchy and Application in New Zealand of Environmental Guideline Values*. (MfE, Revised 2011).
- Preparation of this DSI report. The report has been prepared consistent with MfE *CLMG No. 1: Reporting on Contaminated Sites in New Zealand*. Ministry for the Environment. (MfE, Revised 2021a).

### 1.7 Report Certification

Consistent with Regulation 3(3)(c) of the NESCS, this report is certified by Stanley Howell, CEnvP:SC, a suitably qualified and experienced practitioner (SQEP), and has been prepared in general accordance with MfE *CLMG No. 1: Reporting on Contaminated Sites in New Zealand*. Ministry for the Environment. (MfE, Revised 2021a).

## 2. Environmental Setting

### 2.1 Site Location and Description

The investigation site covers an extent of approximately 2.7 km of the estuary edge along the Christchurch Southshore from Ebbtide Street in the north to just south of Tern Street in the south and includes the current Southshore bund which is the portion of land approximately 15 m inland of the estuary edge. This Southshore bund area has been named Area 5 of the Eastern Estuary Condition Inventory, which was compiled by Jacobs in August 2019 and covers the Southshore from Godwit Street to south of Tern Street. Area 5, hereinafter referred to as “the site” has been divided into four sub areas referred to as Units from Unit 1 through to Unit 4 as follows:

- Unit 1 referring to the estuary edge from 2 Godwit Street to 62C Rocking Horse Road;
- Unit 2 referring to the estuary edge from 64A Rocking Horse Road to 94A Rocking Horse Road;
- Unit 3 referring to the estuary edge from 96A Rocking Horse Road to 1A Tern Street; and
- Unit 4 referring to the estuary edge from 1 Tern Street to 170 Rocking Horse Road.

An additional area of the investigation was added north of Unit 1 to investigate the bund along Ebbtide Street south of Caspian Street.

The investigation site with reference to Units 1 - 4 is shown in Figure A2, **Appendix A**.

The Southshore bund site consists of existing bund / footpath that runs north-south adjacent to the estuary edge over vacant land where 74 former private residential properties were in existence. The structures associated with these former properties were demolished following the Canterbury Earthquake Sequence (in particular the Christchurch earthquake on the 22nd of February 2011). The entire 57,991 m<sup>2</sup> extent of the site is zoned as Special Purpose (Flat Land Recovery) under the Christchurch’s District Plan and is CERA Red Zoned Land in the Land Use Recovery Plan.

The site is relatively flat and apart from the one residence in existence at 44A Rocking Horse Road, comprises vacant open grassed land with several mature trees and shrubs scattered throughout its extent. The estuary edge itself consists of various built structures, soft barriers and natural shorelines.

### 2.2 Surrounding Land Use

Surrounding land use for the Southshore site area is recreational to the north, east and south, with residential properties further to the east. To the west of the site is the Avon-Heathcote Estuary/Ihutai (the Estuary).

### 2.3 Topographic Setting

The general topography of the wider project area is relatively flat with a slight downwards gradient on the western side towards the Estuary. It is low lying at an elevation between 0 m and 2 m above sea-level (m asl).

### 2.4 Site Geology

According to QMAP 1:250 000 Geological Maps, GNS Science (2012) the geology of Southshore is generally comprised of Late Quaternary dunes of the Pakihi Supergroup which is described as sand in mobile and fixed dunes of the coast and rivers. Geotechnical investigations have been undertaken within the site, the logs from the investigative bores confirm that the encountered geology is sand of varying densities which is consistent with the mapped geology<sup>2</sup>.

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<sup>2</sup> Environment Canterbury, 2021, Well Search, <https://ecan.govt.nz/data/well-search/>, accessed 13 December 2021.

## **2.5 Site Hydrogeology**

Observations from the summaries of geotechnical / geological investigative wells installed in the South New Brighton locality in 2021 indicate that the water table (coastal confined gravel aquifer) is expected to be relatively shallow and generally within 0.0 – 2.0 metres of the ground surface<sup>3</sup>. Groundwater level data obtained from Canterbury Maps indicates that several artesian wells are present within 50 m of the site.

## **2.6 Sensitive Receptors**

The nearest body of surface water is the Estuary which runs along the western boundary of the site before ultimately discharging into Pegasus Bay and the Pacific Ocean. The Estuary is listed on the Council District Planning maps as a Site of Ecological Significance<sup>2</sup>.

---

<sup>3</sup> Canterbury Maps, accessed December 2021, WERI (Wetlands of Representative Importance) database, Department of Conservation, updated 2017.

### **3. Review of Available Information**

#### **3.1 Site Walkover and Observations**

Three site walkovers were conducted on 3 June 2020, 21 August 2020 and 2 December 2021 followed by sampling work on the 6 and 7 July 2022. Observations documented during the walkover have been summarised in 3.1.1 and 3.1.2 below.

Photos collected during the site walkover and sampling works have been included in a Photographic loglog (**Appendix B**).

##### **3.1.1 Site Walkover Observations from 2020**

The site walkover on 3 June 2020 was conducted for the initial PSI for the Southshore Erosion Management Investigation to determine whether any visible or olfactory signs of contamination were present.

During this site walkover several structures in varying states of repair were observed to be present along the shoreline. The site walkover involved the visual inspection of each structure and their immediate surrounds for possible contamination.

Considerable erosion of the shoreline and the fill behind many of the structures was evident. This erosion has exposed the fill material in many locations and in the vicinity of nine of the structures, suspected ACM fragments were visible. For the structures where no visible contamination was present, there was generally either substantial amounts of building rubble in the form of large rocks, concrete rubble, concrete blocks, ceramic roof tiles and bricks present, or the land was covered in estuary salt marsh mud, pebbles and natural debris or grass, trees and shrubs.

A second site walkover was conducted on 21 August 2020 to obtain samples of suspected ACM fragments in the vicinity of the nine structures identified in the previous visit.

##### **3.1.2 Site Walkover Observations from 2021**

A site walkover was conducted on 2 December 2021. The walkover included the entire extent of the wider project site from the boat ramp in SNBP in the north to the south of Tern Street in the south. The site was walked in a north to south direction.

The existing Southshore Bund that traverses the former properties is raised bund with a wider base than crest that has been formed into a worn footpath. According to the Council the bund is constructed from topsoil.

No visual or olfactory signs of site contamination or, stressed vegetation were evident. No other potential sources of contamination such as tanks, lagoons or cesspits were observed.

### **3.2 Review of Historical Aerial Imagery**

A review of historic aerial imagery that was conducted for Southshore for the Jacobs 2020 and 2022 PSIs suggests that the site remained in an undeveloped state until sometime between 1955 and 1959 when development of the area for residential use began. Residential development of the area then progressed steadily until a time between 2000 and 2004 when all the properties immediately adjacent to the site were well established. In the process of developing the area for residential use there was a considerable amount of land reclamation in order to extend and level properties close to the shore. Following the Christchurch earthquake in 2011, the land adjacent to the site was declared Red Zone land<sup>4</sup> by the Department of Building and Housing and the residences on these properties were demolished and the land cleared over several years from around 2013

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<sup>4</sup> Areas of land in and around Christchurch, New Zealand, that experienced severe damage in the 2010 and 2011 Christchurch earthquakes and were deemed infeasible to rebuild on

to 2016. All the land that encompasses the site is currently vacant apart from one residence at 44A Rocking Horse Road. The land further east of the site on the Southshore has also been in residential use since between 1955 and 1959 and these residential properties are still in existence.

A full review of historical aerial imagery from the Canterbury Maps, Historical Aerial Photography database (<https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery/>) and Retrolens was undertaken to identify historic land uses and the potential for associated soil contamination. A summary of the review of historic aerial imagery along with selected historic aerial imagery is provided in the PSIs attached as **Appendix C**.

### 3.3 Council Site Records

#### 3.3.1 Listed Land Use Register

The Listed Land Use Register (LLUR) is a publicly available database of locations where activities described on the hazardous activities and industries list (HAIL) have been undertaken throughout Canterbury, held by Environment Canterbury. The LLUR holds information about sites that have been used or are currently used for activities which have the potential to result in ground contamination.

The LLUR review that was conducted for the site and covered within the Jacobs 2022a and 2022b PSIs indicates that none of the properties adjacent to the northern end of the site, within Units 1, 2 and part of Unit 3 have HAIL classifications. The remaining properties adjacent to the site from 124A Rocking Horse Road to the end of Unit 4 are verified non-HAIL in terms of the LLUR.

Three properties ~50 m further east of the former properties adjacent to Unit 3, and six properties ~100 m further east of the former properties adjacent to Unit 4 were noted on the LLUR and have previously had DSIs conducted at them. As the DSI's have confirmed that concentrations of onsite soils are below guideline and/or background values and when considering the proximity to the site, these properties are not considered to be a potential source of soil contamination on site.

According to the LLUR, Rocking Horse Road, Southshore was identified as the location of a fibrous plaster dump (Landfill #77) in Council records. The fibrous plaster was thought to potentially contain asbestos and the cover depth of the landfill was unknown. A polygon (SN10932) to represent this fill area was created on Environment Canterbury's Listed Land Use Register in 2012.

Several reports registered on the LLUR were completed to support neighbouring properties undertaking repair or rebuilds following earthquake damage. Taken as a body of information, the data available was used to better define the area likely to be affected by the fibrous plaster dump and provide a category on the LLUR. The likely location of Landfill #77 was SN981060 (1/99A, 2/199A, 199, 199B, 201 and 203 Rocking Horse Road). The site of this historic land use is approximately 320 m south-east of the site and is not considered to be a potential source of soil contamination on site.

According to the LLUR, Ebbside Street was identified as the location of the Estuary Road Landfill (Landfill Map #40 SIT 11070) with landfill activities occurring at the location from 1945 to 1955. This site is located north of and within 100 m of the northern extent of the investigation area. There are no investigations associated with the historic landfill site. Due to the separation distance between the historic landfill and the northern extent of the investigation site, the historic landfill is unlikely to be considered a potential source of contamination on site.

### 3.4 Sampling of Asbestos Containing Materials

The former residential dwellings were built in the mid-20th century, so there is the possibility that asbestos materials were used in the construction, and that contaminants associated with these materials may have migrated into the soils. The development of some of the properties adjacent to the site is on reclaimed land, and erosion protection structures are in place in these areas. No documentation has been reviewed which describes the nature of the fill behind these structures.

On the initial site visit conducted by Jacobs in 2020, suspected ACM were observed in the vicinity of eleven seawall structures. A second site walkover was conducted on 21 August 2020 to obtain samples of suspected ACM fragments in the vicinity of the nine structures identified in the previous visit. Additionally, suspected ACM fragments were evident in the vicinity of two further structures not identified previously, taking the total number of structures with suspected ACM to 11. Nine samples were obtained on the site visit. One sample applies to two adjacent structures (NS6A and NS6B). Sampling was not feasible at one location due to the location and size of the suspected asbestos containing pipe.

Results show that asbestos was present in eight out of the nine samples analysed, confirming that asbestos contamination is present in the vicinity of nine of the structures and possibly in the vicinity of the proposed bund alignment at these locations. No other visible or olfactory signs of contamination were observed in the vicinity of the estuary edge or in the vicinity of the location of the proposed bund alignment.

### 3.5 HAIL Assessment

The review of available information has established that according to the LLUR analysis no HAIL sites have existed / currently exist adjacent to the structures where the proposed bund is to be located. However, HAIL I may apply owing to the former residential buildings having asbestos materials that could possibly have migrated into the soils.

HAIL I is described as follows:

*Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.*

Based on historical landuse and the positive identification of ACM fragments at the surface of the seawall structure, asbestos was identified as a contaminant of potential concern (CoPC) and more likely than not present in insufficient quantity that it could pose a risk to human health. Further sampling was recommended to confirm the presence/concentration of friable asbestos or asbestos fines in the soil.

Due to the sources of contamination and the potential sources of migration, it is unlikely that HAIL sites within 100 m of the proposed bund alignment would transport contaminants via overland stormwater flow paths and/or groundwater migration.

This assumes:

- Our general understanding of the site hydrology and that stormwater from adjacent sites is not likely to flow on to the site; and
- All identified off-site HAIL activities are either cross- or down-hydraulic gradient of the site, or are a distance from the site such that CoPC migration to the site is considered unlikely.

Based on the findings of the two 2022 PSI's, it is not considered likely for the site to have been impacted by the off-site HAIL activities.

The alignment of the proposed bund within Southshore may need to be set further inland from the existing alignment which will mean that the alignment may traverse the road ends of Godwit Street, Heron Street, Penguin Street, Plover Street and Tern Street. According to historical aerial imagery, these roads were constructed at some time between 1959 and 1965.

Roads are not specifically listed on the HAIL register; however, coal tar may have been used in the construction of the roads that the alignment traverses and thus there is the potential for coal tar contamination in these locations.

According to Ahrens, (2008) coal tar binders were widely used in road construction in New Zealand until the 1970s and used up to 1985 in Christchurch.

### **3.6 Contaminants of Potential Concern**

Asbestos is the primary CoPC associated with identified HAIL activity on-site. Polycyclic aromatic hydrocarbons (PAH) associated with coal tar are an additional class of CoPC that should be considered prior to project works commencing.

## 4. Preliminary Conceptual Site Model

The conceptual site model (CSM) is a comprehensive screening tool that uses available data to evaluate the likelihood of human health and environmental risk, based on linkages between potential contaminant sources, migration and exposure pathways, and receptors. This was initially prepared within the (Jacobs, 2022b) PSI and provided below.

### 4.1 Sources, Impacted Media and CoPC

The potentially impacted media comprises shallow soils where proposed works will be undertaken. CoPC have been identified, primarily based on the on-site historic use and activities, as well as asbestos potentially from former buildings, and imported fill/reclaimed land. The CoPCs comprise:

- Asbestos; and
- PAH.

Based on the current and historical land use, including imported fill/reclaimed land, asbestos in the soil and coal tar is assumed to be diffuse and may be present at discrete locations within the site. Additionally, heavy metals have been assessed to quantify disposal options and the implications for discharge consent compliance.

### 4.2 Migration and Exposure Pathways

The potential migration pathways include:

- Airborne migration of fibres/dust/vapours
- Tracking of soil dust
- Surface runoff of sediment

The potential exposure pathways include:

- Direct/dermal contact with contaminated soil (PAH)
- Ingestion and inhalation of contaminated soil (PAH)
- Inhalation (dust/asbestos fibres/vapours) (Asbestos and PAH)
- Ingestion, direct/dermal contact with impacted surface water (PAH)

### 4.3 Receptors

The potential receptors include:

- Construction and maintenance workers / personnel (human health)
- Future site users of the site (human health)
- Public / off-site occupants of adjacent land parcels (human health)
- The Avon-Heathcote Estuary / Ihutai (environmental)

#### 4.3.1 Preliminary Risk Assessment

Based on the desktop review of the site setting and historical land use information, a summary of the preliminary CSM has been prepared and presented in Figure 1 below.

## Detailed Site Investigation

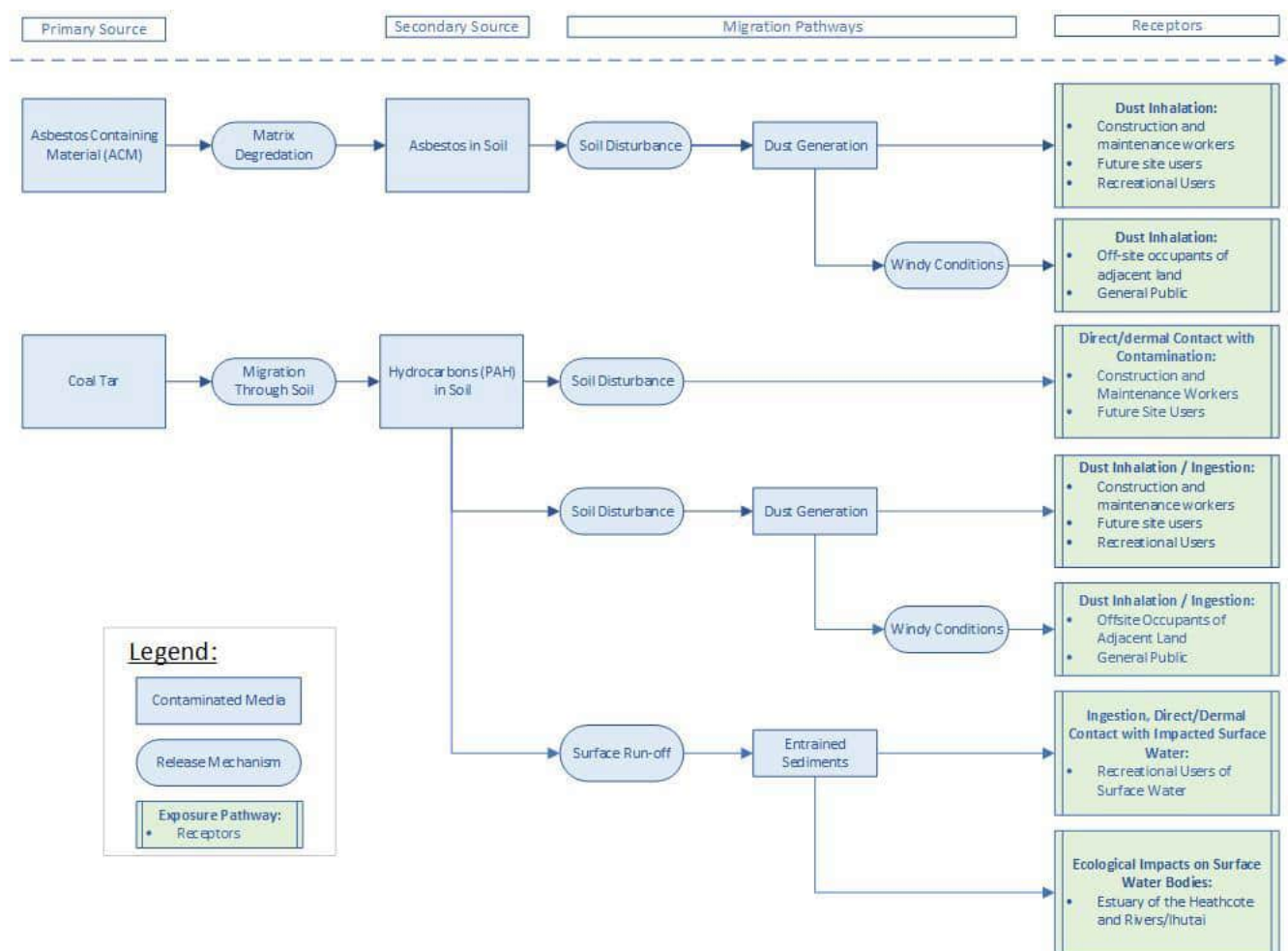


Figure 1: Preliminary conceptual site model for the Southshore bund area

### 4.3.2 Additional CoPC

Heavy metals analysis was added to the CSM, to understand potential implications of the use of the global discharge consent, which permits background levels of metals to be discharged to the Council's reticulated stormwater network. Heavy metals analysis would also support off-site soil disposal options to a cleanfill, where background concentrations of metals are adopted as acceptance levels.

## 5. Investigation, Sampling and Analysis Plan

Based on the preliminary CSM described in (Jacobs, 2022a) PSI, Jacobs developed a Sampling and Analysis Quality Plan (SAQP) to investigate potential HAIL contaminant concentrations in soil within the site. With reference to MfE CLMG No. 5 (MfE, Revised 2021b), 33 testing locations were selected. The SAQP was based on the proposed location, extent, and depth of soil disturbance for the proposed development, the location of where ACM was found along the estuary shoreline and the preliminary CSM. Additionally, heavy metals analysis was added to the CSM to advise waste disposal options and inform implications for discharge consent compliance. The SAQP has been provided as **Appendix D**.

Site plans showing test locations is provided as Figures A3 – A6 **Appendix A**.

### 5.1 Fieldwork Sampling

The soil sampling intrusive investigation works were undertaken on 6 and 7 April 2022. The 33 sampling locations were excavated by the following methods:

- 21 machine excavated test pits to a maximum depth of 0.8 m bgl along the proposed bund development. These test pits were denoted TP01 – TP21, with a total of 42 soil samples obtained from 0.1 m – 0.3 m bgl and 0.5 – 0.8 m bgl; and
- 12 hand-dug surface samples to a maximum depth of 0.3 m bgl along the estuary shoreline. These test pits were denoted SS01 – SS12, with a total of 12 soil samples obtained with a spade from 0.1 – 0.3 m bgl. One fragment of suspected ACM was also collected on the ground surface at sampling location SS07.

The target depth along the existing bund was based on the proposed excavation depth for the new bund, whereas the target depth along the estuary shoreline was based on the previous identification of ACM at the surface and the likely depth of which ACM may impact the soils beneath.

Sample collection and handling procedures are outlined in the SAQP and were followed during site works.

Soil logs are provided as **Appendix E**.

### 5.2 Laboratory Analysis – Contaminants of Potential Concern

The collected soil samples were submitted with chain of custody (CoC) documentation, to Hill Laboratories (Hills). CoC documentation is presented in **Appendix F**.

A total of 54 primary soil samples were obtained from varying depths and the following analytes selected for analysis:

- Testpit Locations – Targeting the Bund Development
  - Heavy metals / metalloids (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc) -All locations TP1 – TP21 across a range of depths.
  - Polycyclic aromatic hydrocarbons (PAH) – One location within TP16 only.
  - Asbestos in soil (semi-quantitative) – All samples across all depths.
- Surface samples – Targeting the Estuary Shoreline Development
  - Asbestos in soil (semi-quantitative) – All locations.

One suspected ACM fragment was collected from the surface near SS07 and analysed for asbestos bulk ID (presence/absence).

### 5.2.1 Quality Assurance / Quality Control

The samples were sent under full CoC to Hills, an IANZ accredited laboratory.

QAQC procedures presented in the SAQP were followed during site works. Five quality control samples were collected as duplicate samples, which were analysed for heavy metals.

Further discussion regarding QAQC analytical results is presented in Section 6.4.

## 5.3 Adopted Guideline Values

Based on the preliminary CSM, analytical results were compared to soil contamination standards and acceptance criteria relevant to two exposure scenarios, as summarised below.

- Protection of human health (soil) during construction and future use as a recreational walking track.
- Protection of environmental and human health and future use of the site by ecological receptors and humans.
- Suitability for onsite reuse and off-site disposal as cleanfill, managed fill, or contaminated fill.

The assessment of risk to human health from contaminated soil is regulated by the NESCS. The NESCS 'Parks / Recreational' land use scenario and workers commercial / industrial scenario are considered to be applicable for this site.

Soil analytical results were compared to the Canadian Council of Ministers of the Environment (CCME) 2002 guidelines. These guidelines are developed for both ecological and human receptors that may be exposed to contaminants through a range of pathways associated with four land use categories. Soil with contaminants present at the guideline levels will provide a healthy functioning ecosystem capable of sustaining the current and likely future uses of the site by ecological receptors and humans. Agricultural land use is the most conservative land use category with the lowest applicable guideline values.

Where a SCS has not been derived, an applicable standard (soil guideline value) for the protection of human health has been selected in accordance with MfE CLMG No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, Revised 2011). The relevant criteria adopted for the assessment of human and ecological health are shown in Table 5-1, below. Table 5-1 Adopted Guideline Values

| Criteria                                                         | Reference                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Human Health                                                     | SCS from the NESCS for arsenic, cadmium, chromium, copper, lead, mercury, and benzo(a)pyrene equivalence (BaPeq).                                                                                                                                                    |
|                                                                  | National Environment Protection Measure (NEPM) Health Investigation Level (HIL-D), (NEPM, 2013) for nickel and zinc.                                                                                                                                                 |
|                                                                  | Asbestos - New Zealand Guidelines for Assessing and Managing Asbestos in Soil (NZGAMAS, 2017).                                                                                                                                                                       |
|                                                                  | Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 2011)                                                                                                                                                            |
| Ecological / Human Health                                        | Soil Quality Guidelines for the Protection of Environmental and Human Health (agricultural, residential / parkland, commercial, industrial (CCME, 2002).                                                                                                             |
| Soil – Background/Cleanfill Criteria and Waste Disposal criteria | Cleanfill acceptance criteria is based on background concentrations of heavy metals and PAH.<br>Environment Canterbury, 2007. Background Concentrations of Selected Trace Elements in Canterbury Soils. (ECan, 2007a)<br>Environment Canterbury, 2007. (ECan, 2007b) |

## Detailed Site Investigation

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|  |                                                                                                                                                                                                 |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Technical Guidelines for Disposal to Land. Waste Management Institute New Zealand (WasteMINZ) (WasteMINZ, 2018)                                                                                 |
|  | Frews Hororata waste acceptance criteria (Frews, 2016)                                                                                                                                          |
|  | Kate Valley waste acceptance criteria (MfE, 20004)<br>These fill sites were assessed as being the closest filling facilities to the site and have only been used as a guide for waste disposal. |

## 6. Results

### 6.1 General Observations Soil

The test pit and shallow soil sampling logs shown in **Appendix E** present an account of the geology identified on site. The materials observed in testpits generally comprised sandy silts with gravels to depths of 0.3 - 0.4 m bgl, underlain by disturbed and natural sands. Natural soils were generally encountered from 0.8 – 1 m bgl and comprised sands.

During the investigation of the Southshore bund (excluding Ebbside Street) visual cues of contamination (building materials including plastic, nails and glass, wood, ceramic, brick and clay fragments) were observed in 17 out of the 21 testpits, with no building debris observed in TP02, TP03, TP06, TP20 and TP21. There was a distinct bituminous odour and dark grey staining noted at TP16 between from 0.6-0.8 m bgl with no odour or staining observed in the remaining testpits. A sample from TP16 was sent to the laboratory for PAH analysis.

The material in the shallow soil samples either consisted of sandy silts or fine sands depending on whether the sample was taken from the backshore behind the existing structure or from locations closer to the foreshore. Building materials were observed on the surface in the vicinity of all the sampling locations.

Suspected ACM fragments were observed on the surface within a 1 m radius of the SS-07. No visible suspected ACM was observed in any of the testpits or the remaining shallow sampling locations.

Groundwater was not observed during the sampling at any of the testpit locations.

### 6.2 Laboratory Results

Detailed analytical laboratory results and soil assessment criteria comparisons are provided in Tables G1-G5, **Appendix G**, and copies of the laboratory reports are provided in **Appendix H**.

#### 6.2.1 Human Health

None of the 33 samples tested for heavy metals / PAH exceeded the human health criteria for recreational land use or commercial / industrial outdoor worker / maintenance.

Asbestos was detected in five out of 54 samples tested, with two surface samples (SS03 and SS07) containing concentrations above the NZGAMAS Asbestos in ACM as % of Total Sample criteria of 0.02% w/w for recreational land use for human health. Additionally, one bulk ACM sample (SACM-SS07) identified from the surface soil surrounding SS07 returned a positive detection of asbestos exceeding both recreational and commercial / industrial land use criteria.

The remaining samples TP05\_05-08 and TP11\_0.1-0.3 contained concentrations of ACM as % of total sample and fibrous/fines (AF/FA) as % of total sample below recreational and commercial / industrial land use criteria.

Additionally, it is important to note that a considerable amount of ACM fragments were identified at multiple surface locations throughout the estuary edge during the earlier investigation (Jacobs, 2022a). Any ACM within the top 100 mm of surface soil is an exceedance of both recreational and commercial / industrial land use criteria. Due to the considerable amount of asbestos identified intermittently throughout the length of the estuary edge.

#### 6.2.2 Ecological and Human Health

When compared to the Canadian Council of Ministers of the Environment (CCME) 2002 guidelines, two soil samples were found to exceed the guideline concentrations for lead in an agricultural land use scenario (70 mg/kg), including a value of 88 mg/kg (18 mg/kg above guidelines) at TP04\_0.5-0.8 and 127 mg/kg (57

mg/kg above guidelines) at TP18\_0.5-0.8. However, none of the samples tested for heavy metals exceeded the CCME 2002 guidelines for the residential / parkland land use scenario.

### 6.2.3 Cleanfill Determination and Waste Disposal

To determine an appropriate landfill for soil disposal, the analytical results have been compared to acceptance criteria for Legget Road, Frews Hororata and Kate Valley landfills. Where soil concentrations exceed the landfill acceptance criteria, Jacobs have calculated a 95% upper confidence limit (UCL) of the dataset. If the 95 % UCL is below landfill acceptance criteria, the soil is likely to be disposed of the that landfill (or equivalent), subject to their approval. Further explanation of the use of the 95% UCL is provided below.

### 6.2.4 Statistical Analysis to Determine Waste Disposal

Due to various heavy metals results exceeding Legget Road Landfill Criteria, Jacobs have undertaken statistical analysis using the US Environmental Protection Agency (USEPA) approved ProUCL statistical package to calculate the 95% upper confidence limit of the data set. Using statistical analysis, a 95% upper confidence limit indicates the boundary at which 95% of the population is either at or below the prescribed value (MfE, Revised 2021b).

The application was considered appropriate use for the following reasons:

- UCL values were calculated for a single consistent soil profile being disturbed/removed.
- The dataset for each analyte is eight or greater.
- Obvious outliers (including those within hotspot areas) are excluded. This included any values that were twice above the acceptance criteria (Lead from TP18\_0.5-0.8). Landfill acceptance of this hotspot will be based on the actual concentration itself and not included within the statistical calculation.

The ProUCL was calculated to determine whether concentrations of soil proposed for disposal were likely to meet the acceptance criteria of Legget Road Fill facility. Results of the analysis indicate concentrations of heavy metals from test pits TP1 – TP21 at depths 0.0 – 1.2 m bgl are likely to comply with Legget Road acceptance criteria. However, due to very elevated concentrations of lead in TP18\_0.5-0.8, Jacobs recommend that all soil from TP18 be disposed of at Frews Hororata (or equivalent). Delineation of the extent of soil to be removed surrounding TP18 can be defined within the CSMP. The 95% UCL calculation is shown in **Appendix I**.

#### 6.2.4.1 Heavy Metals

At least one heavy metal concentration was detected above adopted YBS Christchurch Urban background levels for cleanfill acceptance in all of the 31 samples analysed.

With the exception of TP18\_0.5 – 0.8, the 95% UCL for remaining 30 samples from locations TP1 – TP21 comply with Legget Road acceptance criteria. Sample TP18\_0.5-0.8 exceeds Kate Valley landfill criteria for lead but does not exceed the Frews Hororata cover soil and managed fill waste acceptance criteria (MFWAC). All samples comply with the Frews Hororata cover soil acceptance criteria for heavy metals.

No heavy metal analysis was completed on surface samples SS01 – SS11.

#### 6.2.4.2 PAHs

PAH including BaP<sub>eq</sub><sup>5</sup> was detected in the one sample (TP16\_0.5-0.8) that was analysed for PAH, however the concentrations were below the regional background levels adopted for cleanfill acceptance.

There were no exceedances of the Legget Road, Frews Hororata (MFWAC) or Kate Valley acceptance criteria for PAH.

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<sup>5</sup> Benzo[a]pyrene Potency Equivalency Factor (PEF) NES assumed for the purpose of calculating BaP<sub>eq</sub>

### 6.2.4.3 Asbestos

All five samples where asbestos fibres were detected (SS-03, SS-07, SACM-55-07, TP05\_0.1-0.3, TP11\_0.5-0.8) contained detections of asbestos in ACM as % of total sample exceeding Frews Hororata cover soil quality acceptance criteria but not their managed fill waste acceptance criteria.

None of the samples contained exceedances of Legget Road and/or Kate Valley acceptance criteria for asbestos in soil.

### 6.2.5 Reuse of Soil Onsite

Due to the detections of ACM on the surface at SS07 and asbestos in soil concentrations at locations SS03 and SS07, soil in these areas is not suitable for reuse on-site and should be disposed of to an appropriate landfill, subject to approval from the receiving facility.

Additionally, it is important to note that due to the considerable amount of asbestos that was identified intermittently throughout the length of the estuary edge during the earlier investigation (Jacobs, 2022a), it is recommended that soil within this area is not reused on site.

There is the possibility however that this soil contaminated with ACM could be reused on site if it were to be suitably encapsulated in an appropriate location on site at depths greater than 0.5 m<sup>6</sup> below the finished ground level. Excavation and handling of this soil is likely to pose an unacceptable risk to human health and as such, any soil disturbance works completed in these areas shall be conducted under 'asbestos-related work' controls in accordance with the NZGAMAS by a person competent in working with asbestos in soil. If resource consent is required for these earthworks, then these controls should form part of the Consent conditions.

Due to the level of contamination for heavy metals, PAH and/or asbestos being below the recreational landuse criteria, the remaining soil within sampling locations TP01 – TP21 may be reused on site.

## 6.3 Quality Assurance / Quality Control Results

Five field duplicates were obtained, with testing of the field duplicates undertaken and relative percentage difference (RPDs) calculations completed for heavy metals between the primary sample and duplicate.

The RPD between samples was calculated according to the following formula:

$$RPD = \frac{(Result\ No.\ 1 - Result\ No.\ 2) \times 100}{(Mean\ of\ result\ No.\ 1 + result\ No.\ 2)}$$

The MfE typical Data Quality Objective (DQO) is for an RPD to be within 30 – 50% (MfE, Revised 2021b). The RPD results generally indicate an acceptable RPD for the samples collected and analysed.

RPD comparisons are provided as Table G4 in **Appendix G**.

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<sup>6</sup> Capping requirements for residual contamination above selected soil guideline value for recreational land use (NZGAMAS, 2017).

## 7. Updated Conceptual Site Model

The updated CSM for the proposed development is shown in **Figure 2** below. The CSM represents the soil and characteristics within site based on observations to date. The CSM identifies CoPC, pathways, and receptors and determines whether the source-pathway-receptor linkages from contaminant to receptor is considered complete, incomplete, or uncertain.

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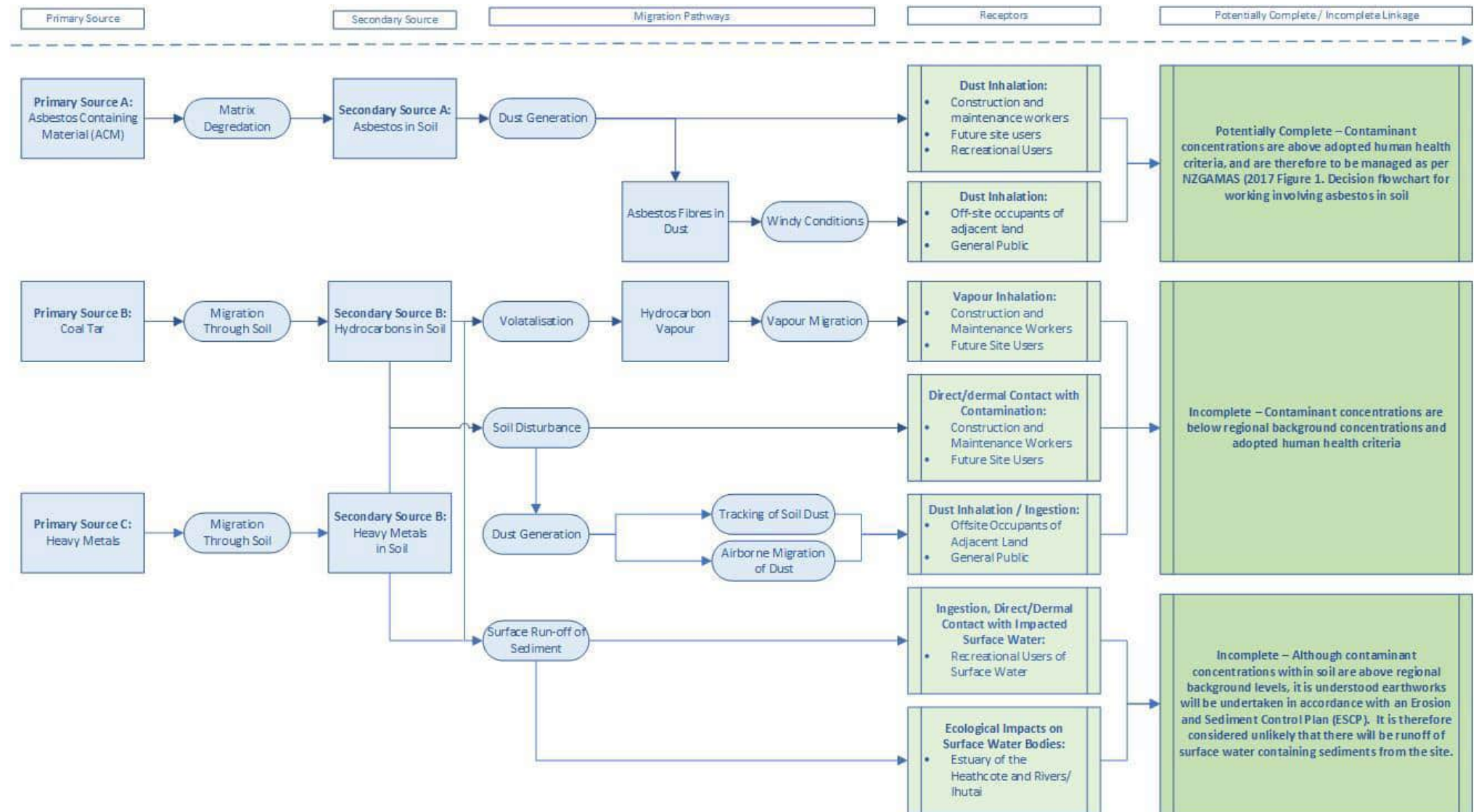


Figure 2 Updated CSM for the site

## 8. Discussion

### 8.1 Soil and Groundwater Management and Disposal

#### 8.1.1 Management Actions

Based on the results of this DSI, management actions are required to ensure that correct handling and disposal of materials are applied during the proposed project works.

With the Council Global NES consent applicable to the works (see **Section 8.2.1**), the findings of this DSI were provided to Council for risk screening to determine the appropriate risk category for the project and the applicable CSMP for the anticipated works. The Council risk screening tool determined the “medium risks” category to be applicable to the project with risk controls to be implemented through the respective Medium Risk CSMP.

Amongst other management requirements, the Medium Risk CSMP sets out the requirements for management of actually or potentially contaminated soil, including coal tar, to be adopted to manage adverse effects to human health and the environment during site works. The CSMP also includes an accidental discovery protocol should an unexpected contamination occur during the works.

Furthermore, the Council Medium Risk CSMP prescribes that a CLS be engaged at the beginning of the project to oversee the works, identify contamination and advise on management, mitigation measures and soil removal. The Council Medium Risk CSMP has been attached as **Appendix J**.

In addition to the CSMP, it is assumed that an Erosion and Secondment Control Plan (ESCP) will be developed and implemented by the contractor to control suspended sediment discharge from the site.

All asbestos works will be completed as per NZGAMAS (2017) *Figure 1. Decision flowchart for work involving asbestos in soil* and further outlined in Section 8.3 below.

#### 8.1.2 Material Classification and Disposal Options

Due to exceedances of background concentrations all soil to be disposed of on-site must be disposed of as managed fill. With the exception of all soil along the estuary edge (due to ACM identified on the surface throughout the Estuary and asbestos in soil concentrations at SS03 and SS07), excavated materials may be reused on site. The excavated soils may be disposed of off-site to a licensed solid waste landfill subject to the landfill operator’s acceptance, as assessed in Section 6 of this report and outlined in Figure A8, **Appendix A**.

Table 8-1, below, outlines the spoil disposal options for the proposed development.

Table 8-1 Spoil disposal options for the development

| Soil Group                                                          | Spoil Disposal/Reuse Options                                                        |                    |                                |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------|--------------------------------|
|                                                                     | On-site reuse                                                                       | Off-site cleanfill | Off-site solid waste landfill* |
| Soil 0.0 – 0.3 m bgl within the estuary edge (SS01 – SS11)          | ✓ cannot be exposed soils and needs to be encapsulated at depths greater than 0.5 m | x                  | Kate Valley <sup>1</sup>       |
| Soil 0.0 – 1.2 m bgl within the proposed bund locations (TP1 -TP21) | ✓ cannot be exposed soils                                                           | x                  | Legget Road                    |

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|                       |                           |   |                |
|-----------------------|---------------------------|---|----------------|
| Soil surrounding TP18 | ✓ cannot be exposed soils | x | Frews Hororata |
|-----------------------|---------------------------|---|----------------|

- 1- Heavy metal analysis could potentially confirm acceptance at Legget Road landfill.  
\* Suggested local landfills or equivalent.

## **8.2 Regulatory Implications**

### **8.2.1 NESCS**

Earthworks for the project would be subject to control under the NESCS given historical land use activities, documented soil contaminants exceedances and the anticipated soil disturbance works.

Discussions with Council have identified that the Global NESCS consent (RMA/2021/2094, CCC Global NESCS Consent) (**Appendix K**) can be utilised to address the NESCS consenting requirement for this project. The Medium Risk CSMP has been identified to support the Global consent to outline measures to mitigate risks to human health and environmental effects of earthworks, provide procedures for construction contractors to following the event that unexpected contamination is encountered during the works and set out general earthwork's controls, disposal requirements and management of soil during the groundworks phase.

### **8.2.2 Global Discharge Consent**

Analytical results confirm concentrations of heavy metals above background levels. It is recommended a planner is engaged to assess the need for a discharge consent and whether the proposed works will be covered under the Councils global consent (RMA/2022/214226) for discharging to stormwater during anticipated soil disturbance works.

### **8.2.3 Canterbury Land and Water Regional Plan**

Sections 5.185 - 5.188 of the Canterbury Land and Water Regional Plan (CLWRP), provide region wide rules and the consenting requirements relating to contaminated land including site investigations and the discharge of contaminants from contaminated land.

As per Section 5.185 investigations to assess concentrations for hazardous substances that may be present in the soil can be conducted as a permitted activity provided that the following conditions are met:

- The site investigation is to be undertaken in accordance with Contaminated Land Management Guidelines No. 5: Site Investigation and Analysis of Soils (Ministry for the Environment, 2011) and reported on in accordance with the Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand, (Ministry for the Environment, 2011); and
- The person or organisation initiating the site investigation provides a copy of the report of the site investigation to the Christchurch Regional Council (CRC) within two months of the completion of the investigation.

The above conditions apply to this investigation.

## **8.3 Christchurch District Plan**

The Christchurch District Plan enables observance of the NESCS and as such **8.2.1** above refers.

This DSI report has not assessed the requirements for resource consents under other rules beyond the NESCS, Sections 5.185 – 5.188 of the Canterbury Land and Water Regional Plan and the Christchurch District Plan.

## **8.4 Conclusions and Recommendations**

Jacobs have been commissioned by the Council to undertake a DSI to support an integrated coastal erosion protection and flood inundation concept for the South New Brighton Park (SNBP) and Southshore Estuary Edge in Christchurch.

It is expected that excavation depths will be between 0.0 – 1.6 m bgl. Proposed volumes of soil disturbance and soil removal required for the redevelopment exceed permitted activity volumes outlined in the NESCS Regulation 8(3).

The purpose of the DSI is to support the Council's existing global land use consent (RMA/2021/2094, CCC Global NESCS Consent) under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations 2011 ('the NESCS') (NESCS, 2011). Additionally, the findings of the investigation were intended to inform the risk classification that applies to the project to determine which Contaminated Soil Management Plan is applicable to the works.

The following observations and findings were made from this investigation:

- A total of 21 testpits within the existing bund and 12 surface samples along the estuary edge were tested, with samples obtained between depths of 0.0 m bgl – 0.8 m bgl.
- None of the 33 samples tested for heavy metals / PAH exceeded the human health criteria for recreational land use or commercial / industrial outdoor worker / maintenance.
- Concentrations of asbestos (ACM as % of total sample) were above adopted human health criteria for recreational land use in the shallow samples obtained from the estuary edge SS03 and SS07.
- The identification of ACM on the surface surrounding SS07 exceeds the adopted human health criteria for both recreational land use and worker scenario (industrial/commercial).
- None of the samples tested for heavy metals exceeded the CCME, 2002 guidelines for the residential / parkland land use scenario.
- All soil within the investigation area does not meet the criteria for cleanfill since contaminant concentrations exceed the adopted background concentrations.
- All soil may be disposed off-site at a licensed solid waste landfill facility (subject to landfill operator approval) as follows:
  - Soil from along the estuary edge (samples SS01 – SS12) may be disposed of to Kate Valley Landfill (or equivalent). Heavy metal analysis could potentially confirm acceptance at Legget Road landfill (or equivalent).
  - Soil within the vicinity of TP-18 may be disposed of to Frews Hororata Landfill (or equivalent) .
  - All remaining soil within the proposed bund location may be disposed of to Legget Road Landfill (or equivalent) .
- Soil within the proposed bund may be reused on site (except in exposed soil areas).
- Due to the large amount of asbestos identified intermittently throughout the length of the estuary edge, it is recommended that soil within this area is not reused on site unless it is encapsulated at depths greater than 0.5 m bgl.
- Excavation and handling of soil within the investigation area surrounding the estuary and SS03/SS07 is likely to pose an unacceptable risk to human health and as such, any soil disturbance works completed in these areas shall be conducted under 'asbestos-related work' controls in accordance with the NZGAMAS by a person competent in working with asbestos in soil.
- Due to detections of FA/AF and ACM as % of total sample below land use criteria at TP05\_0.1-0.3, TP11\_0.5-0.8, any soil disturbance works completed in these areas shall be conducted under 'unlicensed-asbestos work' controls in accordance with the NZGAMAS by a person competent in working with asbestos.

- Roads are not specifically listed on the HAIL; however, coal tar may have been used in the construction of the roads that the alignment traverses and thus there is the potential for coal tar contamination in these locations.
- Based on the findings of the DSI, Council have assigned the “medium risks” category to the project with risk controls to be implemented through the respective CCC CSMP to support the use of the Council’s Global NESCS consent.

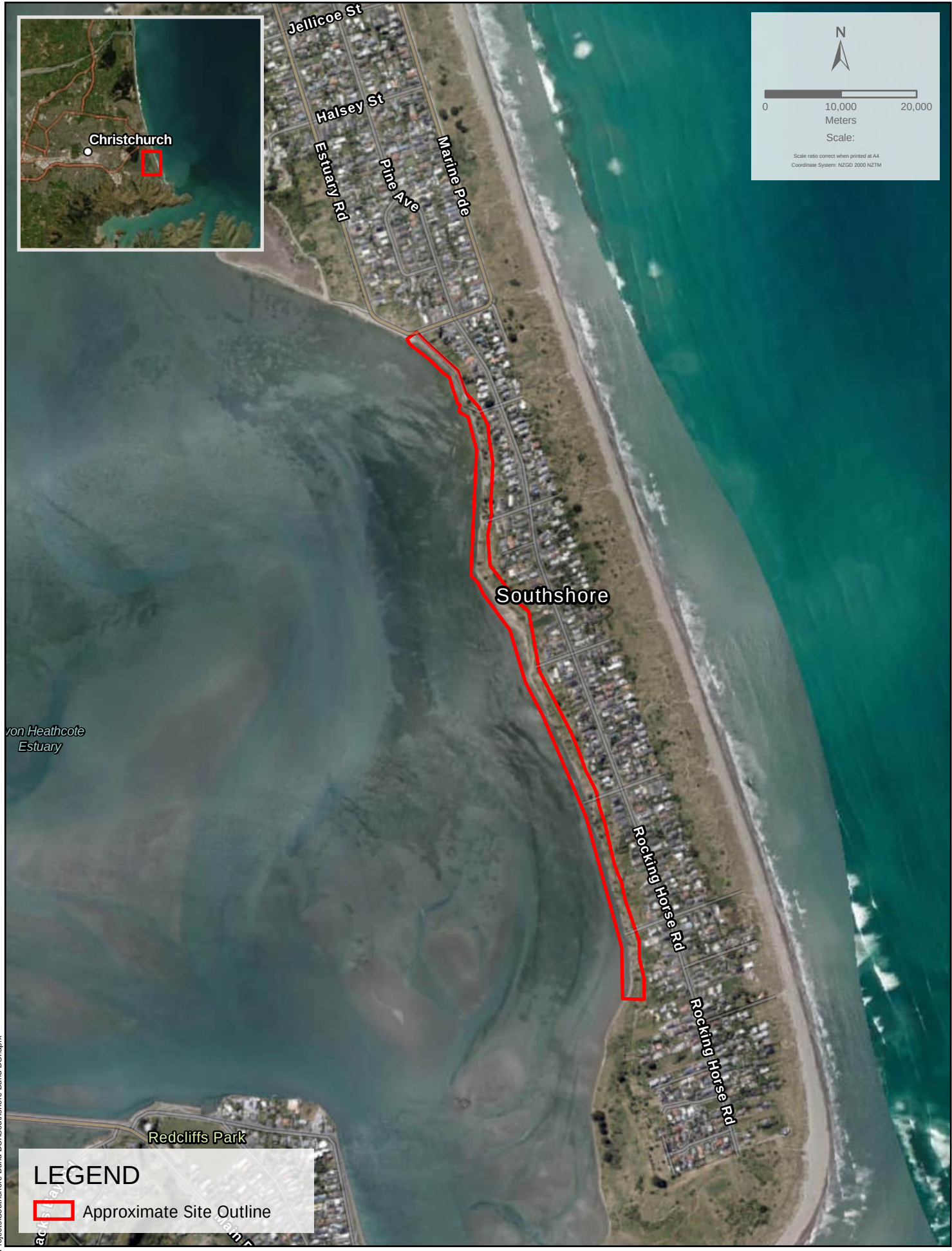
Based on the above findings, the following recommendations are made:

- Additional sampling throughout the estuary in areas containing known ACM (including SS03 and SS07) in order to quantify the extent and potentially reduce disposal requirements. It is also recommended that analysis include heavy metals to inform off-site disposal options. Due to the unknown nature of ACM material along the estuary, it is not recommended that soil from this location is reused on-site within the proposed bund works unless it is capped 0.5 m bgl and that the works are completed as per NZGAMAS (2017) *Figure 1. Decision flowchart for work involving asbestos in soil.*
- Where the bund will transect the existing road ends, it is recommended that samples of the excavated material be submitted for PAH analysis during the construction phase to determine whether coal tar is present and inform material handling and disposal requirements.
- In line with the CCC Medium Risk CSMP A Contaminated Land Specialist (CLS) is to be engaged at the beginning of the project with the works to be overseen by a CLS to identify contamination and advise on management, mitigation measures and soil removal.
- Due to detections of FA/AF and ACM as % of total sample below landuse criteria at TP05\_0.1-0.3, TP11\_0.5-0.8, any soil disturbance works completed in these areas shall be conducted under ‘unlicensed-asbestos work’ controls in accordance with the NZGAMAS by a person competent in working with asbestos.
- In line with the Rule 5.185 of the Canterbury Land and Water Regional Plan, The Council are to provide ECAN with a copy of this site investigation.

## 9. References

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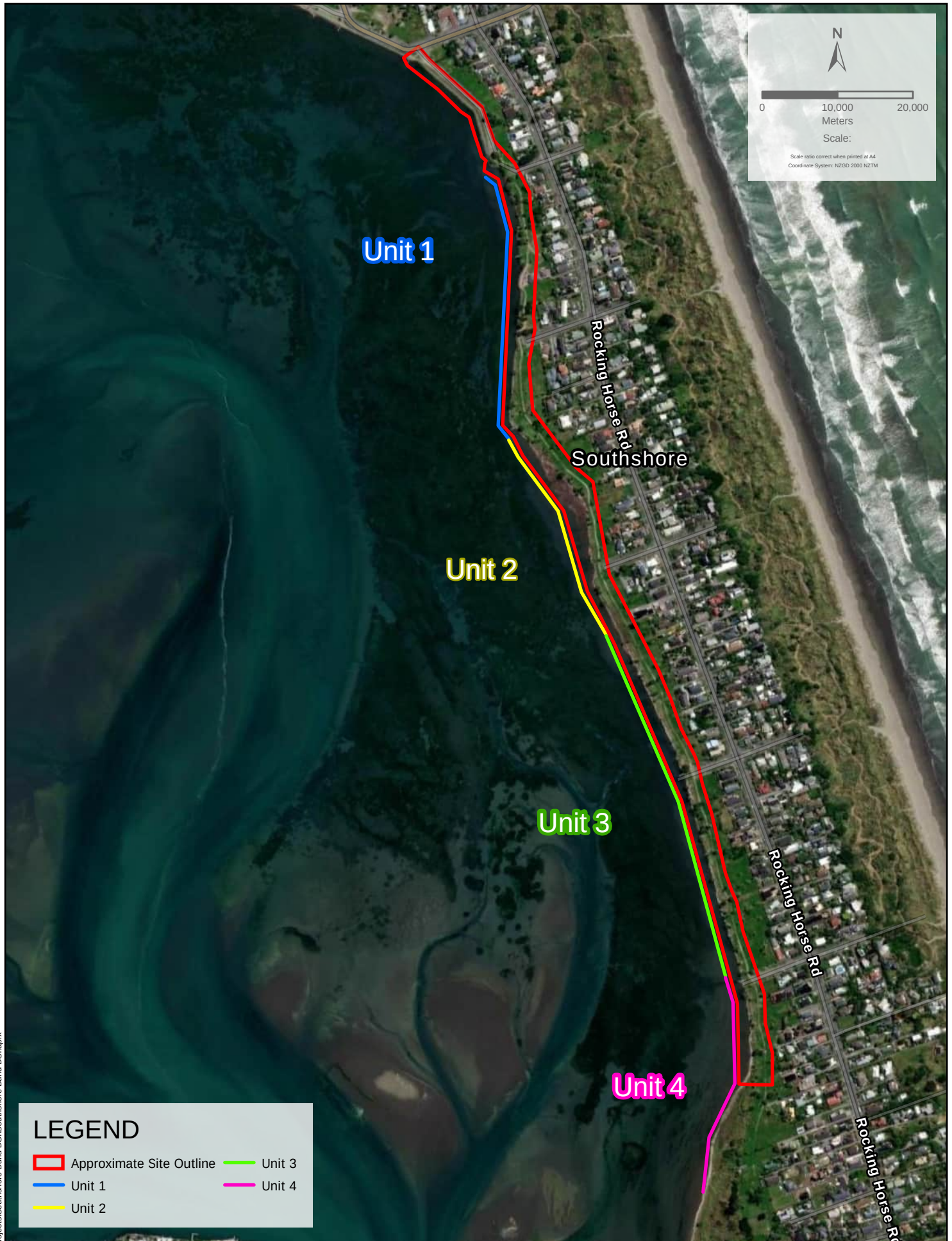
## **Appendix A. Figures A1 – A8**



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|                                                                                                                              |                                                                                                                                                        |                             |               |                                     |
|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------|-------------------------------------|
| <b>Jacobs</b><br>Level 2, 47 Hereford St<br>Wynn Williams Building<br>Christchurch 8013<br>New Zealand<br>Tel +64 4 473 4265 | <b>Figure A1 - Approximate Site Location and Layout</b><br><br>New Brighton Park and Southshore Estuary<br>Southshore Bund Detailed Site Investigation | Project Number:<br>IA271200 | Author:<br>JP | <b>Christchurch</b><br>City Council |
|                                                                                                                              |                                                                                                                                                        | Date:<br>6/28/2022          | Approved By:  |                                     |

Earthstar Geographics, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS, Maxar



**Jacobs**

Level 2, 47 Hereford St  
Wynn Williams Building  
Christchurch 8013  
New Zealand  
Tel +64 4 473 4265

**Figure A2 - Approximate Site layout**

New Brighton Park and Southshore Estuary  
Southshore Bund Detailed Site Investigation

Earthstar Geographics, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS, Maxar

Project Number:

IA271200

Author:

JP

Client:

**Christchurch**  
City Council



Date:

6/28/2022

Approved By:



**Jacobs**

Level 2, 47 Hereford St  
Wynn Williams Building  
Christchurch 8013  
New Zealand  
Tel +64 4 473 4265

**Figure A3 - Sampling Locations Adjacent Unit 1**

New Brighton Park and Southshore Estuary  
Southshore Bund Detailed Site Investigation

ECAN SDC, LINZ, Esri, NASA, NGA, USGS, Earthstar Geographics, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/  
NASA, USGS, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS

Project Number:

IA271200

Author:

JP

Client:

**Christchurch**  
City Council

Date:

6/28/2022

Approved By:



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**Jacobs**

Level 2, 47 Hereford St  
Wynn Williams Building  
Christchurch 8013  
New Zealand  
Tel +64 4 473 4265

#### Figure A4 - Sampling Locations Adjacent Unit 2

New Brighton Park and Southshore Estuary  
Southshore Bund Detailed Site Investigation

Esri, NASA, NGA, USGS, Earthstar Geographics, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS, Maxar

Project Number:

IA271200

Author:

JP

Client:

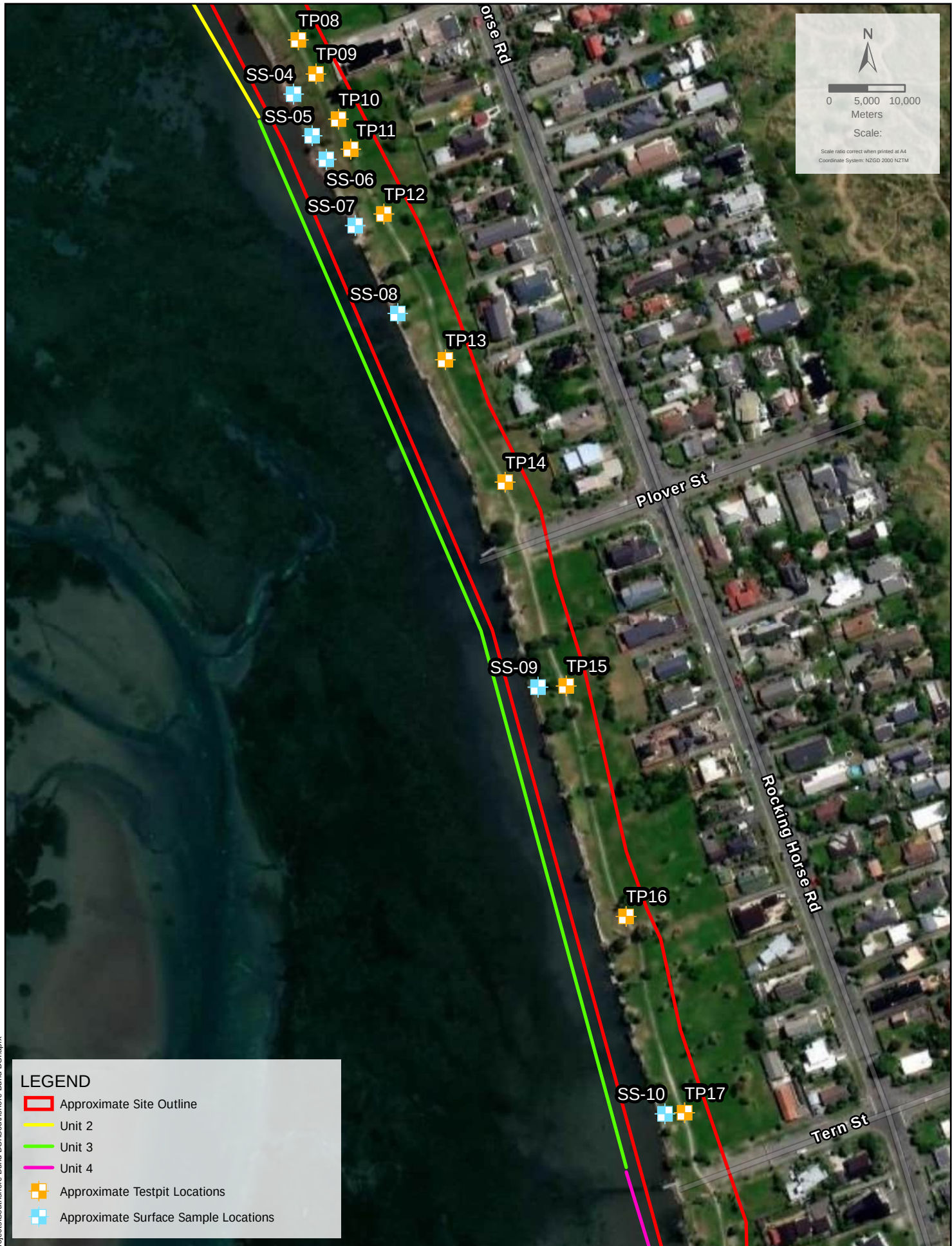
Christchurch  
City Council



Date:

6/28/2022

Approved By:



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**Jacobs**

Level 2, 47 Hereford St  
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New Zealand  
Tel +64 4 473 4265

### Figure A5 - Sampling Locations Adjacent Unit 3

New Brighton Park and Southshore Estuary  
Southshore Bund Detailed Site Investigation

ECAN SDC, LINZ, Esri, NASA, NGA, USGS, Earthstar Geographics, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/  
NASA, USGS, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS

Project Number:

IA271200

Author:

JP

Client:

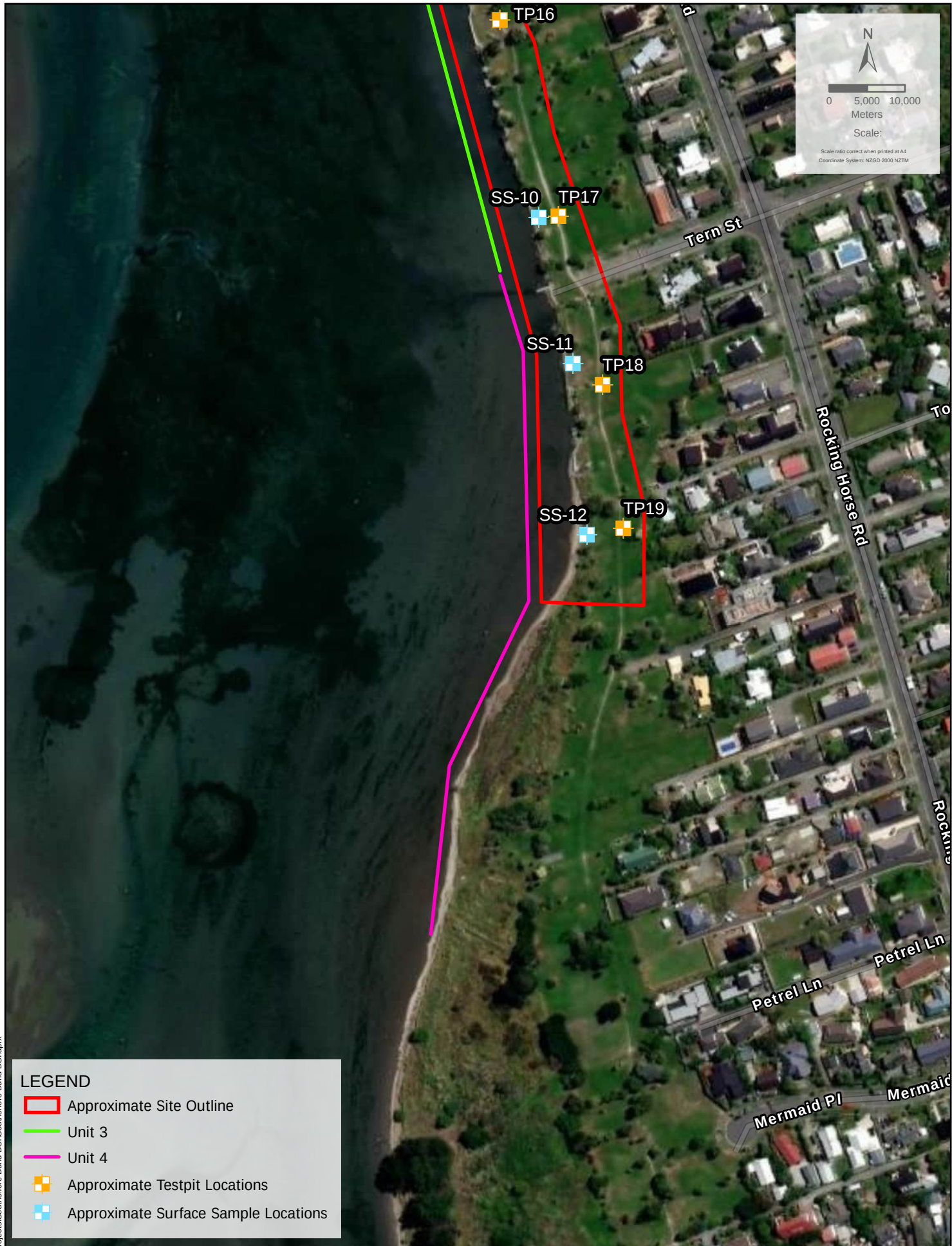
Christchurch  
City Council



Date:

6/28/2022

Approved By:



**Jacobs**

Level 2, 47 Hereford St  
Wynn Williams Building  
Christchurch 8013  
New Zealand  
Tel +64 4 473 4265

### Figure A6 - Sampling Locations Adjacent Unit 4

New Brighton Park and Southshore Estuary  
Southshore Bund Detailed Site Investigation

Esri, NASA, NGA, USGS, Earthstar Geographics, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS, Maxar

Project Number:

IA271200

Author:

JP

Client:

**Christchurch**  
City Council



Date:

6/28/2022

Approved By:



## LEGEND

— Approximate Site Outline

■ Exceeding Residential Criteria ACM as % of Total Sample

● Exceeding Residential and Commercial/Industrial Criteria for Surface ACM (Identified During Jacobs 2022 PSI)

**Jacobs**

Level 2, 47 Hereford St  
Wynn Williams Building  
Christchurch 8013  
New Zealand  
Tel +64 4 473 4265

### Figure A7 - Samples Exceeding Human Health Criteria

New Brighton Park and Southshore Estuary  
Southshore Bund Detailed Site Investigation

Earthstar Geographics, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS, Maxar

Project Number:  
IA271200

Date:  
6/30/2022

Author:  
JP

Approved By:

Client:

**Christchurch**  
City Council



## LEGEND

- Approximate Site Outline
- Approximate Testpit Locations
- Approximate Surface Sample Locations
- Disposal to Kate Valley
- Disposal to Frews Hororata
- Disposal to Legget Road

**Jacobs**

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Christchurch 8013  
New Zealand  
Tel +64 4 473 4265

### Figure A8 - Disposal Options

New Brighton Park and Southshore Estuary  
Southshore Bund Detailed Site Investigation

Earthstar Geographics, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS, Maxar

Project Number:

IA271200

Author:

JP

Client:

**Christchurch**  
City Council

Date:

6/29/2022

Approved By:

## **Appendix B. Photographic Log**

|                                                                                           |                          |                                                                                     |                             |
|-------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| <b>Client Name:</b> Christchurch City Council                                             |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>1</b>                                                              | <b>Date:</b><br>07/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br><br>N/A                                                  |                          |                                                                                     |                             |
| <b>Description:</b><br><br>Example of typical surface conditions of bund sample locations |                          |                                                                                     |                             |

|                                                                                              |                          |                                                                                      |
|----------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------|
| <b>Photo No:</b><br><b>2</b>                                                                 | <b>Date:</b><br>07/04/22 |  |
| <b>Direction Photo Taken:</b><br><br>N/A                                                     |                          |                                                                                      |
| <b>Description:</b><br><br>Example of typical surface conditions of estuary sample locations |                          |                                                                                      |

|                                               |                              |                                                                                     |  |                                |
|-----------------------------------------------|------------------------------|-------------------------------------------------------------------------------------|--|--------------------------------|
| <b>Client Name:</b> Christchurch City Council |                              | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           |  | <b>Project No:</b><br>IA271200 |
| <b>Photo No:</b><br><br>3                     | <b>Date:</b><br><br>07/04/22 |  |  |                                |
| <b>Direction Photo Taken:</b><br><br>N/A      |                              |                                                                                     |  |                                |
| <b>Description:</b><br><br>TP01               |                              |                                                                                     |  |                                |

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|------------------------------------------|------------------------------|--------------------------------------------------------------------------------------|--|--|
| <b>Photo No:</b><br><br>4                | <b>Date:</b><br><br>07/04/22 |  |  |  |
| <b>Direction Photo Taken:</b><br><br>N/A |                              |                                                                                      |  |  |
| <b>Description:</b><br><br>TP02          |                              |                                                                                      |  |  |

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|-----------------------------------------------|------------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| <b>Client Name:</b> Christchurch City Council |                              | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><br>5                     | <b>Date:</b><br><br>07/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br><br>N/A      |                              |                                                                                     |                             |
| <b>Description:</b><br><br>TP03               |                              |                                                                                     |                             |

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| <b>Photo No:</b><br><br>6                | <b>Date:</b><br><br>07/04/22 |  |
| <b>Direction Photo Taken:</b><br><br>N/A |                              |                                                                                      |
| <b>Description:</b><br><br>TP04          |                              |                                                                                      |

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|-----------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>7</b>                  | <b>Date:</b><br>07/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |                             |
| <b>Description:</b><br>TP05                   |                          |                                                                                     |                             |

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| <b>Photo No:</b><br><b>8</b>         | <b>Date:</b><br>07/04/22 |  |  |
| <b>Direction Photo Taken:</b><br>N/A |                          |                                                                                      |  |
| <b>Description:</b><br>TP06          |                          |                                                                                      |  |

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| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           |  | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>9</b>                  | <b>Date:</b><br>07/04/22 |  |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |  |                             |
| <b>Description:</b><br>TP07                   |                          |                                                                                     |  |                             |

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| <b>Photo No:</b><br><b>10</b>        | <b>Date:</b><br>06/04/22 |  |  |  |
| <b>Direction Photo Taken:</b><br>N/A |                          |                                                                                      |  |  |
| <b>Description:</b><br>TP08          |                          |                                                                                      |  |  |

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|-----------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>11</b>                 | <b>Date:</b><br>06/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |                             |
| <b>Description:</b><br>TP09                   |                          |                                                                                     |                             |

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| <b>Photo No:</b><br><b>12</b>        | <b>Date:</b><br>06/04/22 |  |  |
| <b>Direction Photo Taken:</b><br>N/A |                          |                                                                                      |  |
| <b>Description:</b><br>TP10          |                          |                                                                                      |  |

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| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>13</b>                 | <b>Date:</b><br>06/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |                             |
| <b>Description:</b><br>TP11                   |                          |                                                                                     |                             |

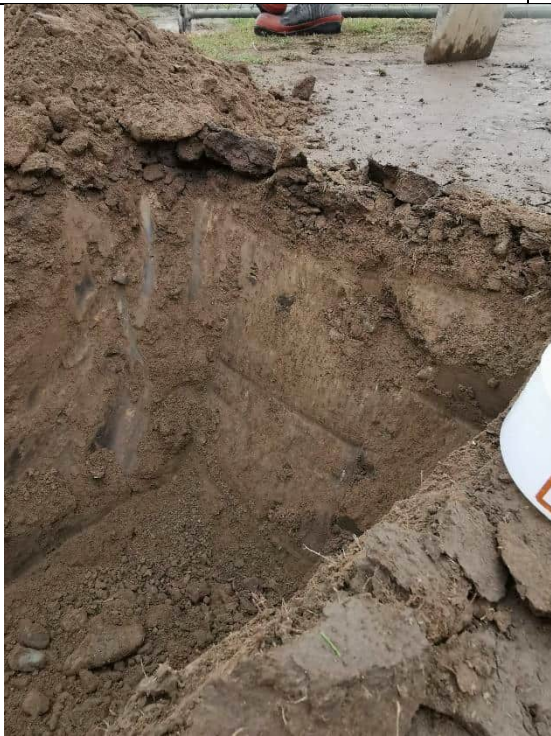
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| <b>Photo No:</b><br><b>14</b>        | <b>Date:</b><br>06/04/22 |  |  |
| <b>Direction Photo Taken:</b><br>N/A |                          |                                                                                      |  |
| <b>Description:</b><br>TP12          |                          |                                                                                      |  |

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| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           |  | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>15</b>                 | <b>Date:</b><br>06/04/22 |  |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |  |                             |
| <b>Description:</b><br>TP13                   |                          |                                                                                     |  |                             |

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| <b>Photo No:</b><br><b>16</b>        | <b>Date:</b><br>06/04/22 |  |  |  |
| <b>Direction Photo Taken:</b><br>N/A |                          |                                                                                      |  |  |
| <b>Description:</b><br>TP14          |                          |                                                                                      |  |  |

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|-----------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>17</b>                 | <b>Date:</b><br>06/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |                             |
| <b>Description:</b><br>TP15                   |                          |                                                                                     |                             |

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|-------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------|--|
| <b>Photo No:</b><br><b>18</b>                                           | <b>Date:</b><br>06/04/22 |  |  |
| <b>Direction Photo Taken:</b><br>N/A                                    |                          |                                                                                      |  |
| <b>Description:</b><br>Fill material identified during sampling of TP15 |                          |                                                                                      |  |

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|-----------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>19</b>                 | <b>Date:</b><br>06/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br><br>N/A      |                          |                                                                                     |                             |
| <b>Description:</b><br><br>TP16               |                          |                                                                                     |                             |

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| <b>Photo No:</b><br><b>20</b>            | <b>Date:</b><br>06/04/22 |  |  |
| <b>Direction Photo Taken:</b><br><br>N/A |                          |                                                                                      |  |
| <b>Description:</b><br><br>TP17          |                          |                                                                                      |  |

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|-----------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>21</b>                 | <b>Date:</b><br>06/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |                             |
| <b>Description:</b><br>TP18                   |                          |                                                                                     |                             |

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| <b>Photo No:</b><br><b>22</b>                                      | <b>Date:</b><br>06/04/22 |  |  |
| <b>Direction Photo Taken:</b><br>N/A                               |                          |                                                                                      |  |
| <b>Description:</b><br>Charcoal identified during sampling of TP18 |                          |                                                                                      |  |

|                                               |                          |                                                                           |                                                                                     |                             |
|-----------------------------------------------|--------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge |                                                                                     | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>23</b>                 | <b>Date:</b><br>06/04/22 |                                                                           |  |                             |
| <b>Direction Photo Taken:</b><br><br>N/A      |                          |                                                                           |                                                                                     |                             |
| <b>Description:</b><br><br>TP19               |                          |                                                                           |                                                                                     |                             |

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|--------------------------------------------------------------------------------------------------|--------------------------|--|--------------------------------------------------------------------------------------|--|
| <b>Photo No:</b><br><b>24</b>                                                                    | <b>Date:</b><br>06/04/22 |  |  |  |
| <b>Direction Photo Taken:</b><br><br>N/A                                                         |                          |  |                                                                                      |  |
| <b>Description:</b><br><br>Fill material identified during sampling of TP19 and plaster fragment |                          |  |                                                                                      |  |

|                                               |                          |                                                                                     |                             |
|-----------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>25</b>                 | <b>Date:</b><br>07/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |                             |
| <b>Description:</b><br>TP20                   |                          |                                                                                     |                             |

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| <b>Photo No:</b><br><b>26</b>        | <b>Date:</b><br>07/04/22 |  |
| <b>Direction Photo Taken:</b><br>N/A |                          |                                                                                      |
| <b>Description:</b><br>TP21          |                          |                                                                                      |

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|-----------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>27</b>                 | <b>Date:</b><br>07/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |                             |
| <b>Description:</b><br>SS-01                  |                          |                                                                                     |                             |

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| <b>Photo No:</b><br><b>28</b>        | <b>Date:</b><br>07/04/22 |  |  |
| <b>Direction Photo Taken:</b><br>N/A |                          |                                                                                      |  |
| <b>Description:</b><br>SS-02         |                          |                                                                                      |  |

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| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>29</b>                 | <b>Date:</b><br>07/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |                             |
| <b>Description:</b><br>SS-03                  |                          |                                                                                     |                             |

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| <b>Photo No:</b><br><b>30</b>        | <b>Date:</b><br>07/04/22 |  |  |
| <b>Direction Photo Taken:</b><br>N/A |                          |                                                                                      |  |
| <b>Description:</b><br>SS-04         |                          |                                                                                      |  |

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| <b>Client Name:</b> Christchurch City Council |                              | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><br>31                    | <b>Date:</b><br><br>07/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br><br>N/A      |                              |                                                                                     |                             |
| <b>Description:</b><br><br>SS-05              |                              |                                                                                     |                             |

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| <b>Photo No:</b><br><br>32               | <b>Date:</b><br><br>07/04/22 |  |
| <b>Direction Photo Taken:</b><br><br>N/A |                              |                                                                                      |
| <b>Description:</b><br><br>SS-06         |                              |                                                                                      |

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| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>33</b>                 | <b>Date:</b><br>07/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |                             |
| <b>Description:</b><br>SS-07                  |                          |                                                                                     |                             |

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| <b>Photo No:</b><br><b>34</b>        | <b>Date:</b><br>07/04/22 |  |  |
| <b>Direction Photo Taken:</b><br>N/A |                          |                                                                                      |  |
| <b>Description:</b><br>SS-08         |                          |                                                                                      |  |

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|-----------------------------------------------|------------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| <b>Client Name:</b> Christchurch City Council |                              | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><br>35                    | <b>Date:</b><br><br>07/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br><br>N/A      |                              |                                                                                     |                             |
| <b>Description:</b><br><br>SS-09              |                              |                                                                                     |                             |

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|------------------------------------------|------------------------------|--------------------------------------------------------------------------------------|--|
| <b>Photo No:</b><br><br>36               | <b>Date:</b><br><br>07/04/22 |  |  |
| <b>Direction Photo Taken:</b><br><br>N/A |                              |                                                                                      |  |
| <b>Description:</b><br><br>SS-10         |                              |                                                                                      |  |

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| <b>Client Name:</b> Christchurch City Council |                          | <b>Site Location:</b> South New Brighton Park and Southshore Estuary Edge           | <b>Project No:</b> IA271200 |
| <b>Photo No:</b><br><b>37</b>                 | <b>Date:</b><br>07/04/22 |  |                             |
| <b>Direction Photo Taken:</b><br>N/A          |                          |                                                                                     |                             |
| <b>Description:</b><br>SS-11                  |                          |                                                                                     |                             |

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| <b>Photo No:</b><br><b>38</b>        | <b>Date:</b><br>07/04/22 |  |
| <b>Direction Photo Taken:</b><br>N/A |                          |                                                                                      |
| <b>Description:</b><br>SS-12         |                          |                                                                                      |

**Client Name:** Christchurch City Council

**Site Location:** South New Brighton Park and Southshore Estuary Edge

**Project No:** IA271200

**Photo No:**

**39**

**Date:**

07/04/22

**Direction Photo Taken:**

West

**Description:**

Isolation of works during excavation and sampling episodes



## **Appendix C. Preliminary Site Investigations (Jacobs, 2022a and 2022b)**



# **Southshore and South New Brighton Erosion Protection**

## **Preliminary Site Investigation**

IA271200-NG-RPT-0001 | B

02 March 2022

**Christchurch City Council**



## Southshore and South New Brighton Erosion Protection

Project No: IA271200  
Document Title: Preliminary Site Investigation  
Document No.: IA271200-NG-RPT-0001  
Revision: B  
Date: 02 March 2022  
Client Name: Christchurch City Council  
Project Manager: Ian Wiseman  
Author: Kate Murray  
File Name: IA271200-NG-RPT-0001 Southshore and South New Brighton Erosion Protection - PSI\_RevB

Jacobs New Zealand Limited

Level 2, Wynn Williams Building  
47 Hereford Street  
Christchurch Central  
PO Box 1147, Christchurch 8140  
New Zealand  
T +64 3 940 4900  
F +64 3 940 4901  
www.jacobs.com

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### Document history and status

| Revision | Date     | Description       | Author | Checked | Reviewed | Approved |
|----------|----------|-------------------|--------|---------|----------|----------|
| A        | 25/01/22 | For client review | KM     | SH      | SH       | CJR      |
| B        | 02/03/22 | For client issue  | KM     | SH      | IMW      | CJR      |
|          |          |                   |        |         |          |          |
|          |          |                   |        |         |          |          |
|          |          |                   |        |         |          |          |
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#### **Appendix A. National Environmental Standards for Assessing & Managing Contaminants in Soil to Protect Human Health**

#### **Appendix B. Canterbury Land and Water Regional Plan**

#### **Appendix C. Site Walkover Photographs**

#### **Appendix D. Environment Canterbury Property Statements from the Listed Land Use Register**

**Appendix E. Historic Aerial Imagery**

**Appendix F. Photographs taken on site of suspected asbestos containing materials**

**Appendix G. Images from Jacobs Community Board Meeting Presentation 20<sup>th</sup> February 2020**

## Executive Summary

Christchurch City Council (CCC) has engaged Jacobs New Zealand Limited (Jacobs) to undertake a Preliminary Site Investigation (PSI) for land along the eastern edge of the Avon-Heathcote Ihutai Estuary, from the boat ramp at South New Brighton Park (SNBP) to Jellicoe Marsh, and a strip of land that lies between 15 m and 100 m inland of the estuary edge from Beatty Street in the north to Tern Street in the south (the site).

The objectives of this PSI are to determine whether the site is a 'piece of land' subject to the NESCS regulations, assess potential site contamination-related risk to human health and the environment, and inform soil management and reuse/disposal requirements.

The scope of work for this PSI comprised:

- A desktop review of available historical and current site information;
- A site walkover and inspection;
- Development of a preliminary conceptual site model (CSM);
- Preparation of this PSI report, concluding whether it is more likely than not that an activity or industry described in the Hazards Activities and Industries List (HAIL) is being, has been, or is more likely than not to have been, undertaken on the site.

The main findings of this report are as follows:

- On the basis of the desktop study and site inspection, it is considered unlikely that an activity listed as HAIL has been undertaken on the portion of land related to the SNBP site.
- Former residential dwellings adjacent to where the Southshore Bund is to be constructed were built in the mid-20th century. There is a likelihood that asbestos materials were used in the construction and that contamination from these materials could possibly have migrated into the soils. It is additionally noted that in the development of some of the properties in the area, erosion protection was installed by individual landowners at the edge of the estuary. Generally, this was accomplished by either constructing and backfilling retaining walls or installing other improvised structures to create a hard edge. It is considered likely that a portion of the land immediately behind these structures was reclaimed/filled by the landowners at that time using a range of materials and there is concern that contamination could exist in this reclaimed/filled land. No documentation has been reviewed which describes the nature of this fill.
- The review of available information has established that according to the LLUR analysis no HAIL sites have existed / currently exist adjacent to the structures where the proposed bund is to be located. However, HAIL I classification may apply owing to the former residential buildings having asbestos materials that could possibly have migrated into the soils.
- Roads are not specifically listed on the HAIL; however, coal tar may have been used in the construction of the roads that the alignment traverses and thus there is the potential for coal tar contamination in these locations.
- The Jacobs September 2020 PSI confirms that asbestos contamination is present in the vicinity of nine of the existing erosion protection structures adjacent to the proposed alignment of the Southshore Bund. No other visible or olfactory signs of contamination were observed in the vicinity of the remaining structures.
- With the historical land use, and the presence of ACM fragments confirmed at nine structures adjacent to the Southshore Bund, it is assumed to be more likely than not that the soil has been contaminated with

friable asbestos or asbestos fines in sufficient quantity that it could be a risk to human health. Further sampling would be required to confirm the presence/concentration of friable asbestos or asbestos fines in the soil.

- The estimated soil disturbance volume associated with the proposed bund construction activity exceeds the permitted activity volume and therefore a resource consent under the NESCS is required.
- The NESCS will require further consideration for project works within the Southshore Bund area of the site, and further sampling would be required to confirm the presence/concentration of friable asbestos or asbestos fines in the soil.
- If further investigations are undertaken, the conditions of Section 5.185 of the Canterbury Land and Water Regional Plan (CLWRP) will apply.

This PSI report has not assessed the requirements for resource consents under other rules beyond the NESCS, Sections 5.185 – 5.188 of the Canterbury Land and Water Regional Plan and the Section 4.2 of the Christchurch District Plan.

This PSI has confirmed the presence of asbestos contamination at properties adjacent to the Southshore Bund. It is recommended that soil sampling be conducted along the proposed bund alignment at locations where asbestos was previously identified, as well as at 100 m intervals along the entire proposed bund alignment to confirm whether there is ACM contamination along the bund alignment and whether the soil has been contaminated with friable asbestos or asbestos fines.

The results of the asbestos sampling can be used to support the resource consent application under the NESCS and allow one to assess potential site contamination related risk to human health and the environment and substantiate soil management requirements that will apply to the works.

Where the bund will transect the existing road ends, it is recommended that samples of the excavated material be submitted for PAH analysis during the construction phase to determine whether coal tar is present and inform material handling and disposal requirements.

We note that CCC have a global land use consent under the NESCS for the disturbance of soil on HAIL sites where providing for projects within CCC controlled land, road corridors, parks and reserves. We recommend that Jacobs on behalf of CCC explore the option of pursuing the use of this consent for the soil disturbance works associated with this project prior to lodgement of the consents for the project.

**Important note about your report**

The sole purpose of this report prepared by Jacobs New Zealand Limited (Jacobs) is to undertake a preliminary site investigation into the contamination potential in the vicinity of the existing erosion protection structures along the eastern edge of the Avon-Heathcote Ihutai Estuary from the boat ramp at South New Brighton Park to Jellicoe Marsh as well as a strip of land that lies between 15 m and 100 m inland of the estuary edge from the vicinity of Beatty Street in the north to south of Tern Street in the south but excludes Ebbtide Street. The contents of the report are in accordance with the scope of services detailed in the terms of engagement between Jacobs and Christchurch City Council (the Client).

In assessing available information and preparing this report, Jacobs has relied upon and presumed accurate, all information provided by the Client and any third party. Unless otherwise stated in this report, Jacobs has not attempted to verify the accuracy or completeness of any such information and Jacobs accepts no liability to the client and/or any third party for any loss and/or damage incurred as a result of any inaccurate or incomplete information.

The information in this report is derived from data provided by the client, a number of public domains and Environment Canterbury.

It is imperative to note that the Report only considers the site conditions current at the time of investigation, and to be aware that conditions may have changed due to natural forces and/or operations on or near the site. Any decisions based on the findings of the Report must take into account any subsequent changes in site conditions and/or developments in legislative and regulatory requirements. Jacobs accepts no liability to the Client or any third party for any loss and/or damage incurred as a result of a change in the site conditions and/or regulatory/legislative framework since the date of the Report.

Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law. Opinions and judgements expressed in the report are based on Jacobs' understanding and interpretation of current regulatory standards and should not be construed as legal opinions.

This report does not have sufficient information to be used for any other purpose than the project specific requirements for which the report was carried out as detailed in the agreement. This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

The report summarises a large amount of information and it is therefore important that the Client is aware that this information may not be complete, and any future assessment of the sites outlined in this report should be individually investigated.

This report has been prepared on behalf of, and for the exclusive use of, the Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

## Abbreviations

|          |                                                                                                                                                |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------|
| ACM      | Asbestos Containing Material                                                                                                                   |
| CA       | Controlled Activity                                                                                                                            |
| CCC      | Christchurch City Council                                                                                                                      |
| CEnvP:SC | Certified Environmental Practitioner in Site Contamination                                                                                     |
| CoPC     | Contaminants of Potential Concern                                                                                                              |
| CLMG     | Contaminated Land Management Guidelines                                                                                                        |
| CLS      | Contaminated Land Specialist                                                                                                                   |
| CSM      | Conceptual Site Model                                                                                                                          |
| DSI      | Detailed Site Investigation                                                                                                                    |
| ECAN     | Environment Canterbury                                                                                                                         |
| HA       | Hand Auger                                                                                                                                     |
| HAIL     | Hazardous Activities and Industries List                                                                                                       |
| IANZ     | International Accreditation New Zealand                                                                                                        |
| Jacobs   | Jacobs New Zealand Limited                                                                                                                     |
| LLUR     | Listed Land Use Register                                                                                                                       |
| LWRP     | Environment Canterbury Land and Water Regional Plan                                                                                            |
| m asl    | Meters above sea level                                                                                                                         |
| m bgl    | Meters below ground level                                                                                                                      |
| MfE      | Ministry for the Environment                                                                                                                   |
| NES-CS   | Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 |
| NZGAMAS  | New Zealand Guidelines for Assessing and Managing Asbestos in Soil                                                                             |
| PA       | Permitted Activity                                                                                                                             |
| PAH      | Polycyclic Aromatic Hydrocarbons                                                                                                               |
| PSI      | Preliminary Site Investigation                                                                                                                 |
| RDA      | Restricted Discretionary Activity                                                                                                              |
| SAQP     | sampling and analysis quality plan                                                                                                             |
| SCS      | Soil Contaminant Standards                                                                                                                     |
| SMP      | Site Management Plan                                                                                                                           |
| SNBP     | South New Brighton Park                                                                                                                        |
| SQEP     | Suitably Qualified and Experienced Practitioner                                                                                                |
| TPH      | Total Petroleum Hydrocarbons                                                                                                                   |

# 1. Introduction

## 1.1 Terms of reference

Christchurch City Council (CCC) has engaged Jacobs New Zealand Limited (Jacobs) to develop design criteria for the Design Basis and Concept Design to develop an integrated coastal erosion protection and flood inundation concept for the South New Brighton Park (SNBP) and Southshore Estuary Edge in Christchurch.

A Preliminary Site Investigation (PSI) is required to inform the possible consenting requirements under the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESC)) Regulations 2011 and the contaminated land rules in the Environment Canterbury Land and Water Regional Plan (LWRP). The area covered by this PSI includes a portion of the existing erosion protection structures along the eastern edge of the Avon-Heathcote Ihutai Estuary, from the boat ramp at SNBP to Jellicoe Marsh, and a strip of land that lies between 15 m and 100 m inland of the estuary edge from Beatty Street in the north to Tern Street in the south but, excludes Ebbtide Street,

## 1.2 Background

In September 2020, a PSI was undertaken by Jacobs as part of the Southshore Erosion Management Investigation<sup>1</sup>. The area investigated covered the Southshore estuary edge from Godwit Street to south of Tern Street and has previously been described as Area 5. The project area has since been extended to the north to include the estuary edge from Godwit Street to the boat ramp in SNBP. The scope has additionally been extended to include the construction of a further engineered bund that is to be located approximately 15 meters inland of the estuary edge and, apart from a section on Ebbtide Street, will extend across the entire project extent from the vicinity of Beatty Street in the north, to south of Tern Street in the south.

There are two separate areas covered in this investigation as follows:

- SNBP which includes the land from the Estuary edge to approximately 15 m to 100 m inland of edge where the bund will be constructed; and
- The Southshore Bund which is the portion of land approximately 15 m inland of the Estuary edge within Area 5 (Godwit Street to Tern Street) where the bund will be constructed.

The investigation areas are indicated in **Figure 1** and **Figure 2** below.

Soil disturbance associated with the works will include that which may be associated with the modification of the existing structures, soft barriers and natural shoreline as well as that associated with the construction of the bund. Topsoil will be stripped from the works area and retained on site for use as landscape fill.

It is envisaged that the soil disturbance will be associated with the following activities:

- Stripping of topsoil;
- construction (and reinstatement) of a haul road;
- the re-alignment of the estuary walkway at grade in SNBP;
- bank trimming;
- the construction of the bund which will be excavated to approximately 0.3 metres below ground level (m bgl); and
- landscaping and planting outside of immediate bund/erosion protection footprint

---

<sup>1</sup> Jacobs (2020), Assessment of Immediate Erosion Management Options Southshore, Preliminary Site Investigation, IZ133900-NG-RPT-0002 | B

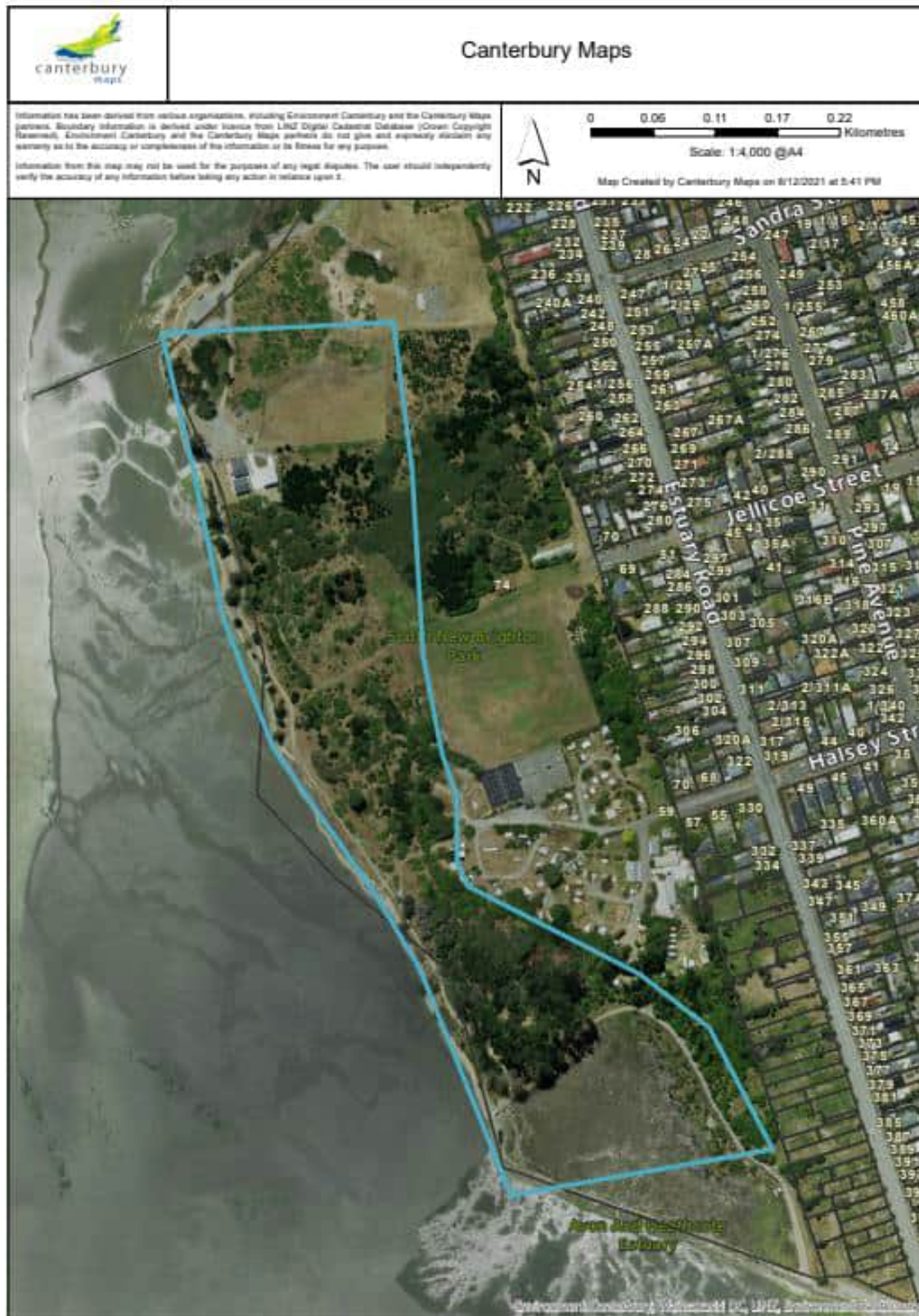


Figure 1: SNBP Investigation Area (outlined in blue) (Canterbury Maps)



Figure 2: Southshore Bund Investigation Area (Jacobs Geospatial Imagery Locator)

### **1.3 Regulatory Context**

#### **1.3.1 The National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health**

The objective of the Resource Management (National Environmental Standard for assessing and managing contaminants in soil to protect human health) Regulations 2011 (NESCS) is to ensure that HAIL land affected/potentially affected by contaminants in soil which may have an adverse effect on human health, is appropriately identified and assessed when soil disturbance and/or a change in land use occurs. This includes, where appropriate, the requirement that contaminants are contained, or the land remediated to make the land safe for human use.

The NESCS applies to specific activities including sampling, investigating, remediating or disturbing a piece of land and changing the use of a piece of land. The NESCS contains definitions of several key terms and consenting requirements relevant to this PSI report which are outlined in **Appendix A**.

A PSI is required to establish whether it is more likely than not that an activity or industry described in the Hazards Activities and Industries List (HAIL) is being, has been, or is more likely than not to have been, undertaken on the site.

#### **1.3.2 Canterbury Regional Policy Statement**

Sections 5.185 - 5.188 of the Canterbury Land and Water Regional Plan (CLWRP) provide region wide rules and the consenting requirements relating to contaminated land including site investigations and the discharge of contaminants from contaminated land. These requirements are outlined in **Appendix B**.

#### **1.3.3 Christchurch District Plan**

Section 4.2 of the Christchurch District Plan provides a policy framework for contaminated land in the district to enable observance of the NESCS. Section 4.2 does not contain any rules and defaults to the NESCS.

### **1.4 Objectives**

The objectives of this PSI are to:

- Determine whether the site is a 'piece of land' subject to the NESCS regulations;
- Assess potential site contamination-related risk to human health and the environment; and
- Inform soil management and reuse/disposal requirements.

### **1.5 Scope of Work**

The scope of work for this PSI comprised the following:

- A review of the Project and site footprint to identify the properties to be covered by the assessment.
- A desktop review of publicly available information, including:
  - Local geology and hydrogeology, using New Zealand Geotechnical Database (NZGD) and published geological maps.
  - Historical aerial photographs using Canterbury Maps and Retrolens to identify potential land uses and or/activities that may have been carried out at the site, that could have led to soil contamination being present at the site.

- The Environment Canterbury Listed Land Use Register and other relevant council records to identify potentially contaminated sites
- A review of existing photos and drone footage to remotely inspect the structure/edge of each land parcel to identify potentially contaminated sites.
- Development of a preliminary conceptual site model (CSM).
- A site walkover and inspection to assess visual and/or olfactory evidence of ground contamination.
- From the assessment of the above, identification of potentially contaminated sites that may contribute contaminants to the structure upgrade works and hence may require further consideration, investigation or management.
- Preparation of this PSI report, including a review and interpretation of the information and data obtained during the investigation.

The Ministry for the Environment (MfE) has prepared a series of guideline documents to reach a uniform approach to contaminated land management in New Zealand. This PSI report and the methodologies used within it have been undertaken in general accordance with the most recent version of the MfE *Contaminated Land Management Guidelines (CLMG) No 1 – Reporting on Contaminated Sites in New Zealand (revised 2021)*.

## **1.6 Report Certification**

This report has been prepared under the supervision of Stanley Howell, CEnvP:SC<sup>2</sup>, a Suitably Qualified and Experienced Practitioner (SQEP) as described under the NESCS and defined in CLMG No. 5 – Site investigation and analysis of soils (Revised 2021).

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<sup>2</sup> CEnvP:SC: Certified Environmental Practitioner, Site Contamination Specialty

## 2. Desktop Review

### 2.1 Environmental Setting and Site Investigation Area

The project area covers an extent of approximately 3.2 km of the estuary edge along the Christchurch Southshore from the boat ramp at SNBP in the north, to south of Tern Street in the south. It also includes a strip of land for the construction of a bund that will run adjacent and between approximately 15 m and 100 m inland of the estuary edge.

This investigation specifically covers a portion of the project area which for ease of reporting has been split in to two separate areas as follows:

- **SNBP** – which includes the existing erosion protection structures along the eastern edge of the Avon-Heathcote Ihutai Estuary from the boat ramp at SNBP to Jellicoe Marsh as well as a strip of land that lies between 15 m and 100 m inland of the estuary edge where the bund will be constructed; and
- **The Southshore bund** - which is the portion of land approximately 15 m inland of the Estuary edge within Area 5 (Godwit Street to Tern Street) where the bund will be constructed.

#### 2.1.1 South New Brighton Park Current Land Use

The SNBP site includes the existing erosion protection structures along the eastern edge of the Avon-Heathcote Ihutai Estuary from the boat ramp at SNBP to Jellicoe Marsh as well as a strip of land that lies between 15 m and 100 m inland of the estuary edge. The bund will run north-south through the SNBP between 15 m and 100 m inland of the estuary edge. The park is 284,300 m<sup>2</sup> in extent, is zoned as open space and is currently reserve/recreational land that directly borders the Estuary to the west and residential South New Brighton to the east.

The park consists of mature exotic forests, shrubs, open grassed areas, sports fields and courts with amenities, the Pleasant Point Yacht club, a playground, a skate area and a campground.

The estuary edge itself consists of a combination of built structures, gabion baskets, reno mattresses, soft barriers and natural shorelines. Substantial erosion scarps are evident along significant extents of the estuary edge.

#### 2.1.2 Southshore Bund Current Land Use

The Southshore bund area under investigation has been named Area 5 of the Eastern Estuary Condition Inventory, which was compiled by Jacobs in August 2019 and covers the Southshore from Godwit Street to south of Tern Street. Area 5, hereinafter referred to as “the Southshore bund site” has been divided into four sub areas referred to as Units from Unit 1 through to Unit 4 as follows:

- Unit 1 referring to the estuary edge from 2 Godwit Street to 62C Rocking Horse Road;
- Unit 2 referring to the estuary edge from 64A Rocking Horse Road to 94A Rocking Horse Road;
- Unit 3 referring to the estuary edge from 96A Rocking Horse Road to 1A Tern Street; and
- Unit 4 referring to the estuary edge from 1 Tern Street to 170 Rocking Horse Road.

The addresses and legal descriptions of the properties that fall within the four Units are provided in **Section 2.1.2.1** to **Section 2.1.2.4**. Each Unit is additionally shown in **Figure 3** to **Figure 6** below.

The strip or portion of land that will incorporate the Southshore bund will likely be located where there is an existing bund / footpath that runs north-south adjacent to the estuary edge over vacant land where 74 former private residential properties were in existence. The structures associated with these former properties were demolished following the Canterbury Earthquake Sequence (in particular the Christchurch earthquake on the 22<sup>nd</sup> of February 2011). The entire 57,991 m<sup>2</sup> extent of the site is zoned as Special Purpose (Flat Land Recovery) under the Christchurch's District Plan and is CERA Red Zoned Land in the Land Use Recovery Plan.

The site is relatively flat and apart from the one residence in existence at 44A Rocking Horse Road, comprises vacant open grassed land with several mature trees and shrubs scattered throughout its extent. The estuary edge itself consists of various built structures, soft barriers and natural shorelines.

### 2.1.2.1 Unit 1

Unit 1 is located on the estuary edge from 2 Godwit Street to 62C Rocking Horse Road adjacent to properties with the legal descriptions from north to south as provided in **Table 1**.

Table 1: Addresses and legal descriptions for Unit 1

| Address                                  | Legal Description | Survey Area (m <sup>2</sup> ) |
|------------------------------------------|-------------------|-------------------------------|
| 2 Godwit Street                          | Lot 1 DP 71198    | 573                           |
| 4 Godwit Street                          | Lot 2 DP 71198    | 650                           |
| 32A Rocking Horse Road                   | Lot 6 DP 16205    | 647                           |
| 34A Rocking Horse Road                   | Lot 7 DP 16205    | 690                           |
| 36B Rocking Horse Road                   | Lot 10 DP 16205   | 678                           |
| 36A Rocking Horse Road                   | Lot 11 DP 16205   | 640                           |
| 40A Rocking Horse Road                   | Lot 14 DP 16205   | 693                           |
| 40B Rocking Horse Road                   | Lot 15 DP 16205   | 698                           |
| 44A Rocking Horse Road                   | Lot 18 DP 16205   | 923                           |
| 46A Rocking Horse Road                   | Lot 19 DP 16205   | 893                           |
| 46B Rocking Horse Road                   | Lot 20 DP 16205   | 1,143                         |
| 5 Heron Street                           | Lot 2 DP 28869    | 660                           |
| 3 Heron Street                           | Lot 3 DP 28869    | 635                           |
| 2 Heron Street                           | Lot 3 DP 26391    | 784                           |
| 2A Heron Street                          | Lot 4 DP 26391    | 607                           |
| 2B Heron Street                          | Lot 5 DP 26391    | 607                           |
| 2C Heron Street                          | Lot 6 DP 26391    | 607                           |
| 9 Kingfisher Lane                        | Lot 6 DP 37149    | 567                           |
| 11 Kingfisher Lane                       | Lot 7 DP 37149    | 536                           |
| 62C Rocking Horse Road                   | Lot 4 DP 24125    | 1,103                         |
| <b>Total Survey Area (m<sup>2</sup>)</b> |                   | <b>14,334</b>                 |



Figure 3: Unit 1 Site location (Canterbury Maps)

### 2.1.2.2 Unit 2

Unit 2 is located on the estuary edge from 64A Rocking Horse Road to 94A Rocking Horse Road adjacent to properties with the legal descriptions from north to south as provided in **Table 2**.

Table 2: Addresses and legal descriptions for Unit 2

| Address                                  | Legal Description                  | Survey Area (m <sup>2</sup> ) |
|------------------------------------------|------------------------------------|-------------------------------|
| 64A Rocking Horse Road                   | Lot 2 DP 49643                     | 634                           |
| 66B Rocking Horse Road                   | Lot 1 DP 51260                     | 1,582                         |
| 66C Rocking Horse Road                   | Lot 2 DP 51260                     | 1,581                         |
| 74B Rocking Horse Road                   | Lot 16 DP 19427                    | 655                           |
| 74C Rocking Horse Road                   | Lot 17 DP 19427                    | 655                           |
| 76A Rocking Horse Road                   | Lot 2 DP 39313                     | 904                           |
| 78 Rocking Horse Road                    | Lot 71 DP 4692                     | 1,525                         |
| 80A Rocking Horse Road                   | Lot 2 DP 17112                     | 789                           |
| 82A Rocking Horse Road                   | Lot 1 DP 36785                     | 901                           |
| 3A Penguin Street                        | Lot 2 DP 37259                     | 863                           |
| 3 Penguin Street                         | Lot 1 DP 37259                     | 909                           |
| 2A Penguin Street                        | Lot 1 DP 36659 &<br>Lot 2 DP 36659 | 607                           |
| 2 Penguin Street                         | Lot 3 DP 36659                     | 607                           |
| 88B Rocking Horse Road                   | Lot 3 DP 21691                     | 506                           |
| 90B Rocking Horse Road                   | Lot 1 DP 57612                     | 735                           |
| 94A Rocking Horse Road                   | Part Lot 2 DP 18852                | 569                           |
| <b>Total Survey Area (m<sup>2</sup>)</b> |                                    | <b>14,022</b>                 |



Figure 4: Unit 2 Site Location (Canterbury Maps)

### 2.1.2.3 Unit 3

Unit 3 is located on the estuary edge from 96A Rocking Horse Road to 1A Tern Street adjacent to properties with the legal descriptions from north to south as provided in **Table 3**.

Table 3: Addresses and legal descriptions for Unit 3

| Address                                  | Legal Description                                                 | Survey Area (m <sup>2</sup> ) |
|------------------------------------------|-------------------------------------------------------------------|-------------------------------|
| 96A Rocking Horse Road                   | Lot 3 DP 18852                                                    | 665                           |
| 96B Rocking Horse Road                   | Lot 4 DP 18852                                                    | 797                           |
| 100A Rocking Horse Road                  | Lot 1 DP 47440                                                    | 1,095                         |
| 100B Rocking Horse Road                  | Lot 2 DP 47440                                                    | 1,045                         |
| 104A Rocking Horse Road                  | Lot 2 DP 16502                                                    | 1,060                         |
| 106A Rocking Horse Road                  | Lot 3 DP 16502                                                    | 1,032                         |
| 108B Rocking Horse Road                  | Lot 4 DP 26460                                                    | 855                           |
| 110C Rocking Horse Road                  | Lot 5 DP 26460                                                    | 680                           |
| 112B Rocking Horse Road                  | Lot 21 DP 19427                                                   | 627                           |
| 112C Rocking Horse Road                  | Lot 22 DP 19427                                                   | 592                           |
| 5 Plover Street                          | Lot 3 DP 35785                                                    | 769                           |
| 1 Plover Street                          | Lot 2 DP 35785                                                    | 625                           |
| 4 Plover Street                          | Part Lot 1 DP 18140<br>Part Lot 2 DP 18140<br>Part Lot 3 DP 18140 | 1,042                         |
| 122A Rocking Horse Road                  | Part Lot 1 DP 18140<br>Part Lot 2 DP 18140<br>Part Lot 3 DP 18140 | 1,070                         |
| 124A Rocking Horse Road                  | Lot 1 DP 27447                                                    | 1,103                         |
| 126A Rocking Horse Road                  | Lot 1 DP 33062                                                    | 697                           |
| 126B Rocking Horse Road                  | Lot 2 DP 33062                                                    | 722                           |
| 132A Rocking Horse Road                  | Lot 2 DP 28790                                                    | 1,019                         |
| 132B Rocking Horse Road                  | Lot 2 DP 58641                                                    | 702                           |
| 134B Rocking Horse Road                  | Lot 2 DP 40548                                                    | 550                           |
| 136B Rocking Horse Road                  | Lot 3 DP 30759                                                    | 556                           |
| 140 Rocking Horse Road                   | Lot 3 DP 51138                                                    | 809                           |
| 142B Rocking Horse Road                  | Lot 1 DP 37187                                                    | 605                           |
| 144B Rocking Horse Road                  | Lot 3 DP 21048                                                    | 524                           |
| 146B Rocking Horse Road                  | Lot 25 DP 19427                                                   | 546                           |
| 148B Rocking Horse Road                  | Lot 3 DP 19246                                                    | 539                           |
| 1A Tern Street                           | Lot 7 DP 30898                                                    | 561                           |
| <b>Total Survey Area (m<sup>2</sup>)</b> |                                                                   | <b>20,887</b>                 |



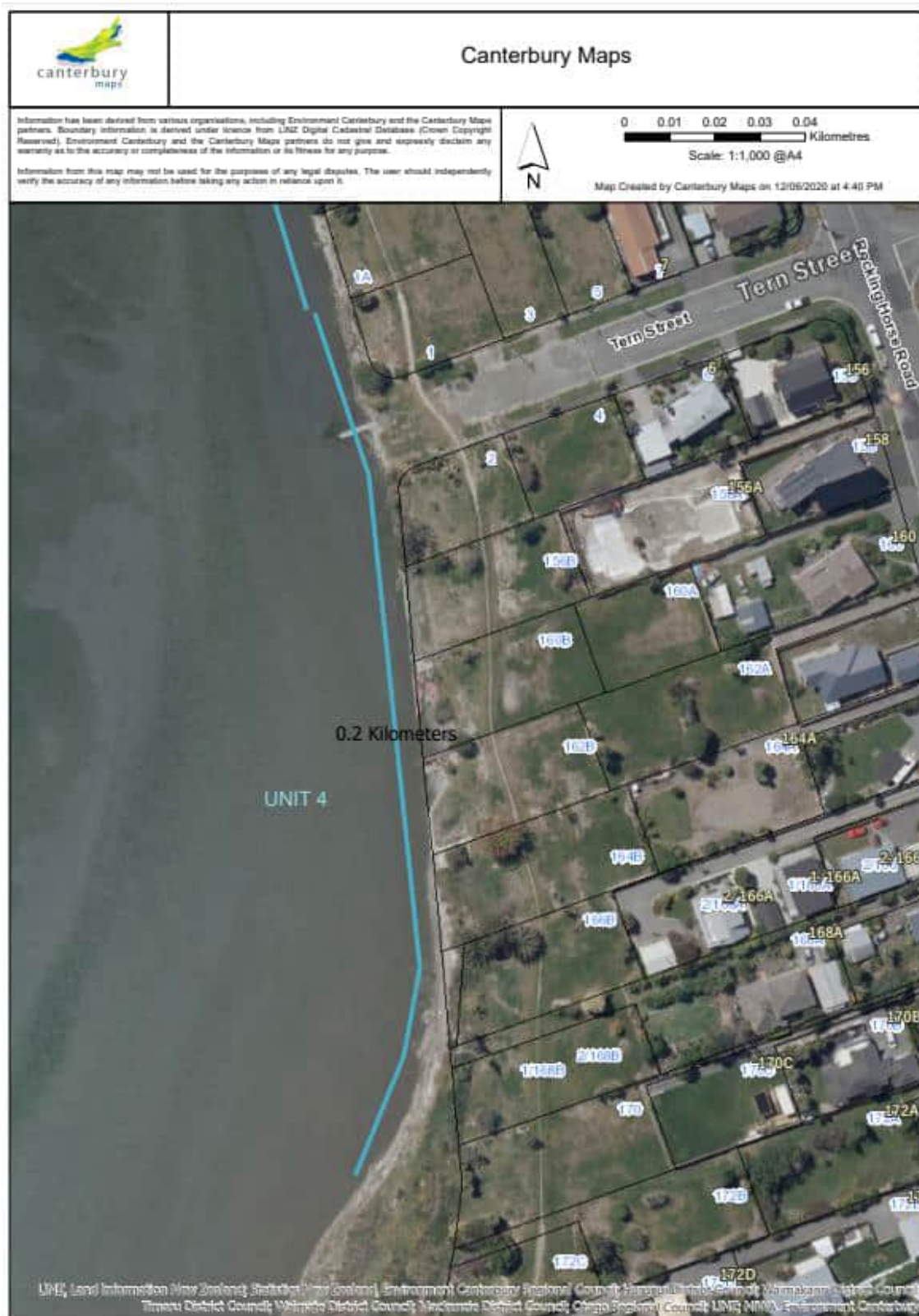
Figure 5: Unit 3 Site Location (Canterbury Maps)

**2.1.2.4 Unit 4**

Unit 4 is located on the estuary edge from 1 Tern Street to 170 Rocking Horse Road adjacent to properties with the legal descriptions from north to south as provided in **Table 4**.

Table 4: Addresses and legal descriptions for Unit 4

| Address                                  | Legal Description | Survey Area (m <sup>2</sup> ) |
|------------------------------------------|-------------------|-------------------------------|
| 1 Tern Street                            | Lot 6 DP 30898    | 581                           |
| 2 Tern Street                            | Lot 4 DP 26246    | 549                           |
| 156B Rocking Horse Road                  | Lot 3 DP 27962    | 792                           |
| 160B Rocking Horse Road                  | Lot 2 DP 360074   | 826                           |
| 162B Rocking Horse Road                  | Lot 3 DP 25957    | 809                           |
| 164B Rocking Horse Road                  | Lot 3 DP 40227    | 1,007                         |
| 166B Rocking Horse Road                  | Lot 2 DP 37175    | 837                           |
| 1/168B Rocking Horse Road                | Lot 3 DP 21876    | 736                           |
| 170 Rocking Horse Road                   | Lot 4 DP 75827    | 1,091                         |
| 172B Rocking Horse Road                  | Lot 3 DP 23008    | 913                           |
| 172C Rocking Horse Road                  | Lot 4 DP 23008    | 607                           |
| <b>Total Survey Area (m<sup>2</sup>)</b> |                   | <b>8,748</b>                  |



## 2.2 Surrounding Land Use

Surrounding land use for both the SNBP and Southshore site areas is recreational with residential properties further to the east. To the west of both areas is the Heathcote Avon Rivers Estuary (the Estuary)

## 2.3 Topographic Setting

The general topography of the wider project area is relatively flat with a slight downwards gradient on the western side towards the Estuary. It is low lying at an elevation between 0 m and 2 m above sea-level (m asl).

## 2.4 Site Geology

According to QMAP 1:250 000 Geological Maps, GNS Science (2012) the geology of Southshore is generally comprised of Late Quaternary dunes of the Pakihi Supergroup which is described as sand in mobile and fixed dunes of the coast and rivers. Geotechnical investigations have been undertaken within the site, the logs from the investigative bores confirm that the encountered geology is sand of varying densities which is consistent with the mapped geology<sup>3</sup>.

## 2.5 Site Hydrogeology

Observations from the summaries of geotechnical / geological investigative wells installed in the South New Brighton locality in 2021 indicate that the water table (unconfined groundwater) is expected to be relatively shallow and generally within a couple of meters of the ground surface<sup>4</sup>. Groundwater level data obtained from Canterbury Maps indicates that several artesian wells are present in close proximity to the site.

## 2.6 Sensitive Receptors

The Heathcote and Avon Rivers Estuary is listed on the Council District Planning maps as a Site of Ecological Significance<sup>4</sup>.

## 2.7 Site Walkover

A site walkover was conducted on 02 December 2021. The walkover included the entire extent of the project site from the boat ramp in SNBP in the north to the south of Tern Street in the south. The site was walked in a north to south direction. Photographs from the site visit are available in **Appendix C**.

At SNBP, the walkover included the estuary edge and the proposed bund alignment inland of the edge which traversed medium density pine, native and invasive vegetation. This section of the project site did not appear to pass through or adjacent to areas that are considered to have a high risk of contaminating the site.

The existing Southshore Bund that traverses the former properties is raised bund with a wider base than crest that has been formed into a worn footpath. According to CCC the bund is constructed from top soil.

No visual or olfactory signs of site contamination or, stressed vegetation were evident. No other potential sources of contamination such as tanks, lagoons or cesspits were observed.

<sup>3</sup> Environment Canterbury, 2021, Well Search, <https://ecan.govt.nz/data/well-search/>, accessed 13 December 2021.

<sup>4</sup> Canterbury Maps, accessed December 2021, WERI (Wetlands of Representative Importance) database, Department of Conservation, updated 2017.

### **2.7.1 Site Walkover and Observations from 2020**

A site walkover was conducted on 03 June 2020 for the initial PSI for the Southshore Erosion Management Investigation to determine whether any visible or olfactory signs of contamination were present.

During this site walkover several structures in varying states of repair were observed to be present along the shoreline. The site walkover involved the visual inspection of each structure and their immediate surrounds for possible contamination.

Considerable erosion of the shoreline and the fill behind many of the structures was evident. This erosion has exposed the fill material in many locations and in the vicinity of nine of the structures, suspected ACM fragments were visibly evident. For the structures where no visible contamination was present, there was generally either substantial amounts of inert looking building rubble in the form of large rocks, concrete rubble, concrete blocks, ceramic roof tiles and bricks present, or the land was covered in estuary salt marsh mud, pebbles and natural debris or grass, trees and shrubs.

A second site walkover was conducted on 21 August 2020 to obtain samples of suspected ACM fragments in the vicinity of the nine structures identified in the previous visit (refer to **Section 3.4**).

### 3. Review of Available Information

#### 3.1 Listed Land Use Register Analysis

The Listed Land Use Register (LLUR) is a publicly available database of sites where hazardous activities and industries have been located throughout Canterbury, held by Environment Canterbury. The LLUR holds information about sites that have been used or are currently used for activities which have the potential to cause contamination.

Two separate LLUR searches were conducted for the two areas covered in this investigation. The results of these two searches are presented in **Section 3.1.1** and **Section 3.1.2**.

##### 3.1.1 South New Brighton Park LLUR Search

A buffered search for the address 74 Beatty Street (Legal Description RES 4875, Section 1 SO 17958, RES 4874) was conducted for the SNBP area. **Figure 7** below shows the extent of the LLUR search<sup>5</sup>.



Figure 7: Extent of SNBP Listed Land Use Register Search (LLUR) (Environment Canterbury)

The search revealed LLUR records within 100 m of the selected land parcel. A property statement was requested and received from Environment Canterbury (ECan) on 14 January 2022 and has been included in **Appendix D**.

<sup>5</sup> Environment Canterbury, <https://llur.ecan.govt.nz/home>, accessed 16 November 2021.

A summary of the sites and HAILs that intersect the area of enquiry only is presented in **Table 5** and a summary of sites and HAILs intersecting the area of enquiry within a 100 m buffer is provided in **Table 6**.

**Figure 8** below indicates the location of the LLUR HAIL activities in relation to the site.

Table 5: Summary of sites and HAILs intersecting SNBP

| Site No. | HAIL Activities on LLUR                                                                                                                                                                                             |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1714     | A17 – Storage Tanks or drums for fuel, chemicals or liquid waste associated with underground storage tank located at the South New Brighton Motor Camp, 59 Halsey St. Site noted by ECan as partially investigated. |
| 28565    | A10 – Persistent pesticide bulk storage or use associated with the South New Brighton Bowling Club at 74 Beatty St. Site noted as not investigated                                                                  |
| 28581    | A10 – Persistent pesticide bulk storage or use associated with cricket pitch and tennis courts as the South New Brighton Motor Camp, 59 Halsey St. Site noted as not investigated                                   |

Table 6: Summary of sites and HAILs within 100 m of SNBP

| Site No. | HAIL Activities on LLUR                                                                                                                          |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 34842    | A10 – Persistent pesticide bulk storage or use associated with the South New Brighton School at 160 Estuary Road, Site noted as not investigated |



Figure 8: LLUR Sites in relation to the investigation site (Environment Canterbury)

### 3.1.2 Southshore Bund LLUR Search

As discussed in **Section 2**, the proposed alignment of the Southshore bund traverses several former private residential properties. A buffered search was conducted for the area in proximity to the bund. **Figure 9** below shows the extent of the LLUR search<sup>6</sup>.



Figure 9: Extent of Southshore Bund LLUR Search (Environment Canterbury)

The search revealed LLUR records within 100 m of the bund. An updated property statement was requested and received from ECan on 14 January 2022 and has been included in **Appendix D**.

<sup>6</sup> Environment Canterbury, <https://llur.ecan.govt.nz/home>, accessed 12 January 2022.

A summary of the sites and HAILs that intersect the area of enquiry only is presented in **Table 7** and a summary of sites and HAILs intersecting the area of enquiry within a 100 m buffer is provided in **Table 8**.

**Figure 10** below indicates the location of the LLUR HAIL activities in relation to the site.

Table 7: Summary of sites and HAILs intersecting the Southshore bund site

| Site No. | HAIL Activity(s) on LLUR                                                                                         |
|----------|------------------------------------------------------------------------------------------------------------------|
| 166253   | I – Any other land, associated with Rocking Horse Road Southshore which is noted by ECan to be verified Non-HAIL |

Table 8: Summary of sites and HAILs within 100 m of Southshore Bund<sup>7</sup>

| Site No.         | Site Name                                                   | HAIL Activity(s)    | Site Category                                |
|------------------|-------------------------------------------------------------|---------------------|----------------------------------------------|
| 11070            | Estuary Road Landfill, Christchurch Landfill Map #40        | G3 – Landfill sites | Not Investigated                             |
| SIT166253        | Rocking Horse Road, Southshore                              |                     | Verified Non-HAIL                            |
| SIT11070         | Estuary Road Landfill, Christchurch Landfill Map #40        |                     | Not Investigated                             |
| SIT125252        | SN125252 - 125 Rocking Horse Road, Southshore, Christchurch |                     | Below guideline values - Residential         |
| <b>SIT85150</b>  | <b>126 Rocking Horse Road, Southshore, Christchurch</b>     |                     | <b>Below guideline values - Residential</b>  |
| SIT83097         | 127A Rocking Horse Road - Landfill                          |                     | Below guideline values - Residential         |
| SIT104949        | 133 Rocking Horse Road, Southshore, Christchurch            |                     | At or below background concentrations        |
| SIT77753         | Flat 1 - 135a Rocking Horse Road, South shore, Christchurch |                     | At or below background concentrations        |
| SIT115702        | 137 Rocking Horse Road, Southshore, Christchurch            |                     | Below guideline values - Residential         |
| <b>SIT67463</b>  | <b>146 Rocking Horse Road, Southshore</b>                   |                     | <b>Below guideline values - Residential</b>  |
| <b>SIT104960</b> | <b>152 Rocking Horse Road, Southshore, Christchurch</b>     |                     | <b>At or below background concentrations</b> |
| SIT113517        | 155 Rocking Horse Road, Southshore, Christchurch            |                     | Below guideline values - Residential         |
| <b>SIT111968</b> | <b>156 Rocking Horse Road, Southshore, Christchurch</b>     |                     | <b>Verified Non-HAIL</b>                     |
| <b>SIT156043</b> | <b>6 Tern Street, Southshore</b>                            |                     | <b>At or below background concentrations</b> |
| SIT147007        | 12B Tern Street, Southshore                                 |                     | Below guideline values - Residential         |
| SIT147019        | 12C Tern Street, Southshore                                 |                     | At or below background concentrations        |

<sup>7</sup> Sites listed in bold are those directly adjacent to the former properties associated with the proposed alignment

| Site No.         | Site Name                                                 | HAIL Activity(s)          | Site Category                                |
|------------------|-----------------------------------------------------------|---------------------------|----------------------------------------------|
| <b>SIT84813</b>  | <b>156a Rocking Horse Road, Southshore, Christchurch</b>  | <b>I – Any other land</b> | <b>Contaminated - Residential</b>            |
| <b>SIT84816</b>  | <b>158 Rocking Horse Road, Southshore, Christchurch</b>   |                           | <b>Below guideline values - Residential</b>  |
| SIT85011         | 157 Rocking Horse Road, Southshore, Christchurch          |                           | At or below background concentrations        |
| <b>SIT82919</b>  | <b>162 Rocking Horse Road, Southshore, Christchurch</b>   |                           | <b>Below guideline values - Residential</b>  |
| SIT116012        | 165a Rocking Horse Road, South New Brighton, Christchurch |                           | Below guideline values - Residential         |
| SIT82765         | 165b Rocking Horse Road, Southshore, Christchurch         |                           | Below guideline values - Residential         |
| <b>SIT111974</b> | <b>166a Rocking Horse Road, Southshore, Christchurch</b>  |                           | <b>At or below background concentrations</b> |
| <b>SIT67470</b>  | <b>168 Rocking Horse Road, Southshore</b>                 |                           | <b>Verified Non-HAIL</b>                     |
| SIT105844        | 169C Rocking Horse Road, Southshore, Christchurch         |                           | Verified Non-HAIL                            |
| SIT104956        | 171 Rocking Horse Road, Southshore, Christchurch          |                           | Below guideline values - Residential         |
| SIT82749         | 174 Rocking Horse Road, Southshore                        |                           | Partially Investigated                       |
| SIT84759         | 176a Rocking Horse Road, Southshore, Christchurch         |                           | Partially Investigated                       |
| SIT84872         | 177 Rocking Horse Road, Southshore, Christchurch          |                           | Partially Investigated                       |
| SIT104931        | 178 Rocking Horse Road, Southshore, Christchurch          |                           | Not Investigated                             |
| SIT82320         | 178A Rocking Horse Road, Southshore                       |                           | Below guideline values - Residential         |
| SIT84895         | 180 Rocking Horse Road, Southshore, Christchurch          |                           | Verified Non-HAIL                            |
| SIT84994         | 180a Rocking Horse Road, Southshore, Christchurch         |                           | Verified Non-HAIL                            |
| SIT104952        | 182 Rocking Horse Road, Southshore, Christchurch          |                           | Verified Non-HAIL                            |
| SIT85002         | 182d Rocking Horse Road, Southshore, Christchurch         | <b>I – Any other land</b> | <b>Contaminated - Residential</b>            |
| SIT104969        | 190 Rocking Horse Road, Southshore, Christchurch          |                           | Verified Non-HAIL                            |
| SIT78638         | 190d Rocking Horse Road, Christchurch                     |                           | Below guideline values - Residential         |
| SIT85194         | 192b Rocking Horse Road, Southshore, Christchurch         |                           | At or below background concentrations        |
| SIT67479         | 194a Rocking Horse Road, Southshore                       |                           | Below guideline values - Residential         |

| Site No.  | Site Name                                  | HAIL Activity(s) | Site Category                         |
|-----------|--------------------------------------------|------------------|---------------------------------------|
| SIT91317  | 2 Mermaid Place, Southshore Christchurch   |                  | Partially Investigated                |
| SIT171573 | 4 Mermaid Place, Southshore                |                  | Below guideline values - Residential  |
| SIT73790  | 9 Mermaid Place, Southshore, Christchurch  |                  | At or below background concentrations |
| SIT157228 | 10 Mermaid Place, Southshore               |                  | Below guideline values - Residential  |
| SIT74153  | 15 Mermaid Place, Southshore, Christchurch |                  | At or below background concentrations |
| SIT67558  | 1-202B Rocking Horse Road, Southshore      |                  | Below guideline values - Residential  |



Figure 10: LLUR Sites in relation to the investigation site

For the purpose of identifying potential contamination considerations for this PSI, the information obtained from the LLUR with regards to contamination has been categorised into each Unit and is presented in **Table 9** below.

Table 9: LLUR HAIL Record per Unit of Project Site

| Unit | LLUR HAIL Record                                                                       |
|------|----------------------------------------------------------------------------------------|
| 1    | According to the LLUR, none of the properties within Unit 1 have HAIL classifications  |
| 2    | According to the LLUR, none of the properties within Unit 2 have HAIL classifications. |

| Unit | LLUR HAIL Record                                                                                                                                                                                                                                                                                                      |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3    | According to the LLUR, the properties up to 124 Rocking Horse Road do not have any HAIL classification, however the properties from 126 Rocking Horse Road to 1A Tern Street are Verified non-HAIL (Site Name - Rocking Horse Road, Southshore, Site No. - SIT 166253). See <b>Figure 11</b>                          |
| 4    | According to the LLUR all the properties within Unit 4 apart from 156A Rocking Horse Road are Verified non-HAIL (Site Name - Rocking Horse Road, Southshore, Site No. - SIT 166253). 156A Rocking Horse Road is categorised as contaminated (HAIL I) for Residential use. See <b>Figure 11</b> and <b>Figure 12</b> . |

The properties within Unit 1, Unit 2 and half of Unit 3 do not have HAIL classifications. Approximately half of the properties within Unit 3 and all of those within Unit 4 fall within a larger Verified non-HAIL, identified as SIT 166253, Rocking Horse Road, Southshore. The LLUR search summary for this Verified non-HAIL site states that "there is information that shows that this property has never been associated with any of the specific land uses on the HAIL." **Figure 11** below shows the extent of the Verified non-HAIL site.



Figure 11: Extent of Verified non-HAIL Site - SIT 166253 (Environment Canterbury)

As shown in **Figure 12** and detailed in **Table 8** above, three properties east of and directly adjacent to the former properties adjacent to Unit 3 and eight properties east of and directly adjacent to the former properties adjacent to Unit 4 were noted on the LLUR and have previously had detailed site investigations (DSIs) conducted at them.



Figure 12: Relevant Listed Land Use Register (LLUR) sites (indicated with a red boundary line) in relation to Unit 3 and Unit 4 (Environment Canterbury)

### 3.2 Review of Historical Aerial Imagery

A review of historical aerial imagery from the Canterbury Maps, Historical Aerial Photography database (<https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery/>) and Retrolens was undertaken to identify historic land uses and the potential for associated soil contamination. A summary of the review of historic aerial imagery is provided in **Table 10** and **Table 11**. Selected historic aerial imagery is shown in **Appendix E**.

#### 3.2.1 South New Brighton Park Review of Historical Aerial Imagery

Table 10: Historical aerial imagery observation summary table for SNBP

| Aerial Photograph | General Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1925-1929         | SNBP is largely undeveloped and exists as a natural sand dune with low-lying vegetation and trees in an extensive wooded area. There is a sports field located in the centre of the park. The wider South New Brighton area to the east is showing early signs of being developed for residential use. The Pacific coast is between 600 m and 800 m east of the eastern limits of the site.                                                                                                 |
| 1940 to 1944      | No significant change observed on site. Four tennis courts that are now located to the east of the site and south of the sports field. Further residential development is evident in wider South New Brighton.                                                                                                                                                                                                                                                                              |
| 1945 to 1949      | No significant change observed on site. An area to the east of the site and south of the tennis courts has been cleared of trees. Residential growth in South New Brighton continues.                                                                                                                                                                                                                                                                                                       |
| 1955 to 1959      | The northern half of the site has been cleared of trees. Residential development continues in South New Brighton, increasing in density and spreading south towards Southshore with South New Brighton now connected to Southshore via Rocking Horse Road.                                                                                                                                                                                                                                  |
| 1965 to 1969      | Trees and shrubs have returned to most of the northern half of the site. A club house / ablutions are evident at the sports fields and the tennis club and there is a large building in existence on the eastern edge of the park just south of the western end of Halsey Street. South New Brighton and Southshore have undergone substantial development with properties and residential land in Southshore reaching the banks of the estuary, and road infrastructure being constructed. |
| 1970 to 1974      | No significant change observed on site. Residential development in South New Brighton and Southshore has further intensified.                                                                                                                                                                                                                                                                                                                                                               |
| 1980 to 1984      | No significant change observed on site. The area south of the tennis courts in SNBP appears to have been developed as a campground / motor camp. Residential development continues in South New Brighton and Southshore.                                                                                                                                                                                                                                                                    |
| 1990 to 1994      | No apparent material change on site. South New Brighton and Southshore now a dense residential suburb.                                                                                                                                                                                                                                                                                                                                                                                      |
| 2000 to 2004      | No significant change to the site. Tree clearance has taken place in a small area to the east of the Jellicoe Marsh area. No significant change to the remainder of the immediate surrounds.                                                                                                                                                                                                                                                                                                |
| 2010 to 2014      | No significant change to the site or immediate site surrounds.                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 2015 to 2019      | Trees have been removed from the northern half of the site and the yacht club and a boat ramp are evident to the north. Several residential properties adjacent to the eastern boundary of the site on the southern half along Estuary Road have been removed as well as several properties in Southshore on the banks of the Estuary.                                                                                                                                                      |

### 3.2.2 Southshore Bund Review of Historical Aerial Imagery

Table 11: Historical aerial imagery observation summary table for the Southshore Bund

| Aerial Photograph | General Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1925-1929         | The entire Southshore is undeveloped and exists as natural sand dune.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 1940 to 1944      | As above                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 1945 to 1949      | As above                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 1955 to 1959      | Early signs of the area being developed for residential use are evident with Rocking Horse Road having been constructed and several houses in existence east of the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 1965 to 1969      | <p>Several more residential properties have been developed.</p> <p>Adjacent to Unit 1 the following properties have built structures on them:</p> <ul style="list-style-type: none"> <li>▪ 4 Godwit Street;</li> <li>▪ 32A Rocking Horse Road;</li> <li>▪ 34A Rocking Horse Road;</li> <li>▪ 36A Rocking Horse Road;</li> <li>▪ 44A Rocking Horse Road; and</li> <li>▪ 46A Rocking Horse Road</li> </ul> <p>Adjacent to Unit 2 the following properties have built structures on them:</p> <ul style="list-style-type: none"> <li>▪ 80A Rocking Horse Road;</li> <li>▪ 88B Rocking Horse Road; and</li> <li>▪ 94A Rocking Horse Road.</li> </ul> <p>Adjacent to Unit 3 the following properties have built structures on them:</p> <ul style="list-style-type: none"> <li>▪ 96A Rocking Horse Road;</li> <li>▪ 146B Rocking Horse Road; and</li> <li>▪ 148B Rocking Horse Road</li> </ul> <p>None of the properties adjacent to Unit 4 have been developed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 1970 to 1974      | <p>Southshore has been further developed.</p> <p>Adjacent to Unit1 the following additional properties have built structures on them with structures on the foreshore built for tidal protection:</p> <ul style="list-style-type: none"> <li>▪ 2 Heron Street;</li> <li>▪ 2A Heron Street (small amount of land reclaimed); and</li> <li>▪ 2B Heron Street; and</li> </ul> <p>Adjacent to Unit 2 the following additional properties have built structures on them:</p> <ul style="list-style-type: none"> <li>▪ 82A Rocking Horse Road.</li> <li>▪ 2 Penguin Street;</li> </ul> <p>Adjacent to Unit 3 the following additional properties have built structures on them:</p> <ul style="list-style-type: none"> <li>▪ 96B Rocking Horse Road;</li> <li>▪ 106A Rocking Horse Road;</li> <li>▪ 108B Rocking Horse Road;</li> <li>▪ 112B Rocking Horse Road;</li> <li>▪ 112C Rocking Horse Road; and</li> <li>▪ 124A Rocking Horse Road;</li> </ul> <p>At 126B there are early signs of development of site with land reclamation under way.</p> <p>132A Rocking Horse Road is developed (land reclaimed).</p> <p>It appears that 146B and 148B have built sea walls.</p> <p>Adjacent to Unit 4 the following properties have built structures on them:</p> <ul style="list-style-type: none"> <li>2 Tern Street (land reclaimed);</li> <li>156B Rocking Horse Road (land reclaimed);</li> </ul> |

| Aerial Photograph                 | General Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                   | 162B Rocking Horse Road (land reclaimed); and<br>172C Rocking Horse Road.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 1975 to 1979 (poor quality image) | The only apparent material change at Unit 1 is that 62C Rocking Horse Road has been developed.<br>Adjacent to Unit 2, 3 Penguin Street and 90B Rocking horse Road have been developed.<br>Adjacent to Unit 3, 5 Plover Street and 126B Rocking Horse Road have been developed and at 134B Rocking Horse Road land has been reclaimed in preparation for development.<br>Adjacent to Unit 4, 1/168B Rocking Horse Road has been developed.                                                                                                                                                                                                                                                                                           |
| 1984                              | Adjacent to Unit 1 the following additional properties have been developed: <ul style="list-style-type: none"> <li>2C Heron Street;</li> <li>9 Kingfisher Lane; and</li> <li>11 Kingfisher Lane;</li> </ul> Adjacent to Unit 2 the following additional properties have been developed: <ul style="list-style-type: none"> <li>66B Rocking Horse Road;</li> <li>76A Rocking Horse Road; and</li> <li>3A Penguin Street.</li> </ul> Adjacent to Unit 3 the following additional properties have been developed: <ul style="list-style-type: none"> <li>100A Rocking Horse Road;</li> <li>110C Rocking Horse Road; and</li> <li>1 Plover Street.</li> </ul> Adjacent to Unit 4, 164B and 166B Rocking Horse Road have been developed. |
| 1990 to 1994                      | No apparent material change at Unit 1.<br>Adjacent to Unit 2 the following additional properties have been developed: <ul style="list-style-type: none"> <li>64A Rocking Horse Road;</li> <li>66C Rocking Horse Road;</li> <li>74B Rocking Horse Road; and</li> <li>74C Rocking Horse Road.</li> </ul> Adjacent to Unit 3, 110B and 104A Rocking Horse Road have been developed<br>Adjacent to Unit 4, 160B and 170 Rocking Horse Road have been developed.                                                                                                                                                                                                                                                                         |
| 1995 to 1999 (poor quality photo) | Unit 1 remains as above.<br>No apparent material change at Unit 2<br>No apparent material change at Unit 3<br>No apparent material change at Unit 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 2000 to 2004 (poor quality photo) | Adjacent to Unit 1, 2 Godwit Street has been developed.<br>Adjacent to Unit 2, 2A Penguin Street has been developed<br>Unit 3 remains as above.<br>Unit 4 remains as above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 2010 to 2015                      | No apparent material change at Unit 1.<br>No apparent material change at Unit 2.<br>Unit 3 remains as above.<br>Unit 4 remains as above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 2013 (Google Earth)               | Several properties adjacent to the site are no longer in existence.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Latest aerial imagery             | All the residential structures adjacent to the Southshore bund site are no longer in existence apart from 44A Rocking Horse Road adjacent to Unit 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

### **3.3 Previous Investigations**

#### **3.3.1 South New Brighton Park**

As highlighted in **Section 3.1.1**, there were two sites with LLUR records within 100 m of SNBP as follows:

- South New Brighton Motor Camp, 59 Halsey Street; and
- Estuary Pump Station, 299 Estuary Road.

This section summarises the findings of the site investigation reports made available for this PSI by Environment Canterbury. The full property statements are attached as **Appendix D**.

##### **3.3.1.1 INV12164: South New Brighton Motor Camp, 59 Halsey Street DSI (Pattle Delamore Partners Ltd, March 2005)**

*Pattle Delamore Partners investigated the decommissioning of one steel underground diesel storage tank from the site on 15 February 2005. The tank was reported to be in "good condition" upon excavation however photos indicate the condition was fair.*

*Five soil samples were collected during removal of the tank. Sampling and analysis of soils is considered adequate given the small size of the tank. Soil test results were compared to Ministry for the Environment petroleum hydrocarbon guidelines (MfE, 1999) and all results were below laboratory detection. No additional work is considered necessary with regard to the removed tank.*

*One additional above ground tank remains at the site and as this constitutes a hazardous activity or industry, the category of "partially investigated" has been assigned to the site. In the event that all hazardous activities and land uses cease at the site and an investigation is submitted to Environment Canterbury, the category for the site will be reviewed to reflect new information.*

##### **3.3.1.2 INV250091 Estuary Pump Station, 299 Estuary Road PSI (Beca Limited, June 2019)**

*Beca were engaged to undertake a desk-based contamination assessment of the Christchurch City Council pumping station at 299 Estuary Road, Christchurch. This investigation does not constitute a full preliminary site investigation (PSI) and included assessment of surrounding land parcels. No HAIL activities were identified on the subject site. However, a number of HAIL activities were identified within a 400 m radius including persistent pesticide use and asbestos manufacture or disposal. The report recommended that a PSI was not recommended*

#### **3.3.2 Southshore Bund**

As highlighted in **Section 3.1.2**, three properties further east of the former properties adjacent to Unit 3 and eight properties further east of the former properties adjacent to Unit 4 were noted on the LLUR and have previously had a DSI conducted at them. One of these properties was identified as a HAIL site. This section summarises the findings of the site investigation reports made available for this PSI by Environment Canterbury. The full property statements are attached as **Appendix D**.

The initial records presented related to sites within a 100 m radius of the bund which was later refined and limited to incorporate only the records for the properties directly adjacent to site. Based on the information provided for the other sites and given the distance between the proposed bund and the properties further east and south, these sites are considered to pose a low risk to the site.

**3.3.2.1 Site 166253: Rocking Horse Road, Southshore, Verified Non-HAIL (Intersects the site of the Bund)**

There are no investigations associated with this site.

A note on the LLUR statement states the following:

*Rocking Horse Road, Southshore was identified as the location of a fibrous plaster dump (Landfill #77) in Christchurch City Council (CCC) records. The fibrous plaster was thought to potentially contain asbestos and the cover depth of the landfill was unknown. A polygon (SN10932) to represent this fill area was created on Environment Canterbury's Listed Land Use Register in 2012 using borelogs to identify fill areas. All properties between these borelogs were assumed to have a similar landuse/uncontrolled fill. Property owners were notified in 2014 as part of the Christchurch HAIL identification programme.*

*A number of reports have been made in the area registered on the LLUR to support residential rebuilding of earthquake damage. Many of these reports have been simple four sample investigations on a single property to assess risk to site workers and provide information for soil disposal locations. Taken as a body of information, the data available was used to better define the area likely to be affected by the fibrous plaster dump and provide a category on the LLUR.*

*Past investigation reports, historical aerial photographs, and borelogs of Rocking Horse Road have been reviewed. Bore logs show shallow soil disturbance or fill with sand, silt and gravel generally to 0.3 metres depth overlying native sand. No plasterboard or potentially asbestos containing material was noted in these reports. The likely location of Landfill #77 was SN981060 (1/99A, 2/199A, 199, 199B, 201 and 203 Rocking Horse Road), as depicted in **Figure 12** (HAIL E1).*

**3.3.2.2 SITE 11070: Estuary Road Landfill, Christchurch, Landfill Map #40**

According to the LLUR this site is a verified HAIL G3 that has not been investigated. It is believed that there was a landfill site in existence at this location from 1945 to 1955.

**3.3.2.3 INV 24621: 126 Rocking Horse Road DSI (Geoscience Consulting Ltd, December 2014)**

*The site is located within an area where fibrous plaster, potentially containing asbestos, was reportedly disposed of. Geoscience Consulting (NZ) Limited undertook a detailed site investigation to determine whether there was contamination present in soil likely to be disturbed during the rebuild of the existing house.*

*Soil sampling was undertaken, and the analytical results showed that one sample exceeded the recorded background concentrations for lead and zinc. All PAH compounds were within recorded background concentrations. There were no exceedances of the acceptance criteria for residential land-use, including if the values are adjusted to account for compositing of the samples. The sampling results are considered to be sufficiently low to be satisfied that the site is below the acceptance criteria for residential land-use.*

There was no analysis for asbestos despite this being the contaminant of concern for this area.

**3.3.2.4 INV 67454: 146 Rocking Horse Road DSI, (Coffey Environments, April 2014)**

*The site is located within an area where fibrous plaster, potentially containing asbestos, was reportedly disposed of. Coffey Environments Limited undertook a DSI to characterise the site soils prior to rebuild works being undertaken.*

*Soil sampling was undertaken, and the analytical results showed that all of the soil samples found concentrations of metals and PAHs within the recorded background concentrations, with the exception of chromium in one*

*sample which exceeded the recorded background levels by a small amount (18mg/kg was found; 16.6mg/kg is the recorded background level). Asbestos was not detected in the sample analysed.*

The LLUR states that *given that the exceedance of the recorded background concentrations was very minimal the site can be categorised as "Below guideline values - Residential".*

### **3.3.2.5 INV 63157: 152 Rocking Horse Road DSI (Geoscience Consulting Ltd, September 2014)**

*A residence was built on the property by 1994. A poorly defined area on both sides of Rocking Horse Road was identified in Christchurch City Council records as a fibrous plaster dump in the 1960s.*

*Geoscience Consulting Ltd conducted an investigation to characterise the soil to guide appropriate disposal and to comply with National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health soil disturbance regulation.*

*The soil samples were composited to a single sample and analysed for a suite of heavy metals and polycyclic aromatic hydrocarbons (PAHs). All results complied with relevant residential soil contaminant standards and guidelines and were below published background concentrations. No potentially asbestos containing material was identified.*

The LLUR states that *the site has been appropriately investigated to demonstrate that the soil is at or below published background concentrations.*

### **3.3.2.6 INV 156044: 6 Tern Street DSI (ENGEO, November 2015)**

*Four locations around the residence had soil sampled at 0.8 metres below ground level. Fine to medium sand was found from surface to 1 metre below ground level. The samples were analysed for a suite of metals and polycyclic aromatic hydrocarbons. All results complied with residential soil contaminant standards and were below background concentrations for yellow brown soil in Canterbury.*

It was concluded that contamination was *at or below background concentrations* and the LLUR states that the site has suitably been investigated to show that it complied with background concentrations for the contaminants of concern. No anthropogenic material was noted in soil in the report.

A note from January 2017 states the following:

*The wider area is identified as Landfill #77 on the CCC Landfill Map (age 1960s, fibrous plaster dump). Source information includes borelogs and identified areas of uncontrolled fill on both sides of Rocking Horse Road. The area identified on the LLUR comprises these parcels and assumes that the parcels in between also had a similar landuse/uncontrolled filling. No housing development is seen in this area in the 1927, 1946 and 1955 aerial photos. No anthropogenic material was noted in soil from a 2015 investigation at 6 Tern Street.*

### **3.3.2.7 INV 99976: 156 Rocking Horse Road DSI (Coffey Environments, August 2015)**

*A basic soil sampling investigation was undertaken to assess soil likely to be disturbed during the rebuild of the existing house. The site is located in an area where fibrous plaster containing asbestos was reportedly buried. The report states that "fill" material was identified up to 0.9m depth. The report states that trace to minor amounts of white specks and white fibrous material were identified in three of the four hand-augers on site.*

*The samples were analysed for a suite of eight metals and PAHs. There was no analysis for asbestos despite this being the contaminant of concern for this area, and the report of white and fibrous material in the soil samples.*

The LLUR states that *the soil sampling results did not exceed recorded background concentrations for the area. However, the investigation undertaken was not comprehensive, with only a small number of samples collected for the depth of fill reported and no analysis for asbestos. The site should be described as “partially investigated”.*

A note from May 2017 states:

*This area was identified as part of Landfill #77 on the CCC Landfill Map (age 1960s, fibrous plaster dump). Source information included borelogs and identified areas of uncontrolled fill on both sides of Rocking Horse Road. The area identified on the LLUR comprises these parcels and the LLUR report assumes that the parcels in between also had a similar landuse/uncontrolled filling. No housing development is seen in this area in the 1927, 1946 and 1955 aerial photos.*

### **3.3.2.8 INV 218482: 156A Rocking Horse Road DSI (Geoscience Consulting Ltd, May 2013 & Eliot Sinclair & Partners Ltd, July 2018)**

*The site is located within an area where fibrous plaster, potentially containing asbestos, was reportedly disposed of. Geoscience Consulting (NZ) Ltd undertook soil sampling to characterise soil likely to be disturbed during the rebuild of the existing dwelling.*

*The sample results indicated elevated levels of arsenic and lead. Cadmium, chromium, copper, and zinc were also found above recorded background levels. PAHs were found above the laboratory limit of detection but be low recorded background levels for the area. The individual subsamples were re-analysed for arsenic and lead, and one location was found to be above the soil acceptance criteria for residential land-use for both contaminants. Both of these contaminants also exceeded the ANZECC sediment quality guidelines.*

*The LLUR states that due to the hotspot of lead and arsenic identified the site should be categorised as contaminated for residential use. The hotspot has not been delineated.*

A note from May 2017 states:

*This area was identified as part of Landfill #77 on the CCC Landfill Map (age 1960s, fibrous plaster dump). Source information included borelogs and identified areas of uncontrolled fill on both sides of Rocking Horse Road. The area identified on the LLUR comprises these parcels and assumes that the parcels in between also had a similar landuse/uncontrolled filling. No housing development is seen in this area in the 1927, 1946 and 1955 aerial photos.*

*In July 2018 Environment Canterbury received a Detailed Site Investigation report that includes all or part of this property.*

*This investigation has not been summarised.*

### **3.3.2.9 INV 82920: 162 Rocking Horse Road DSI (Coffey Environments, September 2014)**

*The site is located within an area where fibrous plaster, potentially containing asbestos, was reportedly disposed of. A detailed site investigation was undertaken for the purposes of characterising the footprint of the former house, which is to be rebuilt on the same location. The former house was demolished following the Canterbury earthquakes and prior to sampling occurring.*

*The surface soil to approximately 0.3 m depth was described as fill containing plasterboard, fragments of brick and black staining. Coffey confirmed via email that the “plasterboard” referred to was only gib board and no potentially asbestos containing material was observed during the investigation. The soil below this was natural sand. The samples were analysed for a suite of eight metals and PAHs. The results found one sample exceeded*

*recorded background levels for arsenic, and two samples exceeded recorded background levels for zinc. PAHs were detected slightly above the laboratory limit of detection in two samples but these did not exceed recorded background levels. There were no exceedances of the acceptance criteria for residential land-use.*

*The LLUR states that given the depth of soil characterised as fill and the size of the land parcel the site is considered to be adequately characterised. The site can be categorised as "Below Guideline Values – Residential".*

### **3.3.2.10 INV 111978: 166A Rocking Horse Road DSI (Coffey Environments, June 2015)**

*A basic soil sampling investigation was undertaken to assess soil likely to be disturbed during the rebuild of the existing house. The site is located within an area where fibrous plaster containing asbestos was reportedly buried. The report states that sandy gravel and sandy silt "fill" material with traces of charcoal was identified up to 0.5 m depth.*

*Soil samples were analysed for a suite of eight metals and polycyclic aromatic hydrocarbons. There was no analysis for asbestos despite this being the contaminant of concern for this area, however there were no visual indications of fibrous plaster type material at the site.*

*The LLUR states that the soil sampling results did not exceed recorded background concentrations for the area. Although the investigation undertaken was not comprehensive the site is small and the soil sampling did not identify contamination. The site can be described as "at or below background concentrations".*

*A note from May 2017 in the Property statement states the following:*

*Rocking Horse Road, Southshore was identified as the location of a fibrous plaster dump (Landfill #77) in Christchurch City Council (CCC) records. The fibrous plaster was thought to potentially contain asbestos and the cover depth of the landfill was unknown. A polygon (SN10932) to represent this fill area was created on Environment Canterbury's Listed Land Use Register in 2012 using borelogs to identify fill areas. All properties between these borelogs were assumed to have a similar landuse/uncontrolled fill. Property owners were notified in 2014 as part of the Christchurch HAIL identification programme.*

*A number of reports have been made in the area registered on the LLUR to support residential rebuilding of earthquake damage. Many of these reports have been simple four sample investigations on a single property to assess risk to site workers and provide information for soil disposal locations. Taken as a body of information, the data available was used to better define the area likely to be affected by the fibrous plaster dump and provide a category on the LLUR.*

*Past investigation reports, historical aerial photographs, and borelogs of Rocking Horse Road have been reviewed. Bore logs show shallow soil disturbance or fill with sand, silt and gravel generally to 0.3 m depth overlying native sand. No plasterboard or potentially asbestos containing material was noted in these reports. The LLUR states that the likely location of Landfill #77 was SN981060 (1/99A, 2/199A, 199, 199B, 201 and 203 Rocking Horse Road).*

### **3.3.2.11 INV 29835: 168 Rocking Horse Road DSI (Coffey Environments, March 2014)**

*The site is located within an area where fibrous plaster, potentially containing asbestos, was reportedly disposed of. A detailed site investigation was to characterise the site soils likely to be disturbed when the house is rebuilt.*

*The sampling and geotechnical hand auger investigations found a fill layer between 0 and 0.7 m deep across the site, with natural sand beneath the fill or a topsoil layer. No evidence of fibrous plaster or similar contamination was observed. The samples were analysed for a suite of eight metals and PAHs, and the three primary samples were analysed for asbestos.*

*The results found one sample exceeded the recorded background concentrations slightly for lead. Two samples found PAH levels above the laboratory limit of detection, but these did not exceed recorded background levels. There were no exceedances of the acceptance criteria for residential land-use for metals or PAHs. There were no detections of asbestos in the three samples analysed.*

A note from May 2017 states:

*This area was identified as part of Landfill #77 on the CCC Landfill Map (age 1960s, fibrous plaster dump). Source information included borelogs and identified areas of uncontrolled fill on both sides of Rocking Horse Road. The area identified on the LLUR comprises these parcels and assumes that the parcels in between also had a similar landuse/uncontrolled filling. No housing development is seen in this area in the 1927, 1946 and 1955 aerial photos.*

### **3.3.2.12 INV 77697: 174 Rocking Horse Road DSI (Coffey Environments, January 2015)**

*The site is located within an area where fibrous plaster, potentially containing asbestos, was reportedly disposed of. A DSI was undertaken to characterise the site soils prior to the rebuild of the residential property.*

*No observations of fibrous plaster or similar contamination were noted when obtaining the samples. The samples were analysed for a suite of eight metals and PAHs.*

*The results found one location in the shallow fill at the rear of the property which contained lead exceeding the relevant acceptance criteria for residential land-use, and the ANZECC sediment quality guideline for protection of aquatic organisms. This sample also exceeded the recorded background concentrations for cadmium and zinc. The two samples collected from fill both contained PAHs above the laboratory limit of detection, but below recorded background concentrations.*

*One sample from the site exceeded the soil contaminant standards for residential use for lead. The LLUR states that further sampling is needed to delineate the extent of the contamination and assess the remainder of the site. Therefore, the site can be described as "partially investigated".*

A note from May 2017 states:

*This area was identified as part of Landfill #77 on the CCC Landfill Map (age 1960s, fibrous plaster dump). Source information included borelogs and identified areas of uncontrolled fill on both sides of Rocking Horse Road. The area identified on the LLUR comprises these parcels and assumes that the parcels in between also had a similar landuse/uncontrolled filling. No housing development is seen in this area in the 1927, 1946 and 1955 aerial photos.*

## **3.4 Asbestos Containing Materials Sampling at Southshore**

### **3.4.1 Sampling**

As part of the PSI conducted by Jacobs in 2020 which focussed on the estuary edge and not the proposed bund alignment, a second site walkover was conducted on 21 August 2020 to obtain samples of suspected ACM fragments in the vicinity of the nine structures identified in the previous visit. Additionally, suspected ACM fragments were evident in the vicinity of two further structures not identified previously, taking the total number of structures with suspected ACM to 11. No. Nine samples were obtained on the site visit. One sample applies to two adjacent structures (NS6A and NS6B). There is a suspected asbestos containing pipe at an eleventh location (Structure IS18A), however verification sampling was not feasible due to the location and size of the suspected asbestos containing pipe. The suspected ACM samples were couriered to RJ Hill Laboratories for qualitative screening (absence/presence for asbestos).

### 3.4.2 Analytical Results

Results show that asbestos was present in eight out of the nine samples analysed, confirming that asbestos contamination is present in the vicinity of nine of the estuary edge protection structures. Although analytical results confirm that no asbestos was detected in the suspected ACM sample from structure NS5A, ACM was detected in samples from adjacent structures IS23A and IS24A, indicating that ACM could also be present at structure NS5A. No other visible or olfactory signs of contamination were observed in the vicinity of the remaining structures.

Photographs of the asbestos materials encountered on both walkovers are presented in **Appendix F**; the locations of these ACM are depicted in **Figure 13** to **Figure 15** below. **Table 12** to **Table 14** below provide a summary of the locations, HAIL status and site observations where ACM and suspected ACM were observed<sup>8</sup>. Images from Jacobs Community Board Meeting Presentation 20th February 2020 provided in **Appendix G** depict the numbering of the structures.

Table 12: Site HAIL Investigation Summary and Observations Unit 1

| Structure ID | 2019 Description                               | Address                                      | Structure History (Council records)     | HAIL Status & Investigation summary                                                                                                                         | Site inspection notes                                                                                                                                                                                                                              |
|--------------|------------------------------------------------|----------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IS33A        | Informal structure - Concrete rubble revetment | 3 Heron Street - 2C Heron Street             | Present in 1995 as concrete rubble wall | No HAIL classification – property adjacent likely built in the early 1970's. Historical Aerial Imagery suggests there is likely fill behind this structure. | Lots of concrete rubble – suspected asbestos fragments visible in the centre of this structure adjacent to a small tree. Analytical results confirm asbestos presence in the sample.                                                               |
| IS31B        | Informal structure - Informal fill             | 11 Kingfisher Lane to 62C Rocking Horse Road | Present in 1995 as concrete rubble wall | No HAIL classification – property adjacent likely built in the late 1970s. Historical Aerial Imagery suggests there is likely fill behind this structure.   | Lots of large stones and concrete slabs concrete rubble and bricks. At least 3 suspected asbestos containing fragments visible near the tree and on the northern end of the structure. Analytical results confirm asbestos presence in the sample. |

Table 13: Site HAIL Investigation Summary and Observations Unit 2

| Structure ID        | 2019 Description | Address                                    | Structure History (Council records)         | HAIL Status & Investigation summary                                                                                                                  | Recommendation                                                                                                                                                                                                                   |
|---------------------|------------------|--------------------------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IS26A               | Concrete wall    | 3 Penguin Street                           | Concrete rubble wall in 1995                | No HAIL classification – property adjacent built early 1970s. Historical aerial imagery indicates fill was used for levelling behind this structure. | Broken and cracked concrete wall. Eroded fill behind the structure. At least 2 suspected asbestos containing fragments visible on the northern end of the structure. Analytical results confirm asbestos presence in the sample. |
| NS6B (same as NS6A) | No Structure     | 2B Penguin street - 90B Rocking Horse Road | Unknown when previous structure was removed | No HAIL classification – Property adjacent built in the mid to late 1960s. Historical Aerial Imagery suggests that it is unlikely that               | Remnants of broken concrete wall on southern end. North of rubble cobble renourishment in foreshore. Grassy maintained backshore. Running from the southern end of                                                               |

<sup>8</sup> Observations and HAIL status information for all other structures is provided in the original PSI, Jacobs, September 2020.

| Structure ID | 2019 Description | Address                | Structure History (Council records)         | HAIL Status & Investigation summary                                                                                                                                                      | Recommendation                                                                                                                                                                                                                                                 |
|--------------|------------------|------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |                  |                        |                                             | much fill was used in the development of this property.                                                                                                                                  | this area into the northern end of NS6A suspected asbestos containing sheets appear vertically in the soil. Analytical results confirm asbestos presence in the sample.                                                                                        |
| NS6A         | No Structure     | 90B Rocking Horse Road | Unknown when previous structure was removed | No HAIL classification – Property adjacent built in the early 1980s. Historical Aerial Imagery suggests that it is unlikely that much fill was used in the development of this property. | On the northern end of this area suspected asbestos containing sheets appear vertically in the soil. Analytical results confirm asbestos presence in the sample. Southern end is a grassy bank with a cobble foreshore, some remnants of a structure – rubble. |

Table 14: Site HAIL Investigation Summary and Recommendations Unit 3

| Structure ID | 2019 Description        | Address                 | Structure History (Council records)                  | HAIL Status & Investigation summary                                                                                                                                                      | Recommendation                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------|-------------------------|-------------------------|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IS24A        | Concrete and brick wall | 96A Rocking Horse Road  | Stone wall present in 1995                           | No HAIL classification – property adjacent built early 1970s. Difficult to conclude whether there is likely fill behind this structure.                                                  | Gravel, bricks and concrete rubble. Saltmarsh planting on backshore. No visual contamination present on the initial walkover however on 21 <sup>st</sup> August 2020 a sample of suspected ACM was obtained from this location. Analytical results confirm asbestos presence in the sample.                                                                                                                                                                              |
| NS5A         | No Structure            | 96B Rocking Horse Road  | Wooden wall present in 2002, constructed around 1992 | No HAIL classification – Property adjacent built in the early 1970s. Historical Aerial Imagery suggests that it is unlikely that much fill was used in the development of this property. | Loose rubble and cobbles. Saltmarsh in foreshore. Grassy backshore. No visual contamination present on the initial site walkover, however on 21 <sup>st</sup> August 2020 a sample of suspected ACM was obtained from this location. Analytical results confirm that no asbestos was present in the sample. Considering that ACM has been detected at adjacent structures it is likely that contamination is present at this location despite the negative asbestos test |
| IS23A        | Concrete wall           | 100B Rocking Horse Road | Concrete block wall (1995) Constructed around 1982   | No HAIL classification – property adjacent built mid to late 1980s. Historical Aerial Imagery suggests there is likely fill behind this structure.                                       | Large erosion scarp behind low lying concrete block wall with concrete base. Upper bricks from ground level up are absent. Several suspected asbestos containing fragments visible behind the structure. Analytical results confirm asbestos presence in the sample.                                                                                                                                                                                                     |

## **Appendix D. Sampling and Analysis Quality Plan**

## Sampling and Analysis Quality Plan

Document no: IA271200-NG-PLN-0001  
Revision no: 02

Christchurch City Council

Southshore and South New Brighton Erosion Protection  
5 April 2022



## Sampling and Analysis Quality Plan

**Client name:** Christchurch City Council  
**Project name:** Southshore and South New Brighton Erosion Protection  
**Document no:** IA271200-NG-PLN-0001  
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**Date:** 5 April 2022  
**Project no:** IA271200  
**Project manager:** Ian IM Wiseman  
**Prepared by:** Kate KM Murray  
**File name:** Sampling and Analysis Quality Plan

## Document history and status

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|----------|----------|------------------------------------------------|--------|---------|----------|----------|
| 01       | 31-01-22 | Draft for internal review                      | KM     | SH      | IMW      | CR       |
| 02       | 05-04-22 | Updated with two additional test pit locations | HW     | KM      |          |          |
|          |          |                                                |        |         |          |          |

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### Jacobs New Zealand Limited

Level 2, Wynn Williams Building  
47 Hereford Street  
Christchurch Central 8013  
PO Box 1147  
Christchurch 8140  
New Zealand

T +64 3 940 4900  
F +64 3 940 4901  
[www.jacobs.com](http://www.jacobs.com)

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## Appendices

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| <b>Appendix A.</b> | <b>Jacobs Work Instruction 9 – Shallow Soil Sampling</b>                             |
| <b>Appendix B.</b> | <b>Sampling Location Plans Unit 1 – Unit 4, Additional 2 Locations TP20 and TP21</b> |
| <b>Appendix C.</b> | <b>Jacobs Work Instruction 24 – Equipment Decontamination</b>                        |

## 1. Introduction

This document comprises the Sampling and Analysis Quality Plan (SAQP) for the soil investigation to be undertaken in the vicinity of the existing erosion protection structures along the eastern edge of the Avon-Heathcote Ihutai Estuary as well as an existing bund alignment that lies approximately between 5 m and 15 m inland of the estuary edge from Godwit Street to south of Tern Street in Southshore (the site) for Christchurch City Council (CCC). This SAQP is prepared in general accordance with the content outlined in Section 4.2 of the Ministry for the Environment (MfE) Contaminated Land management Guideline (CLMG) No 5 Site Investigation and Analysis of Soils (revised 2021).

### 1.1 Background

Two Preliminary Site investigations (PSIs) for the site were undertaken by Jacobs in September 2021 and January 2022 respectively with the main findings of these investigations as follows:

- Former residential dwellings adjacent to the existing erosion protection structures and the Southshore bund were built in the mid-20th century. There is a likelihood that asbestos materials were used in the construction and that contamination from these materials could possibly have migrated into the soils. It is additionally noted that in the development of some of the properties in the area, erosion protection was installed by individual landowners at the edge of the estuary. This was generally accomplished by either constructing and backfilling retaining walls, or installing other improvised structures to create a hard edge. It is considered likely that a portion of the land immediately behind these structures was reclaimed/filled by the landowners at that time using a range of materials and there is concern that contamination could exist in this reclaimed/filled land.
- Asbestos contamination is present in the vicinity of nine of the existing erosion protection structures along the Estuary edge in Southshore. Heavy metals such as lead (found in lead paint) may also be present.
- With the historical land use, and the presence of asbestos-contaminated material (ACM) fragments confirmed at nine structures adjacent to the estuary edge and Southshore bund, it is assumed to be more likely than not that the soil has been contaminated with friable asbestos or asbestos fines in sufficient quantity that it could be a risk to human health. The presence of bonded ACM fragments is also likely. Further sampling would be required to confirm the presence/concentration of friable asbestos or asbestos fines in the soil. If visible ACM is encountered, quantification of ACM fragments would also be required through field screening.

This SAQP has been prepared to support the shallow soil investigation and to substantiate the soil management requirements that will apply to the works.

## 2. Objectives

The objective of this SAQP is to transparently communicate our methodology for understanding the presence/concentration of friable asbestos or asbestos fines in the soil, including ACM that will be disturbed during the proposed erosion protection structure upgrade works.

The planned methodology supports the following objectives for the shallow soil investigation:

- Assess potential soil contamination risk to human health and the environment to substantiate the soil management requirements that will apply to the works and
- Inform soil reuse/disposal options.

### 2.1 Guidance Documents

The following key reference guidance documents provide advice on the site and soil sampling and form the basis of this SAQP:

- Jacobs (2019). Work Instruction 9 – Shallow Soil Sampling;
- Jacobs (2019). Work Instruction 24 – Equipment Decontamination;
- Jacobs (2020). Assessment of Immediate Erosion Management Options Southshore, Preliminary Site Investigation;
- Jacobs (2022). Health, Safety and Environment Field Work Pack; and
- MfE (2011). Contaminated Land Management Guidelines No. 5 – Site Investigation and Analysis of Soils (Revised 2011), Ministry for the Environment, Wellington, New Zealand.

### 3. Scope of Works – Soil Investigation

#### 3.1 Start Date and Notifications

The geotechnical fieldwork is scheduled to take place in April 2022; shallow soil investigation works will be undertaken in conjunction with the geotechnical fieldwork mobilisation. The estimated time required to obtain the proposed 54 No. soil samples is 30 hours.

Services clearances will be required and are to be arranged prior to sampling. The location of the site does not necessitate traffic management.

The bund is a public footpath, when sampling is taking place along the footpath alignment necessary barriers and controls will need to be put in place to protect the public from the moving plant.

#### 3.2 Key Contacts

| Contact Name   | Organisation and Role                 | Phone Number |
|----------------|---------------------------------------|--------------|
| Ian Wiseman    | Project Manager - Jacobs              | 021 632217   |
| Kate Murray    | Contaminated Land Specialist - Jacobs | 027 900 0534 |
| Stanley Howell | Technical Advisor/SQEP - Jacobs       | 021 715 351  |

#### 3.3 Sampling Equipment

The list of equipment required is outlined in **Table 1**.

**Table 1. Sampling Equipment List**

| Equipment                                                                         | Quantity                  |
|-----------------------------------------------------------------------------------|---------------------------|
| Hand tools for shallow soil excavation (Stainless-steel trowel and/or hand auger) | 1                         |
| Tape measure                                                                      | 1                         |
| Chilly bins/ice                                                                   | As required               |
| Laboratory supplied sampling containers and chain of custody template             | As supplied by laboratory |
| 20 L potable rinse water containers                                               | 1 (to be refilled daily)  |
| Decontamination detergent Decon™ 90                                               | 1                         |
| 70% alcohol wipes                                                                 | 1                         |
| Decon buckets                                                                     | 2                         |
| Nitrile gloves                                                                    | 1 box                     |
| Scrubbing brush                                                                   | 1                         |
| Paper towels                                                                      | ~1 roll                   |
| Note pad                                                                          | 1                         |

| Equipment                                      | Quantity                        |
|------------------------------------------------|---------------------------------|
| Pen                                            | 1                               |
| "Sharpie" or vivid marker                      | 1                               |
| Camera or phone                                | 1                               |
| Large buckets for field screening soil for ACM | 2                               |
| Scales – for weighing soil and ACM fragments   | 1                               |
| Respiratory PPE adequate for asbestos fibres   | 1 pp conducting field screening |

### 3.4 Sample collection and Handling Procedures

Soil sampling, including decontamination procedures, will be undertaken in general accordance with Jacobs Work Instruction for Shallow Soil Sampling (**Appendix A**).

These procedures have been summarised in the subsections below.

#### 3.4.1 Soil Logging

The soil profile for the test pits shall be logged using a consistent method and format for soil descriptions. The soil type will be recorded for the surface soil samples. A useful soil logging guide is the Field description of soil and rock: Guideline for the field classification and description of soil and rock for engineering purposes (NZ Geotechnical Society Inc, 2005). IA

The soil description should include the general appearance, colour, soil type, strength, moisture content and particle shape. For environmental investigations, evidence of contamination (for example, visual signs, obvious odours and non-natural colouration) and specific information on the nature of any fill or anthropogenic materials in shallow soils should also be recorded.

#### 3.4.2 Sample Locations and Labelling

A sampling location plan is provided in **Appendix B**.

Each sample container is to have a unique sample identifier, and records kept on the label and in a notebook/field sheet for each sample. Accurately record the sample's location in field notes on a site plan. Include any observations and conditions at the time of sampling that may interpret the data, and any alterations made to the sampling plan.

A unique sample ID will be recorded for each soil sample and will include the sample location name and range of depth where the sample was located. For instance, the sample ID for a sample collected at SS01 from a depth of 0.2 to 0.3 m bgl would be recorded as 'SS01\_0.2-0.3'. All soil samples collected will use this naming convention. Where multiple sampling containers are required for the same location and depth, the same sample ID will be used (ie. depending on the analytical suite, the glass jar, plastic jar and plastic bag will be labelled with the same sample ID). All samples are to have the unique sample numbers provided in the sampling and analysis schedule provided in **Table 2**.

Sampling records should be made with a waterproof pen and dated. The information recorded on the label should include:

- The project or site reference
- The unique sample ID
- The sampling location, date, time, depth
- The sampler's name or identifier

Other information to be recorded in site notes should include:

- Notable characteristics of the sample such as colour, odour, clarity, viscosity, texture, etc.
- Relevant site observations, including weather conditions

### 3.4.3 Sample handling

Sample containers are to be supplied by the analytical laboratory (Hills).

To ensure sample preservation, place filled sample containers in an opaque, chilled container such as a chilly bin, as soon as practicable and stored on ice until they are received by the laboratory.

### 3.4.4 Chain of Custody

Accurately complete the chain of custody (COC) with the samples collected and arrange for the samples to be couriered directly to the laboratory.

### 3.4.5 Equipment Decontamination

Where applicable, equipment is to be decontaminated immediately prior to the collection of each sample in accordance with Jacobs Work Instruction for Shallow Soil Sampling (**Appendix A**) and Jacobs Work Instruction for Equipment Decontamination (**Appendix C**).

Decontamination procedures should include the following:

- Personnel who are handling soil samples to replace their gloves between each sample
- Scraping or brushing off any soil adhere to the sampling equipment
- Wash sampling equipment (eg. shovel or hand auger) in Decon 90 solution, followed by rinsing with tap water

### 3.4.6 Sampling Methodology

The following methodology will be adhered to for sample collection:

- Conduct a 'dial-before-you-dig' search one week prior to mobilisation to advise the location of buried public utilities and obtain available as-built drawings of on-site buried utilities.
- Engage a sub-surface utility clearance contractor to attend site prior to sampling works.
- Conduct sub-surface utility clearance to confirm the proposed sampling locations and depths will not intersect any buried utilities. If a proposed location is within the stand-off distance of a suspected buried utility, contact the Jacobs SQEP to discuss a safer alternative for the sampling location.
- A total of 54 No. soil samples will be obtained from 33 No. locations within the site. (refer to Appendix B).
- Each sampling location will be advanced using a hand auger, shovel, or excavator, depending on the depth and accessibility of the sampling location.
- Samples along the estuary edge or behind the existing erosion protection structures will be obtained with the use of a hand tool such as a shovel, trowel or hand auger and samples from the bund will be obtained with the assistance of a small excavator.
- At each location along the estuary edge one shallow soil sample will be collected from within the upper 0.1 – 0.3 m of each hole/excavation.
- At each test pit location along the Southshore bund one sample will be collected from within the upper 0.1 – 0.3 m of each hole/excavation and another from the base of the proposed earthworks for the bund within 0.5 – 0.8 m bgl.
- Five field duplicates will additionally be obtained from locations and depths to be determined on site.

- Photographs will be taken at each sampling location.
- The lithology at each sampling location will be logged in accordance with the NZ Geotechnical Society Inc, 2005), including soil type, moisture content, density/plasticity (clay), evidence of odour/staining or anthropogenic material.
- All samples sent to Hill Laboratories will be transported in a chilly bin with ice and accompanied by chain of custody (CoC) documentation.

The soil samples will be tested at a certified soil testing laboratory for the following parameters:

- Semi quantitative asbestos in soil.
- Heavy metals suite (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) – selected samples only.

### 3.4.7 Field Screening for ACM

For sampling locations where there is visible ACM, field screening to quantify the ACM concentration in soil is to be undertaken by collecting a minimum 10 L sample of the asbestos-contaminated soil layer. ACM fragments can be hand-picked from the 10 L sample, spread within a large bucket (approx. 40 L) of a contrasting colour.

Bag any ACM found within the 10L and obtain a weight, submit these fragments (or selected) to the lab for analysis to confirm presence of ACM.

The 10L soil sample used for screening should also be weighed with scales.

Note, the 500mL soil sample collected for the analysis of semi-quantitative asbestos should be a discrete sample collected from the soil layer itself within the testpit (not a sub-sample from the screening bucket).

### 3.4.8 Sampling and Analytical Suite

A detailed breakdown of the proposed sample names, depths and analytical suite is shown below in Table below.

All soil samples will be analysed at Hill Laboratories, an International Accreditation New Zealand (IANZ) certified testing laboratory.

**Table 2. Sampling and Analysis Schedule**

| Media                                                                                                                                                                                                                                              | Location             | Sample Name      | Sample Depth  | Semi-Quantitative Asbestos in soil | Heavy Metals Suite |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|---------------|------------------------------------|--------------------|
| Unit 1 – Preferred Erosion protection option - rock revetment: Likely to involve excavation of estuary bed – approximately 6.7m <sup>3</sup> per 1 m length. Possible excavation of soil surface on backshore of 0.4m <sup>3</sup> per 1 m length. |                      |                  |               |                                    |                    |
| Soil                                                                                                                                                                                                                                               | 2 Godwit Street      | SSB-TP01_0.1-0.3 | 0.1-0.3 m bgl | x                                  | x                  |
| Soil                                                                                                                                                                                                                                               |                      | SSB-TP01_0.5-0.8 | 0.5-0.8 m bgl | x                                  | x                  |
| Soil                                                                                                                                                                                                                                               | 40A Rocking Horse Rd | SSB-TP02_0.1-0.3 | 0.1-0.3 m bgl | x                                  |                    |
| Soil                                                                                                                                                                                                                                               |                      | SSB-TP02_0.5-0.8 | 0.5-0.8 m bgl | x                                  |                    |
| Soil                                                                                                                                                                                                                                               | 5 Heron Street       | SSB-TP03_0.1-0.3 | 0.1-0.3 m bgl | x                                  | x                  |
| Soil                                                                                                                                                                                                                                               |                      | SSB-TP03_0.5-0.8 | 0.5-0.8 m bgl | x                                  | x                  |

## Sampling and Analysis Quality Plan

| Media                                                                                                                                                                                                                                              | Location               | Sample Name       | Sample Depth                             | Semi-Quantitative Asbestos in soil | Heavy Metals Suite |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------|------------------------------------------|------------------------------------|--------------------|
| Soil                                                                                                                                                                                                                                               | 2 Heron Street         | SSB-TP04_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               |                        | SSB-TP04_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               | 2/2A Heron Street      | SSEE-SS01_0.1-0.3 | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               | 9 Kingfisher Lane      | SSB-TP05_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  | x                  |
| Soil                                                                                                                                                                                                                                               |                        | SSB-TP05_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  | x                  |
| Soil                                                                                                                                                                                                                                               |                        | SSEE-SS02_0.1-0.3 | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               | 11 Kingfisher Lane     | SSEE-SS03_0.1-0.3 | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               | TBC                    | FD-XX-X           | Field Duplicate – depth and location TBC | x                                  | x                  |
| Unit 2 – Preferred erosion option – Offshore breakwater and cobble beach treatment: encapsulate the existing rubble revetment material, no soil disturbance                                                                                        |                        |                   |                                          |                                    |                    |
| Soil                                                                                                                                                                                                                                               | 1/74C Rocking Horse Rd | SSB-TP06_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               |                        | SSB-TP06_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               | 3 Penguin Street       | SSB-TP07_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  | x                  |
| Soil                                                                                                                                                                                                                                               |                        | SSB-TP07_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  | x                  |
| Soil                                                                                                                                                                                                                                               | 88B Rocking Horse Rd   | SSB-TP08_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               |                        | SSB-TP08_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               | 90B Rocking Horse Rd   | SSB-TP09_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  | x                  |
| Soil                                                                                                                                                                                                                                               |                        | SSB-TP09_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  | x                  |
| Soil                                                                                                                                                                                                                                               |                        | SSEE-SS04_0.1-0.3 | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               | TBC                    | FD-XX-X           | Field Duplicate – depth and location TBC | x                                  |                    |
| Unit 3 - Preferred Erosion protection option - rock revetment: Likely to involve excavation of estuary bed – approximately 6.7m <sup>3</sup> per 1 m length. Possible excavation of soil surface on backshore of 0.4m <sup>3</sup> per 1 m length. |                        |                   |                                          |                                    |                    |
| Soil                                                                                                                                                                                                                                               | 96A Rocking Horse Rd   | SSB-TP10_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               |                        | SSB-TP10_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  |                    |
| Soil                                                                                                                                                                                                                                               |                        | SSEE-SS05_0.1-0.3 | 0.1-0.3 m bgl                            | x                                  |                    |

## Sampling and Analysis Quality Plan

| Media | Location              | Sample Name       | Sample Depth                             | Semi-Quantitative Asbestos in soil | Heavy Metals Suite |
|-------|-----------------------|-------------------|------------------------------------------|------------------------------------|--------------------|
| Soil  | 96B Rocking Horse Rd  | SSB-TP11_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  | x                  |
| Soil  |                       | SSB-TP11_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  | x                  |
| Soil  |                       | SSEE-SS06_0.1-0.3 | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  | 100B Rocking Horse Rd | SSB-TP12_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  |                       | SSB-TP12_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  |                    |
| Soil  |                       | SSEE-SS07_0.1-0.3 | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  | 108B Rocking Horse Rd | SSEE-SS08_0.1-0.3 | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  | 110C Rocking Horse Rd | SSB-TP13_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  | x                  |
| Soil  |                       | SSB-TP13_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  | x                  |
| Soil  | 1 Plover Street       | SSB-TP14_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  |                       | SSB-TP14_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  |                    |
| Soil  | 126A Rocking Horse Rd | SSB-TP15_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  | x                  |
| Soil  |                       | SSB-TP15_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  | x                  |
| Soil  |                       | SSEE-SS09_0.1-0.3 | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  | 140 Rocking Horse Rd  | SSB-TP16_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  |                       | SSB-TP16_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  |                    |
| Soil  | 1A Tern Street        | SSB-TP17_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  | x                  |
| Soil  |                       | SSB-TP17_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  | x                  |
| Soil  |                       | SSEE-SS10_0.1-0.3 | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  | TBC                   | FD-XX-X           | Field Duplicate – depth and location TBC | x                                  |                    |
| Soil  | TBC                   | FD-XX-X           | Field Duplicate – depth and location TBC | x                                  | x                  |

Unit 4 - Preferred Erosion protection option - rock revetment: Likely to involve excavation of estuary bed – approximately 6.7m<sup>3</sup> per 1 m length. Possible excavation of soil surface on backshore of 0.4m<sup>3</sup> per 1 m length.

## Sampling and Analysis Quality Plan

| Media | Location              | Sample Name       | Sample Depth                             | Semi-Quantitative Asbestos in soil | Heavy Metals Suite |
|-------|-----------------------|-------------------|------------------------------------------|------------------------------------|--------------------|
|       | 156 Rocking Horse Rd  | SSEE-SS11_0.1-0.3 | 0.1-0.3 m bgl                            | X                                  |                    |
| Soil  | 160B Rocking Horse Rd | SSB-TP18_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  |                       | SSB-TP18_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  |                    |
| Soil  | 166B Rocking Horse Rd | SSB-TP19_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  | x                  |
| Soil  |                       | SSB-TP19_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  | x                  |
| Soil  |                       | SSEE-SS12_0.1-0.3 | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  | 4 Rocking Horse Road  | SSB-TP20_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  |                       | SSB-TP20_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  |                    |
| Soil  | 20 Rocking Horse Road | SSB-TP21_0.1-0.3  | 0.1-0.3 m bgl                            | x                                  |                    |
| Soil  |                       | SSB-TP21_0.5-0.8  | 0.5-0.8 m bgl                            | x                                  |                    |
| Soil  | TBC                   | FD-XX-X           | Field Duplicate – depth and location TBC | x                                  |                    |

## **Appendix A. Jacobs Work Instruction 9 – Shallow Soil Sampling**

# Work Instruction 9

## SHALLOW SOIL SAMPLING

### General

#### Why

When undertaking investigation of a contaminated site representative samples of soil are required.

#### When?

Shallow soil sampling is usually conducted to provide information on soil quality if a spill, leakage or other deposition of contaminants has occurred.

#### Equipment required

The following provides a checklist of equipment that is generally required when undertaking shallow soil sampling:

- 2 stainless steel bowls (about 30-40 cm diameter)
- 2 stainless steel trowels
- Steel tape measure
- Clean glass sample jars, provided by analytical lab
- Esky and ice packs and packing material
- Decontamination materials
- Appropriate Health and Safety Equipment (Health and Safety Plan)
- Wooden stakes, flagging tape, spray paint or magic marker (as appropriate) for marking and labelling sampling grid
- Digital camera
- Field book and pens/pencils
- Automatic level or transit and measuring rod
- Photoionisation detector (PID) – required if soil is likely to contain gasoline, solvents or other volatile organic compounds.
- Test pit log form
- Sample chain of custody form.

#### Related guidelines

AS4482.1 Guidelines for the Sampling and Investigation of Contaminated Sites, 2005

#### Procedure

The procedures outlined in the following sections follow a logical order. However, some of the stages may need to be undertaken in parallel. To ensure this is undertaken when required please read this entire section prior to undertaking the works to understand potential interaction between procedures.

### 1. Planning and preparing for shallow soil sampling

- Organise equipment and forms
- If necessary (usually), retain an appropriate contractor and equipment (backhoe, bobcat or power auger if necessary) to excavate shallow pits. The backhoe/bobcat should be mobilised to the site with a clean bucket, or auger.
- Shallow samples can also be collected using a hand shovel or hand auger
- Make sure that the sampling equipment is clean and decontaminated.
- Delineate the extent of past and/or present land uses as accurately as possible.
- Determine the types of chemicals used and appropriate analytical parameters
- Obtain and review any available information on soil and groundwater conditions and any previous testing results.
- Determine and appropriate soil sampling program based on the objectives of the sampling and on the information available on the site. In particular the number, location and depth of samples collected.
- Obtain and review information available on subsurface and above grade utilities.

### 2. Marking the soil sampling locations/grids

- Mark soil sampling locations using marker in accordance with the project work plan.
- A labelled grid may be useful

### 3. Preparing the soil sampling location

- If cross contamination is an issue, lay out a piece of plywood or a plastic sheet.
- Cordon off areas which are accessible to the public

### 4. Excavating and logging the shallow pit

- Two approaches to collecting shallow soil samples are;
  - > As the pit deepens progressive soil samples are taken; or
  - > The entire pit is excavated and samples are collected from the walls.
- Plan to sample the pit from appropriate depth intervals.
- Vertical depth intervals for shallow soil sampling programs typically range from 5 – 20 cm;
- Remove any vegetation that may interfere with the sampling ensuring that the surface soil disturbance is minimal;
- Collect sample right at the surface if required;
- If appropriate collect a sample of the asphalt or gravel;

- Using the shovel, backhoe or auger, excavate or auger the pit to the desired depth below ground surface and place the excavated soil in a pile adjacent to the pit;
- Record observations related to the shallow pit in the field notebook;
- The depths to various soil units or observed features should be determined using a tape measure and should be measured relative to the undisturbed ground surface immediately adjacent to the shallow pit.
- The following observations should be made:
  - > the location, spacing and orientation of the grid
  - > the location and orientation of the shallow pit relative to the grid
  - > size of the excavation (lengths, width, depth below grade)
  - > and accurate description of the depth, thickness and position of each stratigraphic unit or zone of inferred contamination
  - > the depth, thickness and nature of any stained zones, odours or debris
  - > the depth, thickness and nature of any organic matter, fill, or native sediments if present
  - > The depths at which samples are obtained
  - > The depth and degree of water seepage
  - > Photographs of the excavations.

#### **A. Collecting samples to be analysed for NON-VOLATILE or SEMI VOLATILE analysis (e.g. CCA, PCP, PCB)**

1. Collect 3 scoops (aliquots) from the depth interval of interest at least 2.5 cm deep into walls and place in a stainless steel bowl trying to avoid suspect sloughed or smeared material.
2. Mix the aliquots in bowl and mix thoroughly to form a discrete sample representative of the depth intervals.
3. Split sample into 2 and fill 1 sample jar to the brim and fasten the lid tightly.
4. If composite sampling is required – place remaining sample in bowl 2 and mix the composite sample.
5. Return remaining discrete sample to soil pile.
6. Rinse trowel and bowls using soapy water and then with distilled water.
7. Repeat steps 1-6 for the next depth interval.

#### **B. Collecting discrete samples for VOLATILE analyses:**

- Using a clean trowel collect soil directly from the shallow pit wall or base and place it directly in the appropriate shallow glass jar. Label and store in esky.

**Note: Under no circumstances should a test pit greater than waist deep be entered. Once the pit is beyond this depth, all samples should be collected from the backhoe bucket or from the soil piles.**

#### **5. Backfilling the pit**

- Replace the excavated soil back into the shallow pit.
- Pits excavated by backhoe require limited compaction via tamping with the backhoe bucket during backfilling and by driving over soils once backfilling is completed.
- Requirements for more extensive compaction should be determined on a site-by-site basis.
- The shallow pit should be mounded slightly to minimise infiltration of surface waters into the backfilled soils and to enable the soils to settle
- Handling, storage and disposal requirements for excess soils should be determined in conjunction with the site investigation coordinator depending on the quality of the soil.

#### **6. Decontaminating the equipment**

- Decontaminating may consist of removing loose soil adhered to the bucket by brushing, pressure washing or steam cleaning.
- Before moving to next location ensure all sampling equipment (i.e. bowls, trowel etc. have been decontaminated).
- Repeat steps 3 -8 for the next sampling locations.

#### **7. Forming a composite sample (if required)**

For shallow soil sampling, composite samples are generally collected and analysed if information on the soil contamination is already available

Composite samples are typically formed from discrete samples collected from the same depth interval in different shallow pits after all discrete samples have been collected and examined, at the end of the sampling day.

If a composite sample is required, it should be formed as follows:

- i. Choose discrete samples to be composited and place in a clean stainless steel bowl.
  - ii. Mix the contents thoroughly until an even consistency is attained.
  - iii. Transfer the composite sample to a glass sample jar until it is completely full. Label Jar. Place in iced esky.
- If required, survey the elevation of the undisturbed ground surface immediately adjacent to each of the sampling locations.
  - If surveying cannot be completed before your leave the site make sure that sample locations are marked clearly and distances between the sampling locations and fixed locations on the site have been recorded.

#### **8. Final stages**

- Complete the chain of custody
- Storing and Submitting the Samples

## 9. Surveying the shallow soil sampling locations

- Grid cell numbers, roads, buildings, other reference points and relevant site features should be noted. Use a sketch to document this information.

### Relevant work instructions

The following work Instructions are also relevant:

- WI 12 Soil Classification
- WI 25 Preparation of EHS Plans

### Key points

- The way a sample is handled in the field and stored during transport to the laboratory can affect the results of laboratory analysis undertaken;
- Records in the field will be used to make decisions on the extent of further investigation, remediation and remediation costs. Make sure relevant information (including sample locations) is recorded clearly and legibly.

## **Appendix B. Sampling Location Plans Unit 1 – Unit 4, Additional 2 Locations TP20 and TP21**

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0 0.03 0.05 0.08 0.1 Kilometres

Scale: 1:1,800 @A4

Map Created by Canterbury Maps on 2/02/2022 at 10:35 AM

UNIT 1

0.4 Kilometers

Heron Street

|                 |                                                                                     |
|-----------------|-------------------------------------------------------------------------------------|
| Reclaimed land  |  |
| Sample Location |  |
| ACM discovery   |  |
| HAIL sites      |  |
| Southshore Bund |  |



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0 0.01 0.03 0.04 0.06  
Kilometres

Scale: 1:1,250 @A4

Map Created by Canterbury Maps on 2/02/2022 at 10:39 AM



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0 0.03 0.06 0.09 0.12  
Kilometres

Scale: 1:2,300 @A4

Map Created by Canterbury Maps on 2/02/2022 at 11:22 AM



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0 0.01 0.02 0.03 0.04  
Kilometres

Scale: 1:1,000 @A4

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SSB-TP-20

SSB-TP-21

## **Appendix C. Jacobs Work Instruction 24 – Equipment Decontamination**

# Work Instruction 24

## EQUIPMENT DECONTAMINATION

### General

#### Why?

To prevent cross contamination between samples and sampling locations, ensure that results of chemical analyses are reliable and representative, ensure proper functioning of some types of equipment and protect workers from exposure to potentially hazardous contaminant residues.

#### When?

Equipment should be decontaminated prior to mobilising to a site and also between samples and at the end of the day.

#### Equipment required

The following provides a checklist of equipment that is generally required when undertaking equipment decontamination:

- Potable water supply
- Deionised water
- Distilled water
- Laboratory-grade non-phosphate detergent (e.g. Decon90™ or Liqui-Nox®)
- Paper towels
- Containers (e.g. buckets or drums with lids, or a tank) to collect wash water if necessary
- Appropriate solvents (e.g. methanol)
- Squeeze bottles (for distilled/deionised water)
- Garbage bag
- Bottle brush
- Pressure washer or steam cleaner
- Broom
- Plywood or plastic sheeting
- Several pairs of nitrile gloves (or others depending on contaminants)
- Field notebook, pens, pencil
- Any existing decontamination procedures identified as part of the field program

#### Procedure

The procedures outlined in the following sections follow a logical order. However, some of the stages may need to be undertaken in parallel. To ensure this is undertaken when required please read this entire section prior to undertaking the works to understand potential interaction between procedures.

### 1. Planning and preparing for decontamination of equipment

#### General planning:

- Review sample or field program, including decontamination procedures, if available.
- Review existing information on the site characteristics, including type and extent of contamination.
- Determine whether a source of potable water is required and whether it is available on site.
- Establish which types of equipment will be used during the field program such as:
  - > Soil sampling equipment such as drill rig, excavator, backhoe or bobcat
  - > Water sampling equipment such as submersible pumps or bailers
  - > Groundwater monitoring equipment such as water level probes, interface probes
  - > Sample collection equipment such as stainless steel trowels, bowls and bailers, split spoon samplers, grab samplers and augers.
- Determine whether economical substitutions might be made to the field program to minimise the need for decontamination.
- Installing dedicated bailers or WaTerra pumps in each well may minimise the need for continual decontamination.

#### Considerations for subsurface investigations:

- At drilling or test pitting locations, consider placing plywood or plastic sheeting adjacent to the sampling location to minimise the potential for below grade contamination by surface material, or for contamination of the ground surface by drill cuttings or excavated material. Cut a hole in the middle of the plywood and drill through the hole.
- If drilling or test pit excavation is part of the field program contact the contractor to establish what decontamination equipment will be mobilised on site. Generally, drilling contractors will bring brushes, a supply of clean water, buckets, and a steam cleaner or pressure washer.
- Confirm the drilling or excavation contractor will mobilise equipment that has already been decontaminated. Plan to inspect the equipment for cleanliness prior to commencing the field program.
- Determine whether an equipment decontamination area may have to be established on the site (i.e. to collect spray and water generated during cleaning).

- Determine whether a sewer discharge permit may be required for the disposal of decontamination wash water, or whether such discharges may be prohibited.
- If wash water must be collected, ensure that appropriate containers (e.g. buckets or drums with lids, or a tank) will be available.

#### Consideration for water sampling:

- If possible plan that the first samples are collected from the areas expected to have the lowest contaminant concentrations, and the last samples are collected from the areas expected to have the highest concentrations of contaminants, in order to minimise concerns of cross-contamination.
- Consider placing sampling equipment, water level probes, sample bottles, lids and filters on clean plywood sheeting or plastic next to the sampling location.

### 2. Selecting appropriate cleaning methods, detergents and solvents

- Consider the type of soil if applicable, the characteristics of the known or suspected contaminants, and the sample data quality required.
- When determining the appropriate detergent to use the following should be considered
  - > Is the detergent likely to be effective for the types of soils being removed
  - > Is the detergent designed for the proposed cleaning method?
  - > Is the detergent free-rinsing? (Any remaining residues of concern?)
  - > How hazardous is the detergent? (Personal health hazards, alkalinity/acidity, corrosive, reactivity, flammable or volatile solvent?)
  - > Can the detergent be disposed of easily? (Biodegradable is best)
  - > How economical is the detergent?
- Laboratory-grade, non-phosphate detergent is typically used for decontamination purposes.
- Solvents such as methanol may be necessary and appropriate if extensive contamination or free products (such as oil or tar) are encountered.
- Solvent should be used sparingly and only if necessary to avoid expense associated with the generation and disposal of large volumes of wash water containing solvents.
- In cases where the use of solvent is considered necessary, the equipment should first be scrubbed using water and detergent, followed by a rinse with distilled or potable water. Solvent rinses should then be applied (make sure excess is collected sequentially, and allowed to evaporate).
- The following examples are considered to be basic levels of decontamination. Depending on the

characteristics of the contaminant, more intensive decontamination may be necessary.

#### Commonly used equipment and minimum levels of decontamination

- **Backhoe, excavator or bobcat bucket** – Between sampling locations the buckets should be brushed using a broom or brush to remove loose soil and/or pressure washed or steam cleaned.
- **Drill rig augers or core barrel** – Between drill holes, augers or cores equipment should be pressure washed or steam cleaned.
- **Split-spoon sampler** – Between soil samples, the inside and outside of the sampler should be washed using a brush and a bucket of clean water followed by a rinse with deionised water or pressure washed/steam cleaned.
- **Stainless steel Bailer** – Between monitoring wells, the bailer should be scrubbed using an appropriate brush with soapy water and rinsed two to three times with deionised water.
- **Stainless steel bowl and trowel** – Between discrete samples, the trowel and bowl should be scrubbed using an appropriate brush with soapy water and rinsed twice with deionised water.
- **Water Level Tape and Probe** – Between monitoring well locations, the water level tape and probe should be as a minimum, rinsed with deionised water, e.g. using a squeeze bottle, and wiped using paper towel or scrubbed using an appropriate brush and clean water with detergent, followed by two or three rinses with deionised water and wiping with a paper towel.
- **Oil/Water Interface Probe and Tape** – The probe and tape should be scrubbed using an appropriate brush and soapy water, followed by three rinses with deionised water.
- **Plastic “Hour-Glass” Filtering Apparatus** – Between samples, the filtering apparatus sections should be rinsed with distilled water to remove the soil and sediment, rinsed with 10% nitric acid solution and rinsed twice with deionised water.

### 3. Implementing decontamination procedures during field program

- Document the selected decontamination procedures and ensure that they are available for reference in the field.
- Ensure that any deviations from the established procedures are recorded in the field book, for future reference.
- Ensure that containers for the collection of wash water (if necessary) are ready.
- Ensure all wash water is disposed of or collected appropriately.
- If possible and appropriate, separate wash water that is expected to have low concentrations of contaminants

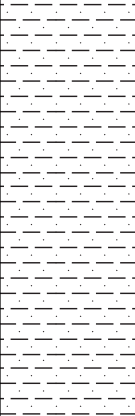
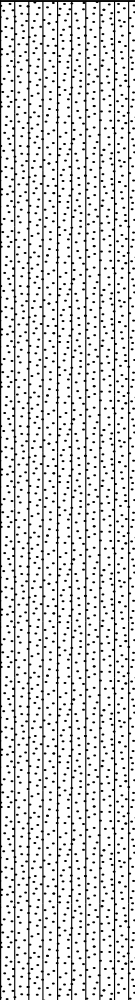
and/or solvents from water expected to have high concentrations.

- To verify decontamination was sufficient, equipment blanks or "rinsate" blanks can be collected and analysed for chemical Parameters of concern.

### Other relevant work instructions

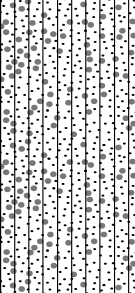
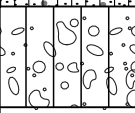
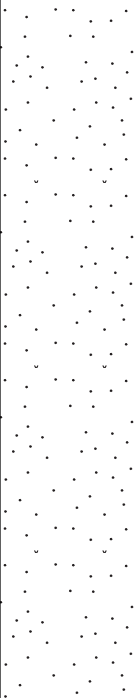
- WI 22 Field Quality Control Sampling

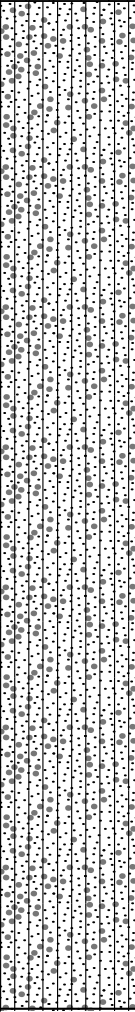
## **Appendix E. Soil Logs**

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |              |                                                                                     | <b>DATE</b> 07/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 1.0 |               |                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |              |                                                                                     |                                                                                                                                   |               |                         |
| Depth (m)                                                                                                                                                                             | Samples      | Graphic Log                                                                         | Material Description                                                                                                              | Moisture      | Additional Observations |
|                                                                                                                                                                                       | TP01_0.1-0.3 |   | Sandy SILT with some gravels, grey brown, well compacted rootlets                                                                 | Dry           | No odour or staining.   |
|                                                                                                                                                                                       | TP01_0.5-0.8 |  | Silty SAND with large amounts of gravels, boulders, cobbles, medium brown, rootlets                                               | Slightly Damp |                         |
| 1                                                                                                                                                                                     |              |                                                                                     | Termination Depth at 1.0 m                                                                                                        |               |                         |

|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 1.1       |

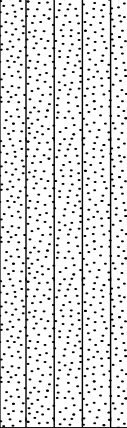
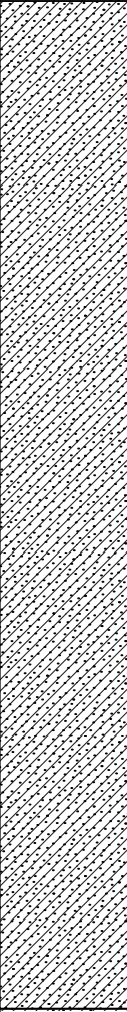
### COMMENTS

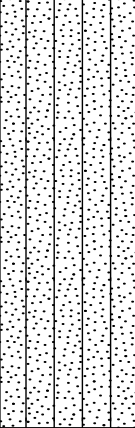
| Depth (m) | Samples      | Graphic Log                                                                         | Material Description                 | Moisture      | Additional Observations |
|-----------|--------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------|-------------------------|
|           |              |                                                                                     |                                      | Slightly Damp | No odour or staining.   |
|           | TP02_0.1-0.3 |    | Silty SAND with some cobbles/gravels |               |                         |
|           |              |   | Silty/Sandy GRAVELS, discrete lens   | Damp          |                         |
| 0.5       | TP02_0.5-0.8 |  | SAND, medium brown, fine             |               |                         |
| 1         |              |                                                                                     |                                      |               |                         |
|           |              |                                                                                     | Termination Depth at 1.1 m           |               |                         |

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |              |                                                                                     | <b>DATE</b> 07/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 1.0 |               |                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |              |                                                                                     |                                                                                                                                   |               |                         |
| Depth (m)                                                                                                                                                                             | Samples      | Graphic Log                                                                         | Material Description                                                                                                              | Moisture      | Additional Observations |
|                                                                                                                                                                                       | TP03_0.1-0.3 |   | Sandy/silty GRAVELS, light brown/grey, cobbles/boulders                                                                           | Dry           | No odour or staining.   |
|                                                                                                                                                                                       | TP03_0.5-0.8 |  | Silty SAND w. some gravels, medium brown, cobbles                                                                                 | Slightly Damp |                         |
| 1                                                                                                                                                                                     |              |                                                                                     | Termination Depth at 1.0 m                                                                                                        |               |                         |

|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 1.0       |

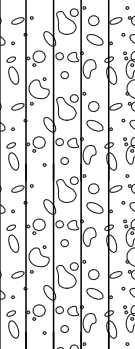
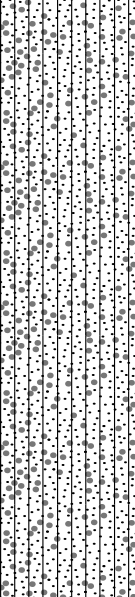
### COMMENTS

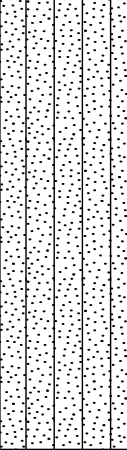
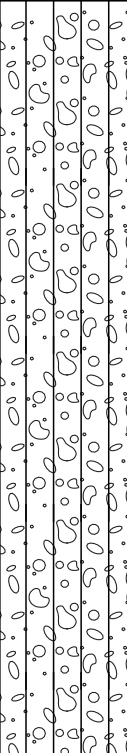
| Depth (m) | Samples      | Graphic Log                                                                         | Material Description              | Moisture | Additional Observations                                                                                             |
|-----------|--------------|-------------------------------------------------------------------------------------|-----------------------------------|----------|---------------------------------------------------------------------------------------------------------------------|
|           | TP04_0.1-0.3 |   | Silty SAND, light brown, rootlets | Dry      | No visible ACM                                                                                                      |
| 0.5       | TP04_0.5-0.8 |  | Sandy SILT, medium brown          |          | Building debris, clay pipes, clay brick fragments, broken blocks, ceramic, wood, glass and brick cladding fragments |
| 1         |              |                                                                                     | Termination Depth at 1.0 m        |          |                                                                                                                     |

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |              |                                                                                     | <b>DATE</b> 07/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 1.2 |          |                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |              |                                                                                     |                                                                                                                                   |          |                         |
| Depth (m)                                                                                                                                                                             | Samples      | Graphic Log                                                                         | Material Description                                                                                                              | Moisture | Additional Observations |
| 0.5                                                                                                                                                                                   | TP05_0.1-0.3 |   | Sandy SILT w. some cobbles, gravels                                                                                               | Dry      | No odour or staining.   |
|                                                                                                                                                                                       |              |  | Sandy SILT w. some gravels/cobbles                                                                                                |          |                         |
|                                                                                                                                                                                       | TP05_0.5-0.8 |  | SAND w. some cobbles, light brown, fine                                                                                           |          |                         |
| 1                                                                                                                                                                                     |              |                                                                                     | Termination Depth at 1.2 m                                                                                                        |          |                         |

|                                                               |  |                              |  |
|---------------------------------------------------------------|--|------------------------------|--|
| <b>PROJECT NUMBER</b> IA271200                                |  | <b>DATE</b> 07/04/2022       |  |
| <b>PROJECT NAME</b> Southshore Bund DSI                       |  | <b>COMPANY</b> CCL           |  |
| <b>CLIENT</b> Christchurch City Council                       |  | <b>LOGGED BY</b> Kate Murray |  |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary |  | <b>METHOD</b> Excavator      |  |
|                                                               |  | <b>TOTAL DEPTH</b> 1.0       |  |

| COMMENTS  |              |             |                                                                                     |               |                         |
|-----------|--------------|-------------|-------------------------------------------------------------------------------------|---------------|-------------------------|
| Depth (m) | Samples      | Graphic Log | Material Description                                                                | Moisture      | Additional Observations |
|           |              |             |                                                                                     | Dry           | No odour or staining.   |
|           | TP06_0.1-0.3 |             | Sandy SILT with some gravels, grey brown, well compacted rootlets                   |               |                         |
| 0.5       |              |             |                                                                                     | Slightly Damp |                         |
|           | TP06_0.5-0.8 |             | Silty SAND with large amounts of gravels, boulders, cobbles, medium brown, rootlets |               |                         |
| 1         |              |             | Termination Depth at 1.0 m                                                          |               |                         |

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |              |                                                                                    | <b>DATE</b> 07/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 1.2 |          |                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |              |                                                                                    |                                                                                                                                   |          |                                                          |
| Depth (m)                                                                                                                                                                             | Samples      | Graphic Log                                                                        | Material Description                                                                                                              | Moisture | Additional Observations                                  |
|                                                                                                                                                                                       |              |   | Silt w. moderate amounts of boulders, light brown, cobbles                                                                        | Dry      | No odour or staining.                                    |
|                                                                                                                                                                                       | TP07_0.1-0.3 |                                                                                    |                                                                                                                                   |          |                                                          |
| 0.5                                                                                                                                                                                   |              |  | Sandy SILT w. some boulders/cobbles, medium brown                                                                                 | Damp     | Remnants of building rubble - red brick and plasterboard |
|                                                                                                                                                                                       | TP07_0.5-0.8 |                                                                                    |                                                                                                                                   |          |                                                          |
| 1                                                                                                                                                                                     |              |                                                                                    |                                                                                                                                   |          |                                                          |
|                                                                                                                                                                                       |              |                                                                                    | Termination Depth at 1.2 m                                                                                                        |          |                                                          |

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |              |                                                                                     | <b>DATE</b> 06/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 0.8 |          |                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |              |                                                                                     |                                                                                                                                   |          |                                                        |
| Depth (m)                                                                                                                                                                             | Samples      | Graphic Log                                                                         | Material Description                                                                                                              | Moisture | Additional Observations                                |
|                                                                                                                                                                                       | TP08_0.1-0.3 |   | Sandy SILT, medium brown, dense, rootlets                                                                                         | Damp     | No odour or staining.                                  |
|                                                                                                                                                                                       | TP08_0.5-0.8 |  | Silty SAND w. some cobbles                                                                                                        |          | Small pieces of wood & plastic, large pieces of rubble |
|                                                                                                                                                                                       |              |                                                                                     | Termination Depth at 0.8 m                                                                                                        |          |                                                        |

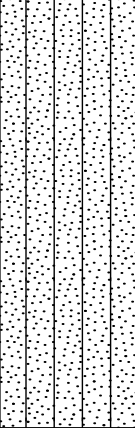
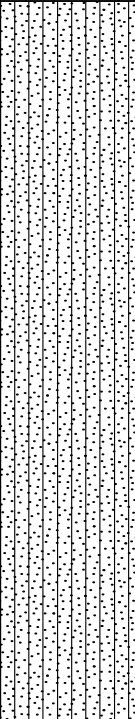
|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 06/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.8       |

### COMMENTS

| Depth (m) | Samples      | Graphic Log | Material Description               | Moisture      | Additional Observations      |
|-----------|--------------|-------------|------------------------------------|---------------|------------------------------|
|           |              |             | Sandy SILT, medium brown, rootlets | Slightly Damp | Two pieces of plastic        |
|           | TP09_0.1-0.3 |             |                                    |               |                              |
| 0.5       |              |             | Sandy SILT, medium brown           | Damp          | No odour or obvious staining |
|           | TP09_0.5-0.8 |             |                                    |               |                              |
|           |              |             | Termination Depth at 0.8 m         |               |                              |

|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 06/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 1.0       |

### COMMENTS

| Depth (m) | Samples      | Graphic Log                                                                         | Material Description                                 | Moisture      | Additional Observations                               |
|-----------|--------------|-------------------------------------------------------------------------------------|------------------------------------------------------|---------------|-------------------------------------------------------|
|           | TP10_0.1-0.3 |   | Sandy SILT, light brown homogenous, rootlets         | Slightly Damp | Pieces of plastic                                     |
| 0.5       | TP10_0.5-0.8 |  | Silty SAND w. discrete pockets of silt, medium brown | Damp          | Timber, large concrete blocks, small pieces of rubble |
| 1         |              |                                                                                     | Termination Depth at 1.0 m                           |               |                                                       |

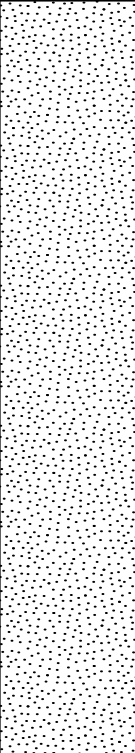
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|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 06/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 1.2       |

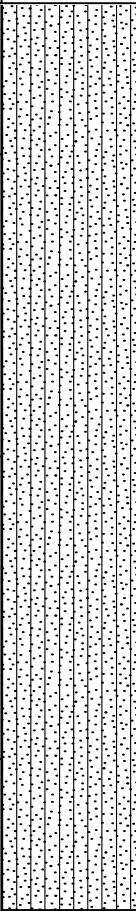
### COMMENTS

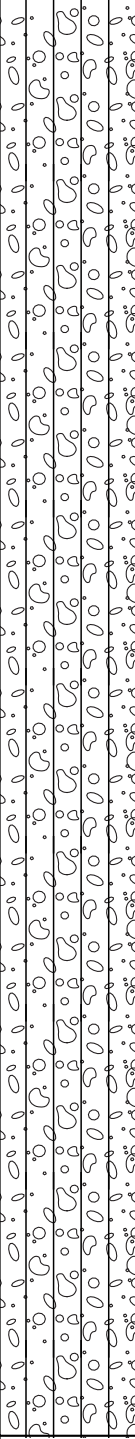
| Depth (m) | Samples      | Graphic Log | Material Description                          | Moisture | Additional Observations                                                          |
|-----------|--------------|-------------|-----------------------------------------------|----------|----------------------------------------------------------------------------------|
|           |              |             |                                               | Damp     | Fragments of plastic and red clay brick                                          |
|           | TP11_0.1-0.3 |             | Clayey SILT, dark brown, rootlets, homogenous |          |                                                                                  |
| 0.5       | TP11_0.5-0.8 |             | Silty SAND, medium brown                      |          | Ceramic tiles, glass, brick, concrete block & Black charcoal layer at 0.67 m bgl |
| 1         |              |             |                                               |          |                                                                                  |
|           |              |             | Termination Depth at 1.2 m                    |          |                                                                                  |

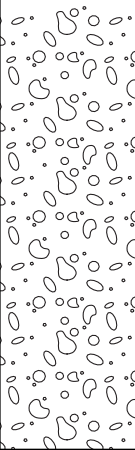
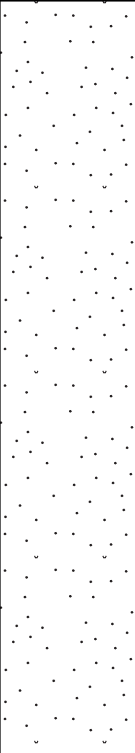
| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |              |             | <b>DATE</b> 06/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 0.8 |               |                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |              |             |                                                                                                                                   |               |                                                           |
| Depth (m)                                                                                                                                                                             | Samples      | Graphic Log | Material Description                                                                                                              | Moisture      | Additional Observations                                   |
|                                                                                                                                                                                       |              |             |                                                                                                                                   | Dry           | Trace plastic                                             |
|                                                                                                                                                                                       | TP12_0.1-0.3 |             | SAND, light brown, fine, trace rootlets                                                                                           |               |                                                           |
| 0.5                                                                                                                                                                                   |              |             | SAND, medium brown                                                                                                                | Slightly Damp | Pieces of plastic, concrete block, ceramic tile fragments |
|                                                                                                                                                                                       | TP12_0.5-0.8 |             |                                                                                                                                   |               |                                                           |
|                                                                                                                                                                                       |              |             | Termination Depth at 0.8 m                                                                                                        |               |                                                           |

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |               |             | <b>DATE</b> 06/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 0.8 |               |                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |               |             |                                                                                                                                   |               |                          |
| Depth (m)                                                                                                                                                                             | Samples       | Graphic Log | Material Description                                                                                                              | Moisture      | Additional Observations  |
|                                                                                                                                                                                       | TP013_0.1-0.3 |             | SAND w. some cobbles, light brown, fine, trace rootlets                                                                           | Slightly Damp | Trace pieces of rootlets |
|                                                                                                                                                                                       |               |             |                                                                                                                                   |               |                          |
| 0.5                                                                                                                                                                                   | TP013_0.5-0.8 |             | Sand w. gravels, medium brown, very fine rootlets                                                                                 | Moist         | Glass, plastic, nails    |
|                                                                                                                                                                                       |               |             | Termination Depth at 0.8 m                                                                                                        |               |                          |

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |              | <b>DATE</b> 06/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 0.8 |                                                  |          |                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------|-----------------------------------------------------------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |              |                                                                                                                                   |                                                  |          |                                                                             |
| Depth (m)                                                                                                                                                                             | Samples      | Graphic Log                                                                                                                       | Material Description                             | Moisture | Additional Observations                                                     |
|                                                                                                                                                                                       |              |                                                 |                                                  | Dry      | Cobbles looked to be river run gravels, pieces of plastic                   |
|                                                                                                                                                                                       | TP14_0.1-0.3 |                                                                                                                                   | SAND w. cobbles, light brown, fine, well graded  |          |                                                                             |
| 0.5                                                                                                                                                                                   |              |                                                | SAND w. gravels, medium brown, fine, well graded |          | Plastic bag/sheets/cables, gardening debris, small pieces of red/clay brick |
|                                                                                                                                                                                       | TP14_0.5-0.8 |                                                                                                                                   |                                                  |          |                                                                             |
|                                                                                                                                                                                       |              |                                                                                                                                   | Termination Depth at 0.8 m                       |          |                                                                             |

| <b>PROJECT NUMBER</b> IA271200                                |              |                                                                                    | <b>DATE</b> 06/04/2022                    |          |                                                                  |
|---------------------------------------------------------------|--------------|------------------------------------------------------------------------------------|-------------------------------------------|----------|------------------------------------------------------------------|
| <b>PROJECT NAME</b> Southshore Bund DSI                       |              |                                                                                    | <b>COMPANY</b> CCL                        |          |                                                                  |
| <b>CLIENT</b> Christchurch City Council                       |              |                                                                                    | <b>LOGGED BY</b> Kate Murray              |          |                                                                  |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary |              |                                                                                    | <b>METHOD</b> Excavator                   |          |                                                                  |
|                                                               |              |                                                                                    | <b>TOTAL DEPTH</b> 0.8                    |          |                                                                  |
| <b>COMMENTS</b>                                               |              |                                                                                    |                                           |          |                                                                  |
| Depth (m)                                                     | Samples      | Graphic Log                                                                        | Material Description                      | Moisture | Additional Observations                                          |
| 0.5                                                           |              |  | Sandy SILT, light brown, fine             | Dry      | Minor black plastic, polystyrene, organic matter 0.1 - 0.3 m bgl |
|                                                               | TP15_0.1-0.3 |                                                                                    |                                           |          |                                                                  |
|                                                               |              |                                                                                    |                                           |          |                                                                  |
|                                                               | TP15_0.5-0.8 |                                                                                    | Silty SAND w. trace gravel, medium brown, | Moist    |                                                                  |
|                                                               |              |                                                                                    | Termination Depth at 0.8 m                |          |                                                                  |

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |              |                                                                                    | <b>DATE</b> 06/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 0.8 |          |                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |              |                                                                                    |                                                                                                                                   |          |                                                                                                              |
| Depth (m)                                                                                                                                                                             | Samples      | Graphic Log                                                                        | Material Description                                                                                                              | Moisture | Additional Observations                                                                                      |
| 0.5                                                                                                                                                                                   |              |  | Sandy SILT w. trace gravels, light brown                                                                                          | Moist    | Minor brick/plastic and white PVC ragments at 0.4 - 0.5 m bgl                                                |
|                                                                                                                                                                                       | TP16_0.1-0.3 |                                                                                    |                                                                                                                                   |          |                                                                                                              |
|                                                                                                                                                                                       |              |                                                                                    |                                                                                                                                   |          |                                                                                                              |
|                                                                                                                                                                                       | TP16_0.5-0.8 |                                                                                    |                                                                                                                                   |          |                                                                                                              |
|                                                                                                                                                                                       |              |                                                                                    | Sandy SILT, brown with dark grey mottling                                                                                         |          | ACM Screen = No ACM<br>10L bucket weight = 17.89 kg<br><br>Glass/metal/brick fragments. Slight PAH fragments |
|                                                                                                                                                                                       |              |                                                                                    | Termination Depth at 0.8 m                                                                                                        |          |                                                                                                              |

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |              |                                                                                     | <b>DATE</b> 06/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 0.8 |          |                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |              |                                                                                     |                                                                                                                                   |          |                                                                                                              |
| Depth (m)                                                                                                                                                                             | Samples      | Graphic Log                                                                         | Material Description                                                                                                              | Moisture | Additional Observations                                                                                      |
|                                                                                                                                                                                       |              |   | Silty SAND, brown, fine, large rocks located at 0.4 m bgl                                                                         | Dry      | Black plastic at 0.4 m bgl, large pavers at 0.6 m bgl<br>ACM Screen = no ACM<br>10L bucket weight = 17.11 kg |
|                                                                                                                                                                                       | TP17_0.1-0.3 |                                                                                     |                                                                                                                                   |          |                                                                                                              |
| 0.5                                                                                                                                                                                   |              |  | SAND, light brown                                                                                                                 |          | Glass/concrete fragments                                                                                     |
|                                                                                                                                                                                       | TP17_0.5-0.8 |                                                                                     |                                                                                                                                   |          |                                                                                                              |
|                                                                                                                                                                                       |              |                                                                                     | Termination Depth at 0.8 m                                                                                                        |          |                                                                                                              |

|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 06/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.8       |

### COMMENTS

| Depth (m) | Samples      | Graphic Log | Material Description                        | Moisture      | Additional Observations                             |
|-----------|--------------|-------------|---------------------------------------------|---------------|-----------------------------------------------------|
|           |              |             | Sandy SILT, brown, organic material present | Slightly damp | Minor black plastic fragments, organic matter       |
|           | TP18_0.1-0.3 |             |                                             |               |                                                     |
|           |              |             |                                             |               | Pieces of charcoal, white plastic, metal wire, wood |
| 0.5       | TP18_0.5-0.8 |             |                                             |               |                                                     |
|           |              |             | Termination Depth at 0.8 m                  |               |                                                     |

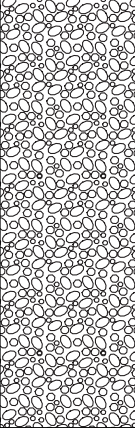
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| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.8       |

### COMMENTS

| Depth (m) | Samples      | Graphic Log | Material Description                            | Moisture | Additional Observations                                            |
|-----------|--------------|-------------|-------------------------------------------------|----------|--------------------------------------------------------------------|
|           |              |             | Sandy SILT, brown, organic matter, clay pockets | Moist    | Minor black plastic, brick and glass fragments                     |
|           | TP19_0.1-0.3 |             |                                                 |          |                                                                    |
|           |              |             | Silty SAND, light brown                         |          |                                                                    |
| 0.5       | TP19_0.5-0.8 |             |                                                 |          |                                                                    |
|           |              |             |                                                 |          | Plaster Fragments, small bricks, rocks and pavers. Glass fragments |
|           |              |             | Termination Depth at 0.8 m                      |          |                                                                    |

|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 1.0       |

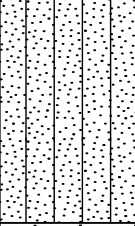
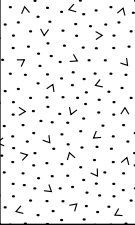
### COMMENTS

| Depth (m) | Samples      | Graphic Log                                                                         | Material Description                             | Moisture | Additional Observations |
|-----------|--------------|-------------------------------------------------------------------------------------|--------------------------------------------------|----------|-------------------------|
|           |              |   |                                                  | Dry      | No odour or staining.   |
|           | TP20_0.1-0.3 |                                                                                     | GRAVELS with asphalt and trace sand, well graded |          |                         |
| 0.5       |              |  | SAND with gravels, chip stone present            |          |                         |
|           | TP21_0.5-0.8 |                                                                                     |                                                  |          |                         |
| 1         |              |                                                                                     | Termination Depth at 1.0 m                       |          |                         |

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |              |             | <b>DATE</b> 07/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 1.1 |          |                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |              |             |                                                                                                                                   |          |                         |
| Depth (m)                                                                                                                                                                             | Samples      | Graphic Log | Material Description                                                                                                              | Moisture | Additional Observations |
| 0.5                                                                                                                                                                                   | TP21_0.1-0.3 |             | GRAVELS/COBBLES with trace silty sand, medium brown, well graded                                                                  | Moist    | No odour or staining.   |
|                                                                                                                                                                                       | TP21_0.5-0.8 |             | SAND with gravels/cobbles, brown, fine                                                                                            |          |                         |
| 1                                                                                                                                                                                     |              |             |                                                                                                                                   |          |                         |
|                                                                                                                                                                                       |              |             | Termination Depth at 1.1 m                                                                                                        |          |                         |

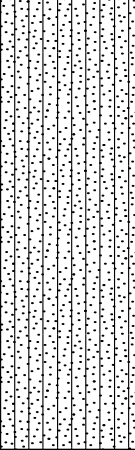
|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.3       |

### COMMENTS

| Depth (m) | Samples       | Graphic Log                                                                        | Material Description                    | Moisture | Additional Observations |
|-----------|---------------|------------------------------------------------------------------------------------|-----------------------------------------|----------|-------------------------|
|           |               |   | SILT, dark brown, rootlets              | Dry      | No odour or staining.   |
|           | SS-01_0.1-0.3 |  | REFUSAL - mixture of rocks and concrete |          |                         |
| 0.5       |               |                                                                                    | Termination Depth at 0.15 m             |          |                         |

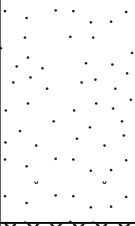
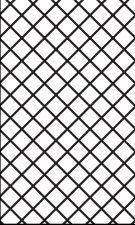
|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.3       |

### COMMENTS

| Depth (m) | Samples       | Graphic Log                                                                        | Material Description              | Moisture | Additional Observations                           |
|-----------|---------------|------------------------------------------------------------------------------------|-----------------------------------|----------|---------------------------------------------------|
|           | SS-02_0.1-0.3 |  | SILT, dark brown, dense, rootlets | Moist    | No odour, staining or visible signs of ACM/debris |
| 0.5       |               |                                                                                    | Termination Depth at 0.3 m        |          |                                                   |

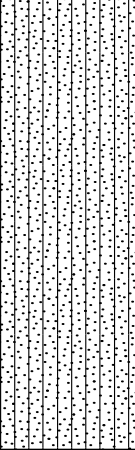
|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.3       |

### COMMENTS

| Depth (m) | Samples       | Graphic Log                                                                        | Material Description                    | Moisture | Additional Observations                   |
|-----------|---------------|------------------------------------------------------------------------------------|-----------------------------------------|----------|-------------------------------------------|
|           |               |   | SAND, dark brown, fine                  | Moist    | Plastic pieces, red clay, brick fragments |
|           | SS-03_0.1-0.3 |                                                                                    |                                         |          |                                           |
|           |               |  | REFUSAL - Fill, red bricks and concrete |          |                                           |
| 0.5       |               |                                                                                    | Termination Depth at 0.3 m              |          |                                           |

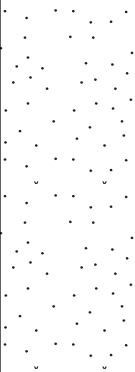
|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.3       |

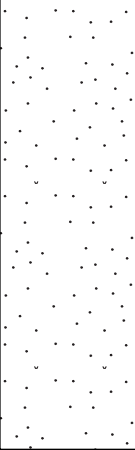
### COMMENTS

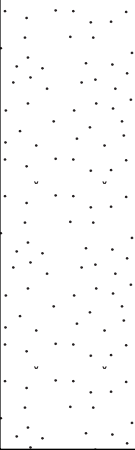
| Depth (m) | Samples       | Graphic Log                                                                        | Material Description                                  | Moisture | Additional Observations                           |
|-----------|---------------|------------------------------------------------------------------------------------|-------------------------------------------------------|----------|---------------------------------------------------|
|           | SS-04_0.1-0.3 |  | SILT with trace cobbles, light brown, orange mottling | Moist    | No odour, staining or visible signs of ACM/debris |
| 0.5       |               |                                                                                    | Termination Depth at 0.3 m                            |          |                                                   |

|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.3       |

### COMMENTS

| Depth (m) | Samples       | Graphic Log                                                                         | Material Description          | Moisture | Additional Observations        |
|-----------|---------------|-------------------------------------------------------------------------------------|-------------------------------|----------|--------------------------------|
|           | SS-05_0.1-0.3 |   | SAND, dark brown              | Dry      | Red brick fragments throughout |
|           |               |  | REFUSAL - Bricks and concrete |          |                                |
| 0.5       |               |                                                                                     | Termination Depth at 0.3 m    |          |                                |

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |               |                                                                                    | <b>DATE</b> 07/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 0.3 |          |                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------|---------------------------------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |               |                                                                                    |                                                                                                                                   |          |                                                   |
| Depth (m)                                                                                                                                                                             | Samples       | Graphic Log                                                                        | Material Description                                                                                                              | Moisture | Additional Observations                           |
|                                                                                                                                                                                       | SS-06_0.1-0.3 |  | SAND, dark brown                                                                                                                  | Wet      | No odour, staining or visible signs of ACM/debris |
| 0.5                                                                                                                                                                                   |               |                                                                                    | Termination Depth at 0.3 m                                                                                                        |          |                                                   |

| <b>PROJECT NUMBER</b> IA271200<br><b>PROJECT NAME</b> Southshore Bund DSI<br><b>CLIENT</b> Christchurch City Council<br><b>ADDRESS</b> South New Brighton Park and Southshore Estuary |               |                                                                                    | <b>DATE</b> 07/04/2022<br><b>COMPANY</b> CCL<br><b>LOGGED BY</b> Kate Murray<br><b>METHOD</b> Excavator<br><b>TOTAL DEPTH</b> 0.3 |          |                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------|
| <b>COMMENTS</b>                                                                                                                                                                       |               |                                                                                    |                                                                                                                                   |          |                                                                 |
| Depth (m)                                                                                                                                                                             | Samples       | Graphic Log                                                                        | Material Description                                                                                                              | Moisture | Additional Observations                                         |
|                                                                                                                                                                                       | SS-07_0.1-0.3 |  | SAND, brown, fine                                                                                                                 | Wet      | Several suspected pieces of ACM within 1m of sample on surface. |
| 0.5                                                                                                                                                                                   |               |                                                                                    | Termination Depth at 0.3 m                                                                                                        |          |                                                                 |

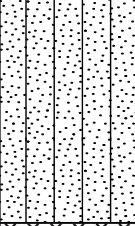
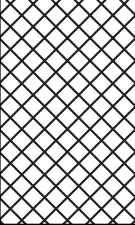
|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.3       |

### COMMENTS

| Depth (m) | Samples       | Graphic Log                                                                        | Material Description       | Moisture | Additional Observations                                          |
|-----------|---------------|------------------------------------------------------------------------------------|----------------------------|----------|------------------------------------------------------------------|
|           |               |  | SILT, light yellow/brown   | Dry      | Large amount of debris on surface in vicinity of sample location |
|           | SS-08_0.1-0.3 |                                                                                    | SAND, brown                |          |                                                                  |
| 0.5       |               |                                                                                    | Termination Depth at 0.3 m |          |                                                                  |

|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.3       |

### COMMENTS

| Depth (m) | Samples       | Graphic Log                                                                        | Material Description          | Moisture | Additional Observations |
|-----------|---------------|------------------------------------------------------------------------------------|-------------------------------|----------|-------------------------|
|           |               |   | Silty SAND, brown, rootlets   | Moist    | Red bricks throughout   |
|           | SS-09_0.1-0.3 |                                                                                    |                               |          |                         |
|           |               |  | REFUSAL - bricks and boulders |          |                         |
| 0.5       |               |                                                                                    | Termination Depth at 0.3 m    |          |                         |

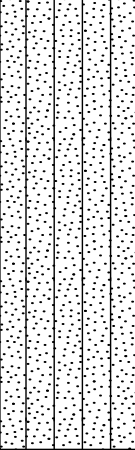
|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.3       |

### COMMENTS

| Depth (m) | Samples       | Graphic Log | Material Description         | Moisture | Additional Observations            |
|-----------|---------------|-------------|------------------------------|----------|------------------------------------|
|           |               |             | SAND, brown                  | Moist    | Large amounts of rubble and debris |
|           | SS-10_0.1-0.3 |             |                              |          |                                    |
|           |               |             | REFUSAL - rubble and rubbish |          |                                    |
| 0.5       |               |             | Termination Depth at 0.3 m   |          |                                    |

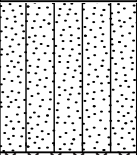
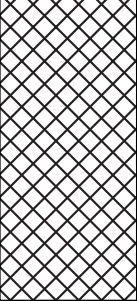
|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.3       |

### COMMENTS

| Depth (m) | Samples       | Graphic Log                                                                        | Material Description       | Moisture | Additional Observations                           |
|-----------|---------------|------------------------------------------------------------------------------------|----------------------------|----------|---------------------------------------------------|
|           | SS-11_0.1-0.3 |  | Sandy SILT, dark brown     | Dry      | No odour, staining or visible signs of ACM/debris |
| 0.5       |               |                                                                                    | Termination Depth at 0.3 m |          |                                                   |

|                                                               |                              |
|---------------------------------------------------------------|------------------------------|
| <b>PROJECT NUMBER</b> IA271200                                | <b>DATE</b> 07/04/2022       |
| <b>PROJECT NAME</b> Southshore Bund DSI                       | <b>COMPANY</b> CCL           |
| <b>CLIENT</b> Christchurch City Council                       | <b>LOGGED BY</b> Kate Murray |
| <b>ADDRESS</b> South New Brighton Park and Southshore Estuary | <b>METHOD</b> Excavator      |
|                                                               | <b>TOTAL DEPTH</b> 0.3       |

### COMMENTS

| Depth (m) | Samples       | Graphic Log                                                                        | Material Description            | Moisture | Additional Observations                           |
|-----------|---------------|------------------------------------------------------------------------------------|---------------------------------|----------|---------------------------------------------------|
|           |               |   | Silty SAND, dark brown          | Moist    | No odour, staining or visible signs of ACM/debris |
|           | SS-12_0.1-0.3 |  | REFUSAL - roots and wood debris |          |                                                   |
| 0.5       |               |                                                                                    | Termination Depth at 0.3 m      |          |                                                   |

## **Appendix F. Chain of Custody**



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819

Primary Contact Hannah Wood 284857

Submitted By Hannah Wood 284857

Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

Email

Charge To Jacobs New Zealand Limited 31905

Client Reference Southshore Bund

Additional Client Ref

Order No

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

- ☐ Email Primary Contact ☐ Email Submitter ☐ Email Client
- ☐ Email Other Kate.Murray@jacobs.com
- ☐ Other

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

## ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 1 of 8 (3chilli bins)

## Quoted Sample Types

Soil

| No. | Sample Name   | Sample Date/Time | Sample Type | Tests Required |
|-----|---------------|------------------|-------------|----------------|
| 1   | TP-01_0.1-0.3 | 07/04/22 11h50   | Soil        | Asb; metals    |
| 2   | TP-02_0.1-0.3 | 07/04/22 11h25   | Soil        | Asbestos       |
| 3   | TP-03_0.1-0.3 | 07/04/22 10h45   | Soil        | Asb; metals    |
| 4   | TP-04_0.1-0.3 | 07/04/22 10h10   | Soil        | Asbestos       |
| 5   | TP-05_0.1-0.3 | 07/04/22 09h45   | Soil        | Asb; metals    |
| 6   | TP-06_0.1-0.3 | 07/04/22 09h15   | Soil        | Asbestos       |
| 7   | TP-07_0.1-0.3 | 07/04/22         | Soil        | Asb; metals    |
| 8   | TP-08_0.1-0.3 | 06/04/22         | Soil        | Asbestos       |

## ANALYSIS REQUEST

Job No:

Date Recv: 09-Apr-22 08:14

295 1007

Received by: Sophie Bain



3129510077

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

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

## CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories Date & Time: 08/04/22

☐ Tick if you require COC to be emailed back

Name: K. Murray

Signature: [Signature]

Received at Hill Laboratories Date & Time:

Name:

Signature:

Condition Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

14.4

☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:

# Hill Laboratories

TRIED, TESTED AND TRUSTED

## ANALYSIS REQUEST

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

Office use only  
(Job No)

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

Quote No 116819  
Primary Contact Hannah Wood 284857  
Submitted By Hannah Wood 284857  
Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

Email

Charge To Jacobs New Zealand Limited 31905

Client Reference Southshore Bund

Additional Client Ref

Order No

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

☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

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

### ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 2 of 8

### CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories Date & Time:

Name:

☐ Tick if you require COC to be emailed back Signature:

Received at Hill Laboratories Date & Time:

Name:

Signature:

Condition Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:

### Quoted Sample Types

| No. | Sample Name  | Sample Date/Time | Sample Type | Tests Required |
|-----|--------------|------------------|-------------|----------------|
| 1   | TP-09_01-0.3 | 06/04/22 16h10   | Soil        | Asb ; Metals   |
| 2   | TP-10_01-0.3 | 06/04/22 15h50   | Soil        | Asbestos       |
| 3   | TP-11_01-0.3 | 06/04/22 15h30   | Soil        | Asb ; Metals   |
| 4   | TP-12_01-0.3 | 06/04/22 15h30   | Soil        | Asb ; Metals   |
| 5   | TP-13_01-0.3 | 06/04/22 14h30   | Soil        | Asb ; Metals   |
| 6   | TP-14_01-0.3 | 06/04/22 14h00   | Soil        | Asbestos       |
| 7   | TP-15_01-0.3 | 06/04/22 11h36   | Soil        | Asb ; Metals   |
| 8   | TP-16_01-0.3 | 06/04/22 11h06   | Soil        | Asbestos       |



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819

Primary Contact Hannah Wood 284857

Submitted By Hannah Wood 284857

Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

Email

Charge To Jacobs New Zealand Limited 31905

Client Reference Southshore Bund

Additional Client Ref

Order No

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

☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

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

## ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 3 of 8

## Quoted Sample Types

| No. | Sample Name  | Sample Date/Time | Sample Type | Tests Required    |
|-----|--------------|------------------|-------------|-------------------|
| 1   | TP-17-01-0.3 | 06/04/22 10h25   | Soil        | Asb } Metals      |
| 2   | TP-18-01-0.3 | 06/04/22 12h43   | Soil        | Asbestos          |
| 3   | TP-19-01-0.3 | 06/04/22 12h20   | Soil        | Asbestos } Metals |
| 4   | TP-20-01-0.3 | 07/04/22 12h20   | Soil        | Asbestos } Metals |
| 5   | TP-21-01-0.3 | 07/04/22         | Soil        | Asbestos          |
| 6   | SS-01-01-0.3 | 07/04/22 13h24   | Soil        | Asbestos          |
| 7   | SS-02-01-0.3 | 07/04/22 13h50   | Soil        | Asbestos          |
| 8   | SS-03-01-0.3 | 07/04/22 14h05   | Soil        | Asbestos          |

## ANALYSIS REQUEST

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

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

Office use only  
(Job No)

## CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories Date & Time:

Name:  
☐ Tick if you require COC to be emailed back Signature:

Received at Hill Laboratories Date & Time:

Name:  
Signature:

Condition Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

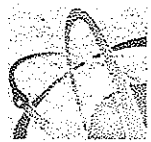
☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819

Primary Contact Hannah Wood 284857

Submitted By Hannah Wood 284857

Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

Email

Charge To Jacobs New Zealand Limited 31905

Client Reference Southshore Bund

Additional Client Ref

Order No

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

☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

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

## ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 4 of 8

## Quoted Sample Types

| No. | Sample Name | Sample Date/Time | Sample Type | Tests Required |
|-----|-------------|------------------|-------------|----------------|
| 1   | SS-04_01-03 | 07/04/22 14h30   | Soil        | Asbestos       |
| 2   | SS-05_01-03 | 07/04/22 14h44   | Soil        | Asbestos       |
| 3   | SS-06_01-03 | 07/04/22 15h00   | Soil        | Asbestos       |
| 4   | SS-07_01-03 | 07/04/22 15h10   | Soil        | Asbestos       |
| 5   | SS-08_01-03 | 07/04/22 15h30   | Soil        | Asbestos       |
| 6   | SS-09_01-03 | 07/04/22 15h41   | Soil        | Asbestos       |
| 7   | SS-10_01-03 | 07/04/22 15h55   | Soil        | Asbestos       |
| 8   | SS-11_01-03 | 07/04/22 16h05   | Soil        | Asbestos       |

## ANALYSIS REQUEST

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28 Duke Street Hamilton 3204  
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E mail@hill-labs.co.nz  
W www.hill-laboratories.com

Office use only  
(Job No)

## CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories Date & Time:

☐ Tick if you require COC to be emailed back Name: Signature:

Received at Hill Laboratories Date & Time:

Name: Signature:

Condition Room Temp ☐ Chilled ☐ Frozen Temp:

☐ Sample & Analysis details checked Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819  
Primary Contact Hannah Wood 284857  
Submitted By Hannah Wood 284857  
Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

Email

Charge To Jacobs New Zealand Limited 31905

Client Reference Southshore Bund

Additional Client Ref

Order No

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

☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

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

## ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 5 of 8

## Quoted Sample Types

| No. | Sample Name   | Sample Date/Time | Sample Type | Tests Required   |
|-----|---------------|------------------|-------------|------------------|
| 1   | SS-12-0.1-0.5 | 07/04/22 16h20   | Soil        | Asbestos         |
| 2   | QC1           | 06/04/22 16h20   | Soil        | Metals           |
| 3   | QC2           | 06/04/22 19h30   | Soil        | Metals           |
| 4   | QC3           | 06/04/22 16h10   | Soil        | Metals           |
| 5   | QC4           | 07/04/22 09h45   | Soil        | Metals           |
| 6   | QC5           | 07/04/22 12h40   | Soil        | Metals           |
| 7   | TP-01-0.5-0.8 | 07/04/22 11h55   | Soil        | Asbestos; Metals |
| 8   | TP-02-0.5-0.8 | 07/04/22 11h25   | Soil        | Asbestos         |

## ANALYSIS REQUEST

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

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

Office use only  
(Job No)

## CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories Date & Time:

Name:

☐ Tick if you require COC to be emailed back

Signature:

Received at Hill Laboratories Date & Time:

Name:

Signature:

Condition Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819

Primary Contact Hannah Wood 284857

Submitted By Hannah Wood 284857

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Address PO Box 1147  
Christchurch 8140, New Zealand

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Page 6 of 8

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☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:

Quoted Sample Types

| No. | Sample Name   | Sample Date/Time          | Sample Type | Tests Required    |
|-----|---------------|---------------------------|-------------|-------------------|
| 1   | TP-03_0.5-0.8 | 07/04/22 <sup>16h45</sup> | Soil        | Asbestos, Metals  |
| 2   | TP-04_0.5-0.8 | 07/04/22 <sup>16h10</sup> | Soil        | Asbestos & Metals |
| 3   | TP-05_0.5-0.8 | 07/04/22 <sup>09h45</sup> | Soil        | Asb, Metals       |
| 4   | TP-06_0.5-0.8 | 07/04/22 <sup>09h15</sup> | Soil        | Asbestos & Metals |
| 5   | TP-07_0.5-0.8 | 07/04/22 <sup>05h45</sup> | Soil        | Asbestos, Metals  |
| 6   | TP-08_0.5-0.8 | 06/04/22 <sup>16h45</sup> | Soil        | Asbestos & Metals |
| 7   | TP-09_0.5-0.8 | 06/04/22 <sup>16h10</sup> | Soil        | Asbestos, Metals  |
| 8   | TP-10_0.5-0.8 | 06/04/22 <sup>15h50</sup> | Soil        | Asbestos & Metals |



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## ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 7 of 8

## Quoted Sample Types

| No. | Sample Name   | Sample Date/Time | Sample Type | Tests Required     |
|-----|---------------|------------------|-------------|--------------------|
| 1   | TP-11_0.5-0.8 | 06/04/22 15h30   | Soil        | Asbestos ; Metals  |
| 2   | TP-12_0.5-0.8 | 06/04/22 13h00   | Soil        | Asbestos ; Metals  |
| 3   | TP-13_0.5-0.8 | 06/04/22 14h50   | Soil        | Asb ; Metals       |
| 4   | TP-14_0.5-0.8 | 06/04/22 14h00   | Soil        | Asbestos ; Metals  |
| 5   | TP-15_0.5-0.8 | 06/04/22 11h36   | Soil        | Asb ; Metals       |
| 6   | TP-16_0.5-0.8 | 06/04/22         | Soil        | Asb ; Metals ; PAH |
| 7   | TP-17_0.5-0.8 | 06/04/22 10h31   | Soil        | Asb ; Metals       |
| 8   | TP-18_0.5-0.8 | 06/04/22 12h49   | Soil        | Asbestos ; Metals  |

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Hill Laboratories

Date & Time:

Name:

Signature:

Condition

Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked

Signature:

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

Requested Reporting Date:



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## ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 8 of 8

## CHAIN OF CUSTODY RECORD

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Received at Hill Laboratories Date & Time:

Name: Signature:

Condition Temp:  
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☐ Sample & Analysis details checked  
Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:

## Quoted Sample Types

| No. | Sample Name   | Sample Date/Time | Sample Type        | Tests Required            |
|-----|---------------|------------------|--------------------|---------------------------|
| 1   | TP-19_0.5-0.8 | 07/04/22 12h20   | Soil               | Ash ; Metals              |
| 2   | TP-20_0.5-0.8 | 07/04/22 12h50   | Soil               | Asbestos ; Metals         |
| 3   | TP-21_0.5-0.8 | 07/04/22 12h35   | Soil               | Asbestos                  |
| 4   | SACM-55-07    | 07/04/22         | Building materials | Asbestos presence/absence |
| 5   |               |                  |                    |                           |
| 6   |               |                  |                    |                           |
| 7   |               |                  |                    |                           |
| 8   |               |                  |                    |                           |



## Job Information Summary

Page 1 of 3

|                 |                                |                          |                            |
|-----------------|--------------------------------|--------------------------|----------------------------|
| <b>Client:</b>  | Jacobs New Zealand Limited     | <b>Lab No:</b>           | 2951007                    |
| <b>Contact:</b> | Hannah Wood                    | <b>Date Registered:</b>  | 09-Apr-2022 11:09 am       |
|                 | C/- Jacobs New Zealand Limited | <b>Priority:</b>         | High                       |
|                 | PO Box 1147                    | <b>Quote No:</b>         | 116819                     |
|                 | Christchurch 8140              | <b>Order No:</b>         | required                   |
|                 |                                | <b>Client Reference:</b> | Southshore Bund            |
|                 |                                | <b>Add. Client Ref:</b>  |                            |
|                 |                                | <b>Submitted By:</b>     | Hannah Wood                |
|                 |                                | <b>Charge To:</b>        | Jacobs New Zealand Limited |
|                 |                                | <b>Target Date:</b>      | 13-Apr-2022 4:30 pm        |

| Samples |                                    |             |             |                                                           |  |
|---------|------------------------------------|-------------|-------------|-----------------------------------------------------------|--|
| No      | Sample Name                        | Sample Type | Containers  | Tests Requested                                           |  |
| 1       | TP-01_0.1-0.3 07-Apr-2022 11:50 am | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 2       | TP-02_0.1-0.3 07-Apr-2022 11:25 am | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 3       | TP-03_0.1-0.3 07-Apr-2022 10:45 am | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 4       | TP-04_0.1-0.3 07-Apr-2022 10:10 am | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 5       | TP-05_0.1-0.3 07-Apr-2022 9:45 am  | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 6       | TP-06_0.1-0.3 07-Apr-2022 9:15 am  | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 7       | TP-07_0.1-0.3 07-Apr-2022          | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 8       | TP-08_0.1-0.3 06-Apr-2022          | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 9       | TP-09_0.1-0.3 06-Apr-2022 4:10 pm  | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 10      | TP-10_0.1-0.3 06-Apr-2022 3:50 pm  | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 11      | TP-11_0.1-0.3 06-Apr-2022 3:30 pm  | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 12      | TP-12_0.1-0.3 06-Apr-2022 3:30 pm  | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 13      | TP-13_0.1-0.3 06-Apr-2022 2:30 pm  | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 14      | TP-14_0.1-0.3 06-Apr-2022 2:00 pm  | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 15      | TP-15_0.1-0.3 06-Apr-2022 11:36 am | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 16      | TP-16_0.1-0.3 06-Apr-2022 11:06 am | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 17      | TP-17_0.1-0.3 06-Apr-2022 10:25 am | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 18      | TP-18_0.1-0.3 06-Apr-2022 12:49 pm | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 19      | TP-19_0.1-0.3 06-Apr-2022 12:20 pm | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 20      | TP-20_0.1-0.3 07-Apr-2022 12:20 pm | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 21      | TP-21_0.1-0.3 07-Apr-2022          | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |
| 22      | SS-01_0.1-0.3 07-Apr-2022 1:24 pm  | Soil        | PSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |  |

| Samples |                                    |             |              |                                                           |
|---------|------------------------------------|-------------|--------------|-----------------------------------------------------------|
| No      | Sample Name                        | Sample Type | Containers   | Tests Requested                                           |
| 23      | SS-02_0.1-0.3 07-Apr-2022 1:50 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 24      | SS-03_0.1-0.3 07-Apr-2022 2:05 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 25      | SS-04_0.1-0.3 07-Apr-2022 2:30 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 26      | SS-05_0.1-0.3 07-Apr-2022 2:44 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 27      | SS-06_0.1-0.3 07-Apr-2022 3:00 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 28      | SS-07_0.1-0.3 07-Apr-2022 3:10 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 29      | SS-08_0.1-0.3 07-Apr-2022 3:30 pm  | Soil        | cPSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 30      | SS-09_0.1-0.3 07-Apr-2022 3:41 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 31      | SS-10_0.1-0.3 07-Apr-2022 3:58 pm  | Soil        | cPSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 32      | SS-11_0.1-0.3 07-Apr-2022 4:05 pm  | Soil        | cPSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 33      | SS-12_0.1-0.3 07-Apr-2022 4:20 pm  | Soil        | cPSoil500Asb | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 34      | TP-01_0.5-0.8 07-Apr-2022 11:55 am | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 35      | TP-02_0.5-0.8 07-Apr-2022 11:25 am | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 36      | TP-03_0.5-0.8 07-Apr-2022 10:45 am | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 37      | TP-04_0.5-0.8 07-Apr-2022 10:10 am | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 38      | TP-05_0.5-0.8 07-Apr-2022 9:45 am  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 39      | TP-06_0.5-0.8 07-Apr-2022 9:15 am  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 40      | TP-07_0.5-0.8 07-Apr-2022 8:45 am  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 41      | TP-08_0.5-0.8 06-Apr-2022 4:45 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 42      | TP-09_0.5-0.8 06-Apr-2022 4:10 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 43      | TP-10_0.5-0.8 06-Apr-2022 3:50 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 44      | TP-11_0.5-0.8 06-Apr-2022 3:30 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 45      | TP-12_0.5-0.8 06-Apr-2022 1:00 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 46      | TP-13_0.5-0.8 06-Apr-2022 2:30 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 47      | TP-14_0.5-0.8 06-Apr-2022 2:00 pm  | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 48      | TP-15_0.5-0.8 06-Apr-2022 11:36 am | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 49      | TP-16_0.5-0.8 06-Apr-2022          | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 50      | TP-17_0.5-0.8 06-Apr-2022 10:31 am | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 51      | TP-18_0.5-0.8 06-Apr-2022 12:49 pm | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 52      | TP-19_0.5-0.8 06-Apr-2022 12:20 pm | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 53      | TP-20_0.5-0.8 07-Apr-2022 12:50 pm | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |
| 54      | TP-21_0.5-0.8 07-Apr-2022 12:35 pm | Soil        | PSoil500Asb  | New Zealand Guidelines Semi Quantitative Asbestos in Soil |

## Samples

| No | Sample Name | Sample Type | Containers | Tests 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                                                |                                                                                                                                                                                                                                                                                                         |                         |           |
| Weight of Asbestos as Asbestos Fines in <10mm >2mm Fraction     | Measurement on analytical balance, from the <10mm >2mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.                                                                                                                                                            | 0.00001 g dry wt        | 1-54      |
| 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                   | 1-54      |
| Dry Weight                                                      | Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.                                                                                                                                                                       | 0.1 g                   | 1-54      |
| Moisture                                                        | Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.                                                                                                                                                                                               | 1 %                     | 1-54      |
| 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            | 1-54      |
| 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            | 1-54      |
| 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            | 1-54      |
| <b>Asbestos Presence / Absence</b>                              | 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%                   | 1-54      |
| Description of Asbestos Form                                    | Description of asbestos form and/or shape if present.                                                                                                                                                                                                                                                   | -                       | 1-54      |
| 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        | 1-54      |
| 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             | 1-54      |
| 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        | 1-54      |
| 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             | 1-54      |
| 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        | 1-54      |
| 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             | 1-54      |
| 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             | 1-54      |



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819  
Primary Contact Hannah Wood 284857  
Submitted By Hannah Wood 284857  
Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
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Client Reference Southshore Bund

Additional Client Ref

Order No

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☐ Email Other

☐ Other

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## ADDITIONAL INFORMATION / KNOWN DETAILS

Page 6 of 8

## Quoted Sample Types

|  |
|--|
|  |
|--|

| No. | Sample Name   | Sample Date/Time | Sample Type | Tests Required   |
|-----|---------------|------------------|-------------|------------------|
| 1   | TP-03_0.5-0.8 | 07/04/22 10h45   | Soil        | Asbestos; Metals |
| 2   | TP-04_0.5-0.8 | 07/04/22 10h10   | Soil        | Asbestos; Metals |
| 3   | TP-05_0.5-0.8 | 07/04/22 09h45   | Soil        | Asb; Metals      |
| 4   | TP-06_0.5-0.8 | 07/04/22 09h15   | Soil        | Asbestos; Metals |
| 5   | TP-07_0.5-0.8 | 07/04/22 09h45   | Soil        | Asbestos; Metals |
| 6   | TP-08_0.5-0.8 | 06/04/22 16h45   | Soil        | Asbestos; Metals |
| 7   | TP-09_0.5-0.8 | 06/04/22 16h10   | Soil        | Asbestos; Metals |
| 8   | TP-10_0.5-0.8 | 06/04/22 15h50   | Soil        | Asbestos; Metals |

## ANALYSIS REQUEST

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

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

Office use only  
(Job No)

## CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories Date & Time:

Name:

☐ Tick if you require COC to be emailed back Signature:

Received at Hill Laboratories Date & Time:

Name:

Signature:

Condition Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:

# Hill Laboratories

TRIED, TESTED AND TRUSTED

ote No 116819

mary Contact Hannah Wood 284857

mitted By Hannah Wood 284857

ent Name Jacobs New Zealand Limited 31905

dress PO Box 1147

Christchurch 8140, New Zealand

one 03 940 4900 Mobile

mail

arge To Jacobs New Zealand Limited 31905

ient Reference Southshore Bund

ditional Client Ref

order No

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

☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

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

ADDITIONAL INFORMATION / COMMENTS

Page 7 of 8

## Quoted Sample Types

| No. | Sample Name   | Sample Date/Time | Sample Type | Tests Required     |
|-----|---------------|------------------|-------------|--------------------|
| 1   | TP-11_0.5-0.8 | 06/04/22 15h30   | Soil        | Asbestos & Metals  |
| 2   | TP-12_0.5-0.8 | 06/04/22 13h00   | Soil        | Asbestos & Metals  |
| 3   | TP-13_0.5-0.8 | 06/04/22 14h30   | Soil        | Asb & Metals       |
| 4   | TP-14_0.5-0.8 | 06/04/22 14h00   | Soil        | Asbestos & Metals  |
| 5   | TP-15_0.5-0.8 | 06/04/22 11h30   | Soil        | Asb & Metals       |
| 6   | TP-16_0.5-0.8 | 06/04/22         | Soil        | Asb & Metals & PAH |
| 7   | TP-17_0.5-0.8 | 06/04/22 10h31   | Soil        | Asb & Metals       |
| 8   | TP-18_0.5-0.8 | 06/04/22 12h49   | Soil        | Asbestos & Metals  |

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Office use only  
(Job No)

|                                                                                                     |       |              |
|-----------------------------------------------------------------------------------------------------|-------|--------------|
| Sent to<br>Hill Laboratories                                                                        |       | Date & Time: |
| <input type="checkbox"/> Tick if you require COC to be emailed back                                 |       | Name:        |
|                                                                                                     |       | Signature:   |
| Received at<br>Hill Laboratories                                                                    |       | Date & Time: |
|                                                                                                     |       | Name:        |
|                                                                                                     |       | Signature:   |
| Condition                                                                                           | Temp: |              |
| <input type="checkbox"/> Room Temp <input type="checkbox"/> Chilled <input type="checkbox"/> Frozen |       |              |
| <input type="checkbox"/> Sample & Analysis details checked                                          |       |              |
| Signature:                                                                                          |       |              |

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:

Quote No 116819

Primary Contact Hannah Wood 284857

Submitted By Hannah Wood 284857

Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

Email

Charge To Jacobs New Zealand Limited 31905

Client Reference Southshore Bund

Additional Client Ref

Order No

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

☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

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E mail@hill-labs.co.nz  
W www.hill-laboratories.com

Office use only  
(Job No)

## CHAINED CUSTODY RECORD

Sent to Hill Laboratories Date & Time:

Name:

☐ Tick if you require COC to be emailed back Signature:

Received at Hill Laboratories Date & Time:

Name:

Signature:

Condition Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:

ADDITIONAL INFORMATION / COMMENTS

Page 8 of 8

## Quoted Sample Types

| No. | Sample Name   | Sample Date/Time | Sample Type        | Tests Required            |
|-----|---------------|------------------|--------------------|---------------------------|
| 1   | TP-19_0.5-0.8 | 07/04/22 12h20   | Soil               | Ash ; Metals              |
| 2   | TP-20_0.5-0.8 | 07/04/22 12h50   | Soil               | Asbestos ; Metals         |
| 3   | TP-21_0.5-0.8 | 07/04/22 12h35   | Soil               | Asbestos                  |
| 4   | SALM-55-07    | 07/04/22         | Building materials | Asbestos presence/absence |
| 5   |               |                  |                    |                           |
| 6   |               |                  |                    |                           |
| 7   |               |                  |                    |                           |
| 8   |               |                  |                    |                           |



## Job Information Summary

Page 1 of 2

|                 |                                |                          |                            |
|-----------------|--------------------------------|--------------------------|----------------------------|
| <b>Client:</b>  | Jacobs New Zealand Limited     | <b>Lab No:</b>           | 2951225                    |
| <b>Contact:</b> | Hannah Wood                    | <b>Date Registered:</b>  | 12-Apr-2022 10:51 am       |
|                 | C/- Jacobs New Zealand Limited | <b>Priority:</b>         | High                       |
|                 | PO Box 1147                    | <b>Quote No:</b>         | 116819                     |
|                 | Christchurch 8140              | <b>Order No:</b>         | Required                   |
|                 |                                | <b>Client Reference:</b> | Southshore Bund            |
|                 |                                | <b>Add. Client Ref:</b>  |                            |
|                 |                                | <b>Submitted By:</b>     | Kate Murray                |
|                 |                                | <b>Charge To:</b>        | Jacobs New Zealand Limited |
|                 |                                | <b>Target Date:</b>      | 20-Apr-2022 4:30 pm        |

| Samples |                                    |             |            |                            |
|---------|------------------------------------|-------------|------------|----------------------------|
| No      | Sample Name                        | Sample Type | Containers | Tests Requested            |
| 1       | TP-01_0.1-0.3 07-Apr-2022 11:50 am | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 2       | TP-03_0.1-0.3 07-Apr-2022 10:45 am | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 3       | TP-05_0.1-0.3 07-Apr-2022 9:45 am  | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 4       | TP-07_0.1-0.3 07-Apr-2022          | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 5       | TP-09_0.1-0.3 06-Apr-2022 4:10 pm  | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 6       | TP-11_0.1-0.3 06-Apr-2022 3:30 pm  | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 7       | TP-13_0.1-0.3 06-Apr-2022 2:00 pm  | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 8       | TP-15_0.1-0.3 06-Apr-2022 11:50 am | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 9       | TP-17_0.1-0.3 06-Apr-2022 10:25 am | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 10      | TP-19_0.1-0.3 06-Apr-2022 12:20 pm | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 11      | TP-20_0.1-0.3 07-Apr-2022 12:20 pm | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 12      | QC1 06-Apr-2022 12:20 pm           | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 13      | QC2 06-Apr-2022 2:30 pm            | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 14      | QC3 06-Apr-2022 4:10 pm            | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 15      | QC4 07-Apr-2022 9:45 am            | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 16      | QC5 07-Apr-2022 12:40 pm           | Soil        | cPSoil     | Heavy Metals, Screen Level |
| 17      | TP-01_0.5-0.8 07-Apr-2022 11:55 am | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 18      | TP-03_0.5-0.8 07-Apr-2022 10:45 am | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 19      | TP-05_0.5-0.8 07-Apr-2022 9:45 am  | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 20      | TP-07_0.5-0.8 07-Apr-2022 8:45 am  | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 21      | TP-09_0.5-0.8 06-Apr-2022 4:10 pm  | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 22      | TP-11_0.5-0.8 06-Apr-2022 3:50 pm  | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 23      | TP-13_0.5-0.8 06-Apr-2022 2:50 pm  | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 24      | TP-15_0.5-0.8 06-Apr-2022 11:36 am | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 25      | TP-16_0.5-0.8 06-Apr-2022          | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 26      | TP-17_0.5-0.8 06-Apr-2022 10:31 am | Soil        | PSoil250   | Heavy Metals, Screen Level |

| Samples |                                    |             |            |                            |
|---------|------------------------------------|-------------|------------|----------------------------|
| No      | Sample Name                        | Sample Type | Containers | Tests Requested            |
| 27      | TP-19_0.5-0.8 06-Apr-2022 12:20 pm | Soil        | cPSoil     | Heavy Metals, Screen Level |
| 28      | TP-20_0.5-0.8 07-Apr-2022 12:50 pm | Soil        | PSoil250   | Heavy Metals, Screen Level |
| 29      | TP-12_0.1-0.3 06-Apr-2022 3:30 pm  | Soil        | cPSoil     | Heavy Metals, Screen Level |
| 30      | TP-04_0.5-0.8 07-Apr-2022 10:10 am | Soil        | cPSoil     | Heavy Metals, Screen Level |
| 31      | TP-06_0.5-0.8 07-Apr-2022 9:15 am  | Soil        | cPSoil     | Heavy Metals, Screen Level |
| 32      | TP-08_0.5-0.8 06-Apr-2022 4:45 pm  | Soil        | cPSoil     | Heavy Metals, Screen Level |
| 33      | TP-10_0.5-0.8 06-Apr-2022 3:50 pm  | Soil        | cPSoil     | Heavy Metals, Screen Level |
| 34      | TP-12_0.5-0.8 06-Apr-2022 1:00 pm  | Soil        | cPSoil     | Heavy Metals, Screen Level |
| 35      | TP-14_0.5-0.8 06-Apr-2022 2:00 pm  | Soil        | cPSoil     | Heavy Metals, Screen Level |
| 36      | TP-18_0.5-0.8 06-Apr-2022 12:49 pm | Soil        | cPSoil     | Heavy Metals, Screen Level |

## Summary of Methods

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

| Sample Type: Soil                  |                                                                                                                                                                                                       |                         |           |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------|
| Test                               | Method Description                                                                                                                                                                                    | Default Detection Limit | Sample No |
| Environmental Solids Sample Drying | Air dried at 35°C<br>Used for sample preparation.<br>May contain a residual moisture content of 2-5%.                                                                                                 | -                       | 1-36      |
| Heavy Metals, Screen Level         | Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required. | 0.10 - 4 mg/kg dry wt   | 1-36      |



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819

Primary Contact Hannah Wood 284857

Submitted By Hannah Wood 284857

Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

Email

Charge To Jacobs New Zealand Limited 31905

Client Reference Southshore Bund

Additional Client Ref

Order No

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

☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other Kate.murphy@jacobs.com

☐ Other

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

## ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 1 of 8

(3 chilli bins)

## Quoted Sample Types

Soil

| No. | Sample Name  | Sample Date/Time | Sample Type | Tests Required |
|-----|--------------|------------------|-------------|----------------|
| 1   | TP-01_01-0.3 | 07/04/22 11h50   | Soil        | Asb; Metals    |
| 2   | TP-02_01-0.3 | 07/04/22 11h25   | Soil        | Asbestos       |
| 3   | TP-03_01-0.3 | 07/04/22 10h45   | Soil        | Asb; Metals    |
| 4   | TP-04_01-0.3 | 07/04/22 10h10   | Soil        | Asbestos       |
| 5   | TP-05_01-0.3 | 07/04/22 09h45   | Soil        | Asb; Metals    |
| 6   | TP-06_01-0.3 | 07/04/22 09h15   | Soil        | Asbestos       |
| 7   | TP-07_01-0.3 | 07/04/22         | Soil        | Asb; Metals    |
| 8   | TP-08_01-0.3 | 06/04/22         | Soil        | Asbestos       |

ANALYSIS

Job No: Date Recv: 09-Apr-22 10:47

295 1227

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

T 0508 HILL LAB (44 555 2  
T +64 7 858 2000  
E mail@hill-labs.co.nz  
W www.hill-laboratories.com

Received by: Jamie Staton



## CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories Date & Time: 08/04/22

Name: K. Murphy  
☐ Tick if you require COC to be emailed back  
Signature: [Signature]

Received at Hill Laboratories Date & Time:

Name:  
Signature:

Condition Temp: 14.4  
☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked  
Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819

Primary Contact Hannah Wood 284857

Submitted By Hannah Wood 284857

Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

Email

Charge To Jacobs New Zealand Limited 31905

Client Reference Southshore Burd

Additional Client Ref

Order No

Results To Reports will be emailed to Primary Contact by default.  
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☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

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## ADDITIONAL INFORMATION / KNOWLEDGE

Page 2 of 8

## Quoted Sample Types

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|

| No. | Sample Name  | Sample Date/Time | Sample Type | Tests Required |
|-----|--------------|------------------|-------------|----------------|
| 1   | TP-09.01-0.3 | 06/04/22 16h10   | Soil        | Asb ; Metals   |
| 2   | TP-10.01-0.3 | 06/04/22 15h50   | Soil        | Asbestos       |
| 3   | TP-11.01-0.3 | 06/04/22 15h30   | Soil        | Asb ; Metals   |
| 4   | TP-12.01-0.3 | 06/04/22 15h30   | Soil        | Asb ; Metals   |
| 5   | TP-13.01-0.3 | 06/04/22 14h30   | Soil        | Asb ; Metals   |
| 6   | TP-14.01-0.3 | 06/04/22 14h00   | Soil        | Asbestos       |
| 7   | TP-15.01-0.3 | 06/04/22 11h36   | Soil        | Asb ; Metals   |
| 8   | TP-16.01-0.3 | 06/04/22 11h00   | Soil        | Asbestos       |

## ANALYSIS REQUEST

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E mail@hill-labs.co.nz  
W www.hill-laboratories.com

Office use only  
(Job No)

## CHANGES / RECORD

Sent to Hill Laboratories Date & Time:

☐ Tick if you require COC to be emailed back

Received at Hill Laboratories Date & Time:

Signature:

Condition Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819

Primary Contact Hannah Wood 284857

Submitted By Hannah Wood 284857

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Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

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Charge To Jacobs New Zealand Limited 31905

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## ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 3 of 8

## Quoted Sample Types

|  |  |  |  |  |  |
|--|--|--|--|--|--|
|  |  |  |  |  |  |
|--|--|--|--|--|--|

| No. | Sample Name  | Sample Date/Time | Sample Type | Tests Required    |
|-----|--------------|------------------|-------------|-------------------|
| 1   | TP-17-01-0.3 | 06/04/22 10h25   | Soil        | Asb / Metals      |
| 2   | TP-18-01-0.3 | 06/04/22 12h43   | Soil        | Asbestos          |
| 3   | TP-19-01-0.3 | 06/04/22 12h20   | Soil        | Asbestos / Metals |
| 4   | TP-20-01-0.3 | 07/04/22 12h20   | Soil        | Asbestos / Metals |
| 5   | TP-21-01-0.3 | 07/04/22         | Soil        | Asbestos          |
| 6   | SS-01-01-0.3 | 07/04/22 13h24   | Soil        | Asbestos          |
| 7   | SS-02-01-0.3 | 07/04/22 13h50   | Soil        | Asbestos          |
| 8   | SS-03-01-0.3 | 07/04/22 14h05   | Soil        | Asbestos          |

## ANALYSIS REQUEST

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E mail@hill-labs.co.nz  
W www.hill-laboratories.com

Office use only  
(Job No)

## CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories Date & Time:

Name:

☐ Tick if you require COC to be emailed back

Signature:

Received at Hill Laboratories Date & Time:

Name:

Signature:

Condition Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:



# Hill Laboratories

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Quote No 116819

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Submitted By Hannah Wood 284857

Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
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Phone 03 940 4900 Mobile

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☐ Email Other

☐ Other

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## ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 4 of 8

## Quoted Sample Types

|  |  |
|--|--|
|  |  |
|--|--|

| No. | Sample Name | Sample Date/Time | Sample Type | Tests Required |
|-----|-------------|------------------|-------------|----------------|
| 1   | SS-04_01-03 | 07/04/22 14h30   | Soil        | Asbestos       |
| 2   | SS-05_01-03 | 07/04/22 14h44   | Soil        | Asbestos       |
| 3   | SS-06_01-03 | 07/04/22 15h00   | Soil        | Asbestos       |
| 4   | SS-07_01-03 | 07/04/22 15h10   | Soil        | Asbestos       |
| 5   | SS-08_01-03 | 07/04/22 15h30   | Soil        | Asbestos       |
| 6   | SS-09_01-03 | 07/04/22 15h41   | Soil        | Asbestos       |
| 7   | SS-10_01-03 | 07/04/22 15h58   | Soil        | Asbestos       |
| 8   | SS-11_01-03 | 07/04/22 16h05   | Soil        | Asbestos       |

## ANALYSIS REQUEST

R J Hill Laboratories Limited  
28 Duke Street Hamilton 3204  
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(Job No)

## CHAIN OF CUSTODY RECORD

|                                                                                                     |              |
|-----------------------------------------------------------------------------------------------------|--------------|
| Sent to<br>Hill Laboratories                                                                        | Date & Time: |
| Name:                                                                                               |              |
| <input type="checkbox"/> Tick if you require COC to be emailed back                                 | Signature:   |
| Received at<br>Hill Laboratories                                                                    | Date & Time: |
| Name:                                                                                               |              |
| Signature:                                                                                          |              |
| Condition                                                                                           | Temp:        |
| <input type="checkbox"/> Room Temp <input type="checkbox"/> Chilled <input type="checkbox"/> Frozen |              |
| <input type="checkbox"/> Sample & Analysis details checked                                          |              |
| Signature:                                                                                          |              |

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819

Primary Contact Hannah Wood 284857

Submitted By Hannah Wood 284857

Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

Email

Charge To Jacobs New Zealand Limited 31905

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Additional Client Ref

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☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

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## ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 5 of 8

## Quoted Sample Types

|  |
|--|
|  |
|--|

| No. | Sample Name   | Sample Date/Time | Sample Type | Tests Required    |
|-----|---------------|------------------|-------------|-------------------|
| 1   | SS-1204-0.5   | 07/04/22 16h20   | Soil        | Asbestos          |
| 2   | QC1           | 06/04/22 12h20   | Soil        | Metals            |
| 3   | QC2           | 06/04/22 14h30   | Soil        | Metals            |
| 4   | QC3           | 06/04/22 16h10   | Soil        | Metals            |
| 5   | QC4           | 07/04/22 09h45   | Soil        | Metals            |
| 6   | QC5           | 07/04/22 12h40   | Soil        | Metals            |
| 7   | TP-01-0.5-0.8 | 07/04/22 11h55   | Soil        | Asbestos / Metals |
| 8   | TP-02-0.5-0.8 | 07/04/22 11h25   | Soil        | Asbestos          |

## ANALYSIS REQUEST

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

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

Office use only  
(Job No)

## CHAIN OF CUSTODY RECORD

Sent to  
Hill Laboratories

Date & Time:

Name:

☐ Tick if you require COC  
to be emailed back

Signature:

Received at  
Hill Laboratories

Date & Time:

Name:

Signature:

Condition

Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819

Primary Contact Hannah Wood 284857

Submitted By Hannah Wood 284857

Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

Email

Charge To Jacobs New Zealand Limited 31905

Client Reference Southshore Bund

Additional Client Ref

Order No

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

- ☐ Email Primary Contact ☐ Email Submitter ☐ Email Client
- ☐ Email Other
- ☐ Other

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

## ADDITIONAL INFORMATION / KNOWN HEADS

Page 6 of 8

## Quoted Sample Types

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|

| No. | Sample Name   | Sample Date/Time | Sample Type | Tests Required    |
|-----|---------------|------------------|-------------|-------------------|
| 1   | TP-03_0.5-0.8 | 07/04/22 10h45   | Soil        | Asbestos, Metals  |
| 2   | TP-04_0.5-0.8 | 07/04/22 10h10   | Soil        | Asbestos & Metals |
| 3   | TP-05_0.5-0.8 | 07/04/22 09h45   | Soil        | Asb, Metals       |
| 4   | TP-06_0.5-0.8 | 07/04/22 09h15   | Soil        | Asbestos & Metals |
| 5   | TP-07_0.5-0.8 | 07/04/22 09h45   | Soil        | Asbestos, Metals  |
| 6   | TP-08_0.5-0.8 | 06/04/22 16h45   | Soil        | Asbestos & Metals |
| 7   | TP-09_0.5-0.8 | 06/04/22 16h10   | Soil        | Asbestos, Metals  |
| 8   | TP-10_0.5-0.8 | 06/04/22 15h50   | Soil        | Asbestos & Metals |

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## CHAIN OF CUSTODY RECORD

|                                                                                                     |              |
|-----------------------------------------------------------------------------------------------------|--------------|
| Sent to<br>Hill Laboratories                                                                        | Date & Time: |
| Name:                                                                                               |              |
| <input type="checkbox"/> Tick if you require COC to be emailed back                                 | Signature:   |
| Received at<br>Hill Laboratories                                                                    | Date & Time: |
| Name:                                                                                               |              |
| Signature:                                                                                          |              |
| Condition                                                                                           | Temp:        |
| <input type="checkbox"/> Room Temp <input type="checkbox"/> Chilled <input type="checkbox"/> Frozen |              |
| <input type="checkbox"/> Sample & Analysis details checked                                          |              |
| Signature:                                                                                          |              |

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:



# Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 116819

Primary Contact Hannah Wood 284857

Submitted By Hannah Wood 284857

Client Name Jacobs New Zealand Limited 31905

Address PO Box 1147  
Christchurch 8140, New Zealand

Phone 03 940 4900 Mobile

Email

Charge To Jacobs New Zealand Limited 31905

Client Reference Southshore Bund

Additional Client Ref

Order No

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☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

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## ADDITIONAL INFORMATION / KNOWN HAZARDS

Page 7 of 8

## Quoted Sample Types

|  |
|--|
|  |
|--|

| No. | Sample Name   | Sample Date/Time | Sample Type | Tests Required     |
|-----|---------------|------------------|-------------|--------------------|
| 1   | TP-11_0.5-0.8 | 06/04/22 15h30   | Soil        | Asbestos & Metals  |
| 2   | TP-12_0.5-0.8 | 06/04/22 13h00   | Soil        | Asbestos & Metals  |
| 3   | TP-13_0.5-0.8 | 06/04/22 14h30   | Soil        | Asb & Metals       |
| 4   | TP-14_0.5-0.8 | 06/04/22 14h00   | Soil        | Asbestos & Metals  |
| 5   | TP-15_0.5-0.8 | 06/04/22 11h30   | Soil        | Asb & Metals       |
| 6   | TP-16_0.5-0.8 | 06/04/22         | Soil        | Asb & Metals & PAH |
| 7   | TP-17_0.5-0.8 | 06/04/22 10h31   | Soil        | Asb & Metals       |
| 8   | TP-18_0.5-0.8 | 06/04/22 12h49   | Soil        | Asbestos & Metals  |

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Hill Laboratories

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Name:

Signature:

Condition

Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked

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☐ Email Other

☐ Other

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Please inform the laboratory if you would like this information reported.

## ADDITIONAL INFORMATION / KNOWLEDGE

Page 8 of 8

## Quoted Sample Types

|  |
|--|
|  |
|--|

| No. | Sample Name   | Sample Date/Time | Sample Type        | Tests Required            |
|-----|---------------|------------------|--------------------|---------------------------|
| 1   | TP-19_0.5-0.8 | 01/04/22 12h30   | Soil               | Ash & Metals              |
| 2   | TP-20_0.5-0.8 | 01/04/22 12h50   | Soil               | Asbestos & Metals         |
| 3   | TP-21_0.5-0.8 | 01/04/22 12h35   | Soil               | Asbestos                  |
| 4   | SACM-55-07    | 01/04/22         | Building materials | Asbestos presence/absence |
| 5   |               |                  |                    |                           |
| 6   |               |                  |                    |                           |
| 7   |               |                  |                    |                           |
| 8   |               |                  |                    |                           |

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## CHAIN OF CUSTODY RECORD

Sent to  
Hill Laboratories

Date & Time:

Name:

☐ Tick if you require COC  
to be emailed back

Signature:

Received at  
Hill Laboratories

Date & Time:

Name:

Signature:

Condition

Temp:

☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

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

Requested Reporting Date:



## Job Information Summary

Page 1 of 1

|                 |                                |                          |                            |
|-----------------|--------------------------------|--------------------------|----------------------------|
| <b>Client:</b>  | Jacobs New Zealand Limited     | <b>Lab No:</b>           | 2951227                    |
| <b>Contact:</b> | Hannah Wood                    | <b>Date Registered:</b>  | 09-Apr-2022 11:50 am       |
|                 | C/- Jacobs New Zealand Limited | <b>Priority:</b>         | High                       |
|                 | PO Box 1147                    | <b>Quote No:</b>         | 116819                     |
|                 | Christchurch 8140              | <b>Order No:</b>         | required                   |
|                 |                                | <b>Client Reference:</b> | Southshore Bund            |
|                 |                                | <b>Add. Client Ref:</b>  |                            |
|                 |                                | <b>Submitted By:</b>     | Hannah Wood                |
|                 |                                | <b>Charge To:</b>        | Jacobs New Zealand Limited |
|                 |                                | <b>Target Date:</b>      | 13-Apr-2022 4:30 pm        |

### Samples

| No | Sample Name            | Sample Type       | Containers | Tests Requested           |
|----|------------------------|-------------------|------------|---------------------------|
| 1  | SACM-55-07 07-Apr-2022 | Building Material | cpzBag2    | Asbestos in Bulk Material |

## Summary of Methods

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

| Sample Type: Building Material                     |                                                                                                                                                                                                                                                                                                         |                         |           |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------|
| Test                                               | Method Description                                                                                                                                                                                                                                                                                      | Default Detection Limit | Sample No |
| Asbestos in Bulk Material                          |                                                                                                                                                                                                                                                                                                         |                         |           |
| Sample Category                                    | Assessment of sample type. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.                                                                                                                                                                                                  | -                       | 1         |
| Sample Weight on receipt                           | Sample weight. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.                                                                                                                                                                                                              | 0.01 g                  | 1         |
| <b>Asbestos Presence / Absence</b>                 | 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         |
| Description of Asbestos in Non Homogeneous Samples | Form, dimensions and/or weight of asbestos fibres present. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.                                                                                                                                                      | -                       | 1         |

## **Appendix G. Analytical Results Tables**

## IA271200 - Southshore Bund - Detailed Site Investigation

Table G1 - Heavy Metal Soil Analytical Results for Human Health and Disposal

| Human Health and Disposal                              |             |                         |            |             |              |                   |             |             |                             |                           |
|--------------------------------------------------------|-------------|-------------------------|------------|-------------|--------------|-------------------|-------------|-------------|-----------------------------|---------------------------|
| Sample Name                                            | Sample Date | Depth (m bgl)           | Arsenic    | Cadmium     | Chromium     | Copper            | Lead        | Mercury     | Nickel (NEPM <sup>1</sup> ) | Zinc (NEPM <sup>1</sup> ) |
| Background Concentrations <sup>2</sup>                 |             | YBS Christchurch Urban  | <u>5.9</u> | <u>0.09</u> | <u>16.6</u>  | <u>10.2</u>       | <u>25.3</u> | <u>0.09</u> | <u>12.3</u>                 | <u>62.2</u>               |
| NESCS <sup>3</sup>                                     |             | Recreational            | <b>80</b>  | <b>400</b>  | <b>2,700</b> | <b>&gt;10,000</b> | <b>880</b>  | <b>1800</b> | <b>600</b>                  | <b>14,000</b>             |
|                                                        |             | Commercial / Industrial | <b>70</b>  | <b>1300</b> | <b>6300</b>  | <b>&gt;10,000</b> | <b>3300</b> | <b>4200</b> | <b>6,000</b>                | <b>400,000</b>            |
| Legget Road Fill facility                              |             |                         | 12.58      | 0.19        | 22.70        | 20.30             | 40.96       | 0.11        | 20.70                       | 93.94                     |
| Frews Hororata Acceptance Criteria <sup>4a</sup>       |             |                         | 20         | 3           | 37           | 100               | 210         | 0.2         | 400                         | 1,000                     |
| Frews Hororata Acceptance Criteria <sup>4b</sup>       |             |                         | 70         | 10          | 25           | 300               | 400         | 0.2         | 1,000                       | 1,000                     |
| Frews Hororata Acceptance Criteria <sup>4c</sup>       |             |                         | 140        | 55          | 375          | 500               | 500         | 0.2         | 2,000                       | 1,800                     |
| Kate Valley (Class A) Acceptance Criteria <sup>6</sup> |             |                         | 100        | 20          | 100          | 100               | 100         | 4           | 200                         | 200                       |
| Units                                                  |             |                         | mg/kg      |             |              |                   |             |             |                             |                           |
| Testpit Locations                                      |             |                         |            |             |              |                   |             |             |                             |                           |
| TP01_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | <u>7</u>   | < 0.10      | 15           | 10                | <u>28</u>   | < 0.10      | <u>13</u>                   | <u>71</u>                 |
| TP01_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | 4          | < 0.10      | 11           | 7                 | <u>40</u>   | < 0.10      | 9                           | <u>64</u>                 |
| TP03_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | <u>6</u>   | < 0.10      | 15           | 9                 | <u>26</u>   | < 0.10      | 12                          | <u>64</u>                 |
| TP03_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | 5          | < 0.10      | 14           | <u>19</u>         | <u>41</u>   | < 0.10      | 10                          | <u>86</u>                 |
| TP04_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | <u>8</u>   | <u>0.12</u> | 14           | <u>18</u>         | <u>88</u>   | <u>0.18</u> | 11                          | <u>121</u>                |
| TP05_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | <u>7</u>   | <u>0.12</u> | <u>17</u>    | <u>11</u>         | <u>29</u>   | < 0.10      | <u>13</u>                   | <u>72</u>                 |
| TP05_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | 4          | < 0.10      | 11           | 8                 | <u>42</u>   | < 0.10      | 9                           | <u>63</u>                 |
| TP06_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | <u>8</u>   | < 0.10      | 16           | <u>12</u>         | 24          | < 0.10      | 12                          | <u>72</u>                 |
| TP07_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | 5          | < 0.10      | 13           | 8                 | 14.3        | < 0.10      | 11                          | 45                        |
| TP07_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | <u>7</u>   | <u>0.18</u> | 16           | <u>13</u>         | <u>63</u>   | < 0.10      | 12                          | <u>96</u>                 |
| TP08_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | 4          | < 0.10      | 11           | 9                 | 23          | < 0.10      | 9                           | 48                        |
| TP09_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | <u>6</u>   | <u>0.11</u> | 16           | 9                 | 20          | < 0.10      | 12                          | <u>63</u>                 |
| TP09_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | 4          | < 0.10      | 12           | 7                 | 14.6        | < 0.10      | 11                          | 45                        |
| TP10_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | <u>7</u>   | <u>0.11</u> | 14           | 9                 | 25          | < 0.10      | 12                          | <u>70</u>                 |
| TP11_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | <u>6</u>   | < 0.10      | 15           | 8                 | 21          | < 0.10      | 12                          | 61                        |
| TP11_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | 4          | < 0.10      | 10           | 3                 | 11.1        | < 0.10      | 8                           | 37                        |
| TP12_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | 5          | < 0.10      | 14           | 8                 | 18.1        | < 0.10      | 12                          | 59                        |
| TP13_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | <u>7</u>   | < 0.10      | 15           | 10                | 19.3        | < 0.10      | <u>13</u>                   | <u>64</u>                 |
| TP13_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | <u>10</u>  | <u>0.12</u> | 15           | <u>16</u>         | <u>33</u>   | < 0.10      | 12                          | <u>111</u>                |
| TP14_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | 4          | < 0.10      | 10           | 5                 | 16.1        | < 0.10      | 8                           | 57                        |
| TP14_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | 4          | < 0.10      | 10           | 5                 | 11.4        | < 0.10      | 8                           | 44                        |
| TP15_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | <u>6</u>   | <u>0.12</u> | 14           | <u>11</u>         | <u>29</u>   | < 0.10      | 12                          | <u>80</u>                 |
| TP15_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | 5          | <u>0.11</u> | 13           | <u>11</u>         | <u>47</u>   | < 0.10      | 10                          | <u>80</u>                 |
| TP16_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | <u>7</u>   | <u>0.11</u> | 14           | <u>14</u>         | <u>32</u>   | < 0.10      | 11                          | <u>89</u>                 |
| TP17_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | <u>7</u>   | < 0.10      | 16           | <u>13</u>         | 24          | < 0.10      | <u>14</u>                   | <u>81</u>                 |
| TP17_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | 4          | < 0.10      | 11           | 4                 | 14.6        | < 0.10      | 8                           | 48                        |
| TP18_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | <u>9</u>   | <u>0.13</u> | 15           | <u>16</u>         | <u>127</u>  | < 0.10      | <u>13</u>                   | <u>116</u>                |
| TP19_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | <u>6</u>   | < 0.10      | 15           | 10                | 19.6        | < 0.10      | <u>13</u>                   | <u>63</u>                 |
| TP19_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | 5          | < 0.10      | <u>17</u>    | 7                 | 14.7        | < 0.10      | 9                           | 53                        |
| TP20_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | 3          | < 0.10      | <u>17</u>    | <u>16</u>         | 17.9        | < 0.10      | <u>22</u>                   | 47                        |
| TP20_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | 3          | < 0.10      | 13           | 9                 | 12.4        | < 0.10      | 12                          | 37                        |

### Key:

|                   |                                                                       |
|-------------------|-----------------------------------------------------------------------|
| <u>Underlined</u> | Background Criteria                                                   |
| <b>Red Text</b>   | Commercial/Industrial Landuse Criteria                                |
| <b>Black Text</b> | Recreational Landuse Criteria                                         |
| <b>Blue</b>       | Legget Road Criteria                                                  |
| <b>Orange</b>     | Frews Hororata Criteria (Column 4- cover soil)                        |
| <b>Green</b>      | Frews Hororata Criteria (Column 2 - 12 month rolling mean)            |
| <b>Pink</b>       | Frews Hororata Criteria (Column 3 - Maximum concentration)            |
| <b>Yellow</b>     | Kate Valley Criteria                                                  |
| Grey Text         | Indicates concentration below the laboratory limit of reporting (LOR) |
| m bgl             | Indicates meters below ground level                                   |
| mg/kg             | Indicates milligrams per kilogram (dry weight)                        |

1.No standards derived under National Environmental Standard for Managing Contaminants in Soil to Protect Human Health. National

## IA271200 - Southshore Bund - Detailed Site Investigation

Table G1 - Heavy Metal Soil Analytical Results for Human Health and Disposal

| Human Health and Disposal                              |             |                         |            |             |              |                   |             |             |                             |                           |
|--------------------------------------------------------|-------------|-------------------------|------------|-------------|--------------|-------------------|-------------|-------------|-----------------------------|---------------------------|
| Sample Name                                            | Sample Date | Depth (m bgl)           | Arsenic    | Cadmium     | Chromium     | Copper            | Lead        | Mercury     | Nickel (NEPM <sup>1</sup> ) | Zinc (NEPM <sup>1</sup> ) |
| Background Concentrations <sup>2</sup>                 |             | YBS Christchurch Urban  | <u>5.9</u> | <u>0.09</u> | <u>16.6</u>  | <u>10.2</u>       | <u>25.3</u> | <u>0.09</u> | <u>12.3</u>                 | <u>62.2</u>               |
| NESCS <sup>3</sup>                                     |             | Recreational            | <b>80</b>  | <b>400</b>  | <b>2,700</b> | <b>&gt;10,000</b> | <b>880</b>  | <b>1800</b> | <b>600</b>                  | <b>14,000</b>             |
|                                                        |             | Commercial / Industrial | <b>70</b>  | <b>1300</b> | <b>6300</b>  | <b>&gt;10,000</b> | <b>3300</b> | <b>4200</b> | <b>6,000</b>                | <b>400,000</b>            |
| Legget Road Fill facility                              |             |                         | 12.58      | 0.19        | 22.70        | 20.30             | 40.96       | 0.11        | 20.70                       | 93.94                     |
| Frews Hororata Acceptance Criteria <sup>4a</sup>       |             |                         | 20         | 3           | 37           | 100               | 210         | 0.2         | 400                         | 1,000                     |
| Frews Hororata Acceptance Criteria <sup>4b</sup>       |             |                         | 70         | 10          | 25           | 300               | 400         | 0.2         | 1,000                       | 1,000                     |
| Frews Hororata Acceptance Criteria <sup>4c</sup>       |             |                         | 140        | 55          | 375          | 500               | 500         | 0.2         | 2,000                       | 1,800                     |
| Kate Valley (Class A) Acceptance Criteria <sup>6</sup> |             |                         | 100        | 20          | 100          | 100               | 100         | 4           | 200                         | 200                       |
| Units                                                  |             |                         | mg/kg      |             |              |                   |             |             |                             |                           |
| Testpit Locations                                      |             |                         |            |             |              |                   |             |             |                             |                           |

Environmental Protection (Assessment of Site Contamination) Measure 1999 (Australia); Schedule B1 (as amended May 2013) - Guideline on Investigation Levels For Soil and Groundwater, Federal Register of Legislative Instruments F2013C00288, National Environmental Protection Council. (NEPM, 2011).

2. Environment Canterbury, 2007. Background Concentrations of Selected Trace Elements in Canterbury Soils.

3. Ministry for the Environment, 2012. 'Users Guide National Environmental Standard (NES) For Assessing and Managing Contaminants in Soil to 4a-c. Frews Contracting Limited Hearing Commissioners Decision for the establishment and operation of a quarry and managed fill facility at Plantation Road, Hororata (CRC201181, CRC201182, CRC20180 and RC195747), 13 August 2022. Schedule CRC201182B Managed Fill Waste Acceptance Criteria (MFWAC) and Cover Soil Quality. (Frews Hororata Acceptance Criteria).

5. Environment Canterbury, 2015. Scoping Project on the Management, Disposal and Remediation of Soils in Christchurch, Selwyn and Waimakariri (R15/105)

6. Transwaste values are taken from: Ministry for the Environment, 2004. Module 2 - Hazardous Waste Guidelines: Landfill Waste Acceptance Criteria and Landfill Classification. Appendix A. Class A screening criteria. Note that additional contaminants are included in Appendix A. (Kate Valley Landfill (Class A)).

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Table G2 - Polycyclic Aromatic Hydrocarbons for Human Health and Disposal Options

| Human Health and Disposal                                                                             |                         |               |              |                |            |                    |                      |                           |                      |          |                        |              |          |                         |             |              |        |                      |       |
|-------------------------------------------------------------------------------------------------------|-------------------------|---------------|--------------|----------------|------------|--------------------|----------------------|---------------------------|----------------------|----------|------------------------|--------------|----------|-------------------------|-------------|--------------|--------|----------------------|-------|
| Sample Name                                                                                           | Sample Date             | Depth (m bgl) | Acenaphthene | Acenaphthylene | Anthracene | Benzo[a]anthracene | Benzo[a]pyrene (BAP) | Benzo[b + j] fluoranthene | Benzo[k]fluoranthene | Chrysene | Dibenzo[a,h]anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene | Phenanthrene | Pyrene | BAP TEQ <sup>1</sup> |       |
| Cleanfill - Canterbury PAH Background Concentrations for Soil 95% upper confidence limit <sup>1</sup> |                         |               |              |                |            |                    |                      |                           |                      |          |                        |              |          |                         |             |              |        |                      |       |
| Cleanfill - Canterbury PAH Background Concentrations for Soil 95% upper confidence limit <sup>2</sup> |                         |               | 0.055        | 0.069          | 0.113      | 0.47               | 0.595                | 0.947                     | 0.459                | 0.296    | 0.539                  | 0.112        | 1.345    | 0.06                    | 0.385       | 0.029        | 0.703  | 1.362                | 0.922 |
| NESCS <sup>3</sup>                                                                                    | Recreational            |               | -            | -              | -          | -                  | -                    | -                         | -                    | -        | -                      | -            | -        | -                       | -           | -            | 40     | 40                   |       |
|                                                                                                       | Commercial / Industrial |               | -            | -              | -          | -                  | -                    | -                         | -                    | -        | -                      | -            | -        | -                       | -           | -            | 35     | 35                   |       |
| Legget Road Fill Facility                                                                             |                         |               | -            | -              | -          | -                  | -                    | -                         | -                    | -        | -                      | -            | -        | -                       | -           | -            | -      | 0.922                |       |
| Frews Hororata Acceptance Criteria <sup>4a</sup>                                                      |                         |               | -            | -              | -          | -                  | -                    | -                         | -                    | -        | -                      | -            | -        | -                       | -           | -            | -      | not accepted         |       |
| Frews Hororata Acceptance Criteria <sup>4b</sup>                                                      |                         |               | -            | -              | -          | -                  | -                    | -                         | -                    | -        | -                      | -            | -        | -                       | -           | -            | -      | 35                   |       |
| Frews Hororata Acceptance Criteria <sup>4c</sup>                                                      |                         |               | -            | -              | -          | -                  | -                    | -                         | -                    | -        | -                      | -            | -        | -                       | -           | -            | -      | 45                   |       |
| Kate Valley (Class A) Acceptance Criteria <sup>6</sup>                                                |                         |               | -            | -              | -          | -                  | 400                  | -                         | -                    | -        | -                      | -            | -        | -                       | -           | -            | -      | 300                  |       |
| Units                                                                                                 |                         |               | mg/kg        |                |            |                    |                      |                           |                      |          |                        |              |          |                         |             |              |        |                      |       |
| Testpit Locations                                                                                     |                         |               |              |                |            |                    |                      |                           |                      |          |                        |              |          |                         |             |              |        |                      |       |
| TP01_0.1-0.3                                                                                          | 7/04/2022               | 0.1 - 0.3     | <0.012       | 0.012          | 0.041      | 0.104              | 0.105                | 0.114                     | 0.059                | 0.046    | 0.086                  | 0.014        | 0.21     | 0.027                   | 0.06        | <0.06        | 0.2    | 0.2                  | 0.15  |

### Key:

|            |                                                                       |
|------------|-----------------------------------------------------------------------|
| Underlined | Background Criteria                                                   |
| Red Text   | Commercial/Industrial Landuse Criteria                                |
| Black Text | Recreational Landuse Criteria                                         |
| Blue       | Legget Road Criteria                                                  |
| Orange     | Frews Hororata Criteria (Column 4 - cover soil)                       |
| Green      | Frews Hororata Criteria (Column 2 - 12 month rolling mean)            |
| Pink       | Frews Hororata Criteria (Column 3 - Maximum concentration)            |
| Yellow     | Kate Valley Criteria                                                  |
| Grey Text  | Indicates concentration below the laboratory limit of reporting (LOR) |
| m bgl      | Indicates meters below ground level                                   |
| mg/kg      | Indicates milligrams per kilogram (dry weight)                        |

1. BaP TEQ is calculated as the sum of each of nine carcinogenic PAHs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and indeno(1,2,3-cd)pyrene, multiplied by their respective potency equivalency factors.

2. Environment Canterbury Background Concentrations of Polycyclic Aromatic Hydrocarbons in Christchurch Urban Soils. RO7/19 Dated July 2007.

3. Ministry for the Environment, 2012. 'Users Guide National Environmental Standard (NES) For Assessing and Managing

4a-c. Frews Contracting Limited Hearing Commissioners Decision for the establishment and operation of a quarry and managed fill facility at Plantation Road, Hororata (CRC201181, CRC201182, CRC20180 and RC195747), 13 August 2022. Schedule CRC201182B Managed Fill Waste Acceptance Criteria (MFWAC) and Cover Soil Quality. (Frews Hororata Acceptance Criteria).

5. Environment Canterbury, 2015. Scoping Project on the Management, Disposal and Remediation of Soils in Christchurch, Selwyn and Waimakariri (R15/105)

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Table G2 - Polycyclic Aromatic Hydrocarbons for Human Health and Disposal Options

| Human Health and Disposal                                                                             |             |                         |              |                |            |                    |                      |                           |                    |                      |          |                        |              |          |                         |             |              |        |                      |
|-------------------------------------------------------------------------------------------------------|-------------|-------------------------|--------------|----------------|------------|--------------------|----------------------|---------------------------|--------------------|----------------------|----------|------------------------|--------------|----------|-------------------------|-------------|--------------|--------|----------------------|
| Sample Name                                                                                           | Sample Date | Depth (m bgl)           | Acenaphthene | Acenaphthylene | Anthracene | Benzo[a]anthracene | Benzo[a]pyrene (BAP) | Benzo[b + j] fluoranthene | Benzo[ghi]perylene | Benzo[k]fluoranthene | Chrysene | Dibenzo[a,h]anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene | Phenanthrene | Pyrene | BAP TEQ <sup>1</sup> |
| Cleanfill - Canterbury PAH Background Concentrations for Soil 95% upper confidence limit <sup>1</sup> |             |                         |              |                |            |                    |                      |                           |                    |                      |          |                        |              |          |                         |             |              |        |                      |
| Cleanfill - Canterbury PAH Background Concentrations for Soil 95% upper confidence limit <sup>2</sup> |             |                         | 0.055        | 0.069          | 0.113      | 0.47               | 0.595                | 0.947                     | 0.459              | 0.296                | 0.539    | 0.112                  | 1.345        | 0.06     | 0.385                   | 0.029       | 0.703        | 1.362  | 0.922                |
| NESCS <sup>3</sup>                                                                                    |             | Recreational            | -            | -              | -          | -                  | -                    | -                         | -                  | -                    | -        | -                      | -            | -        | -                       | -           | -            | 40     | 40                   |
|                                                                                                       |             | Commercial / Industrial | -            | -              | -          | -                  | -                    | -                         | -                  | -                    | -        | -                      | -            | -        | -                       | -           | -            | -      | 35                   |
| Legget Road Fill Facility                                                                             |             |                         | -            | -              | -          | -                  | -                    | -                         | -                  | -                    | -        | -                      | -            | -        | -                       | -           | -            | -      | 0.922                |
| Frews Hororata Acceptance Criteria <sup>4a</sup>                                                      |             |                         | -            | -              | -          | -                  | -                    | -                         | -                  | -                    | -        | -                      | -            | -        | -                       | -           | -            | -      | not accepted         |
| Frews Hororata Acceptance Criteria <sup>4b</sup>                                                      |             |                         | -            | -              | -          | -                  | -                    | -                         | -                  | -                    | -        | -                      | -            | -        | -                       | -           | -            | -      | 35                   |
| Frews Hororata Acceptance Criteria <sup>4c</sup>                                                      |             |                         | -            | -              | -          | -                  | -                    | -                         | -                  | -                    | -        | -                      | -            | -        | -                       | -           | -            | -      | 45                   |
| Kate Valley (Class A) Acceptance Criteria <sup>6</sup>                                                |             |                         | -            | -              | -          | -                  | 400                  | -                         | -                  | -                    | -        | -                      | -            | -        | -                       | -           | -            | -      | 300                  |
| Units                                                                                                 |             |                         | mg/kg        |                |            |                    |                      |                           |                    |                      |          |                        |              |          |                         |             |              |        |                      |
| Testpit Locations                                                                                     |             |                         |              |                |            |                    |                      |                           |                    |                      |          |                        |              |          |                         |             |              |        |                      |

6. Transwaste values are taken from: Ministry for the Environment, 2004. Module 2 - Hazardous Waste Guidelines: Landfill Waste Acceptance Criteria and Landfill Classification. Appendix A. Class A screening criteria. Note that additional contaminants are included in Appendix A. (Kate Valley Landfill (Class A)).

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Table G3 - Asbestos in Soil Analytical Results for Human Health and Disposal

| Human Health and Disposal                              |             |                         |                                                                      |               |                                      |                                                                 |
|--------------------------------------------------------|-------------|-------------------------|----------------------------------------------------------------------|---------------|--------------------------------------|-----------------------------------------------------------------|
| Sample Name                                            | Sample Date | Depth (m bgl)           | Presence / Absence                                                   | Asbestos Type | Asbestos in ACM as % of Total Sample | Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample |
| NZGAMAS <sup>1</sup>                                   |             | Recreational            | -                                                                    | -             | 0.02                                 | 0.001                                                           |
|                                                        |             | Commercial / Industrial | -                                                                    | -             | 0.05                                 | 0.001                                                           |
| Leggett Road Fill Facility                             |             |                         | -                                                                    | -             | 5                                    | 0.1                                                             |
| Frews Hororata Acceptance Criteria <sup>2a</sup>       |             |                         | Not Accepted                                                         |               |                                      |                                                                 |
| Frews Hororata Acceptance Criteria <sup>2b</sup>       |             |                         | -                                                                    | -             | 0.1*                                 | 0.1                                                             |
| Frews Hororata Acceptance Criteria <sup>2c</sup>       |             |                         | -                                                                    | -             | 5*                                   | 5                                                               |
| Kate Valley (Class A) Acceptance Criteria <sup>4</sup> |             |                         | No Limit                                                             | -             | No Limit                             |                                                                 |
| Units                                                  |             |                         | mg/kg                                                                |               |                                      |                                                                 |
| Testpit Locations                                      |             |                         |                                                                      |               |                                      |                                                                 |
| TP01_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP01_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP02_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP02_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP03_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP03_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP04_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP04_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP05_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP05_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | Chrysotile (White Asbestos) and Crocidolite (Blue Asbestos) detected | ACM debris    | < 0.001                              | 0.001                                                           |
| TP06_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP06_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP07_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP07_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP08_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP08_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP09_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP09_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP10_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP10_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP11_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP11_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | Chrysotile (White Asbestos) detected                                 | ACM debris    | < 0.001                              | 0.001                                                           |
| TP12_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP12_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP13_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP13_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP14_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP14_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP15_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP15_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP16_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP16_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP17_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP17_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP18_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP18_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP19_0.1-0.3                                           | 6/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP19_0.5-0.8                                           | 6/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP20_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP20_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP21_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |
| TP21_0.5-0.8                                           | 7/04/2022   | 0.5 - 0.8               | No Asbestos Detected                                                 | -             | NAD                                  | NAD                                                             |

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Table G3 - Asbestos in Soil Analytical Results for Human Health and Disposal

| Human Health and Disposal                              |             |                         |                                      |               |                                      |                                                                 |
|--------------------------------------------------------|-------------|-------------------------|--------------------------------------|---------------|--------------------------------------|-----------------------------------------------------------------|
| Sample Name                                            | Sample Date | Depth (m bgl)           | Presence / Absence                   | Asbestos Type | Asbestos in ACM as % of Total Sample | Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample |
| NZGAMAS <sup>1</sup>                                   |             | Recreational            | -                                    | -             | 0.02                                 | 0.001                                                           |
|                                                        |             | Commercial / Industrial | -                                    | -             | 0.05                                 | 0.001                                                           |
| Legget Road Fill Facility                              |             |                         | -                                    | -             | 5                                    | 0.1                                                             |
| Frews Hororata Acceptance Criteria <sup>2a</sup>       |             |                         | Not Accepted                         |               |                                      |                                                                 |
| Frews Hororata Acceptance Criteria <sup>2b</sup>       |             |                         | -                                    | -             | 0.1 <sup>+</sup>                     | 0.1                                                             |
| Frews Hororata Acceptance Criteria <sup>2c</sup>       |             |                         | -                                    | -             | 5 <sup>+</sup>                       | 5                                                               |
| Kate Valley (Class A) Acceptance Criteria <sup>4</sup> |             |                         | No Limit                             | -             | No Limit                             |                                                                 |
| Units                                                  |             |                         | mg/kg                                |               |                                      |                                                                 |
| Surface Samples                                        |             |                         |                                      |               |                                      |                                                                 |
| SS01_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                 | -             | NAD                                  | NAD                                                             |
| SS02_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                 | -             | NAD                                  | NAD                                                             |
| SS03_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | Chrysotile (White Asbestos) detected | Fibre Cement  | 0.038                                | < 0.001                                                         |
| SS04_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                 | -             | NAD                                  | NAD                                                             |
| SS05_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                 | -             | NAD                                  | NAD                                                             |
| SS06_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                 | -             | NAD                                  | NAD                                                             |
| SS07_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | Chrysotile (White Asbestos) detected | Fibre Cement  | 0.028                                | < 0.001                                                         |
| SS08_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                 | -             | NAD                                  | NAD                                                             |
| SS09_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                 | -             | NAD                                  | NAD                                                             |
| SS10_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                 | -             | NAD                                  | NAD                                                             |
| SS11_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                 | -             | NAD                                  | NAD                                                             |
| SS12_0.1-0.3                                           | 7/04/2022   | 0.1 - 0.3               | No Asbestos Detected                 | -             | NAD                                  | NAD                                                             |

### Key:

Underlined Background Criteria

**Red Text** Commercial/Industrial Landuse Criteria

**Black Text** Recreational Landuse Criteria

**Blue** Legget Road Criteria

**Orange** Frews Hororata Criteria (Column 4 - cover soil)

**Green** Frews Hororata Criteria (Column 2 - 12 month rolling mean)

**Pink** Frews Hororata Criteria (Column 3 - Maximum concentration)

**Yellow** Kate Valley Criteria

Grey Text Indicates concentration below the laboratory limit of reporting (LOR)

m bgl Indicates meters below ground level

mg/kg Indicates milligrams per kilogram (dry weight)

FA / AF Indicates friable asbestos / asbestos fines

ACM Asbestos Containing Material

% w/w Indicates % weight / weight

\* The waste acceptance criteria for asbestos (12 month annual rolling mean 0.1% and maximum allowable concentration 5%) where the asbestos is contained in fragments of building material mixed into soil is for the weight percent of all asbestos minerals in the combined mass of soil and the fragments of building material present in the soil. It is not the weight percent of asbestos in the building material alone.

1. BRANZ, 2017. New Zealand Guidelines for Assessing and Managing Asbestos in Soil (NZGAMAS). Values taken from Table 5 of the BRANZ Document.

2a-c. Frews Contracting Limited Hearing Commissioners Decision for the establishment and operation of a quarry and managed fill facility at Plantation Road, Hororata (CRC201181, CRC201182, CRC20180 and RC195747), 13 August 2022. Schedule CRC201182B Managed Fill Waste Acceptance Criteria (MFWAC) and Cover Soil Quality. (Frews Hororata Acceptance Criteria).

3. Environment Canterbury, 2015. Scoping Project on the Management, Disposal and Remediation of Soils in Christchurch, Selwyn and Waimakariri (R15/105)

4. Transwaste values are taken from: Ministry for the Environment, 2004. Module 2 - Hazardous Waste Guidelines: Landfill Waste Acceptance Criteria and Landfill Classification. Appendix A. Class A screening criteria. Note that additional contaminants are included in Appendix A. (Kate Valley Landfill (Class A)).

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Table G4 - Relative Percentage Difference

| RPD          |           |                  |           |           |           |         |           |            |
|--------------|-----------|------------------|-----------|-----------|-----------|---------|-----------|------------|
| Sample Name  | Arsenic   | Cadmium          | Chromium  | Copper    | Lead      | Mercury | Nickel    | Zinc       |
| Units        | mg/kg     |                  |           |           |           |         |           |            |
| QC1          | <u>7</u>  | < 0.10           | <u>16</u> | <u>10</u> | 20        | < 0.10  | <u>13</u> | <u>63</u>  |
| TP19_0.1-0.3 | <u>6</u>  | < 0.10           | <u>15</u> | <u>10</u> | 19.6      | < 0.10  | <u>13</u> | <u>63</u>  |
| <b>RPD</b>   | 15.38     | 0                | 6.45      | 0         | 2.02      | 0       | 0         | 0          |
| QC2          | <u>10</u> | <u>0.12</u>      | <u>15</u> | <u>16</u> | 33        | < 0.10  | <u>12</u> | <u>111</u> |
| TP13_0.5-0.8 | <u>12</u> | <u>0.11</u>      | <u>19</u> | <u>18</u> | 27        | < 0.10  | <u>11</u> | <u>99</u>  |
| <b>RPD</b>   | 18.18     | 8.70             | 23.53     | 11.75     | 20        | 0       | 8.70      | 11.43      |
| QC3          | <u>6</u>  | <u>&lt; 0.10</u> | <u>15</u> | 9         | 19.6      | < 0.10  | <u>14</u> | <u>64</u>  |
| TP09_0.1-0.3 | <u>6</u>  | <u>0.11</u>      | <u>16</u> | 9         | 20        | < 0.10  | <u>12</u> | <u>63</u>  |
| <b>RPD</b>   | 0         | 0                | 6.45      | 0         | 2.02      | 0       | 15.38     | 1.57       |
| QC4          | <u>4</u>  | < 0.10           | 11        | <u>8</u>  | <u>49</u> | < 0.10  | 9         | <u>72</u>  |
| TP05_0.5-0.8 | <u>4</u>  | < 0.10           | 11        | <u>8</u>  | <u>42</u> | < 0.10  | 9         | <u>63</u>  |
| <b>RPD</b>   | 0         | 0                | 0         | 0         | 15.38     | 0       | 0         | 13.33      |
| QC5          | 3         | < 0.10           | <u>12</u> | <u>9</u>  | 10.7      | < 0.10  | <u>11</u> | 35         |
| TP20_0.5-0.8 | 3         | < 0.10           | <u>13</u> | <u>9</u>  | 12.4      | < 0.10  | <u>12</u> | 37         |
| <b>RPD</b>   | 0         | 0                | -8        | 0         | 14.72     | 0       | 8.70      | 5.56       |

**Key:**

Indicated where one sample contains a detection and one sample is below the laboratory LOR, half the value of the laboratory LOR has been used to calculate the RPD

\*

Grey Text

Indicates concentrations below the laboratory limit of reporting (LOR)

**Red Bold Text**

Indicates an exceedance of the MfE Data Quality Objectives.

IA271200 - Southshore Bund - Detailed Site Investigation  
Table G5 - Heavy Metal Soil Analytical Results Compared to CCME, 2002 Guidelines

| Environmental Standards - CCME 2002 |             |               |         |         |          |        |      |         |        |      |
|-------------------------------------|-------------|---------------|---------|---------|----------|--------|------|---------|--------|------|
| Sample Name                         | Sample Date | Depth (m bgl) | Arsenic | Cadmium | Chromium | Copper | Lead | Mercury | Nickel | Zinc |
| CCME 2002 - Agricultural            |             |               | 12      | 1.4     | 64       | 63     | 70   | 6.6     | 45     | 250  |
| CCME 2002 - Residential/Parkland    |             |               | 12      | 10      | 64       | 63     | 140  | 6.6     | 45     | 250  |
| CCME 2002 - Commercial              |             |               | 12      | 22      | 87       | 91     | 260  | 24      | 89     | 410  |
| CCME 2002 - Industrial              |             |               | 12      | 22      | 87       | 91     | 600  | 50      | 89     | 410  |
| Units                               |             |               | mg/kg   |         |          |        |      |         |        |      |
| Testpit Locations                   |             |               |         |         |          |        |      |         |        |      |
| TP01_0.1-0.3                        | 7/04/2022   | 0.1 - 0.3     | 7       | < 0.10  | 15       | 10     | 28   | < 0.10  | 13     | 71   |
| TP01_0.5-0.8                        | 7/04/2022   | 0.5 - 0.8     | 4       | < 0.10  | 11       | 7      | 40   | < 0.10  | 9      | 64   |
| TP03_0.1-0.3                        | 7/04/2022   | 0.1 - 0.3     | 6       | < 0.10  | 15       | 9      | 26   | < 0.10  | 12     | 64   |
| TP03_0.5-0.8                        | 7/04/2022   | 0.5 - 0.8     | 5       | < 0.10  | 14       | 19     | 41   | < 0.10  | 10     | 86   |
| TP04_0.5-0.8                        | 7/04/2022   | 0.5 - 0.8     | 8       | 0.12    | 14       | 18     | 88   | 0.18    | 11     | 121  |
| TP05_0.1-0.3                        | 7/04/2022   | 0.1 - 0.3     | 7       | 0.12    | 17       | 11     | 29   | < 0.10  | 13     | 72   |
| TP05_0.5-0.8                        | 7/04/2022   | 0.5 - 0.8     | 4       | < 0.10  | 11       | 8      | 42   | < 0.10  | 9      | 63   |
| TP06_0.5-0.8                        | 7/04/2022   | 0.5 - 0.8     | 8       | < 0.10  | 16       | 12     | 24   | < 0.10  | 12     | 72   |
| TP07_0.1-0.3                        | 7/04/2022   | 0.1 - 0.3     | 5       | < 0.10  | 13       | 8      | 14.3 | < 0.10  | 11     | 45   |
| TP07_0.5-0.8                        | 7/04/2022   | 0.5 - 0.8     | 7       | 0.18    | 16       | 13     | 63   | < 0.10  | 12     | 96   |
| TP08_0.5-0.8                        | 6/04/2022   | 0.5 - 0.8     | 4       | < 0.10  | 11       | 9      | 23   | < 0.10  | 9      | 48   |
| TP09_0.1-0.3                        | 6/04/2022   | 0.1 - 0.3     | 6       | 0.11    | 16       | 9      | 20   | < 0.10  | 12     | 63   |
| TP09_0.5-0.8                        | 6/04/2022   | 0.5 - 0.8     | 4       | < 0.10  | 12       | 7      | 14.6 | < 0.10  | 11     | 45   |
| TP10_0.5-0.8                        | 6/04/2022   | 0.5 - 0.8     | 7       | 0.11    | 14       | 9      | 25   | < 0.10  | 12     | 70   |
| TP11_0.1-0.3                        | 6/04/2022   | 0.1 - 0.3     | 6       | < 0.10  | 15       | 8      | 21   | < 0.10  | 12     | 61   |
| TP11_0.5-0.8                        | 6/04/2022   | 0.5 - 0.8     | 4       | < 0.10  | 10       | 3      | 11.1 | < 0.10  | 8      | 37   |
| TP12_0.1-0.3                        | 6/04/2022   | 0.1 - 0.3     | 5       | < 0.10  | 14       | 8      | 18.1 | < 0.10  | 12     | 59   |
| TP13_0.1-0.3                        | 6/04/2022   | 0.1 - 0.3     | 7       | < 0.10  | 15       | 10     | 19.3 | < 0.10  | 13     | 64   |
| TP13_0.5-0.8                        | 6/04/2022   | 0.5 - 0.8     | 10      | 0.12    | 15       | 16     | 33   | < 0.10  | 12     | 111  |
| TP14_0.1-0.3                        | 6/04/2022   | 0.1 - 0.3     | 4       | < 0.10  | 10       | 5      | 16.1 | < 0.10  | 8      | 57   |
| TP14_0.5-0.8                        | 6/04/2022   | 0.5 - 0.8     | 4       | < 0.10  | 10       | 5      | 11.4 | < 0.10  | 8      | 44   |
| TP15_0.1-0.3                        | 6/04/2022   | 0.1 - 0.3     | 6       | 0.12    | 14       | 11     | 29   | < 0.10  | 12     | 80   |
| TP15_0.5-0.8                        | 6/04/2022   | 0.5 - 0.8     | 5       | 0.11    | 13       | 11     | 47   | < 0.10  | 10     | 80   |
| TP16_0.5-0.8                        | 6/04/2022   | 0.5 - 0.8     | 7       | 0.11    | 14       | 14     | 32   | < 0.10  | 11     | 89   |
| TP17_0.1-0.3                        | 6/04/2022   | 0.1 - 0.3     | 7       | < 0.10  | 16       | 13     | 24   | < 0.10  | 14     | 81   |
| TP17_0.5-0.8                        | 6/04/2022   | 0.5 - 0.8     | 4       | < 0.10  | 11       | 4      | 14.6 | < 0.10  | 8      | 48   |
| TP18_0.5-0.8                        | 6/04/2022   | 0.5 - 0.8     | 9       | 0.13    | 15       | 16     | 127  | < 0.10  | 13     | 116  |
| TP19_0.1-0.3                        | 6/04/2022   | 0.1 - 0.3     | 6       | < 0.10  | 15       | 10     | 19.6 | < 0.10  | 13     | 63   |
| TP19_0.5-0.8                        | 6/04/2022   | 0.5 - 0.8     | 5       | < 0.10  | 17       | 7      | 14.7 | < 0.10  | 9      | 53   |
| TP20_0.1-0.3                        | 7/04/2022   | 0.1 - 0.3     | 3       | < 0.10  | 17       | 16     | 17.9 | < 0.10  | 22     | 47   |
| TP20_0.5-0.8                        | 7/04/2022   | 0.5 - 0.8     | 3       | < 0.10  | 13       | 9      | 12.4 | < 0.10  | 12     | 37   |

|                         |                                                                                                                                                               |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Key:                    |                                                                                                                                                               |
| Environmental Standards |                                                                                                                                                               |
| Blue                    | Canadian Council of Ministers of the Environment, 2002, Soil Quality Guidelines for the Protection of Environmental and Human Health - Agricultural           |
| Light Blue              | Canadian Council of Ministers of the Environment, 2002, Soil Quality Guidelines for the Protection of Environmental and Human Health - Residential / parkland |
| Light Green             | Canadian Council of Ministers of the Environment, 2002, Soil Quality Guidelines for the Protection of Environmental and Human Health - Commerical             |
| Green                   | Canadian Council of Ministers of the Environment, 2002, Soil Quality Guidelines for the Protection of Environmental and Human Health - Industrial             |

## **Appendix H. Laboratory Results**



## Certificate of Analysis

Page 1 of 8

|                 |                                |                          |                 |       |
|-----------------|--------------------------------|--------------------------|-----------------|-------|
| <b>Client:</b>  | Jacobs New Zealand Limited     | <b>Lab No:</b>           | 2951007         | A2Pv1 |
| <b>Contact:</b> | Hannah Wood                    | <b>Date Received:</b>    | 09-Apr-2022     |       |
|                 | C/- Jacobs New Zealand Limited | <b>Date Reported:</b>    | 28-Apr-2022     |       |
|                 | PO Box 1147                    | <b>Quote No:</b>         | 116819          |       |
|                 | Christchurch 8140              | <b>Order No:</b>         | 1062            |       |
|                 |                                | <b>Client Reference:</b> | Southshore Bund |       |
|                 |                                | <b>Submitted By:</b>     | Kate Murray     |       |

### Sample Type: Soil

| Sample Name:                                                     | TP-01_0.1-0.3<br>07-Apr-2022<br>11:50 am | TP-02_0.1-0.3<br>07-Apr-2022<br>11:25 am | TP-03_0.1-0.3<br>07-Apr-2022<br>10:45 am | TP-04_0.1-0.3<br>07-Apr-2022<br>10:10 am | TP-05_0.1-0.3<br>07-Apr-2022 9:45<br>am |
|------------------------------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|-----------------------------------------|
| Lab Number:                                                      | 2951007.1                                | 2951007.2                                | 2951007.3                                | 2951007.4                                | 2951007.5                               |
| <b>Asbestos Presence / Absence</b>                               | 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                            | % w/w < 0.001                            | % w/w < 0.001                            | % w/w < 0.001                            | % w/w < 0.001                           |
| Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample* | % w/w < 0.001                            | % w/w < 0.001                            | % w/w < 0.001                            | % w/w < 0.001                            | % w/w < 0.001                           |
| Asbestos as Fibrous Asbestos as % of Total Sample*               | % w/w < 0.001                            | % w/w < 0.001                            | % w/w < 0.001                            | % w/w < 0.001                            | % w/w < 0.001                           |
| Asbestos as Asbestos Fines as % of Total Sample*                 | % w/w < 0.001                            | % w/w < 0.001                            | % w/w < 0.001                            | % w/w < 0.001                            | % w/w < 0.001                           |
| As Received Weight                                               | g 758.2                                  | g 746.3                                  | g 802.4                                  | g 725.8                                  | g 746.4                                 |
| Dry Weight                                                       | g 687.0                                  | g 685.9                                  | g 736.7                                  | g 634.2                                  | g 683.2                                 |
| Moisture                                                         | % 9                                      | % 8                                      | % 8                                      | % 13                                     | % 8                                     |
| Sample Fraction >10mm                                            | g dry wt 83.2                            | g dry wt 25.8                            | g dry wt 119.8                           | g dry wt 60.5                            | g dry wt 90.3                           |
| Sample Fraction <10mm to >2mm                                    | g dry wt 128.1                           | g dry wt 107.7                           | g dry wt 182.5                           | g dry wt 147.7                           | g dry wt 187.8                          |
| Sample Fraction <2mm                                             | g dry wt 474.2                           | g dry wt 551.7                           | g dry wt 433.0                           | g dry wt 424.9                           | g dry wt 403.9                          |
| <2mm Subsample Weight                                            | g dry wt 57.5                            | g dry wt 57.6                            | g dry wt 52.4                            | g dry wt 55.5                            | g dry wt 58.3                           |
| Weight of Asbestos in ACM (Non-Friable)                          | g dry wt < 0.00001                       | g dry wt < 0.00001                       | g dry wt < 0.00001                       | g dry wt < 0.00001                       | g dry wt < 0.00001                      |
| Weight of Asbestos as Fibrous Asbestos (Friable)                 | g dry wt < 0.00001                       | g dry wt < 0.00001                       | g dry wt < 0.00001                       | g dry wt < 0.00001                       | g dry wt < 0.00001                      |
| Weight of Asbestos as Asbestos Fines (Friable)*                  | g dry wt < 0.00001                       | g dry wt < 0.00001                       | g dry wt < 0.00001                       | g dry wt < 0.00001                       | g dry wt < 0.00001                      |

| Sample Name:                                                     | TP-06_0.1-0.3<br>07-Apr-2022 9:15<br>am | TP-07_0.1-0.3<br>07-Apr-2022 | TP-08_0.1-0.3<br>06-Apr-2022 | TP-09_0.1-0.3<br>06-Apr-2022 4:10<br>pm | TP-10_0.1-0.3<br>06-Apr-2022 3:50<br>pm |
|------------------------------------------------------------------|-----------------------------------------|------------------------------|------------------------------|-----------------------------------------|-----------------------------------------|
| Lab Number:                                                      | 2951007.6                               | 2951007.7                    | 2951007.8                    | 2951007.9                               | 2951007.10                              |
| <b>Asbestos Presence / Absence</b>                               | 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                           | % w/w < 0.001                | % w/w < 0.001                | % w/w < 0.001                           | % w/w < 0.001                           |
| Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample* | % w/w < 0.001                           | % w/w < 0.001                | % w/w < 0.001                | % w/w < 0.001                           | % w/w < 0.001                           |
| Asbestos as Fibrous Asbestos as % of Total Sample*               | % w/w < 0.001                           | % w/w < 0.001                | % w/w < 0.001                | % w/w < 0.001                           | % w/w < 0.001                           |
| Asbestos as Asbestos Fines as % of Total Sample*                 | % w/w < 0.001                           | % w/w < 0.001                | % w/w < 0.001                | % w/w < 0.001                           | % w/w < 0.001                           |
| As Received Weight                                               | g 783.0                                 | g 799.6                      | g 649.2                      | g 687.1                                 | g 670.5                                 |
| Dry Weight                                                       | g 757.5                                 | g 759.6                      | g 561.0                      | g 583.9                                 | g 576.6                                 |



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                                                |          |                                          |                                          |                                          |                                          |                                          |
|------------------------------------------------------------------|----------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| <b>Sample Name:</b>                                              |          | TP-06_0.1-0.3<br>07-Apr-2022 9:15<br>am  | TP-07_0.1-0.3<br>07-Apr-2022             | TP-08_0.1-0.3<br>06-Apr-2022             | TP-09_0.1-0.3<br>06-Apr-2022 4:10<br>pm  | TP-10_0.1-0.3<br>06-Apr-2022 3:50<br>pm  |
| <b>Lab Number:</b>                                               |          | 2951007.6                                | 2951007.7                                | 2951007.8                                | 2951007.9                                | 2951007.10                               |
| Moisture                                                         | %        | 3                                        | 5                                        | 14                                       | 15                                       | 14                                       |
| Sample Fraction >10mm                                            | g dry wt | 235.3                                    | 174.0                                    | 9.7                                      | 2.7                                      | 22.8                                     |
| Sample Fraction <10mm to >2mm                                    | g dry wt | 294.4                                    | 308.0                                    | 86.2                                     | 89.3                                     | 88.6                                     |
| Sample Fraction <2mm                                             | g dry wt | 226.9                                    | 277.2                                    | 463.8                                    | 491.3                                    | 464.3                                    |
| <2mm Subsample Weight                                            | g dry wt | 55.7                                     | 59.6                                     | 54.6                                     | 56.6                                     | 55.1                                     |
| 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                                |
| <b>Sample Name:</b>                                              |          | TP-11_0.1-0.3<br>06-Apr-2022 3:30<br>pm  | TP-12_0.1-0.3<br>06-Apr-2022 3:30<br>pm  | TP-13_0.1-0.3<br>06-Apr-2022 2:30<br>pm  | TP-14_0.1-0.3<br>06-Apr-2022 2:00<br>pm  | TP-15_0.1-0.3<br>06-Apr-2022 11:36<br>am |
| <b>Lab Number:</b>                                               |          | 2951007.11                               | 2951007.12                               | 2951007.13                               | 2951007.14                               | 2951007.15                               |
| <b>Asbestos Presence / Absence</b>                               |          | 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                                  |
| 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        | 687.9                                    | 537.3                                    | 710.8                                    | 757.2                                    | 789.3                                    |
| Dry Weight                                                       | g        | 576.4                                    | 488.1                                    | 622.7                                    | 700.0                                    | 694.2                                    |
| Moisture                                                         | %        | 16                                       | -                                        | 12                                       | 8                                        | 12                                       |
| Sample Fraction >10mm                                            | g dry wt | 24.2                                     | 7.6                                      | 15.2                                     | 52.0                                     | 12.9                                     |
| Sample Fraction <10mm to >2mm                                    | g dry wt | 58.6                                     | 78.3                                     | 125.7                                    | 135.4                                    | 103.7                                    |
| Sample Fraction <2mm                                             | g dry wt | 492.6                                    | 401.0                                    | 480.5                                    | 511.5                                    | 576.4                                    |
| <2mm Subsample Weight                                            | g dry wt | 54.8                                     | 56.7                                     | 51.9                                     | 57.7                                     | 59.3                                     |
| Weight of Asbestos in >10mm Sample Fraction                      | g dry wt | -                                        | < 0.00001                                | -                                        | -                                        | -                                        |
| Weight of Asbestos in <10mm to >2mm Sample Fraction              | g dry wt | -                                        | < 0.00001                                | -                                        | -                                        | -                                        |
| Weight of Asbestos in <2mm Sample Fraction                       | g dry wt | -                                        | < 0.00001                                | -                                        | -                                        | -                                        |
| 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                                |
| <b>Sample Name:</b>                                              |          | TP-16_0.1-0.3<br>06-Apr-2022 11:06<br>am | TP-17_0.1-0.3<br>06-Apr-2022 10:25<br>am | TP-18_0.1-0.3<br>06-Apr-2022 12:49<br>pm | TP-19_0.1-0.3<br>06-Apr-2022 12:20<br>pm | TP-20_0.1-0.3<br>07-Apr-2022 12:20<br>pm |
| <b>Lab Number:</b>                                               |          | 2951007.16                               | 2951007.17                               | 2951007.18                               | 2951007.19                               | 2951007.20                               |
| <b>Asbestos Presence / Absence</b>                               |          | 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                                  |

| Sample Type: Soil                                |          |                                          |                                          |                                          |                                          |                                          |
|--------------------------------------------------|----------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| <b>Sample Name:</b>                              |          | TP-16_0.1-0.3<br>06-Apr-2022<br>11:06 am | TP-17_0.1-0.3<br>06-Apr-2022<br>10:25 am | TP-18_0.1-0.3<br>06-Apr-2022<br>12:49 pm | TP-19_0.1-0.3<br>06-Apr-2022<br>12:20 pm | TP-20_0.1-0.3<br>07-Apr-2022<br>12:20 pm |
| <b>Lab Number:</b>                               |          | 2951007.16                               | 2951007.17                               | 2951007.18                               | 2951007.19                               | 2951007.20                               |
| As Received Weight                               | g        | 694.0                                    | 775.5                                    | 650.3                                    | 681.2                                    | 903.0                                    |
| Dry Weight                                       | g        | 600.1                                    | 691.1                                    | 547.7                                    | 571.8                                    | 855.1                                    |
| Moisture                                         | %        | 14                                       | 11                                       | 16                                       | 16                                       | 5                                        |
| Sample Fraction >10mm                            | g dry wt | 14.0                                     | 77.4                                     | 30.0                                     | 26.3                                     | 323.6                                    |
| Sample Fraction <10mm to >2mm                    | g dry wt | 94.4                                     | 123.7                                    | 61.4                                     | 81.7                                     | 260.0                                    |
| Sample Fraction <2mm                             | g dry wt | 490.8                                    | 488.8                                    | 455.5                                    | 463.1                                    | 271.2                                    |
| <2mm Subsample Weight                            | g dry wt | 54.1                                     | 59.7                                     | 57.8                                     | 59.3                                     | 55.7                                     |
| 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                                |

|                                                                  |          |                              |                                      |                                      |                                       |                                      |
|------------------------------------------------------------------|----------|------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|--------------------------------------|
| <b>Sample Name:</b>                                              |          | TP-21_0.1-0.3<br>07-Apr-2022 | SS-01_0.1-0.3<br>07-Apr-2022 1:24 pm | SS-02_0.1-0.3<br>07-Apr-2022 1:50 pm | SS-03_0.1-0.3<br>07-Apr-2022 2:05 pm  | SS-04_0.1-0.3<br>07-Apr-2022 2:30 pm |
| <b>Lab Number:</b>                                               |          | 2951007.21                   | 2951007.22                           | 2951007.23                           | 2951007.24                            | 2951007.25                           |
| <b>Asbestos Presence / Absence</b>                               |          | Asbestos NOT detected.       | Asbestos NOT detected.               | Asbestos NOT detected.               | Chrysotile (White Asbestos) detected. | Asbestos NOT detected.               |
| Description of Asbestos Form                                     |          | -                            | -                                    | -                                    | Fibre Cement                          | -                                    |
| Asbestos in ACM as % of Total Sample*                            | % w/w    | < 0.001                      | < 0.001                              | < 0.001                              | 0.038                                 | < 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        | 862.4                        | 568.0                                | 624.9                                | 682.5                                 | 863.6                                |
| Dry Weight                                                       | g        | 831.1                        | 500.0                                | 510.5                                | 617.6                                 | 722.5                                |
| Moisture                                                         | %        | 4                            | 12                                   | 18                                   | 10                                    | 16                                   |
| Sample Fraction >10mm                                            | g dry wt | 375.6                        | 20.3                                 | 1.5                                  | 62.1                                  | 62.7                                 |
| Sample Fraction <10mm to >2mm                                    | g dry wt | 272.2                        | 29.6                                 | 112.5                                | 103.2                                 | 163.0                                |
| Sample Fraction <2mm                                             | g dry wt | 183.0                        | 449.7                                | 394.4                                | 452.1                                 | 494.3                                |
| <2mm Subsample Weight                                            | g dry wt | 54.9                         | 54.4                                 | 59.7                                 | 52.7                                  | 56.5                                 |
| Weight of Asbestos in ACM (Non-Friable)                          | g dry wt | < 0.00001                    | < 0.00001                            | < 0.00001                            | 0.2333                                | < 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                            |

|                                                                  |       |                                      |                                      |                                                                       |                                      |                                      |
|------------------------------------------------------------------|-------|--------------------------------------|--------------------------------------|-----------------------------------------------------------------------|--------------------------------------|--------------------------------------|
| <b>Sample Name:</b>                                              |       | SS-05_0.1-0.3<br>07-Apr-2022 2:44 pm | SS-06_0.1-0.3<br>07-Apr-2022 3:00 pm | SS-07_0.1-0.3<br>07-Apr-2022 3:10 pm                                  | SS-08_0.1-0.3<br>07-Apr-2022 3:30 pm | SS-09_0.1-0.3<br>07-Apr-2022 3:41 pm |
| <b>Lab Number:</b>                                               |       | 2951007.26                           | 2951007.27                           | 2951007.28                                                            | 2951007.29                           | 2951007.30                           |
| <b>Asbestos Presence / Absence</b>                               |       | Asbestos NOT detected.               | Asbestos NOT detected.               | Chrysotile (White Asbestos) and Crocidolite (Blue Asbestos) detected. | Asbestos NOT detected.               | Asbestos NOT detected.               |
| Description of Asbestos Form                                     |       | -                                    | -                                    | Fibre cement                                                          | -                                    | -                                    |
| Asbestos in ACM as % of Total Sample*                            | % w/w | < 0.001                              | < 0.001                              | 0.028                                                                 | < 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                              |

| Sample Type: Soil                                |          |                                         |                                         |                                         |                                         |                                         |
|--------------------------------------------------|----------|-----------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|
| <b>Sample Name:</b>                              |          | SS-05_0.1-0.3<br>07-Apr-2022 2:44<br>pm | SS-06_0.1-0.3<br>07-Apr-2022 3:00<br>pm | SS-07_0.1-0.3<br>07-Apr-2022 3:10<br>pm | SS-08_0.1-0.3<br>07-Apr-2022 3:30<br>pm | SS-09_0.1-0.3<br>07-Apr-2022 3:41<br>pm |
| <b>Lab Number:</b>                               |          | 2951007.26                              | 2951007.27                              | 2951007.28                              | 2951007.29                              | 2951007.30                              |
| As Received Weight                               | g        | 759.8                                   | 820.7                                   | 877.2                                   | 967.2                                   | 624.4                                   |
| Dry Weight                                       | g        | 607.2                                   | 699.1                                   | 739.9                                   | 801.6                                   | 536.8                                   |
| Moisture                                         | %        | 20                                      | 15                                      | 16                                      | 17                                      | 14                                      |
|                                                  |          |                                         |                                         |                                         |                                         |                                         |
| Sample Fraction >10mm                            | g dry wt | 48.6                                    | 12.9                                    | 15.1                                    | 49.5                                    | 69.7                                    |
| Sample Fraction <10mm to >2mm                    | g dry wt | 61.2                                    | 36.8                                    | 66.0                                    | 240.5                                   | 162.9                                   |
| Sample Fraction <2mm                             | g dry wt | 497.1                                   | 648.9                                   | 658.6                                   | 509.9                                   | 303.0                                   |
| <2mm Subsample Weight                            | g dry wt | 58.6                                    | 55.1                                    | 57.3                                    | 54.4                                    | 51.4                                    |
| Weight of Asbestos in ACM (Non-Friable)          | g dry wt | < 0.00001                               | < 0.00001                               | 0.2039                                  | < 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                               |

|                                                                  |          |                                         |                                         |                                         |                                       |                                       |
|------------------------------------------------------------------|----------|-----------------------------------------|-----------------------------------------|-----------------------------------------|---------------------------------------|---------------------------------------|
| <b>Sample Name:</b>                                              |          | SS-10_0.1-0.3<br>07-Apr-2022 3:58<br>pm | SS-11_0.1-0.3<br>07-Apr-2022 4:05<br>pm | SS-12_0.1-0.3<br>07-Apr-2022 4:20<br>pm | TP-01_0.5-0.8<br>07-Apr-2022 11:55 am | TP-02_0.5-0.8<br>07-Apr-2022 11:25 am |
| <b>Lab Number:</b>                                               |          | 2951007.31                              | 2951007.32                              | 2951007.33                              | 2951007.34                            | 2951007.35                            |
| <b>Asbestos Presence / Absence</b>                               |          | 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        | 778.1                                   | 860.7                                   | 690.2                                   | 645.3                                 | 809.6                                 |
| Dry Weight                                                       | g        | 685.7                                   | 682.5                                   | 583.1                                   | 581.4                                 | 719.7                                 |
| Moisture                                                         | %        | 12                                      | 21                                      | 16                                      | 10                                    | 11                                    |
|                                                                  |          |                                         |                                         |                                         |                                       |                                       |
| Sample Fraction >10mm                                            | g dry wt | 2.3                                     | 5.6                                     | 14.7                                    | 46.7                                  | 8.5                                   |
| Sample Fraction <10mm to >2mm                                    | g dry wt | 43.6                                    | 112.2                                   | 48.2                                    | 103.4                                 | 23.9                                  |
| Sample Fraction <2mm                                             | g dry wt | 638.8                                   | 563.6                                   | 519.2                                   | 430.6                                 | 686.1                                 |
| <2mm Subsample Weight                                            | g dry wt | 54.8                                    | 54.4                                    | 54.6                                    | 57.3                                  | 59.8                                  |
| 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                             |

|                                                                  |       |                                       |                                       |                                                                       |                                      |                                      |
|------------------------------------------------------------------|-------|---------------------------------------|---------------------------------------|-----------------------------------------------------------------------|--------------------------------------|--------------------------------------|
| <b>Sample Name:</b>                                              |       | TP-03_0.5-0.8<br>07-Apr-2022 10:45 am | TP-04_0.5-0.8<br>07-Apr-2022 10:10 am | TP-05_0.5-0.8<br>07-Apr-2022 9:45 am                                  | TP-06_0.5-0.8<br>07-Apr-2022 9:15 am | TP-07_0.5-0.8<br>07-Apr-2022 8:45 am |
| <b>Lab Number:</b>                                               |       | 2951007.36                            | 2951007.37                            | 2951007.38                                                            | 2951007.39                           | 2951007.40                           |
| <b>Asbestos Presence / Absence</b>                               |       | Asbestos NOT detected.                | Asbestos NOT detected.                | Chrysotile (White Asbestos) and Crocidolite (Blue Asbestos) detected. | Asbestos NOT detected.               | Asbestos NOT detected.               |
| Description of Asbestos Form                                     |       | -                                     | -                                     | ACM debris                                                            | -                                    | -                                    |
| Asbestos in ACM as % of Total Sample*                            | % w/w | < 0.001                               | -                                     | < 0.001                                                               | -                                    | < 0.001                              |
| Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample* | % w/w | < 0.001                               | -                                     | 0.001                                                                 | -                                    | < 0.001                              |
| Asbestos as Fibrous Asbestos as % of Total Sample*               | % w/w | < 0.001                               | -                                     | < 0.001                                                               | -                                    | < 0.001                              |
| Asbestos as Asbestos Fines as % of Total Sample*                 | % w/w | < 0.001                               | -                                     | 0.001                                                                 | -                                    | < 0.001                              |
| As Received Weight                                               | g     | 632.5                                 | 504.2                                 | 758.9                                                                 | 449.4                                | 715.2                                |

| Sample Type: Soil                                      |          |                                          |                                          |                                         |                                         |                                         |
|--------------------------------------------------------|----------|------------------------------------------|------------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|
| <b>Sample Name:</b>                                    |          | TP-03_0.5-0.8<br>07-Apr-2022<br>10:45 am | TP-04_0.5-0.8<br>07-Apr-2022<br>10:10 am | TP-05_0.5-0.8<br>07-Apr-2022 9:45<br>am | TP-06_0.5-0.8<br>07-Apr-2022 9:15<br>am | TP-07_0.5-0.8<br>07-Apr-2022 8:45<br>am |
| <b>Lab Number:</b>                                     |          | 2951007.36                               | 2951007.37                               | 2951007.38                              | 2951007.39                              | 2951007.40                              |
| Dry Weight                                             | g        | 570.5                                    | 453.6                                    | 702.2                                   | 401.2                                   | 627.3                                   |
| Moisture                                               | %        | 10                                       | -                                        | 7                                       | -                                       | 12                                      |
| Sample Fraction >10mm                                  | g dry wt | 48.6                                     | 42.3                                     | 71.4                                    | 37.9                                    | 93.3                                    |
| Sample Fraction <10mm to >2mm                          | g dry wt | 97.2                                     | 141.5                                    | 93.4                                    | 134.2                                   | 167.1                                   |
| Sample Fraction <2mm                                   | g dry wt | 424.1                                    | 269.3                                    | 536.8                                   | 228.7                                   | 366.6                                   |
| <2mm Subsample Weight                                  | g dry wt | 59.5                                     | 55.2                                     | 57.2                                    | 58.9                                    | 57.4                                    |
| Weight of Asbestos in >10mm<br>Sample Fraction         | g dry wt | -                                        | < 0.00001                                | -                                       | < 0.00001                               | -                                       |
| Weight of Asbestos in <10mm<br>to >2mm Sample Fraction | g dry wt | -                                        | < 0.00001                                | -                                       | < 0.00001                               | -                                       |
| Weight of Asbestos in <2mm Sample<br>Fraction          | g dry wt | -                                        | < 0.00001                                | -                                       | < 0.00001                               | -                                       |
| Weight of Asbestos in ACM (Non-<br>Friable)            | g dry wt | < 0.00001                                | -                                        | < 0.00001                               | -                                       | < 0.00001                               |
| Weight of Asbestos as Fibrous<br>Asbestos (Friable)    | g dry wt | < 0.00001                                | -                                        | < 0.00001                               | -                                       | < 0.00001                               |
| Weight of Asbestos as Asbestos<br>Fines (Friable)*     | g dry wt | < 0.00001                                | -                                        | 0.01023                                 | -                                       | < 0.00001                               |

|                                                                     |          |                                         |                                         |                                         |                                             |                                         |
|---------------------------------------------------------------------|----------|-----------------------------------------|-----------------------------------------|-----------------------------------------|---------------------------------------------|-----------------------------------------|
| <b>Sample Name:</b>                                                 |          | TP-08_0.5-0.8<br>06-Apr-2022 4:45<br>pm | TP-09_0.5-0.8<br>06-Apr-2022 4:10<br>pm | TP-10_0.5-0.8<br>06-Apr-2022 3:50<br>pm | TP-11_0.5-0.8<br>06-Apr-2022 3:30<br>pm     | TP-12_0.5-0.8<br>06-Apr-2022 1:00<br>pm |
| <b>Lab Number:</b>                                                  |          | 2951007.41                              | 2951007.42                              | 2951007.43                              | 2951007.44                                  | 2951007.45                              |
| <b>Asbestos Presence / Absence</b>                                  |          | Asbestos NOT<br>detected.               | Asbestos NOT<br>detected.               | Asbestos NOT<br>detected.               | Chrysotile (White<br>Asbestos)<br>detected. | Asbestos NOT<br>detected.               |
| Description of Asbestos Form                                        |          | -                                       | -                                       | -                                       | ACM debris                                  | -                                       |
| Asbestos in ACM as % of Total<br>Sample*                            | % w/w    | -                                       | < 0.001                                 | -                                       | < 0.001                                     | -                                       |
| Combined Fibrous Asbestos +<br>Asbestos Fines as % of Total Sample* | % w/w    | -                                       | < 0.001                                 | -                                       | 0.001                                       | -                                       |
| Asbestos as Fibrous Asbestos as % of<br>Total Sample*               | % w/w    | -                                       | < 0.001                                 | -                                       | < 0.001                                     | -                                       |
| Asbestos as Asbestos Fines as % of<br>Total Sample*                 | % w/w    | -                                       | < 0.001                                 | -                                       | 0.001                                       | -                                       |
| As Received Weight                                                  | g        | 561.7                                   | 743.4                                   | 507.1                                   | 837.5                                       | 489.8                                   |
| Dry Weight                                                          | g        | 482.8                                   | 640.0                                   | 431.6                                   | 701.9                                       | 448.0                                   |
| Moisture                                                            | %        | -                                       | 14                                      | -                                       | 16                                          | -                                       |
| Sample Fraction >10mm                                               | g dry wt | 17.0                                    | 38.8                                    | 46.7                                    | 19.2                                        | 14.3                                    |
| Sample Fraction <10mm to >2mm                                       | g dry wt | 65.9                                    | 89.0                                    | 83.6                                    | 45.2                                        | 48.1                                    |
| Sample Fraction <2mm                                                | g dry wt | 399.3                                   | 511.6                                   | 300.7                                   | 636.8                                       | 385.2                                   |
| <2mm Subsample Weight                                               | g dry wt | 54.7                                    | 57.4                                    | 56.3                                    | 58.8                                        | 60.0                                    |
| Weight of Asbestos in >10mm<br>Sample Fraction                      | g dry wt | < 0.00001                               | -                                       | < 0.00001                               | -                                           | < 0.00001                               |
| Weight of Asbestos in <10mm<br>to >2mm Sample Fraction              | g dry wt | < 0.00001                               | -                                       | < 0.00001                               | -                                           | < 0.00001                               |
| Weight of Asbestos in <2mm Sample<br>Fraction                       | g dry wt | < 0.00001                               | -                                       | < 0.00001                               | -                                           | < 0.00001                               |
| Weight of Asbestos in ACM (Non-<br>Friable)                         | g dry wt | -                                       | < 0.00001                               | -                                       | < 0.00001                                   | -                                       |
| Weight of Asbestos as Fibrous<br>Asbestos (Friable)                 | g dry wt | -                                       | < 0.00001                               | -                                       | < 0.00001                                   | -                                       |
| Weight of Asbestos as Asbestos<br>Fines (Friable)*                  | g dry wt | -                                       | < 0.00001                               | -                                       | 0.00751                                     | -                                       |

|                                    |  |                                         |                                         |                                          |                              |                                          |
|------------------------------------|--|-----------------------------------------|-----------------------------------------|------------------------------------------|------------------------------|------------------------------------------|
| <b>Sample Name:</b>                |  | TP-13_0.5-0.8<br>06-Apr-2022 2:30<br>pm | TP-14_0.5-0.8<br>06-Apr-2022 2:00<br>pm | TP-15_0.5-0.8<br>06-Apr-2022<br>11:36 am | TP-16_0.5-0.8<br>06-Apr-2022 | TP-17_0.5-0.8<br>06-Apr-2022<br>10:31 am |
| <b>Lab Number:</b>                 |  | 2951007.46                              | 2951007.47                              | 2951007.48                               | 2951007.49                   | 2951007.50                               |
| <b>Asbestos Presence / Absence</b> |  | Asbestos NOT<br>detected.               | Asbestos NOT<br>detected.               | Asbestos NOT<br>detected.                | Asbestos NOT<br>detected.    | Asbestos NOT<br>detected.                |
| Description of Asbestos Form       |  | -                                       | -                                       | -                                        | -                            | -                                        |

| Sample Type: Soil                                                |          |                                      |                                      |                                       |                              |                                       |
|------------------------------------------------------------------|----------|--------------------------------------|--------------------------------------|---------------------------------------|------------------------------|---------------------------------------|
| Sample Name:                                                     |          | TP-13_0.5-0.8<br>06-Apr-2022 2:30 pm | TP-14_0.5-0.8<br>06-Apr-2022 2:00 pm | TP-15_0.5-0.8<br>06-Apr-2022 11:36 am | TP-16_0.5-0.8<br>06-Apr-2022 | TP-17_0.5-0.8<br>06-Apr-2022 10:31 am |
| Lab Number:                                                      |          | 2951007.46                           | 2951007.47                           | 2951007.48                            | 2951007.49                   | 2951007.50                            |
| 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        | 648.3                                | 488.1                                | 549.7                                 | 851.2                        | 803.5                                 |
| Dry Weight                                                       | g        | 547.4                                | 464.8                                | 453.0                                 | 751.8                        | 716.8                                 |
| Moisture                                                         | %        | 16                                   | -                                    | 18                                    | 12                           | 11                                    |
| Sample Fraction >10mm                                            | g dry wt | 51.5                                 | 15.2                                 | 17.2                                  | 64.8                         | 20.7                                  |
| Sample Fraction <10mm to >2mm                                    | g dry wt | 95.7                                 | 49.8                                 | 53.8                                  | 117.4                        | 45.3                                  |
| Sample Fraction <2mm                                             | g dry wt | 399.4                                | 399.1                                | 381.3                                 | 568.6                        | 650.2                                 |
| <2mm Subsample Weight                                            | g dry wt | 53.4                                 | 52.7                                 | 51.8                                  | 54.5                         | 55.4                                  |
| Weight of Asbestos in >10mm Sample Fraction                      | g dry wt | -                                    | < 0.00001                            | -                                     | -                            | -                                     |
| Weight of Asbestos in <10mm to >2mm Sample Fraction              | g dry wt | -                                    | < 0.00001                            | -                                     | -                            | -                                     |
| Weight of Asbestos in <2mm Sample Fraction                       | g dry wt | -                                    | < 0.00001                            | -                                     | -                            | -                                     |
| 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                             |

| Sample Name:                                                     |          | TP-18_0.5-0.8<br>06-Apr-2022 12:49 pm | TP-19_0.5-0.8<br>06-Apr-2022 12:20 pm | TP-20_0.5-0.8<br>07-Apr-2022 12:50 pm | TP-21_0.5-0.8<br>07-Apr-2022 12:35 pm |   |
|------------------------------------------------------------------|----------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---|
| Lab Number:                                                      |          | 2951007.51                            | 2951007.52                            | 2951007.53                            | 2951007.54                            |   |
| 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                               | - |
| Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample* | % w/w    | -                                     | < 0.001                               | < 0.001                               | < 0.001                               | - |
| Asbestos as Fibrous Asbestos as % of Total Sample*               | % w/w    | -                                     | < 0.001                               | < 0.001                               | < 0.001                               | - |
| Asbestos as Asbestos Fines as % of Total Sample*                 | % w/w    | -                                     | < 0.001                               | < 0.001                               | < 0.001                               | - |
| As Received Weight                                               | g        | 414.1                                 | 690.7                                 | 808.5                                 | 944.0                                 | - |
| Dry Weight                                                       | g        | 330.2                                 | 606.6                                 | 747.6                                 | 892.7                                 | - |
| Moisture                                                         | %        | -                                     | 12                                    | 8                                     | 5                                     | - |
| Sample Fraction >10mm                                            | g dry wt | 2.6                                   | 42.1                                  | 85.7                                  | 367.0                                 | - |
| Sample Fraction <10mm to >2mm                                    | g dry wt | 76.5                                  | 92.1                                  | 139.5                                 | 185.2                                 | - |
| Sample Fraction <2mm                                             | g dry wt | 250.6                                 | 472.1                                 | 521.9                                 | 339.4                                 | - |
| <2mm Subsample Weight                                            | g dry wt | 55.2                                  | 54.6                                  | 55.7                                  | 50.7                                  | - |
| Weight of Asbestos in >10mm Sample Fraction                      | g dry wt | < 0.00001                             | -                                     | -                                     | -                                     | - |
| Weight of Asbestos in <10mm to >2mm Sample Fraction              | g dry wt | < 0.00001                             | -                                     | -                                     | -                                     | - |
| Weight of Asbestos in <2mm Sample Fraction                       | g dry wt | < 0.00001                             | -                                     | -                                     | -                                     | - |
| Weight of Asbestos in ACM (Non-Friable)                          | g dry wt | -                                     | < 0.00001                             | < 0.00001                             | < 0.00001                             | - |
| Weight of Asbestos as Fibrous Asbestos (Friable)                 | g dry wt | -                                     | < 0.00001                             | < 0.00001                             | < 0.00001                             | - |

| Sample Type: Soil                                        |                                          |                                          |                                          |                                          |   |
|----------------------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|---|
| <b>Sample Name:</b>                                      | TP-18_0.5-0.8<br>06-Apr-2022<br>12:49 pm | TP-19_0.5-0.8<br>06-Apr-2022<br>12:20 pm | TP-20_0.5-0.8<br>07-Apr-2022<br>12:50 pm | TP-21_0.5-0.8<br>07-Apr-2022<br>12:35 pm |   |
| <b>Lab Number:</b>                                       | 2951007.51                               | 2951007.52                               | 2951007.53                               | 2951007.54                               |   |
| Weight of Asbestos as Asbestos Fines (Friable)* g dry wt | -                                        | < 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.

Testing has been carried out under the assumption that the weight of asbestos in the sample is unaffected by the ashing process.

## Summary of Methods

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

| Sample Type: Soil                                            |                                                                                                                                                                                                                                                                                                         |                         |                                               |
|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------|
| Test                                                         | Method Description                                                                                                                                                                                                                                                                                      | Default Detection Limit | Sample No                                     |
| Individual Tests                                             |                                                                                                                                                                                                                                                                                                         |                         |                                               |
| Weight of Asbestos as Asbestos Fines in <10mm >2mm Fraction* | Measurement on analytical balance, from the <10mm >2mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.                                                                                                                                                            | 0.00001 g dry wt        | 1-11, 13-36, 38, 40, 42, 44, 46, 48-50, 52-54 |
| Semi Quantitative Asbestos in Soil                           | Based on approximately 100g of sample provided.                                                                                                                                                                                                                                                         | -                       | 12, 37, 39, 41, 43, 45, 47, 51                |
| Semi Quantitative Asbestos in Soil                           |                                                                                                                                                                                                                                                                                                         |                         |                                               |
| Weight of Asbestos in >10mm Sample Fraction                  | Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.                                                                                                                                                                                          | 0.00001 g dry wt        | 12, 37, 39, 41, 43, 45, 47, 51                |
| Weight of Asbestos in <10mm to >2mm Sample Fraction          | Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.                                                                                                                                                                                          | 0.00001 g dry wt        | 12, 37, 39, 41, 43, 45, 47, 51                |
| Weight of Asbestos in <2mm Sample Fraction                   | Measurement on analytical balance. Asbestos weight in <2mm subsample, if <2mm subsample weight is not "Entire Fraction". Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.                                                                                                    | 0.00001 g dry wt        | 12, 37, 39, 41, 43, 45, 47, 51                |
| 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                   | 1-54                                          |
| Dry Weight                                                   | Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.                                                                                                                                                                       | 0.1 g                   | 1-54                                          |
| Moisture                                                     | Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.                                                                                                                                                                                               | 1 %                     | 1-11, 13-36, 38, 40, 42, 44, 46, 48-50, 52-54 |
| 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            | 1-54                                          |
| 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            | 1-54                                          |
| 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            | 1-54                                          |
| <b>Asbestos Presence / Absence</b>                           | 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%                   | 1-54                                          |

| Sample Type: Soil                                                |                                                                                                                                                                                                                                                                                |                         |                                               |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------|
| Test                                                             | Method Description                                                                                                                                                                                                                                                             | Default Detection Limit | Sample No                                     |
| Description of Asbestos Form                                     | Description of asbestos form and/or shape if present.                                                                                                                                                                                                                          | -                       | 1-54                                          |
| 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        | 1-11, 13-36, 38, 40, 42, 44, 46, 48-50, 52-54 |
| 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             | 1-11, 13-36, 38, 40, 42, 44, 46, 48-50, 52-54 |
| 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        | 1-11, 13-36, 38, 40, 42, 44, 46, 48-50, 52-54 |
| 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             | 1-11, 13-36, 38, 40, 42, 44, 46, 48-50, 52-54 |
| 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        | 1-11, 13-36, 38, 40, 42, 44, 46, 48-50, 52-54 |
| 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             | 1-11, 13-36, 38, 40, 42, 44, 46, 48-50, 52-54 |
| 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             | 1-11, 13-36, 38, 40, 42, 44, 46, 48-50, 52-54 |

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

Testing was completed between 14-Apr-2022 and 19-Apr-2022. For completion dates of individual analyses please contact the laboratory.

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

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



Rhodri Williams BSc (Hons)  
Technical Manager - Asbestos



## Certificate of Analysis

Page 1 of 4

|                 |                                |                          |                 |           |
|-----------------|--------------------------------|--------------------------|-----------------|-----------|
| <b>Client:</b>  | Jacobs New Zealand Limited     | <b>Lab No:</b>           | 2951225         | SPV2      |
| <b>Contact:</b> | Hannah Wood                    | <b>Date Received:</b>    | 09-Apr-2022     |           |
|                 | C/- Jacobs New Zealand Limited | <b>Date Reported:</b>    | 09-May-2022     | (Amended) |
|                 | PO Box 1147                    | <b>Quote No:</b>         | 116819          |           |
|                 | Christchurch 8140              | <b>Order No:</b>         | 1062            |           |
|                 |                                | <b>Client Reference:</b> | Southshore Bund |           |
|                 |                                | <b>Submitted By:</b>     | Kate Murray     |           |

### Sample Type: Soil

|                     |                                          |                                          |                                         |                              |                                         |
|---------------------|------------------------------------------|------------------------------------------|-----------------------------------------|------------------------------|-----------------------------------------|
| <b>Sample Name:</b> | TP-01_0.1-0.3<br>07-Apr-2022<br>11:50 am | TP-03_0.1-0.3<br>07-Apr-2022<br>10:45 am | TP-05_0.1-0.3<br>07-Apr-2022 9:45<br>am | TP-07_0.1-0.3<br>07-Apr-2022 | TP-09_0.1-0.3<br>06-Apr-2022 4:10<br>pm |
| <b>Lab Number:</b>  | 2951225.1                                | 2951225.2                                | 2951225.3                               | 2951225.4                    | 2951225.5                               |

#### Individual Tests

|                            |              |        |        |        |        |        |
|----------------------------|--------------|--------|--------|--------|--------|--------|
| Total Recoverable Mercury  | mg/kg dry wt | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Heavy Metals, Screen Level |              |        |        |        |        |        |
| Total Recoverable Arsenic  | mg/kg dry wt | 7      | 6      | 7      | 5      | 6      |
| Total Recoverable Cadmium  | mg/kg dry wt | < 0.10 | < 0.10 | 0.12   | < 0.10 | 0.11   |
| Total Recoverable Chromium | mg/kg dry wt | 15     | 15     | 17     | 13     | 16     |
| Total Recoverable Copper   | mg/kg dry wt | 10     | 9      | 11     | 8      | 9      |
| Total Recoverable Lead     | mg/kg dry wt | 28     | 26     | 29     | 14.3   | 20     |
| Total Recoverable Nickel   | mg/kg dry wt | 13     | 12     | 13     | 11     | 12     |
| Total Recoverable Zinc     | mg/kg dry wt | 71     | 64     | 72     | 45     | 63     |

|                     |                                         |                                         |                                          |                                          |                                          |
|---------------------|-----------------------------------------|-----------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| <b>Sample Name:</b> | TP-11_0.1-0.3<br>06-Apr-2022 3:30<br>pm | TP-13_0.1-0.3<br>06-Apr-2022 2:00<br>pm | TP-15_0.1-0.3<br>06-Apr-2022<br>11:50 am | TP-17_0.1-0.3<br>06-Apr-2022<br>10:25 am | TP-19_0.1-0.3<br>06-Apr-2022<br>12:20 pm |
| <b>Lab Number:</b>  | 2951225.6                               | 2951225.7                               | 2951225.8                                | 2951225.9                                | 2951225.10                               |

#### Individual Tests

|                            |              |        |        |        |        |        |
|----------------------------|--------------|--------|--------|--------|--------|--------|
| Total Recoverable Mercury  | mg/kg dry wt | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Heavy Metals, Screen Level |              |        |        |        |        |        |
| Total Recoverable Arsenic  | mg/kg dry wt | 6      | 7      | 6      | 7      | 6      |
| Total Recoverable Cadmium  | mg/kg dry wt | < 0.10 | < 0.10 | 0.12   | < 0.10 | < 0.10 |
| Total Recoverable Chromium | mg/kg dry wt | 15     | 15     | 14     | 16     | 15     |
| Total Recoverable Copper   | mg/kg dry wt | 8      | 10     | 11     | 13     | 10     |
| Total Recoverable Lead     | mg/kg dry wt | 21     | 19.3   | 29     | 24     | 19.6   |
| Total Recoverable Nickel   | mg/kg dry wt | 12     | 13     | 12     | 14     | 13     |
| Total Recoverable Zinc     | mg/kg dry wt | 61     | 64     | 80     | 81     | 63     |

|                     |                                          |                             |                            |                            |                            |
|---------------------|------------------------------------------|-----------------------------|----------------------------|----------------------------|----------------------------|
| <b>Sample Name:</b> | TP-20_0.1-0.3<br>07-Apr-2022<br>12:20 pm | QC1 06-Apr-2022<br>12:20 pm | QC2 06-Apr-2022<br>2:30 pm | QC3 06-Apr-2022<br>4:10 pm | QC4 07-Apr-2022<br>9:45 am |
| <b>Lab Number:</b>  | 2951225.11                               | 2951225.12                  | 2951225.13                 | 2951225.14                 | 2951225.15                 |

#### Individual Tests

|                            |              |        |        |        |        |        |
|----------------------------|--------------|--------|--------|--------|--------|--------|
| Total Recoverable Mercury  | mg/kg dry wt | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Heavy Metals, Screen Level |              |        |        |        |        |        |
| Total Recoverable Arsenic  | mg/kg dry wt | 3      | 7      | 12     | 6      | 4      |
| Total Recoverable Cadmium  | mg/kg dry wt | < 0.10 | < 0.10 | 0.11   | < 0.10 | < 0.10 |
| Total Recoverable Chromium | mg/kg dry wt | 17     | 16     | 19     | 15     | 11     |
| Total Recoverable Copper   | mg/kg dry wt | 16     | 10     | 18     | 9      | 8      |
| Total Recoverable Lead     | mg/kg dry wt | 17.9   | 20     | 27     | 19.6   | 49     |
| Total Recoverable Nickel   | mg/kg dry wt | 22     | 13     | 11     | 14     | 9      |
| Total Recoverable Zinc     | mg/kg dry wt | 47     | 63     | 99     | 64     | 72     |



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                                       |                |                                          |                                          |                                          |                                          |                                          |
|---------------------------------------------------------|----------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| <b>Sample Name:</b>                                     |                | QC5 07-Apr-2022<br>12:40 pm              | TP-01_0.5-0.8<br>07-Apr-2022<br>11:55 am | TP-03_0.5-0.8<br>07-Apr-2022<br>10:45 am | TP-05_0.5-0.8<br>07-Apr-2022 9:45<br>am  | TP-07_0.5-0.8<br>07-Apr-2022 8:45<br>am  |
| <b>Lab Number:</b>                                      |                | 2951225.16                               | 2951225.17                               | 2951225.18                               | 2951225.19                               | 2951225.20                               |
| Individual Tests                                        |                |                                          |                                          |                                          |                                          |                                          |
| Total Recoverable Mercury                               | mg/kg dry wt   | < 0.10                                   | < 0.10                                   | < 0.10                                   | < 0.10                                   | < 0.10                                   |
| Heavy Metals, Screen Level                              |                |                                          |                                          |                                          |                                          |                                          |
| Total Recoverable Arsenic                               | mg/kg dry wt   | 3                                        | 4                                        | 5                                        | 4                                        | 7                                        |
| Total Recoverable Cadmium                               | mg/kg dry wt   | < 0.10                                   | < 0.10                                   | < 0.10                                   | < 0.10                                   | 0.18                                     |
| Total Recoverable Chromium                              | mg/kg dry wt   | 12                                       | 11                                       | 14                                       | 11                                       | 16                                       |
| Total Recoverable Copper                                | mg/kg dry wt   | 9                                        | 7                                        | 19                                       | 8                                        | 13                                       |
| Total Recoverable Lead                                  | mg/kg dry wt   | 10.7                                     | 40                                       | 41                                       | 42                                       | 63                                       |
| Total Recoverable Nickel                                | mg/kg dry wt   | 11                                       | 9                                        | 10                                       | 9                                        | 12                                       |
| Total Recoverable Zinc                                  | mg/kg dry wt   | 35                                       | 64                                       | 86                                       | 63                                       | 96                                       |
|                                                         |                |                                          |                                          |                                          |                                          |                                          |
| <b>Sample Name:</b>                                     |                | TP-09_0.5-0.8<br>06-Apr-2022 4:10<br>pm  | TP-11_0.5-0.8<br>06-Apr-2022 3:50<br>pm  | TP-13_0.5-0.8<br>06-Apr-2022 2:50<br>pm  | TP-15_0.5-0.8<br>06-Apr-2022<br>11:36 am | TP-16_0.5-0.8<br>06-Apr-2022             |
| <b>Lab Number:</b>                                      |                | 2951225.21                               | 2951225.22                               | 2951225.23                               | 2951225.24                               | 2951225.25                               |
| Individual Tests                                        |                |                                          |                                          |                                          |                                          |                                          |
| Dry Matter                                              | g/100g as rcvd | -                                        | -                                        | -                                        | -                                        | 87                                       |
| Total Recoverable Mercury                               | mg/kg dry wt   | < 0.10                                   | < 0.10                                   | < 0.10                                   | < 0.10                                   | < 0.10                                   |
| Heavy Metals, Screen Level                              |                |                                          |                                          |                                          |                                          |                                          |
| Total Recoverable Arsenic                               | mg/kg dry wt   | 4                                        | 4                                        | 10                                       | 5                                        | 7                                        |
| Total Recoverable Cadmium                               | mg/kg dry wt   | < 0.10                                   | < 0.10                                   | 0.12                                     | 0.11                                     | 0.11                                     |
| Total Recoverable Chromium                              | mg/kg dry wt   | 12                                       | 10                                       | 15                                       | 13                                       | 14                                       |
| Total Recoverable Copper                                | mg/kg dry wt   | 7                                        | 3                                        | 16                                       | 11                                       | 14                                       |
| Total Recoverable Lead                                  | mg/kg dry wt   | 14.6                                     | 11.1                                     | 33                                       | 47                                       | 32                                       |
| Total Recoverable Nickel                                | mg/kg dry wt   | 11                                       | 8                                        | 12                                       | 10                                       | 11                                       |
| Total Recoverable Zinc                                  | mg/kg dry wt   | 45                                       | 37                                       | 111                                      | 80                                       | 89                                       |
| Polycyclic Aromatic Hydrocarbons Screening in Soil*     |                |                                          |                                          |                                          |                                          |                                          |
| Total of Reported PAHs in Soil                          | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 1.4                                      |
| 1-Methylnaphthalene                                     | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | < 0.012                                  |
| 2-Methylnaphthalene                                     | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | < 0.012                                  |
| Acenaphthylene                                          | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.012                                    |
| Acenaphthene                                            | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | < 0.012                                  |
| Anthracene                                              | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.041                                    |
| Benzo[a]anthracene                                      | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.104                                    |
| Benzo[a]pyrene (BAP)                                    | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.105                                    |
| Benzo[a]pyrene Potency<br>Equivalency Factor (PEF) NES* | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.15                                     |
| Benzo[a]pyrene Toxic<br>Equivalence (TEF)*              | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.15                                     |
| Benzo[b]fluoranthene + Benzo[j]<br>fluoranthene         | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.114                                    |
| Benzo[e]pyrene                                          | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.057                                    |
| Benzo[g,h,i]perylene                                    | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.059                                    |
| Benzo[k]fluoranthene                                    | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.046                                    |
| Chrysene                                                | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.086                                    |
| Dibenzo[a,h]anthracene                                  | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.014                                    |
| Fluoranthene                                            | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.21                                     |
| Fluorene                                                | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.027                                    |
| Indeno(1,2,3-c,d)pyrene                                 | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.060                                    |
| Naphthalene                                             | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | < 0.06                                   |
| Perylene                                                | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.022                                    |
| Phenanthrene                                            | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.20                                     |
| Pyrene                                                  | mg/kg dry wt   | -                                        | -                                        | -                                        | -                                        | 0.20                                     |
|                                                         |                |                                          |                                          |                                          |                                          |                                          |
| <b>Sample Name:</b>                                     |                | TP-17_0.5-0.8<br>06-Apr-2022<br>10:31 am | TP-19_0.5-0.8<br>06-Apr-2022<br>12:20 pm | TP-20_0.5-0.8<br>07-Apr-2022<br>12:50 pm | TP-12_0.1-0.3<br>06-Apr-2022 3:30<br>pm  | TP-04_0.5-0.8<br>07-Apr-2022<br>10:10 am |
| <b>Lab Number:</b>                                      |                | 2951225.26                               | 2951225.27                               | 2951225.28                               | 2951225.29                               | 2951225.30                               |

| Sample Type: Soil          |                                          |                                          |                                          |                                         |                                          |      |
|----------------------------|------------------------------------------|------------------------------------------|------------------------------------------|-----------------------------------------|------------------------------------------|------|
| <b>Sample Name:</b>        | TP-17_0.5-0.8<br>06-Apr-2022<br>10:31 am | TP-19_0.5-0.8<br>06-Apr-2022<br>12:20 pm | TP-20_0.5-0.8<br>07-Apr-2022<br>12:50 pm | TP-12_0.1-0.3<br>06-Apr-2022 3:30<br>pm | TP-04_0.5-0.8<br>07-Apr-2022<br>10:10 am |      |
| <b>Lab Number:</b>         | 2951225.26                               | 2951225.27                               | 2951225.28                               | 2951225.29                              | 2951225.30                               |      |
| Individual Tests           |                                          |                                          |                                          |                                         |                                          |      |
| Total Recoverable Mercury  | mg/kg dry wt                             | < 0.10                                   | < 0.10                                   | < 0.10                                  | < 0.10                                   | 0.18 |
| Heavy Metals, Screen Level |                                          |                                          |                                          |                                         |                                          |      |
| Total Recoverable Arsenic  | mg/kg dry wt                             | 4                                        | 5                                        | 3                                       | 5                                        | 8    |
| Total Recoverable Cadmium  | mg/kg dry wt                             | < 0.10                                   | < 0.10                                   | < 0.10                                  | < 0.10                                   | 0.12 |
| Total Recoverable Chromium | mg/kg dry wt                             | 11                                       | 17                                       | 13                                      | 14                                       | 14   |
| Total Recoverable Copper   | mg/kg dry wt                             | 4                                        | 7                                        | 9                                       | 8                                        | 18   |
| Total Recoverable Lead     | mg/kg dry wt                             | 14.6                                     | 14.7                                     | 12.4                                    | 18.1                                     | 88   |
| Total Recoverable Nickel   | mg/kg dry wt                             | 8                                        | 9                                        | 12                                      | 12                                       | 11   |
| Total Recoverable Zinc     | mg/kg dry wt                             | 48                                       | 53                                       | 37                                      | 59                                       | 121  |

|                            |                                         |                                         |                                         |                                         |                                         |        |
|----------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|--------|
| <b>Sample Name:</b>        | TP-06_0.5-0.8<br>07-Apr-2022 9:15<br>am | TP-08_0.5-0.8<br>06-Apr-2022 4:45<br>pm | TP-10_0.5-0.8<br>06-Apr-2022 3:50<br>pm | TP-12_0.5-0.8<br>06-Apr-2022 1:00<br>pm | TP-14_0.5-0.8<br>06-Apr-2022 2:00<br>pm |        |
| <b>Lab Number:</b>         | 2951225.31                              | 2951225.32                              | 2951225.33                              | 2951225.34                              | 2951225.35                              |        |
| Individual Tests           |                                         |                                         |                                         |                                         |                                         |        |
| Total Recoverable Mercury  | mg/kg dry wt                            | < 0.10                                  | < 0.10                                  | < 0.10                                  | < 0.10                                  | < 0.10 |
| Heavy Metals, Screen Level |                                         |                                         |                                         |                                         |                                         |        |
| Total Recoverable Arsenic  | mg/kg dry wt                            | 8                                       | 4                                       | 7                                       | 4                                       | 4      |
| Total Recoverable Cadmium  | mg/kg dry wt                            | < 0.10                                  | < 0.10                                  | 0.11                                    | < 0.10                                  | < 0.10 |
| Total Recoverable Chromium | mg/kg dry wt                            | 16                                      | 11                                      | 14                                      | 10                                      | 10     |
| Total Recoverable Copper   | mg/kg dry wt                            | 12                                      | 9                                       | 9                                       | 5                                       | 5      |
| Total Recoverable Lead     | mg/kg dry wt                            | 24                                      | 23                                      | 25                                      | 16.1                                    | 11.4   |
| Total Recoverable Nickel   | mg/kg dry wt                            | 12                                      | 9                                       | 12                                      | 8                                       | 8      |
| Total Recoverable Zinc     | mg/kg dry wt                            | 72                                      | 48                                      | 70                                      | 57                                      | 44     |

|                            |                                          |        |   |   |   |   |
|----------------------------|------------------------------------------|--------|---|---|---|---|
| <b>Sample Name:</b>        | TP-18_0.5-0.8<br>06-Apr-2022<br>12:49 pm |        |   |   |   |   |
| <b>Lab Number:</b>         | 2951225.36                               |        |   |   |   |   |
| Individual Tests           |                                          |        |   |   |   |   |
| Total Recoverable Mercury  | mg/kg dry wt                             | < 0.10 | - | - | - | - |
| Heavy Metals, Screen Level |                                          |        |   |   |   |   |
| Total Recoverable Arsenic  | mg/kg dry wt                             | 9      | - | - | - | - |
| Total Recoverable Cadmium  | mg/kg dry wt                             | 0.13   | - | - | - | - |
| Total Recoverable Chromium | mg/kg dry wt                             | 15     | - | - | - | - |
| Total Recoverable Copper   | mg/kg dry wt                             | 16     | - | - | - | - |
| Total Recoverable Lead     | mg/kg dry wt                             | 127 #1 | - | - | - | - |
| Total Recoverable Nickel   | mg/kg dry wt                             | 13     | - | - | - | - |
| Total Recoverable Zinc     | mg/kg dry wt                             | 116    | - | - | - | - |

### 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. The average of the results of the replicate analyses has been reported. Replicate 1 = 163mg/kg, replicate 2 = 91mg/kg.

**Amended Report:** This certificate of analysis replaces report '2951225-SPv1' issued on 28-Apr-2022 at 3:40 pm.  
Reason for amendment: Missed PAH added.

## Summary of Methods

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

| Sample Type: Soil                   |                                                                                                       |                         |           |
|-------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------|-----------|
| Test                                | Method Description                                                                                    | Default Detection Limit | Sample No |
| Environmental Solids Sample Drying* | Air dried at 35°C<br>Used for sample preparation.<br>May contain a residual moisture content of 2-5%. | -                       | 1-36      |
| Total of Reported PAHs in Soil      | Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.                                 | 0.03 mg/kg dry wt       | 25        |

| Sample Type: Soil                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                           |           |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------|
| Test                                                 | Method Description                                                                                                                                                                                                                                                                                                                                                                                                                                         | Default Detection Limit   | Sample No |
| Heavy Metals, Screen Level                           | Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.                                                                                                                                                                                                                                                      | 0.10 - 4 mg/kg dry wt     | 1-36      |
| Polycyclic Aromatic Hydrocarbons Screening in Soil*  | Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.                                                                                                                                                                                                                                                                                                                                                        | 0.002 - 0.05 mg/kg dry wt | 25        |
| 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       | 25        |
| Total Recoverable Mercury                            | Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.                                                                                                                                                                                                                                                                                                                                   | 0.10 mg/kg dry wt         | 1-36      |
| 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        | 25        |
| 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        | 25        |

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

Testing was completed between 19-Apr-2022 and 09-May-2022. For completion dates of individual analyses please contact the laboratory.

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

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



## Certificate of Analysis

Page 1 of 2

|                 |                                |                          |                 |       |
|-----------------|--------------------------------|--------------------------|-----------------|-------|
| <b>Client:</b>  | Jacobs New Zealand Limited     | <b>Lab No:</b>           | 2951227         | A2Pv1 |
| <b>Contact:</b> | Hannah Wood                    | <b>Date Received:</b>    | 09-Apr-2022     |       |
|                 | C/- Jacobs New Zealand Limited | <b>Date Reported:</b>    | 28-Apr-2022     |       |
|                 | PO Box 1147                    | <b>Quote No:</b>         | 116819          |       |
|                 | Christchurch 8140              | <b>Order No:</b>         | 1062            |       |
|                 |                                | <b>Client Reference:</b> | Southshore Bund |       |
|                 |                                | <b>Submitted By:</b>     | Hannah Wood     |       |

### Sample Type: Building Material

| Sample Name | Lab Number | Sample Category | Sample Weight on receipt (g) | Asbestos Presence / Absence                                                 | Description of Asbestos in Non Homogeneous Samples |
|-------------|------------|-----------------|------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------|
| SACM-55-07  | 2951227.1  | Fibre Cement    | 83.05                        | Amosite (Brown Asbestos) detected.<br>Chrysotile (White Asbestos) detected. | N/A                                                |

### Glossary of Terms

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

For further details, please contact the Asbestos Team.

## Summary of Methods

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

### Sample Type: Building Material

| Test                                               | Method Description                                                                                                                                                                                                                                                                                      | Default Detection Limit | Sample No |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------|
| Asbestos in Bulk Material                          |                                                                                                                                                                                                                                                                                                         |                         |           |
| Sample Category                                    | Assessment of sample type. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.                                                                                                                                                                                                  | -                       | 1         |
| Sample Weight on receipt                           | Sample weight. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.                                                                                                                                                                                                              | 0.01 g                  | 1         |
| <b>Asbestos Presence / Absence</b>                 | 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         |
| Description of Asbestos in Non Homogeneous Samples | Form, dimensions and/or weight of asbestos fibres present. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.                                                                                                                                                      | -                       | 1         |



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.

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

Testing was completed between 11-Apr-2022 and 13-Apr-2022. For completion dates of individual analyses please contact the laboratory.

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

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Rhodri Williams BSc (Hons)  
Technical Manager - Asbestos

## **Appendix I. 95% ProUCL Calculation**

|    |                                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
|----|-----------------------------------------------------------------|---|---|---------------------------------|--------|-------------------------------------|-----------------------------------------------------------------|---|---|-------|-------|---|
|    | A                                                               | B | C | D                               | E      | F                                   | G                                                               | H | I | J     | K     | L |
| 1  | UCL Statistics for Uncensored Full Data Sets                    |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 2  |                                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 3  | User Selected Options                                           |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 4  | Date/Time of Computation                                        |   |   | ProUCL 5.16/30/2022 10:27:48 PM |        |                                     |                                                                 |   |   |       |       |   |
| 5  | From File                                                       |   |   | WorkSheet.xls                   |        |                                     |                                                                 |   |   |       |       |   |
| 6  | Full Precision                                                  |   |   | OFF                             |        |                                     |                                                                 |   |   |       |       |   |
| 7  | Confidence Coefficient                                          |   |   | 95%                             |        |                                     |                                                                 |   |   |       |       |   |
| 8  | Number of Bootstrap Operations                                  |   |   | 2000                            |        |                                     |                                                                 |   |   |       |       |   |
| 9  |                                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 10 |                                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 11 | Lead                                                            |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 12 |                                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 13 | General Statistics                                              |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 14 | Total Number of Observations                                    |   |   |                                 | 30     |                                     | Number of Distinct Observations                                 |   |   |       | 27    |   |
| 15 |                                                                 |   |   |                                 |        |                                     | Number of Missing Observations                                  |   |   |       | 0     |   |
| 16 | Minimum                                                         |   |   |                                 | 11.1   |                                     | Mean                                                            |   |   |       | 27.3  |   |
| 17 | Maximum                                                         |   |   |                                 | 88     |                                     | Median                                                          |   |   |       | 23.5  |   |
| 18 | SD                                                              |   |   |                                 | 16.53  |                                     | Std. Error of Mean                                              |   |   |       | 3.018 |   |
| 19 | Coefficient of Variation                                        |   |   |                                 | 0.605  |                                     | Skewness                                                        |   |   |       | 2.129 |   |
| 20 |                                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 21 | Normal GOF Test                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 22 | Shapiro Wilk Test Statistic                                     |   |   |                                 | 0.795  |                                     | Shapiro Wilk GOF Test                                           |   |   |       |       |   |
| 23 | 5% Shapiro Wilk Critical Value                                  |   |   |                                 | 0.927  |                                     | Data Not Normal at 5% Significance Level                        |   |   |       |       |   |
| 24 | Lilliefors Test Statistic                                       |   |   |                                 | 0.192  |                                     | Lilliefors GOF Test                                             |   |   |       |       |   |
| 25 | 5% Lilliefors Critical Value                                    |   |   |                                 | 0.159  |                                     | Data Not Normal at 5% Significance Level                        |   |   |       |       |   |
| 26 | Data Not Normal at 5% Significance Level                        |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 27 |                                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 28 | Assuming Normal Distribution                                    |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 29 | 95% Normal UCL                                                  |   |   |                                 |        | 95% UCLs (Adjusted for Skewness)    |                                                                 |   |   |       |       |   |
| 30 | 95% Student's-t UCL                                             |   |   |                                 | 32.43  |                                     | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |       | 33.52 |   |
| 31 |                                                                 |   |   |                                 |        |                                     | 95% Modified-t UCL (Johnson-1978)                               |   |   |       | 32.63 |   |
| 32 |                                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 33 | Gamma GOF Test                                                  |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 34 | A-D Test Statistic                                              |   |   |                                 | 0.604  |                                     | Anderson-Darling Gamma GOF Test                                 |   |   |       |       |   |
| 35 | 5% A-D Critical Value                                           |   |   |                                 | 0.75   |                                     | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |       |   |
| 36 | K-S Test Statistic                                              |   |   |                                 | 0.12   |                                     | Kolmogorov-Smirnov Gamma GOF Test                               |   |   |       |       |   |
| 37 | 5% K-S Critical Value                                           |   |   |                                 | 0.161  |                                     | Detected data appear Gamma Distributed at 5% Significance Level |   |   |       |       |   |
| 38 | Detected data appear Gamma Distributed at 5% Significance Level |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 39 |                                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 40 | Gamma Statistics                                                |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 41 | k hat (MLE)                                                     |   |   |                                 | 3.911  |                                     | k star (bias corrected MLE)                                     |   |   |       | 3.542 |   |
| 42 | Theta hat (MLE)                                                 |   |   |                                 | 6.982  |                                     | Theta star (bias corrected MLE)                                 |   |   |       | 7.709 |   |
| 43 | nu hat (MLE)                                                    |   |   |                                 | 234.6  |                                     | nu star (bias corrected)                                        |   |   |       | 212.5 |   |
| 44 | MLE Mean (bias corrected)                                       |   |   |                                 | 27.3   |                                     | MLE Sd (bias corrected)                                         |   |   |       | 14.51 |   |
| 45 |                                                                 |   |   |                                 |        | Approximate Chi Square Value (0.05) |                                                                 |   |   | 179.8 |       |   |
| 46 | Adjusted Level of Significance                                  |   |   |                                 | 0.041  |                                     | Adjusted Chi Square Value                                       |   |   |       | 178   |   |
| 47 |                                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 48 | Assuming Gamma Distribution                                     |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 49 | 95% Approximate Gamma UCL (use when n>=50)                      |   |   |                                 | 32.28  |                                     | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |       | 32.59 |   |
| 50 |                                                                 |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 51 | Lognormal GOF Test                                              |   |   |                                 |        |                                     |                                                                 |   |   |       |       |   |
| 52 | Shapiro Wilk Test Statistic                                     |   |   |                                 | 0.963  |                                     | Shapiro Wilk Lognormal GOF Test                                 |   |   |       |       |   |
| 53 | 5% Shapiro Wilk Critical Value                                  |   |   |                                 | 0.927  |                                     | Data appear Lognormal at 5% Significance Level                  |   |   |       |       |   |
| 54 | Lilliefors Test Statistic                                       |   |   |                                 | 0.0829 |                                     | Lilliefors Lognormal GOF Test                                   |   |   |       |       |   |

|     |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|----------------------------------|------------------------------------------------|---|---|---|---|---------|--|
|     | A                                                                                                                                         | B | C | D | E | F                                | G                                              | H | I | J | K | L       |  |
| 55  | 5% Lilliefors Critical Value                                                                                                              |   |   |   |   | 0.159                            | Data appear Lognormal at 5% Significance Level |   |   |   |   |         |  |
| 56  | Data appear Lognormal at 5% Significance Level                                                                                            |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 57  |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 58  | Lognormal Statistics                                                                                                                      |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 59  | Minimum of Logged Data                                                                                                                    |   |   |   |   | 2.407                            | Mean of logged Data                            |   |   |   |   | 3.174   |  |
| 60  | Maximum of Logged Data                                                                                                                    |   |   |   |   | 4.477                            | SD of logged Data                              |   |   |   |   | 0.501   |  |
| 61  |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 62  | Assuming Lognormal Distribution                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 63  | 95% H-UCL                                                                                                                                 |   |   |   |   | 32.48                            | 90% Chebyshev (MVUE) UCL                       |   |   |   |   | 34.69   |  |
| 64  | 95% Chebyshev (MVUE) UCL                                                                                                                  |   |   |   |   | 38.18                            | 97.5% Chebyshev (MVUE) UCL                     |   |   |   |   | 43.04   |  |
| 65  | 99% Chebyshev (MVUE) UCL                                                                                                                  |   |   |   |   | 52.58                            |                                                |   |   |   |   |         |  |
| 66  |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 67  | Nonparametric Distribution Free UCL Statistics                                                                                            |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 68  | Data appear to follow a Discernible Distribution at 5% Significance Level                                                                 |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 69  |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 70  | Nonparametric Distribution Free UCLs                                                                                                      |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 71  | 95% CLT UCL                                                                                                                               |   |   |   |   | 32.27                            | 95% Jackknife UCL                              |   |   |   |   | 32.43   |  |
| 72  | 95% Standard Bootstrap UCL                                                                                                                |   |   |   |   | 32.03                            | 95% Bootstrap-t UCL                            |   |   |   |   | 34.69   |  |
| 73  | 95% Hall's Bootstrap UCL                                                                                                                  |   |   |   |   | 36.1                             | 95% Percentile Bootstrap UCL                   |   |   |   |   | 32.37   |  |
| 74  | 95% BCA Bootstrap UCL                                                                                                                     |   |   |   |   | 34.06                            |                                                |   |   |   |   |         |  |
| 75  | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   |   |   |   | 36.36                            | 95% Chebyshev(Mean, Sd) UCL                    |   |   |   |   | 40.46   |  |
| 76  | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   |   |   | 46.15                            | 99% Chebyshev(Mean, Sd) UCL                    |   |   |   |   | 57.33   |  |
| 77  |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 78  | Suggested UCL to Use                                                                                                                      |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 79  | 95% Adjusted Gamma UCL                                                                                                                    |   |   |   |   | 32.59                            |                                                |   |   |   |   |         |  |
| 80  |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 81  | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 82  | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 83  | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 84  | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 85  |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 86  |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 87  | Mercury                                                                                                                                   |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 88  |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 89  | General Statistics                                                                                                                        |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 90  | Total Number of Observations                                                                                                              |   |   |   |   | 30                               | Number of Distinct Observations                |   |   |   |   | 2       |  |
| 91  |                                                                                                                                           |   |   |   |   |                                  | Number of Missing Observations                 |   |   |   |   | 0       |  |
| 92  | Minimum                                                                                                                                   |   |   |   |   | 0.1                              | Mean                                           |   |   |   |   | 0.103   |  |
| 93  | Maximum                                                                                                                                   |   |   |   |   | 0.18                             | Median                                         |   |   |   |   | 0.1     |  |
| 94  | SD                                                                                                                                        |   |   |   |   | 0.0146                           | Std. Error of Mean                             |   |   |   |   | 0.00267 |  |
| 95  | Coefficient of Variation                                                                                                                  |   |   |   |   | 0.142                            | Skewness                                       |   |   |   |   | 5.477   |  |
| 96  |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 97  | Normal GOF Test                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 98  | Shapiro Wilk Test Statistic                                                                                                               |   |   |   |   | 0.187                            | Shapiro Wilk GOF Test                          |   |   |   |   |         |  |
| 99  | 5% Shapiro Wilk Critical Value                                                                                                            |   |   |   |   | 0.927                            | Data Not Normal at 5% Significance Level       |   |   |   |   |         |  |
| 100 | Lilliefors Test Statistic                                                                                                                 |   |   |   |   | 0.539                            | Lilliefors GOF Test                            |   |   |   |   |         |  |
| 101 | 5% Lilliefors Critical Value                                                                                                              |   |   |   |   | 0.159                            | Data Not Normal at 5% Significance Level       |   |   |   |   |         |  |
| 102 | Data Not Normal at 5% Significance Level                                                                                                  |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 103 |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 104 | Assuming Normal Distribution                                                                                                              |   |   |   |   |                                  |                                                |   |   |   |   |         |  |
| 105 | 95% Normal UCL                                                                                                                            |   |   |   |   | 95% UCLs (Adjusted for Skewness) |                                                |   |   |   |   |         |  |
| 106 | 95% Student's-t UCL                                                                                                                       |   |   |   |   | 0.107                            | 95% Adjusted-CLT UCL (Chen-1995)               |   |   |   |   | 0.11    |  |
| 107 |                                                                                                                                           |   |   |   |   |                                  | 95% Modified-t UCL (Johnson-1978)              |   |   |   |   | 0.108   |  |
| 108 |                                                                                                                                           |   |   |   |   |                                  |                                                |   |   |   |   |         |  |

|     | A                                                                                                                                         | B | C | D | E | F       | G                                                   | H | I | J | K | L       |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---------|-----------------------------------------------------|---|---|---|---|---------|
| 109 | Gamma GOF Test                                                                                                                            |   |   |   |   |         |                                                     |   |   |   |   |         |
| 110 | A-D Test Statistic                                                                                                                        |   |   |   |   | 11.13   | Anderson-Darling Gamma GOF Test                     |   |   |   |   |         |
| 111 | 5% A-D Critical Value                                                                                                                     |   |   |   |   | 0.745   | Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |         |
| 112 | K-S Test Statistic                                                                                                                        |   |   |   |   | 0.541   | Kolmogorov-Smirnov Gamma GOF Test                   |   |   |   |   |         |
| 113 | 5% K-S Critical Value                                                                                                                     |   |   |   |   | 0.16    | Data Not Gamma Distributed at 5% Significance Level |   |   |   |   |         |
| 114 | Data Not Gamma Distributed at 5% Significance Level                                                                                       |   |   |   |   |         |                                                     |   |   |   |   |         |
| 115 |                                                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |
| 116 | Gamma Statistics                                                                                                                          |   |   |   |   |         |                                                     |   |   |   |   |         |
| 117 | k hat (MLE)                                                                                                                               |   |   |   |   | 74.52   | k star (bias corrected MLE)                         |   |   |   |   | 67.09   |
| 118 | Theta hat (MLE)                                                                                                                           |   |   |   |   | 0.00138 | Theta star (bias corrected MLE)                     |   |   |   |   | 0.00153 |
| 119 | nu hat (MLE)                                                                                                                              |   |   |   |   | 4471    | nu star (bias corrected)                            |   |   |   |   | 4026    |
| 120 | MLE Mean (bias corrected)                                                                                                                 |   |   |   |   | 0.103   | MLE Sd (bias corrected)                             |   |   |   |   | 0.0125  |
| 121 |                                                                                                                                           |   |   |   |   |         | Approximate Chi Square Value (0.05)                 |   |   |   |   | 3879    |
| 122 | Adjusted Level of Significance                                                                                                            |   |   |   |   | 0.041   | Adjusted Chi Square Value                           |   |   |   |   | 3871    |
| 123 |                                                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |
| 124 | Assuming Gamma Distribution                                                                                                               |   |   |   |   |         |                                                     |   |   |   |   |         |
| 125 | 95% Approximate Gamma UCL (use when n>=50))                                                                                               |   |   |   |   | 0.107   | 95% Adjusted Gamma UCL (use when n<50)              |   |   |   |   | 0.107   |
| 126 |                                                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |
| 127 | Lognormal GOF Test                                                                                                                        |   |   |   |   |         |                                                     |   |   |   |   |         |
| 128 | Shapiro Wilk Test Statistic                                                                                                               |   |   |   |   | 0.187   | Shapiro Wilk Lognormal GOF Test                     |   |   |   |   |         |
| 129 | 5% Shapiro Wilk Critical Value                                                                                                            |   |   |   |   | 0.927   | Data Not Lognormal at 5% Significance Level         |   |   |   |   |         |
| 130 | Lilliefors Test Statistic                                                                                                                 |   |   |   |   | 0.539   | Lilliefors Lognormal GOF Test                       |   |   |   |   |         |
| 131 | 5% Lilliefors Critical Value                                                                                                              |   |   |   |   | 0.159   | Data Not Lognormal at 5% Significance Level         |   |   |   |   |         |
| 132 | Data Not Lognormal at 5% Significance Level                                                                                               |   |   |   |   |         |                                                     |   |   |   |   |         |
| 133 |                                                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |
| 134 | Lognormal Statistics                                                                                                                      |   |   |   |   |         |                                                     |   |   |   |   |         |
| 135 | Minimum of Logged Data                                                                                                                    |   |   |   |   | -2.303  | Mean of logged Data                                 |   |   |   |   | -2.283  |
| 136 | Maximum of Logged Data                                                                                                                    |   |   |   |   | -1.715  | SD of logged Data                                   |   |   |   |   | 0.107   |
| 137 |                                                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |
| 138 | Assuming Lognormal Distribution                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |
| 139 | 95% H-UCL                                                                                                                                 |   |   |   |   | 0.106   | 90% Chebyshev (MVUE) UCL                            |   |   |   |   | 0.109   |
| 140 | 95% Chebyshev (MVUE) UCL                                                                                                                  |   |   |   |   | 0.111   | 97.5% Chebyshev (MVUE) UCL                          |   |   |   |   | 0.115   |
| 141 | 99% Chebyshev (MVUE) UCL                                                                                                                  |   |   |   |   | 0.123   |                                                     |   |   |   |   |         |
| 142 |                                                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |
| 143 | Nonparametric Distribution Free UCL Statistics                                                                                            |   |   |   |   |         |                                                     |   |   |   |   |         |
| 144 | Data do not follow a Discernible Distribution (0.05)                                                                                      |   |   |   |   |         |                                                     |   |   |   |   |         |
| 145 |                                                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |
| 146 | Nonparametric Distribution Free UCLs                                                                                                      |   |   |   |   |         |                                                     |   |   |   |   |         |
| 147 | 95% CLT UCL                                                                                                                               |   |   |   |   | 0.107   | 95% Jackknife UCL                                   |   |   |   |   | N/A     |
| 148 | 95% Standard Bootstrap UCL                                                                                                                |   |   |   |   | N/A     | 95% Bootstrap-t UCL                                 |   |   |   |   | N/A     |
| 149 | 95% Hall's Bootstrap UCL                                                                                                                  |   |   |   |   | N/A     | 95% Percentile Bootstrap UCL                        |   |   |   |   | N/A     |
| 150 | 95% BCA Bootstrap UCL                                                                                                                     |   |   |   |   | N/A     |                                                     |   |   |   |   |         |
| 151 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   |   |   |   | 0.111   | 95% Chebyshev(Mean, Sd) UCL                         |   |   |   |   | 0.114   |
| 152 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   |   |   | 0.119   | 99% Chebyshev(Mean, Sd) UCL                         |   |   |   |   | 0.129   |
| 153 |                                                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |
| 154 | Suggested UCL to Use                                                                                                                      |   |   |   |   |         |                                                     |   |   |   |   |         |
| 155 | 95% Student's-t UCL                                                                                                                       |   |   |   |   | 0.107   | or 95% Modified-t UCL                               |   |   |   |   | 0.108   |
| 156 |                                                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |
| 157 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |   |   |         |                                                     |   |   |   |   |         |
| 158 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |   |   |         |                                                     |   |   |   |   |         |
| 159 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |   |   |         |                                                     |   |   |   |   |         |
| 160 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |   |   |         |                                                     |   |   |   |   |         |
| 161 |                                                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |
| 162 |                                                                                                                                           |   |   |   |   |         |                                                     |   |   |   |   |         |

|     |                                                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
|-----|-----------------------------------------------------------------|---|---|---|---|--------|-----------------------------------------------------------------|---|---|---|---|-------|
|     | A                                                               | B | C | D | E | F      | G                                                               | H | I | J | K | L     |
| 163 | Zinc                                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 164 |                                                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 165 | General Statistics                                              |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 166 | Total Number of Observations                                    |   |   |   |   | 30     | Number of Distinct Observations                                 |   |   |   |   | 21    |
| 167 |                                                                 |   |   |   |   |        | Number of Missing Observations                                  |   |   |   |   | 0     |
| 168 | Minimum                                                         |   |   |   |   | 37     | Mean                                                            |   |   |   |   | 66.37 |
| 169 | Maximum                                                         |   |   |   |   | 121    | Median                                                          |   |   |   |   | 63.5  |
| 170 | SD                                                              |   |   |   |   | 20.36  | Std. Error of Mean                                              |   |   |   |   | 3.718 |
| 171 | Coefficient of Variation                                        |   |   |   |   | 0.307  | Skewness                                                        |   |   |   |   | 0.879 |
| 172 |                                                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 173 | Normal GOF Test                                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 174 | Shapiro Wilk Test Statistic                                     |   |   |   |   | 0.938  | Shapiro Wilk GOF Test                                           |   |   |   |   |       |
| 175 | 5% Shapiro Wilk Critical Value                                  |   |   |   |   | 0.927  | Data appear Normal at 5% Significance Level                     |   |   |   |   |       |
| 176 | Lilliefors Test Statistic                                       |   |   |   |   | 0.146  | Lilliefors GOF Test                                             |   |   |   |   |       |
| 177 | 5% Lilliefors Critical Value                                    |   |   |   |   | 0.159  | Data appear Normal at 5% Significance Level                     |   |   |   |   |       |
| 178 | Data appear Normal at 5% Significance Level                     |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 179 |                                                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 180 | Assuming Normal Distribution                                    |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 181 | 95% Normal UCL                                                  |   |   |   |   |        | 95% UCLs (Adjusted for Skewness)                                |   |   |   |   |       |
| 182 | 95% Student's-t UCL                                             |   |   |   |   | 72.68  | 95% Adjusted-CLT UCL (Chen-1995)                                |   |   |   |   | 73.12 |
| 183 |                                                                 |   |   |   |   |        | 95% Modified-t UCL (Johnson-1978)                               |   |   |   |   | 72.78 |
| 184 |                                                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 185 | Gamma GOF Test                                                  |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 186 | A-D Test Statistic                                              |   |   |   |   | 0.285  | Anderson-Darling Gamma GOF Test                                 |   |   |   |   |       |
| 187 | 5% A-D Critical Value                                           |   |   |   |   | 0.745  | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |       |
| 188 | K-S Test Statistic                                              |   |   |   |   | 0.11   | Kolmogorov-Smirnov Gamma GOF Test                               |   |   |   |   |       |
| 189 | 5% K-S Critical Value                                           |   |   |   |   | 0.16   | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |       |
| 190 | Detected data appear Gamma Distributed at 5% Significance Level |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 191 |                                                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 192 | Gamma Statistics                                                |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 193 | k hat (MLE)                                                     |   |   |   |   | 11.7   | k star (bias corrected MLE)                                     |   |   |   |   | 10.55 |
| 194 | Theta hat (MLE)                                                 |   |   |   |   | 5.673  | Theta star (bias corrected MLE)                                 |   |   |   |   | 6.29  |
| 195 | nu hat (MLE)                                                    |   |   |   |   | 701.9  | nu star (bias corrected)                                        |   |   |   |   | 633   |
| 196 | MLE Mean (bias corrected)                                       |   |   |   |   | 66.37  | MLE Sd (bias corrected)                                         |   |   |   |   | 20.43 |
| 197 |                                                                 |   |   |   |   |        | Approximate Chi Square Value (0.05)                             |   |   |   |   | 575.7 |
| 198 | Adjusted Level of Significance                                  |   |   |   |   | 0.041  | Adjusted Chi Square Value                                       |   |   |   |   | 572.5 |
| 199 |                                                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 200 | Assuming Gamma Distribution                                     |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 201 | 95% Approximate Gamma UCL (use when n>=50))                     |   |   |   |   | 72.98  | 95% Adjusted Gamma UCL (use when n<50)                          |   |   |   |   | 73.38 |
| 202 |                                                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 203 | Lognormal GOF Test                                              |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 204 | Shapiro Wilk Test Statistic                                     |   |   |   |   | 0.975  | Shapiro Wilk Lognormal GOF Test                                 |   |   |   |   |       |
| 205 | 5% Shapiro Wilk Critical Value                                  |   |   |   |   | 0.927  | Data appear Lognormal at 5% Significance Level                  |   |   |   |   |       |
| 206 | Lilliefors Test Statistic                                       |   |   |   |   | 0.0934 | Lilliefors Lognormal GOF Test                                   |   |   |   |   |       |
| 207 | 5% Lilliefors Critical Value                                    |   |   |   |   | 0.159  | Data appear Lognormal at 5% Significance Level                  |   |   |   |   |       |
| 208 | Data appear Lognormal at 5% Significance Level                  |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 209 |                                                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 210 | Lognormal Statistics                                            |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 211 | Minimum of Logged Data                                          |   |   |   |   | 3.611  | Mean of logged Data                                             |   |   |   |   | 4.152 |
| 212 | Maximum of Logged Data                                          |   |   |   |   | 4.796  | SD of logged Data                                               |   |   |   |   | 0.298 |
| 213 |                                                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 214 | Assuming Lognormal Distribution                                 |   |   |   |   |        |                                                                 |   |   |   |   |       |
| 215 | 95% H-UCL                                                       |   |   |   |   | 73.43  | 90% Chebyshev (MVUE) UCL                                        |   |   |   |   | 77.35 |
| 216 | 95% Chebyshev (MVUE) UCL                                        |   |   |   |   | 82.33  | 97.5% Chebyshev (MVUE) UCL                                      |   |   |   |   | 89.26 |

|     | A                                                                                                                                         | B | C | D | E | F     | G                            | H | I | J | K | L     |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|-------|------------------------------|---|---|---|---|-------|
| 217 | 99% Chebyshev (MVUE) UCL                                                                                                                  |   |   |   |   | 102.9 |                              |   |   |   |   |       |
| 218 |                                                                                                                                           |   |   |   |   |       |                              |   |   |   |   |       |
| 219 | <b>Nonparametric Distribution Free UCL Statistics</b>                                                                                     |   |   |   |   |       |                              |   |   |   |   |       |
| 220 | <b>Data appear to follow a Discernible Distribution at 5% Significance Level</b>                                                          |   |   |   |   |       |                              |   |   |   |   |       |
| 221 |                                                                                                                                           |   |   |   |   |       |                              |   |   |   |   |       |
| 222 | <b>Nonparametric Distribution Free UCLs</b>                                                                                               |   |   |   |   |       |                              |   |   |   |   |       |
| 223 | 95% CLT UCL                                                                                                                               |   |   |   |   | 72.48 | 95% Jackknife UCL            |   |   |   |   | 72.68 |
| 224 | 95% Standard Bootstrap UCL                                                                                                                |   |   |   |   | 72.19 | 95% Bootstrap-t UCL          |   |   |   |   | 73.64 |
| 225 | 95% Hall's Bootstrap UCL                                                                                                                  |   |   |   |   | 73.19 | 95% Percentile Bootstrap UCL |   |   |   |   | 72.63 |
| 226 | 95% BCA Bootstrap UCL                                                                                                                     |   |   |   |   | 72.7  |                              |   |   |   |   |       |
| 227 | 90% Chebyshev(Mean, Sd) UCL                                                                                                               |   |   |   |   | 77.52 | 95% Chebyshev(Mean, Sd) UCL  |   |   |   |   | 82.57 |
| 228 | 97.5% Chebyshev(Mean, Sd) UCL                                                                                                             |   |   |   |   | 89.58 | 99% Chebyshev(Mean, Sd) UCL  |   |   |   |   | 103.4 |
| 229 |                                                                                                                                           |   |   |   |   |       |                              |   |   |   |   |       |
| 230 | <b>Suggested UCL to Use</b>                                                                                                               |   |   |   |   |       |                              |   |   |   |   |       |
| 231 | 95% Student's-t UCL                                                                                                                       |   |   |   |   | 72.68 |                              |   |   |   |   |       |
| 232 |                                                                                                                                           |   |   |   |   |       |                              |   |   |   |   |       |
| 233 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |   |   |   |   |       |                              |   |   |   |   |       |
| 234 | Recommendations are based upon data size, data distribution, and skewness.                                                                |   |   |   |   |       |                              |   |   |   |   |       |
| 235 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |   |   |   |   |       |                              |   |   |   |   |       |
| 236 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |   |   |   |   |       |                              |   |   |   |   |       |
| 237 |                                                                                                                                           |   |   |   |   |       |                              |   |   |   |   |       |

## **Appendix J. Christchurch City Council Medium Risk Contaminated Soils Management Plan**



**enviser**

Enviser Ref:1044  
October 2019

# CONTAMINATED SOIL MANAGEMENT PLAN

## MEDIUM RISK PROJECTS

Christchurch City Council

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# 1 Introduction

This contaminated soil management plan (CSMP) has been prepared in accordance with national guidelines and standards for carrying out ground contamination investigations in New Zealand. This includes compliance with the general format described in the Ministry for the Environment (MfE) Contaminated Land Management Guideline No.1 Reporting on Contaminated Sites in New Zealand<sup>1</sup> and the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health<sup>2</sup>.

## 1.1 When you need this plan

This plan is for projects that have been given a 'medium risk' classification. This medium risk rating is a combination of the type of work being undertaken and the nature, extent and scale of potential contamination on the work site. As the risk at the site is moderate, staff and Contractors working at these sites should be aware of what this means for them, the public and the environment.

## 1.2 What this plan does

The purpose of this plan is to provide enough information so that contractors working on site can:

- Manage potential adverse environmental effects during works such as dust, runoff and tracked soil,
- Monitor the works to ensure appropriate disposal; and
- Protect the health and safety of workers and the surrounding population during the period of works.

## 1.3 Distribution and review

This CSMP is a controlled document and Christchurch City Council (CCC) is responsible for updating it as required. Only the CCC, in conjunction with a Contaminated Land Specialist (CLS) can amend the document.

## 1.4 Why is contamination important?

Some contaminants can cause a variety of adverse health effects. Health effects may be acute (immediately felt) or chronic (felt in the long-term). Acute effects generally occur when exposed to high levels of contamination. Chronic effects occur over time as a result of a long-term exposure to contaminants, sometimes at relatively low levels. As construction workers regularly work with soil, or on sites with exposed soil, they are at risk of being exposed to contaminants regularly during their day-to-day work.

Workers can be exposed to contaminants via inhalation (by nose and mouth), ingestion (mouth) or by absorption through the skin. Appropriate work methods and PPE can minimise or prevent this exposure.

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<sup>1</sup> Ministry for the Environment (MfE) Contaminated Land Management Guideline No.1 *Reporting on Contaminated Sites in New Zealand* (2011)

<sup>2</sup> Ministry for the Environment (MfE) National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (2012)

In addition to health effects, uncontrolled release of contaminants by wind, surface water, groundwater or inappropriate handling of soil or water during disposal can have a significant impact on the environment and members of the public living, working or occupying surrounding sites

On projects classified as 'medium risk', the risk to humans and the environment is judged to be moderate and procedures are required to make sure the risks are managed. This plan sets out what these procedures are and how to put them in place.

## 1.5 How to keep the site and environment safe

The following are important requirements for keeping the site safe during excavation or investigation:

1. **Site Hazard Board** - have one visible at the site entry which explains what contamination may be present and the associated hazard.
2. **Personal Protective Equipment (PPE)** - make sure you have PPE available on site that is relevant to the type of contamination that may be present. Make sure all staff know when and how to use it. Look at Section 5 for more detail.
3. **Earthworks Controls** – put the correct controls in place prior to starting the works. Look at Section 3 for more information on this.
4. **Security** – make sure the site is secure. This includes preventing unauthorised access when work is not happening.
5. **Contaminated Land Specialist (CLS)** – have one engaged at the beginning of the project to identify contamination and advise on management, mitigation measures and soil removal. See Section 2.1 for more information on what a CLS is.
6. **Extra Controls** – if you come across low levels of asbestos during excavation, extra controls will need to be put in place to keep things safe. More information about asbestos is in Section 3.14.

There is a useful checklist in Appendix A which covers what your responsibilities are.

## 1.6 Have you done things correctly?

To make sure you have put in place the appropriate controls and managed the site correctly, verification procedures are required. These check compliance with the relevant resource consent and contaminated land management guidelines. The CLS and the Contractor should work together to fill in a Works Verification Form found in Appendix B. This form will be submitted to the Project Manager at the conclusion of the work.

# 2 Who does what?

## 2.1 Roles and responsibilities

**Contractors/Site Staff are responsible for:**

- Ensuring a current CSMP is available to site staff carrying out the works,
- Ensuring site staff have been trained in the CSMP and understand what needs to be done,
- Implementing the correct management procedures and health and safety requirements,
- Monitoring and maintaining any controls to ensure they remain effective,
- Communicating with the CLS; and
- Notifying contaminated land related incidents to the Project Manager in a timely manner.

**The Project Manager/CCC Project Representative is responsible for:**

- Making sure that the work has been categorised into the correct level,
- Providing an appropriate CSMP,
- Auditing the works to ensure they are being carried out in accordance with the correct procedures,
- Making sure all Contractors/Site staff are aware of, and comply with, the relevant health and safety procedures; and
- Providing information to Team Leader Environmental Compliance at the CCC.

**Contaminated Land Specialist (CLS):**

A CLS is a person who can provide technical expertise, overseeing the identification and disposal of contaminated soil. A CLS needs to meet the following criteria:

*The Contaminated Land Specialist shall be a person who is qualified to undertake a detailed site investigation and who should have at least tertiary education in environmental science, engineering or a related field and 2+ years of professional experience in environmental investigations and risk assessments.*

In the event that contaminated material is suspected or found, it is the role of the CLS to investigate the material and advise on any health and safety precautions and appropriate excavation and disposal.

It is the role of the CLS to appropriately train the key staff (e.g. Project Manager, Site Foreman, excavator operator) on how to carry out regular inspections of the site to identify contamination. The training should at a minimum consist of an induction and Toolbox presentation. Any key staff added to the project need to be trained in this way.

## **2.2 How much training do you need and what can you do?**

The training needed and decision making roles are outlined below:

|                                   | <b>Site Staff</b><br>(e.g. excavator operators, site construction staff)                   | <b>Contaminated Land Specialist</b>                                                                                                                        | <b>Asbestos Specialist</b>                                                                  |
|-----------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <b>What training do you need?</b> | 15 minute toolbox in the CSMP                                                              | Degree qualified and 2+ years relevant experience                                                                                                          | Certified asbestos assessor or suitably qualified health and safety consultant <sup>3</sup> |
| <b>What is your role?</b>         | Day to day site inspections during works, report suspicious looking soil/ground conditions | Decisions on the investigation, appropriate excavation and disposal of soil. Advising on health and safety requirements and additional mitigation methods. | Provide advice on removal and disposal of asbestos                                          |

<sup>3</sup>As described in WorkSafe New Zealand – Approved Code of Practice – *Management and Removal of Asbestos* (November 2016) and *Health and Safety at Work* (Asbestos – Prescribed Relevant Courses) Safe Work Instrument (2017)

## 2.3 Reporting for consent compliance

To comply with resource consent conditions, a site completion report is required to be submitted to the CCC Consent Compliance Team and to Environment Canterbury (ECan). To support this reporting, the following information must be provided by the Contractors/Site Staff for each job:

1. Records of all contaminated land inspections undertaken during the job,
2. Any contaminated land reports or testing undertaken to comply with this CSMP. The report needs to include information on the location, depth and extent of contamination, photos and any soil validation undertaken,
3. Details of any incidents relating to contamination e.g. fuels spills, encountering asbestos, health and safety incidents. An appropriate form can be found in Appendix C,
4. A completed Works Verification Form (Appendix B); and
5. If soil is disposed offsite, evidence of that disposal (i.e. weighbridge dockets, receipts etc).

## 3 Controls

This section describes what controls need to be put in place during your work. These controls are appropriate for the amount and type of contaminants expected on moderate risk sites.

If you see anything that suggests the soil is contaminated (see Section 3.2), you must contact the CLS as additional controls may be needed.

It is important that the contaminated soil is identified, handled and disposed of correctly to minimise risks to health and safety and the surrounding environment.

### 3.1 How to inspect the ground

Inspections of the area you are working in need to be undertaken by a CLS or an appropriately trained key staff member (see Section 2.1). The CLS will advise at the start of the project how often the inspections will need to be undertaken

In addition, all site staff should be on the lookout for signs of contamination, particularly when working in new areas of the site or undertaking excavation activities. If anything unusual is identified while working or you are unsure of what to do, get in touch with your CLS who will advise on how to move forward.

### 3.2 What does contamination look like?

A range of contaminants may be present on the site. Some types of contamination you can see or smell, but many you cannot. If you experience any of the following it is likely that contaminants are present:

- A hydrocarbon odour (smells like petrol, diesel, kerosene or similar),
- Other abnormal odours not usually associated with soil,
- Discoloured soil (e.g. areas of soil with dark staining, mottled appearance, abnormal or unnatural colouration),
- Soil containing rubbish or building debris (e.g. plastics, metals, brick, timber) indicating the ground has been filled; or
- An oily substance or rainbow sheen on the surface of the soil or on the surface of water in the excavation.

Examples of what you might come across are shown below.



A rainbow sheen on the surface of water.



Areas of dark staining and unnatural colouration in a shallow excavation.



Discoloured soil and water in the base of an excavation.



Unexpected building rubble in an excavation.

If you see any of these or other unusual signs, look at the rest of Section 3 for what to do, and contact a CLS to inspect the excavation and provide advice on how to move forward.

### 3.3 How to handle soil

The following instructions are for soil that is assumed to have moderate level contamination.

- Where possible, excavated soil, which is being removed offsite, should be placed directly into trucks,
- Trucks need to be loaded in an area where any spills can be contained,
- If you must stockpile the soil, follow the instructions in Section 3.4,
- Have a method to prevent soil being tracked off site. This could be a wheel wash, area to dry brush the wheels or a rumble strip/construction entrance,
- Get a permit/approval from the disposal facility before trucking the soil there (this is the Contractor's job). Information on where to send the soil is in Section 4.1,

- Have a tracking document (e.g. drivers log sheet) signed onsite to track how much soil is being trucked away; and
- Keep the weighbridge docket for each truckload to provide to the Project Manager.

### 3.4 Stockpiling

At times, you may have to stockpile soil at your worksite. The duration needs to be kept to a minimum and the stockpile must be managed in the following ways:

1. Locate the stockpiles away from surface waters, site boundaries and areas where water may pool or run through during rainfall (i.e. kerb and channel). It may be necessary to divert 'clean' water around the stockpile.
2. To stop sediment laden runoff, you must encircle the stockpile with either:
  - An earth bund (minimum height 0.3m)
  - Hay bales lined with geotextile or plastic sheeting
  - Silt fences
  - Filter socks
3. Keep stockpile heights less than 1.5m. If a higher stockpile is required, approval needs to be sought from the Project Manager who must consult with the CLS.
4. Compact the surface of the stockpile with excavator bucket to prevent erosion and minimise dust.
5. If the stockpile needs to remain for longer than a week, it must be covered (with either geotextile cloth or plastic sheeting) to prevent erosion and dust. Seek advice from your CLS in this situation.
6. The stockpile needs to be secured so it cannot be accessed by unauthorised people, either within the site boundary or with a specific fence. Ensure any resource consent conditions relating to the location and management of the stockpile are adhered to.

An example of some stockpile controls are shown below.



Haybales and a geotextile liner around a soil stockpile.



An impermeable cover on a stockpile.



A silt fence around the base of a soil stockpile.



A hay bund around a stockpile.

### 3.5 Dust

Dust generated during earthworks causes a nuisance, is not good for human health or the environment, particularly if it contains contaminants. To reduce the chance of dust leaving the worksite, the following controls need to be put in place:

1. Avoid work which causes dust in windy conditions.
2. Limit the amount of open excavations or disturbed ground as much as you can. You should not open more ground than you can keep damp or cover with geotextile.
3. Cover stockpiles or keep damp, including during non-working times.
4. Reduce vehicle speeds on site.
5. For large or longer-term sites, you must create haul roads with a geotextile overlain with a granular running surface.
6. Minimise drop heights when loading soil onto trucks.
7. Dampen the soil with water – but not too much. Using too much water can cause runoff, soggy soil or surface ponding.
8. Have a sprinkler or portable hose onsite at all times in case continuous dust control is required.

### 3.6 Stormwater and sediment

Rainwater can mix with contaminated soil and become contaminated itself. Contaminated runoff and sediment can then wash offsite onto someone else's land or into streams or the sea via the stormwater network. The key areas for focus are:

- Preventing clean rainwater from contacting contaminated material.
- Controlling sediment from going down sumps/stormwater inlets.
- Controlling sediment from moving or being tracked to uncontaminated areas of the worksite.
- Controlling sediment from moving or being tracked offsite.

All earthworks sites require a site-specific Erosion and Sediment Control Plan (ESCP) that achieves the outcomes of the CCC Environmental Management Plan (EMP), in particular the sections relating to contamination, erosion and sediment control.

The purpose of an ESCP is to identify the specific erosion and sediment issues associated with the site, describe the specific controls that will be used, and allow for monitoring during site works.

A typical ESC would normally include information on:

- The extent of the disturbed area,
- The location of waterways and inlets that need protection,
- What control measures will be put in place for the site boundary, stockpiles and excavations,
- How to separate clean and dirty water,
- How monitoring will be undertaken; and
- A drawing showing the locations of proposed stockpiles and the proposed control tools.

The ESCP should be submitted to the Project Manager for review at least 2 weeks before the start of the project.

### **3.7 Dewatering**

At times, during deep excavation or when working in areas with a high groundwater table, dewatering may be required to remove excess water from the work area. Dewatering from (potentially) contaminated sites must be undertaken in accordance with Resource Consents CRC190368 and CRC190369 held by Christchurch City Council.

During dewatering, it is important to be on the lookout for:

- Signs of contaminated soil, particularly if you are excavating to levels not yet disturbed on the site. Refer to Section 3.3 for how to handle contaminated soil.
- The appearance and smell of the groundwater before commencing dewatering. Does it look unusual or smell? Refer to Section 3.2 to help with identification of contaminated groundwater.
- If groundwater being removed from the hole is suspected as being contaminated, sampling is required by the CLS. Dewatering from the excavation should be retained in a secure tank or put into a tanker truck for disposal at an appropriate facility as described in Section 4.2.

In addition, the Contractor is required to:

- Get approval from the CCC prior to disposing any dewatering water to the stormwater or sewer system
- Get a permit/approval from the disposal facility before trucking the groundwater there
- Have a tracking document (e.g. drivers log sheet) signed onsite to track what volume of water is being trucked away; and
- Keep the weighbridge dockets for each truckload to provide to the Project Manager.

#### **3.7.1 Suspended Sediment**

If the CLS determines that the groundwater is not contaminated, it may still contain suspended sediment and will not be suitable for returning to the site stormwater system. Treatment of the suspended sediments will be required to achieve the standards in CRC190369. Disposal of groundwater to the stormwater or sewer system requires approval from CCC's stormwater/wastewater engineers.

#### **3.7.2 Contaminant Migration**

Dewatering may draw groundwater from surrounding areas towards the excavation where dewatering is taking place. This may cause migration of contaminants from other areas towards the excavation. Regular observations of the groundwater quality should be undertaken by site staff and the CLS throughout the dewatering stage to quickly identify if the water quality changes. If it appears that contaminated groundwater is being removed from the excavation, work should stop until appropriate containment facilities are made available. See Section 3.7 for how to dispose of the water appropriately.

### 3.7.3 Ground Stability

Dewatering may result in localised settlement of the ground in the area around the excavation. This is likely in areas of reclaimed land e.g. former landfills. Dewatering may result in trench wall failure and slope stability issues as landfill material is dislodged or moved during settlement. It is important to take appropriate health and safety precautions around trench and slope stability e.g. sheet piling or shoring and to dewatering in a slow and steady manner in stages to minimise the risk of collapse. Expert advice should be sought if this issue presents itself on site.

## 3.8 Odour

Odours released during excavation can be unpleasant and may impact on human health. If odorous material is uncovered during earthworks, the following controls should be put in place:

- All work in the area of the odorous material shall stop immediately and the odorous material covered with plastic or soil to prevent odours escaping. The Contractor should then get advice from the CLS.
- The CLS will assess the potential for noxious and explosive gases and advise on health and safety requirements.
- Wind conditions should be monitored and if necessary, work stopped until conditions are better for minimising the discharge of odour.
- If natural dispersion is not adequate, ventilation or other mitigation measures e.g. odour suppression sprays may have to be used.
- Health and safety procedures as set out in Section 5 should be followed.

## 3.9 Unexpected Material or Landfill

You may come across unexpected items buried in the ground during your excavation. These could be isolated items e.g. old underground storage tanks or drums containing chemicals or waste or you may come across a historical landfill. Landfill material could be a mixture of domestic, industrial and commercial waste which may cause ground contamination.

There are many historical landfill sites across Christchurch, many of them have been converted into parks and grassed areas. Landfills pose a risk during excavations because the material can be both physically and chemically dangerous:

- **Physically** – buried material like steel, glass and sharp objects can cause physical injury to site workers when removing.
- **Chemically** – decomposing solid waste can emit gases such as methane causing asphyxiation or explosion risk for site workers entering trenches or when waste is exposed during excavation.
- Leachate containing metals and organic compounds can also drain or be exposed during excavation.

### 3.9.1 Control Measures:

- Before starting earthworks, the potential for VOC exposure must be determined, see Section 5.4.2 for how to work this out.
- For the control of explosion risk and inhalation of toxic gases, see Section 5.4.3 has more detail.
- Limit the amount of open excavation where possible.
- Use tools to remove objects from the excavation where possible to avoid manual handling.
- If manual handling is required, wear thick leather gloves or similar, to protect hands.

- Follow the stormwater and sediment control measures outlined in Section **Error! Reference source not found.**
- Stockpiled material needs to be controlled as described in Section 3.4.
- Any removed material needs to be transported safely to Kate Valley landfill as described in Section 4.1
- Seek advice from your CLS if you are unsure on material identification or how to proceed.

### 3.10 Are you putting in a pipeline?

Installing pipes and conduit in contaminated soil can create a flow path for contaminants to move through and off the site. If you come across groundwater in your excavation, control measures e.g. pipe dams, may be needed to stop any mobile contamination spreading. In this situation, get advice from your CLS on how to move forward safely.

### 3.11 Cross contamination

To avoid transferring contaminated soils to other locations, all machinery and equipment should be cleaned before moving it to another site. This could be achieved by dry brushing or using a pressure washer. If using water, make sure you control the runoff in accordance with Section 4.2.

### 3.12 Imported cleanfill

Soil and cleanfill material that is coming to site needs to be suitable for the site use and environment. The following table explains what needs to happen to the cleanfill before arriving at site.

| Virgin quarry material or certified cleanfill | Uncertified cleanfill                                                                                     |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Use straight away.                            | Fill should be tested at the source prior to trucking to site.                                            |
|                                               | Sampled at a rate of 1 sample every 500m <sup>3</sup> .                                                   |
|                                               | Needs to be tested for metals, hydrocarbons and any other identified contaminants by your CLS.            |
|                                               | Results must be suitable for the land use criteria and for the relevant ecological receptors in the area. |

### 3.13 Does the soil at the site need to be sampled?

It is likely that you may need to sample soil, either before earthworks begin, while earthworks are underway or from the stockpile during the work programme. Soil sampling is for determining the protection of human health and needs to be undertaken by a CLS in accordance with the NES Regulations 2012<sup>4</sup> and the MfE Contaminated Land Management Guidelines No.5<sup>5</sup>.

<sup>4</sup> Ministry for the Environment (MfE) National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (2012)

<sup>5</sup> Ministry for the Environment, 2004: Contaminated Land Management Guideline No.5 – *Site Investigation and Sampling*, revised 2011

Based on the specific work site's historical use, or the duration of time the excavation may be left open, it may be necessary to undertake prework sampling to identify areas of greatest risk to health and safety before beginning earthworks.

A desktop study of the site may identify:

- whether there has been a potentially contaminating land use,
- the nature of probable contaminants,
- the possible locations of contamination.

Combining the results of the desktop study with the area where the earthworks are to be undertaken should provide an area for sampling to be concentrated in.

Selecting an appropriate sampling pattern requires professional knowledge and experience, and should be supported by clear justification. There are two main approaches to sampling design are:

- Targeted sampling - which focuses on known, suspected or point source areas of contamination
- Grid sampling – also known as probability-based sampling, which characterises the contamination status of a defined area of a site.

If enough historical information is available, targeted sampling could be undertaken as it is generally less expensive to carry out than grid sampling and is easier to do.

Prepared a sampling plan and carrying out the sampling should be undertaken by a CLS, in accordance with the Contaminated Land Management Guidelines.<sup>6</sup>

Soil samples need to be collected in the following way:

1. The soils need to be described using the NZ Geotechnical Society "Guidelines for the classification and field description of soils and rocks for engineering purposes".
2. Soil needs to be collected and put into 300mL glass jars using freshly gloved hands or a stainless steel trowel.
3. Any equipment used to collect the soils needs to be decontaminated using clean water and Decon 90 (a phosphate free detergent) or similar.
4. Samples need to be shipped immediately in a chilled container to an IANZ accredited laboratory under Chain of Custody documentation.
5. The CLS will decide what the appropriate testing is. This should be based on the site history, reason for the sampling and any observations made by site staff.
6. Any evidence of asbestos shall trigger testing for asbestos content in the soil.

All results should be compared to the NES Regulations (2012) soil contaminant standards with respect to protection of human health and the relevant ecological receptors for the local area.

### 3.14 Coal Tar

Coal tar is a by-product of the gasworks industry, commonly used as a sealant and road metal binder prior to the 1970's. It is typically a dark brown/black colour with a strong and distinctive hydrocarbon/naphthalene odour. It is typically used with a blue/grey angular aggregate. There is the potential to come across this product during excavation works, particularly in roads, roadside verges and footpaths. Coal tar contains very high concentrations of polycyclic aromatic hydrocarbons (PAH's) and can pose a risk to human and ecological receptors. Some people are sensitive to the odours and can experience headaches, even at low levels of exposure.

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<sup>6</sup> MfE Contaminated Land Management Guidelines No.5 *Site Investigation and Analysis of Soils* (2016 Revised Draft)



An example of aggregate bound by coal tar in a road surface.

If coal tar is found during site works, the contractor should notify the CLS and follow the procedures below:

- All workers on site must wear P2 dust masks and hand protection.
- Work should stop if conditions are windy and dust cannot be controlled.
- If odours become offensive, particularly in surrounding public areas, the exposed coal tar should be covered with soil to prevent further odour generation.
- All coal tar contaminated material is to be treated in accordance with the CCC Construction Standard Specification<sup>7</sup> and either be:
  - loaded directly onto trucks, covered and transported to an approved facility. Disposal receipts are to be provided to the CLS and Project Manager.
  - encapsulated in Bidim A29 (or equivalent) fabric within the excavation.
- Stockpiling of material containing coal tar should be avoided, but if it is unavoidable, follow the procedures outlined in Section. 3.4
- Any groundwater encountered during the excavation should be controlled following the measures outlined in Section 4.2.
- All PPE, in particular dust masks and hand protection used to handle coal tar contamination is to be disposed of at the conclusion of the site works.

### 3.15 Asbestos

There is the potential during excavation to come across asbestos cement (ACM) in building materials or as free fibres. There are specific procedures to deal with asbestos and these are detailed in WorkSafe New Zealand – Approved Code of Practice – *Management and Removal of Asbestos* (November 2016). When carrying out earthworks, it is important to know how to identify asbestos so the correct procedures can be followed. Asbestos cement products come in many forms, most common are:

1. Cement boards or tiles, characterised by a flat, thin white-grey board with visible threads/fibres on a broken edge.
2. Super 6 roofing – white grey roofing material with a broad corrugation (larger than coloursteel).
3. Vinyl floorboards or sheet vinyl floor coverings.
4. Loose fill insulation (mainly in residential environments).
5. Textured ceiling panels and tiles, typically stippled.

<sup>7</sup> Christchurch City Council Construction Standard Specification Part 1:2017 Section 17.4.1

6. ACM downpipes, vent pipes, capping, gutters and door mouldings – often characterised by brown spiky fibres on a broken edge.

Illustrated examples of what you may come across are shown below.



Textured ceiling tiles containing asbestos



Asbestos insulated pipework



Super 6 roofing corrugations containing asbestos



Loose fill asbestos insulation

If suspected asbestos is found during site works or is known to be present on site, the Contractor/Site Staff should notify the Project Manager and seek advice from the CLS prior to proceeding. Work involving asbestos must be done under the supervision of an approved asbestos contractor with the works notified to WorkSafe NZ<sup>8</sup>.

Cutting or breaking of the ACM pipe should be avoided, and it should be removed in whole sections if possible. Any cutting or excavation of ACM pipe is to be done under wet conditions with Contractors wearing full face and body protection and using methods outlined in the Approved Code of Practice.

- All workers on site must wear P2 dust masks.
- Work should stop if conditions are windy.

<sup>8</sup> WorkSafe New Zealand – Approved Code of Practice – *Management and Removal of Asbestos* (November 2016)

- All asbestos contaminated material is to be loaded directly onto trucks, covered and transported to an approved facility. Depending on the material it may need to be double bagged.
- Stockpiling of material containing asbestos should be avoided, but if it is unavoidable, procedures are outlined in Section 3.4.
- All PPE used to handle asbestos contamination is to be double bagged and disposed of at an approved facility.
- Approval for disposal must be sought from the receiving facility prior to carting soil offsite. Disposal receipts are to be provided to the CLS and Project Manager.

## 4 How to safely dispose

### 4.1 Disposal of contaminated soil

All soils or hydro excavated material from site shall be assumed to be contaminated until the results of the sampling undertaken as described in Section 3.13 prove otherwise. Contaminated soils should be stockpiled separately from known uncontaminated soils to reduce disposal costs.

Results of laboratory testing will dictate where the soil can be disposed of, broad guidelines are as follows:

- **Cleanfill Facility**– if the levels of contaminants are less than background,
- **Managed Fill Facility** – levels above background but generally below residential,
- **Texco Remediation or Kate Valley** – if the levels exceed the Burwood Landfill acceptance criteria,
- **Asbestos Facility**- if asbestos is present in the soil, it must be disposed of at a licensed facility with the prior approval of the operator.

### 4.2 Disposal of water

Groundwater and ponded surface water cannot be put in the stormwater, sewer or wastewater system without approval from CCC's engineers. Approval is unlikely unless the sediment can be mostly removed and the quality of the water is known. Some hydro excavated material may be able to be disposed of at Burwood Landfill.

### 4.3 Disposal of uncontaminated soil

Uncontaminated soil that has been tested as per Section 3.13 can be transported to a cleanfill facility for disposal or reused at site. Seek approval from the cleanfill operator before commencing loading of trucks. Keep all weighbridge dockets for proof of disposal and make sure the loading of trucks and transportation should be undertaken as per the procedures in Section 3.

### 4.4 Onsite management

During site works, it is important to appropriately manage, record and report the movement of contaminated soil.

Seek advice from a CLS to determine if contaminated soil can be reused the site e.g. if soil is to be reused to create an earthen bund. The CLS will provide guidance on appropriate use of the soil at the site.

Recording of the planned or unplanned movement of contaminated soil at the site needs to be documented to protect those working on the site in the future. It is the role of the project manager to provide this information to the CCC at the completion of the project so the LLUR can be appropriately updated.

## 5 How to keep healthy and safe

This section contains suggested **additional measures** to the standard health and safety requirements during site works that will help reduce the risk to site workers.

The following information should be used as a guide for developing site-specific safety documentation. It is still the obligation of the Contractor to fully assess the risks posed by ground contamination, develop appropriate work methods and apply the appropriate PPE.

### 5.1 Setting up the site

Before ground works start, the following minimum requirements should be put in place:

1. Where possible, the site should be fenced with 1.8m secure fencing to prevent unauthorised access. Appropriate warning signs e.g. “*Restricted Entry*”, “*Danger Open Excavations*” should be visible on the fencing.
2. Signage should also include environmental hazards (i.e. asbestos).
3. Set up any required environmental control measures (i.e. erosion and sediment controls) prior to starting site works.
4. Health and safety inductions and daily prestart meeting should be held and specifically cover the environmental risks and this plan.
5. Wash facilities, PPE stores and first aid points should be provided.

### 5.2 General safety requirements

Anyone working at or visiting the site will need to undergo a site-specific safety induction before beginning work or visiting the site. This is important so everyone is aware of the risks and hazards associated with contaminated soil at the site, safe working procedures, safety equipment and the action plan in case of an emergency.

The Contractor needs to appoint an Environmental Safety Officer (ESO) for the duration of the works who will make sure health and safety procedures are followed and potential hazards are controlled.

Anyone working or visiting the site must follow the general safety procedures:

1. All incidents need to be reported to the ESO.
2. Workers need to be made aware of potential site hazards so control measures can be put in place.
3. Everyone should avoid unnecessary contact with site soils and asbestos containing materials.
4. Everyone should wear the correct PPE as outlined in Section 5.
5. A first aid kit and fire extinguisher should be available at all times.
6. Wash facilities as described in Section 5.1 should be available.

## 5.3 General Hazard management

Although works undertaken on the site are unlikely to contain significantly contaminated soil, precautionary health and safety measures by site workers and visitors should still be taken. These include:

- Wearing clothes that covers arms and legs when involved in works where soil contact is likely (i.e. manual excavation, working in trenches etc),
- Wearing P2 dust masks in dusty conditions; and
- Having good hygiene practices e.g. washing hands before eating, drinking, smoking or using the toilet.

If signs of contamination are observed, site works must be stopped until additional health and safety measures are put in place. Seek advice from a suitably qualified H&S advisor or the CLS prior to proceeding.

The Contractor should regularly review any new areas of work, assess the hazards and determine if they are related to ground contamination. If they are, new health and safety procedures should be put in place with the help of the CLS and all site staff advised.

## 5.4 Specific Hazard Management

### 5.4.1 Noxious and explosive atmospheres

Vapours from ground contaminated with hydrocarbons, or containing landfill materials, can create atmospheres which are potentially explosive, or toxic to human health.

If unusual odours are noticed or you unexpectedly encounter landfill materials, you must:

- Halt work in that area and notify the CLS (for unusual odours or unexpected landfill materials)
- Seek advice from the CLS on what the risks are, and how to manage them

The CLS may recommend the measures set out in the following two sections, or something similar. These must be implemented at all times as directed by the CLS.

### 5.4.2 Noxious gases

Certain contaminants in soil can release noxious gases. Landfill materials and hydrocarbon contamination are the usual source of noxious gases.

The most commonly encountered noxious gases are:

- **Volatile Organic Compounds (VOC's)** - Volatile Organic Compounds (VOC's) are the vapour product of petroleum fuels, solvents and heavy end hydrocarbons such as tar and creosote. VOC's can remain in the soil, even when the source product is gone, possibly creating a hazardous atmosphere to workers when disturbed.
- **Hydrogen sulphide** - Hydrogen sulphide is colourless, highly explosive and has a characteristic 'rotten egg' smell. It is dangerous at relatively low levels, irritates the eyes, mouth and respiratory system. Exposure to high levels can cause rapid unconsciousness and can be fatal
- **Carbon monoxide** - Carbon monoxide is odourless and if inhaled can prevent your blood carrying oxygen, which can be fatal.
- **Carbon dioxide** - Carbon dioxide is less dangerous but can cause respiratory difficulties and may displace oxygen in the air you breathe.

The following procedures will be used where there is the potential for noxious gases to be present. The procedures can be modified by the CLS to accommodate a specific work site.

- Before starting earthworks, before entering an excavation at the start of the day or after a break of more than 15 minutes or excavating in a higher risk area the levels of noxious gases must be determined.
- If noxious gases are identified, the levels must be measured using a photoionisation detector (PID) and compared with the below workplace exposure standards and appropriate PPE chosen (Section 5.4).
- Based on the levels, the CLS may require specific PPE, adjustments to the monitoring or wearing of personal gas monitors.

|                                             | <b>Exposure Limit</b>                 |                                                                      |
|---------------------------------------------|---------------------------------------|----------------------------------------------------------------------|
|                                             | Time Weighted Average (TWA) – 8 hours | Short Term Exposure Limit (STEL) – 15 minutes                        |
| <b>VOC's Total (adopted n-hexane limit)</b> | 20 ppm                                |                                                                      |
| <b>Benzene</b>                              | 1 ppm                                 | 2.5 ppm                                                              |
| <b>Carbon monoxide</b>                      | 25ppm                                 | Ceiling 400 ppm<br>200 ppm 15 min<br>100 ppm 30 min<br>50 ppm 60 min |
| <b>Carbon dioxide</b>                       | 5,000 ppm                             | 30,000ppm                                                            |
| <b>Hydrogen sulphide</b>                    | 10 ppm                                | 15 ppm                                                               |

Reference: WorkSafe *Workplace Exposure Standards and Biological Exposure Indices* (November 2018)

- Noxious gas levels can change depending on temperature and wind conditions. Conditions should be monitored during earthworks and work stopped if necessary, until more favourable conditions return.
- If natural dispersion is not adequate, ventilation measures may have to be used.
- Health and safety procedures as set out in Section 5 should be followed.

### 5.4.3 Explosive atmospheres

Some soil contamination can produce explosive gases, which could accumulate in excavations and services. If exposed to an ignition source, these gases could explode or cause a fire.

Explosive gases are most commonly associated with high levels of hydrocarbon contamination and landfills. If either of these are suspected on the project site, the CLS should check if explosive gases could be present.

If the potential exists, the CLS will require precautions to be implemented. This may include:

7. Requiring all excavations deeper than 1m and narrower than 3m to be treated as confined spaces. Use the appropriate confined space procedures in AS2865 *Confined Space* to determine what steps need to be followed and what training is required.
- Using intrinsically safe equipment and fitting spark arrestors
  - Monitoring the gases in excavations prior to work commence for the day, after any breaks, or when moving into higher risk areas
  - All staff working in excavations to wear personal gas meters

- Halt works if explosive gases are detected above the lower explosive limit (LEL)
- Use of active ventilation (fans)
- Have fire extinguishers on site at all times

## 5.5 Emergency procedures

Before work starts, the ESO must develop an Emergency Response Plan (ERP) and make sure everyone on site is familiar with what to do in an environmental emergency. The plan should be tested onsite to make sure the correct equipment is available. At minimum, the plan should explain:

1. The Assembly Point.
2. The location of the nearest telephone.
3. The location of the nearest first aid kit and fire extinguisher.
4. Local medical emergency numbers (and example is below).

|                              |              |
|------------------------------|--------------|
| Emergency                    | 111          |
| Project Manager              | Job specific |
| Contaminated Land Specialist | Job specific |
| Local Medical Centre         | Job specific |
| Worksafe NZ                  | 0800 030 040 |

The ESO must be notified immediately of any environmental related injury or accident occurring at the site. If serious harm occurs, WorkSafe NZ must be notified immediately.

## 6 How to finish the job

### 6.1 Information required

Working with the CLS, the Contractor must complete a Works Verification Form (Appendix B) at the conclusion of the earthworks. The form must be submitted to the Project Manager within 1 month of completing the works and includes items such as:

- Confirmation the soil disturbance works are complete,
- Whether or not contaminated material was found,
- Confirmation the works were completed following the CSMP procedures,
- Any variations that occurred during the works,
- Information on any environmental incidents,
- Results of laboratory testing; and
- Confirmation of where the clean and contaminated soils were disposed of.

Documents that need to be attached to the Works Verification Form:

- Copies of weighbridge summaries and disposal location for the disposed of soil,
- Records of visitors to site,
- Details of any complaints,
- Details of any incidents relating to contamination and how they were resolved; and
- Details of the onsite movement of soil for updating the LLUR.

## **6.2 Validation sampling**

Validation sampling will be determined on a case-by-case basis by the Project Manager in conjunction with the CLS. Any validation sampling results will be attached to the Works Verification Form.

## 7 Applicability statement

Enviser Ltd has prepared this report for Christchurch City Council (CCC) in accordance with the agreed scope. No other party, aside from those agents authorised by the CCC, may rely on this report, or any conclusions or opinions within it, for any purpose without the express written permission of Enviser Ltd.

The opinions and conclusions within this report are based on the information that was viewed during preparation of the report.

Prepared for Enviser Ltd by:



Alison Peters  
Environmental Consultant  
BSc, PG Dip (Eng. Geol)

Authorised for Enviser Ltd by:



Jared Pettersson  
Director  
CPEng, MIPENZ, IntPE

# Appendices

## Appendix A – Contractor/Site Worker Checklist

| Before Siteworks Begin |                                                                                                                            |         |
|------------------------|----------------------------------------------------------------------------------------------------------------------------|---------|
| 1                      | Find a CLS, discuss the proposed work with them and provide them with a copy of the CSMP.                                  | Check ✓ |
|                        |                                                                                                                            |         |
| 2                      | Set up the required site safety controls e.g. fencing, hazards board, wash facilities, PPE store.                          |         |
| 3                      | Put environmental control measures in place e.g. silt fences at site boundary, wheel wash and stormwater inlet protection. |         |
| 4                      | Arrange permits for soil disposal and water discharge (if required).                                                       |         |
| 5                      | Complete training as per the CSMP with all site staff and the CLS.                                                         |         |
| During Siteworks       |                                                                                                                            |         |
| 6                      | Ongoing monitoring of the site by Contractors and CLS as detailed in the CSMP.                                             |         |
| 7                      | Any unexpected contamination or environmental incident, advise the Project Manager immediately.                            |         |
| 8                      | Maintain erosion and sediment control as per the site specific ESCP.                                                       |         |
| 9                      | Complete testing of soil as advised by the CLS.                                                                            |         |
| 10                     | Record all material being exported from and imported to site.                                                              |         |
|                        | End of Siteworks                                                                                                           |         |
| 11                     | Complete a Works Verification Form.                                                                                        |         |
| 12                     | Make sure any other resource consent conditions have been met.                                                             |         |

## Appendix B – Works Verification Form

|                                                   |            |             |                              |
|---------------------------------------------------|------------|-------------|------------------------------|
| <b>Site Name and Location:</b>                    |            |             |                              |
| <b>Dates of Sitework:</b>                         |            |             |                              |
| <b>Job Description:</b>                           |            |             |                              |
| <b>Was contaminated soil or water identified?</b> |            |             |                              |
| <b>What volume of material was exported?</b>      | Cleanfill: | Where to:   |                              |
|                                                   | Landfill:  | Where to:   |                              |
| <b>Was material imported?</b>                     | Volume:    | Where from: |                              |
| <b>Any laboratory testing results?</b>            | Yes:       | No:         | Attach results to this form. |
| <b>Form completed by:</b>                         |            |             | Date:                        |
| <b>Project Manager:</b>                           |            |             | Signed:                      |
| <b>Contaminated Land Specialist:</b>              |            |             | Signed:                      |

## Appendix C – Incident and Monitoring Reporting Forms

### In the event of an incident:

- Stop work in the immediate area of the contamination incident and isolate the area e.g. using cones, tape, barriers.
- Immediately advise the Site Manager who must advise the CLS and Project Manager.
- Implement the contaminated soil Health and Safety procedures as per the CSMP.
- Implement environmental controls as per the CSMP e.g. sediment, water, dust controls.
- Update the Hazard Board.
- Implement additional controls as per the CSMP and on advice from the CLS.
- Make sure monitoring and disposal records are kept, including the form below.

### Incident Reporting Form

|                                      |                                                                           |                                                      |                       |
|--------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------|-----------------------|
| <b>1</b>                             | Isolate the area of contamination.                                        | Describe area:                                       | Describe containment: |
| <b>2</b>                             | Arrange disposal of the contaminated material offsite.                    | Volume:                                              | Location:             |
| <b>3</b>                             | Apply any additional controls as per the CSMP and on advice from the CLS. | Details:                                             |                       |
| <b>4</b>                             | Monitor soil/water/air as advised by the CLS.                             | Use the <b>Monitoring Reporting Form</b> and attach. |                       |
| <b>5</b>                             | Notify CCC and ECan as required.                                          | CCC:                                                 | ECan:                 |
| <b>6</b>                             | Describe the incident resolution and actions taken.                       |                                                      |                       |
| <b>Form completed by:</b>            |                                                                           |                                                      | Date:                 |
| <b>Project Manager:</b>              |                                                                           |                                                      | Signed:               |
| <b>Contaminated Land Specialist:</b> |                                                                           |                                                      | Signed:               |

## Monitoring Reporting Form

This form can be used for monitoring of soil, water and air throughout the project. Attach any laboratory testing results to this document at the conclusion of the siteworks.

| Date and Time: | Location Monitored: | Parameter Monitored?<br>e.g. soil, water, air | Results: | Observations: | Recorded<br>By: |
|----------------|---------------------|-----------------------------------------------|----------|---------------|-----------------|
|                |                     |                                               |          |               |                 |
|                |                     |                                               |          |               |                 |
|                |                     |                                               |          |               |                 |
|                |                     |                                               |          |               |                 |
|                |                     |                                               |          |               |                 |
|                |                     |                                               |          |               |                 |

## **Appendix K. RMA/2021/2094, CCC Global NESCS Consent**

# Report / Decision on Change or Cancellation of Condition(s)

(Section 127)

**s127 Application Number:** RMA/2021/2094  
**Original application number:** RMA/2019/2727  
**Applicant:** Christchurch City Council  
**Site address:** Various – Global Consent  
**Legal Description:** Various  
**Zoning:** Any zone within the Christchurch District Plan  
**Overlays and map notations:** Any overlays within the Christchurch District Plan  
**Activity Status:** Discretionary activity

**Description of Application:** Change of conditions pursuant to Section 127 for Global land use consent under the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES-SC) for the disturbance of soil on Hazardous Activity and Industries List (HAIL) sites where providing for projects within Council-controlled land, road corridors, parks and reserves

## Introduction

The applicant is seeking to vary the conditions of an existing resource consent (RMA/2019/2727) which was granted on a non-notified basis by Independent Commissioner David Mountfort on 23 January 2020.

The existing consent is a global land use consent under the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES-SC) is sought for the disturbance of soil on Hazardous Activity and Industries List (HAIL) sites where providing for projects within Council-controlled land, road corridors, parks and reserves.

The existing resource consent extends to activities under the NES-SC and therefore the consent scope is specific to the NES-SC only. The consent does not grant resource consent for activities/earthworks that may be required by projects and that do not comply with rules of the Christchurch District Plan.

The applicant proposes to amend two conditions and also proposes an additional advice note be added to the existing notes. The original wording proposed in the application was not in the end workable, and has been amended with agreement of the applicant under an initial review of this report by the decision maker.

The text of both the changes proposed and the new advice note are repeated below with additions in bold and underlined:

1. The development shall proceed in accordance with the information and plans submitted with the application. The Approved Consent Document has been entered into Council records as RMA/2019/2727(94 pages) **and as amended by RMA/2021/2094.**
14. (a) Any soils removed from the site during the course of the activity shall be disposed of to a facility authorised to accept the material **or with approved permission from the Council's Environmental Compliance Team to an alternative suitable site.**
  - (b) If the soil is disposed of to an authorised facility the consent holder shall provide evidence such as weighbridge receipts or waste manifest, to the Christchurch City Council's Environmental Compliance Team, or nominee (Email [rcmon@ccc.govt.nz](mailto:rcmon@ccc.govt.nz)) within two months of the completion of works.
  - (c) **if the soil proposed to be disposed of to an alternative suitable site a report signed and documented by a Contaminated Land Specialist (CLS),** should be submitted to the Christchurch City Council's Environmental Compliance Team, or nominee (Email [rcmon@ccc.govt.nz](mailto:rcmon@ccc.govt.nz)) at least two weeks prior to the disposal of the soil, and the disposal shall not proceed until approval has been received.

## Advice Notes:

**A Contaminated Land Specialist (CLS) is a person who can provide technical expertise, overseeing the identification and disposal of contaminated soil. A CLS needs to meet the following criteria:**

**The Contaminated Land Specialist shall be a person who is qualified to undertake a detailed site investigation and who should have at least tertiary education in environmental science, engineering or a related field and 2+ years of professional experience in environmental investigations and risk assessments.**

The proposal and the likely effects are well described in the application document in sections 1 and 4. Given the intent of the changes and the amended wording of the condition these are still accurate. I accept and adopt those sections for the purposes of discussions below.

### Description of site and existing environment

A description of the site is not of material value here. The consent as it stands covers any site within the city boundaries that is within Council controlled land, road corridors, parks and reserves.

### Statutory Considerations

Section 127 of the Resource Management Act 1991 states:

#### ***“127. Change or cancellation of consent condition on application by consent holder***

- (1) *The holder of a resource consent may apply to the consent authority for a change or cancellation of a condition of a consent, subject to the following:*
  - (a) *the holder of a subdivision consent must apply under this section for a change or cancellation of the consent before the deposit of the survey plan (and must apply under section 221 for a variation or cancellation of a consent notice after the deposit of the survey plan); and*
  - (b) *No holder of any consent may apply for a change or cancellation of a condition on the duration of the consent.*
- (2) *Repealed*
- (3) *Sections 88 to 121 apply, with all necessary modifications, as if -*
  - (a) *the application were an application for a resource consent for a discretionary activity; and*
  - (b) *the references to a resource consent and to the activity were references only to the change or cancellation of a condition and the effects of the change or cancellation respectively.*
- (4) *For the purposes of determining who is adversely affected by the change or cancellation, the local authority must consider, in particular, every person who -*
  - (a) *made a submission on the original application; and*
  - (b) *may be affected by the change or cancellation.*

### Type of Application

The first consideration that is required is whether the application can be treated as one for a change of conditions or whether it will result in a fundamentally different activity or one having materially different adverse effects, such that it should be treated as a new application. The original application sought to allow Council to operate in terms of earthworks in potentially contaminated land under a single consent umbrella with appropriate acceptance and reporting processes in place. The changes proposed serve to refine this operation and also to provide for a more time and cost effective response to contaminated land/excavation spoil than simply disposing of it to a landfill facility. In my opinion this application can be considered as a variation to the original resource consent as the nature of the activity will not fundamentally change and the adverse effects will not be materially different from those associated with the original consent.

### Written approvals [Sections 95D(e), 95E(3)(a) and 104(3)(a)(ii)]

No written approvals have been provided with the application.

### Effects on the environment and affected persons [Sections 95A, 95B, 95E(3), 95D and 104(1)(a)]

Pursuant to Section 127(3) the application must be assessed as a discretionary activity. As such, the Council's assessment is unrestricted and all actual and potential effects of this proposal must be considered. In my opinion the effects on the environment associated with the proposed change/cancellation of conditions relate to surety of management of potentially contaminated materials.

I have circulated the application to Council's Senior Environmental Health Officer Ms Isobel Stout for comment. Ms Stout made the following statement in response:

*This change has come about from a desire to reuse more material both on and between sites in order that disposal costs are reduced and we can make more efficient use of a resource.  
Whilst arguably this was an outcome available under the original consent, explicitly stating so will make interpretation clearer and we can tailor the on line 'application' process to match.  
As an aside the Global has been used around 100 times so far and it's been great to see some innovation being explored in terms of seeing surplus soil materials as a resource rather than a cost.  
This small change to the conditions will help refine the process further.*

Ms Stout is in support of the proposed changes and does not consider that they will give rise to adverse effects. I accept Ms Stout's advice.

I note in that regard that the movement and deposition of any contaminated soils under the umbrella of this consent will still require sign off from Council's own Environmental Health Officers. The contamination status and destination of any material will be known and recorded. Any material not disposed of at a landfill facility (because it meets the criteria for use as either recreation or industrial fill) will be utilised on another site only with relevant permissions from Council's technical staff, and with associated reporting and documentation as already required under the consent.

I consider that in light of the minor changes proposed to condition wording any adverse effects arising will be less than minor and adequately managed.

#### **Notification assessment [Sections 95A and 95B]**

Sections 95A and 95B set out the steps that must be followed to determine whether public notified or limited notification of an application is required.

##### **Public notification**

- Step 1. The application does not meet any of the criteria for mandatory notification in section 95A(2).
- Step 2. The application does not meet any of the criteria in section 95(A)(5)(b) precluding public notification.
- Step 3. There are no rules or NES requiring notification, and any adverse effects on the environment will be no more than minor (section 95A(8)).
- Step 4. There are no special circumstances that warrant public notification (section 95A(9)).

**In accordance with the provisions of section 95A, the application must not be publicly notified.**

##### **Limited notification assessment**

- Step 1. There are no affected groups or persons in relation to customary rights, customary marine titles or statutory acknowledgements as outlined in section 95B(2) and (3).
- Step 2. There are no rules or NES preventing limited notification, and the application is not for a controlled activity land use consent under the District Plan (section 95B(6)).
- Step 3. As discussed above, no persons are considered to be affected under section 95E (sections 95B(7) and (8)).
- Step 4. There are no special circumstances that warrant notification to any other persons (section 95B(10)).

**In accordance with the provisions of section 95B, the application must not be limited notified.**

## Other Section 104 matters

The application is:

- Consistent with the relevant objectives and policies in the District Plan. An assessment was undertaken in the original consent and that is not altered by the minor changes proposed here. For simplicity I repeat the assessment contained in this application here, and note that I consider this is accurate and so adopt it:

*The District Plan does not control works relating to contaminated soil. As such the proposal is a Permitted Activity under the District Plan. The District Plan does contain a complex set of rules relating to earthworks, however consent is not sought against the general earthworks provisions. The consent and this s.127 are specific to the NES-CS. However, as per the Approved Consent Document, the objectives and policies of the District Plan that are considered to be of most relevance to the consent were assessed. In addition this s.127 supports Policy 4.2.2.1.3 Future use which includes 'unless comparable or better containment is provided.', and further supports Objective 3.3.12. The change and enabling of placement of appropriate soil to be reused in appropriate locations provides better management of our resources and further of this depleting natural resource; and provides better environmental and economic benefits for Council projects.*

- Able to be granted consent without notification, pursuant to Section 104(3)(d).

For completeness, I note that the District Plan gives effect to Part 2 of the Act and the higher order planning documents referred to in s104(1)(b). The Plan was competently prepared and appropriately reflects the higher order provisions, so they do not need to be specifically addressed in this report<sup>1</sup>.

## Recommendations

That, for the reasons outlined above:

- A. The application be processed on a **non-notified** basis in accordance with Sections 95A and 95B of the Resource Management Act 1991.
- B. The application **be granted** pursuant to Section 127 of the Resource Management Act 1991.

The conditions of consent shall now read as follows:

1. The development shall proceed in accordance with the information and plans submitted with the application. The Approved Consent Document has been entered into Council records as RMA/2019/2727(94 pages) **and as amended by RMA/2021/2094.**
2. This resource consent shall only be exercised by Council or where they are the principal or client representative on the contract for any works covered under this resource consent.
3. This resource consent shall only be exercised for works undertaken within the Christchurch City Territorial Authority Boundaries and on land that is under Council's ownership or control.
4. The works approved under this resource consent are limited to soil disturbance associated with construction, replacement, or repair of Council-controlled or maintained:
  - (i) Roads within road reserves;
  - (ii) Network utilities and infrastructure, including stormwater basins;
  - (iii) Sports fields and recreational facilities located in Council-controlled or maintained parks or recreation reserves;
  - (iv) Community facilities;
  - (v) Waterway banks and margins (including dredging);
  - (vi) Former landfills, and;
  - (vii) Cemeteries;

<sup>1</sup> R J Davidson Family Trust v Marlborough District Council [2018] NZCA 316

5. This resource consent does not provide for works that constitute a change of land use or a subdivision activity under the NES-SC or soil disturbance associated with the establishment of residential units.

*N/B. The following conditions apply to each individual project covered by this resource consent*

6. Prior to exercising the consent, the consent holder shall provide the following information for certification to the Council's Team Leader Environmental Compliance (Email [rcmon@ccc.govt.nz](mailto:rcmon@ccc.govt.nz)), or nominee, as per the Risk Screen Process document (Pages 28-32 of the Approved Consent Document):
  - (i) Information about the project from the Project Team that confirms the proposed works are within the scope of the consent.
  - (ii) Information from the Project Team on the project risk confirming the risk rating.
  - (iii) Confirmation of the name and employer of the Contaminated Land Specialist (as defined in the Site Management Plan (SMP)) to be used on the project.
7. No works shall commence on site until the consent holder receives confirmation from the Council's Team Leader Environmental Compliance, or nominee, of the project contamination risk and SMP (or if a high risk category, the requirement to produce a site specific SMP) to be used.
8. At least 10 working days prior to the works commencing on site the consent holder shall submit a site specific Erosion and Sediment Control Plan (ESCP) to the Team Leader Environmental Compliance, or nominee, (Email [rcmon@ccc.govt.nz](mailto:rcmon@ccc.govt.nz)) for acceptance covering all earthworks associated with the project. The ESCP shall be designed by a suitably qualified person and a design certificate (template available on request from CCC) supplied with the ESCP. The performance criteria for the ESCP, unless directed otherwise by the Subdivision Engineering section of Council, will be based on Environment Canterbury's Erosion and Sediment Control Toolbox for Canterbury (ESCT) (<http://esccanterbury.co.nz/>).

The ESCP shall include (but is not limited to):

- (a) A map showing the location of all works including any areas of protection of natural assets and habitats (if applicable);
- (b) Detailed plans showing the location of sediment and dust control measures, on-site catchment boundaries and sources of runoff;
- (c) Area(s) of contamination and location(s) where contaminated material will be stockpiled;
- (d) Detailed description and plans showing any stormwater and/or dewatering treatment system and discharge point;
- (e) Drawings and specifications of designated sediment and dust control measures;
- (f) A programme of works including a proposed timeframe and completion date;
- (g) Installation of devices until the site is stabilised (e.g. grassed); and
- (h) Inspection and maintenance schedules for the sediment and dust control measures.

Unless approved as part of a separate ECan resource consent for stormwater discharge or excavation/filling the ESCP will require acceptance by the Council's Team Leader Environmental Compliance, or nominee, as meeting the requirements of this condition, prior to any work commencing on site. Once accepted, the ESCP will thereafter form part of the Approved Consent Document and all works shall be undertaken in accordance with the ESCP.

9. Works confirmed to be low risk under Condition 6 shall be undertaken in accordance with the, 'Contaminated Soils Management Plans – User Guide' and 'Contaminated Soil Management Plan – Low Risk Projects' (SMP), prepared by Enviser, dated October 2019 (Pages 33-66 of the Approved Consent Document), or any revised version accepted by the Council's Team Leader, Environmental Compliance, or nominee under Condition 13. Any reporting required as part of the SMP shall be provided to the Council's Team Leader, Environmental Compliance, or nominee within 21 days of the completion of the project (Email [rcmon@ccc.govt.nz](mailto:rcmon@ccc.govt.nz)).
10. Works confirmed to be medium risk under Condition 6 shall be undertaken in accordance with the Contaminated Soils Management Plans – User Guide' and 'Contaminated Soil Management Plan – Medium Risk Projects' (SMP), prepared by Enviser, dated October 2019 (Pages 33-44 and 67-94 of the Approved Consent Document), or any revised version accepted by the Team Leader Environmental Compliance, or nominee under Condition 13. Any reporting required as part of the SMP shall be provided

to the Council's Team Leader, Environmental Compliance, or nominee within 21 days of the completion of the project (Email [rcmon@ccc.govt.nz](mailto:rcmon@ccc.govt.nz)).

11. Works confirmed to be high risk under Condition 6 shall be undertaken in accordance with a SMP prepared by or under the supervision of a Suitably Qualified and Experienced Practitioner (SQEP). The SMP shall include as a minimum:
  - i. Risk assessment, analysis and recommendations for treatment that are consistent with the National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health 2011.
  - ii. Procedures and mitigation methods to ensure that contaminated soil is excavated, handled and disposed of appropriately.
  - iii. The consideration of stormwater and dewatering discharges, and the requirements of the Council's consents for these discharges.
  - iv. Internal project monitoring methods to be undertaken by the SQEP, or Environmental Specialist under the supervision of a SQEP.
  - v. Procedures for sampling and record keeping.
  - vi. Reporting to the Council's Team Leader, Environmental Compliance, or nominee, within 21 days of the completion of the project (Email [rcmon@ccc.govt.nz](mailto:rcmon@ccc.govt.nz)).
12. At least 10 working days prior to the works confirmed to be high risk under Condition 6 being undertaken the consent holder shall submit an SMP prepared under Condition 11 to the Team Leader Environmental Compliance, or nominee (Email [rcmon@ccc.govt.nz](mailto:rcmon@ccc.govt.nz)) for certification that it provides for the requirements listed under Condition 11. Council shall provide the certification within 5 working days of receiving the SMP. No works shall commence on site until the consent holder receives the certification.
13. The SMPs required under Conditions 9-12, and the associated Users Guide, may be amended from time to time by a SQEP providing that any amendments shall:
  - i. Not result in the level of environmental protection being decreased, and;
  - ii. Be made to improve the effectiveness of the SMP;
  - iii. Be submitted by the consent holder to the Team Leader Environmental Compliance, or nominee (Email [rcmon@ccc.govt.nz](mailto:rcmon@ccc.govt.nz)) at least 10 working days prior to the works being undertaken, for certification that the SMP achieves 13 (i) and (ii) above. Council shall provide certification within 5 working days of receiving the SMP. No works shall commence until site until the consent holder receives the certification.
14. (a) Any soils removed from the site during the course of the activity shall be disposed of to a facility authorised to accept the material **or with approved permission from the Council's Environmental Compliance Team to an alternative suitable site.**  
  
(b) If the soil is disposed of to an authorised facility the consent holder shall provide evidence such as weighbridge receipts or waste manifest, to the Christchurch City Council's Environmental Compliance Team, or nominee (Email [rcmon@ccc.govt.nz](mailto:rcmon@ccc.govt.nz)) within two months of the completion of works.  
  
**(c) If the soil proposed to be disposed of to an alternative suitable site a report signed and documented by a Contaminated Land Specialist (CLS),** should be submitted to the Christchurch City Council's Environmental Compliance Team, or nominee (Email [rcmon@ccc.govt.nz](mailto:rcmon@ccc.govt.nz)) at least two weeks prior to the disposal of the soil, and the disposal shall not proceed until approval has been received.
15. The consent holder, and all persons exercising this consent, shall ensure that all personnel undertaking activities authorised by this consent are made aware of, and have access to, the contents of this consent document and the relevant SMP and User's Guide required under Conditions 9-12 prior to the commencement of the works.

16. A copy of the relevant SMP and Users Guide required under Conditions 9-12 shall be kept on site at all times.
17. Pursuant to Section 128 of the Resource Management Act 1991, the Council may review conditions by serving notice on the consent holder within a period of one month of any 12 month period following the date of this decision;
  - (a) In order to deal with any adverse effects on the environment which may arise from the exercise of this consent and which it is appropriate to deal with at a later stage; or
  - (b) Requiring the consent holder to carry out monitoring and reporting instead of, or in addition to, that required by the consent.

#### **Advice Notes:**

- The Council will require payment of its administrative charges in relation to monitoring of conditions, as authorised by the provisions of section 36 of the Resource Management Act 1991. The current monitoring charges are:
  - (i) A monitoring programme administration fee of \$102.00 to cover the cost of setting up the monitoring programme; and
  - (ii) A monitoring fee of \$175.50 for the first monitoring inspection to ensure compliance with the conditions of this consent;
  - (iii) Time charged at an hourly rate if more than one inspection, certification of conditions, or additional monitoring activities (including those relating to non-compliance with conditions), are required.

The monitoring programme administration fee and initial inspection fee / inspection fees will be charged to the applicant with the consent processing costs. Any additional monitoring time will be invoiced to the consent holder when the monitoring is carried out, at the hourly rate specified in the applicable Annual Plan Schedule of Fees and Charges.

- Sites may be an archaeological sites as defined and protected under the provisions of the Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA). Archaeological sites are defined in the HNZPTA as any place in New Zealand where there is physical evidence of pre-1900 occupation, regardless whether the site is known or not, recorded in the NZAA Site Recording Scheme or not, or listed with Heritage New Zealand or the local council. Authority from Heritage New Zealand is required for any work that affects or may affect an archaeological site. Please contact the Heritage New Zealand regional archaeologist on 03 363 1880 or [archaeologistcw@heritage.org.nz](mailto:archaeologistcw@heritage.org.nz) before commencing work on the land.
- It is unlawful for any person to destroy, damage, or modify the whole or any part of an archaeological site without the prior authority of the Heritage New Zealand Pouhere Taonga. This is the case regardless of the legal status of the land on which the site is located, whether the activity is permitted under the District or Regional Plan or whether a resource or building consent has been granted. The HNZPTA provides for substantial penalties for unauthorised damage or destruction.
- Refer also to the Accidental Discovery Protocol (ADP) set out in Appendix 3 of the Mahaanui Iwi Management Plan (IMP).
- **A Contaminated Land Specialist (CLS) is a person who can provide technical expertise, overseeing the identification and disposal of contaminated soil. A CLS needs to meet the following criteria:**

**The Contaminated Land Specialist shall be a person who is qualified to undertake a detailed site investigation and who should have at least tertiary education in environmental science, engineering or a related field and 2+ years of professional experience in environmental investigations and risk assessments.**
- Prior to the commencement of any portion of works involving discharge of dewatering water (or similar non-stormwater discharge) to the Council's stormwater or wastewater network, approval for the flows to

enter the network will be required from the relevant Asset Planning Team, Three Waters and Waste Christchurch City Council.

- For works involving the discharge of stormwater, confirmation shall be sought from Council's Asset Planning Team, Three Waters and Waste, in advance of works commencing that such discharges are authorised under existing CCC held discharge consents. Where such discharges are not authorised, a separate consent may be required from the Canterbury Regional Council.
- This resource consent relates to planning matters in relation to the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 only. This resource consent does not give approval under any District or Regional Plan. A separate resource consent will be required for any activities that are not permitted under any applicable District or Regional Plan.
- A Wildlife Authority from the Department of Conservation may be required earthworks that disturb the habitat of lizards and geckos within Christchurch. All these species are absolutely protected under the Wildlife Act.

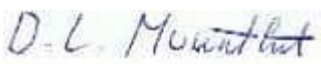
**Reported and recommended by:** Sean Ward, Principal Advisor – Resource Consents **Date:** 5 August 2021

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| <b>Decision</b> |
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That the above recommendations be adopted for the reasons outlined in the report.

**Commissioner:**

Name: David Mountfort

Signature: 

Date: 16 August 2021