Parliament FAS

Ballantrae Place Detailed Site Investigation

Parliamentary Services

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Document prepared by:

Aurecon New Zealand Limited
Spark Central
Level 8, 42-52 Willis Street
Wellington 6011
PO Box 1591
Wellington 6140
New Zealand

T +64 4 472 9589
F +64 4 472 9922
E wellington@aurecongroup.com
W aurecongroup.com

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Author signature		Approver signature	
Name	Shauna McAuley	Name	Marcus Welby
Title	Consultant, Contaminated Land	Title	Buildings Mechanical Practice Leader

Executive Summary

Parliamentary Services engaged Aurecon New Zealand Limited (Aurecon) to undertake a Detailed Site Investigation (DSI) at the area predominantly used as an existing carpark area at Ballantrae Place. Aurecon understands that redevelopment of the site will occur to accommodate additional facilities and help improve the day to day functionality of the Parliament Precinct. The proposed work will result in a change of land use to offices and movement of goods.

The intrusive investigations were completed in February and March 2020. The investigations were completed in conjunction with geotechnical investigations, resulting in a total of six borehole locations (BH101-105 and BH06) in the carpark and one hand auger (HA101) to the north of the carpark (see Appendix A for investigation plan). Two boreholes encountered unexpected ground conditions and were terminated in the fill layer. The hand auger was targeted on the hill at the north of the site and met refusal at approximately 1 m below ground level (bgl) within the fill layer.

Fill was encountered at all locations extending to depths of up to 1.8 m bgl, and comprised silt and gravel overlying a similar composition of natural ground. Fill at BH101, the western most part of the site, also contained cobbles and boulders and prevented the progression of the borehole. Demolition waste (bricks and brick fragments) was encountered at BH104.

The samples collected were scheduled for analysis of heavy metals, PAHs, TPH, BTEX and presence of asbestos.

None of the samples returned exceedances of applicable human health criteria for heavy metals, PAHs, TPH or BTEX. Asbestos was confirmed present at one location, BH104. The fill at BH105 has not been classified due to obstruction being reached at 0.5 m bgl and this area will require further sampling, recommended to take place prior to the start of earthworks to avoid delays to program and inform health and safety management. Depth to natural ground has not been confirmed at the hill to the north of the site due to the refusal of the hand auger. Appropriate management of these materials and appropriate health and safety controls can be achieved through a Contaminated Site Management Plan (CSMP).

Asbestos

One detection of asbestos within demolition fill at BH104 could not be quantified due to insufficient sample size and means excavations of the demolition fill from this area may need to be under Class A controls (e.g. air monitoring, suitable PPE, asbestos waste), which would be documented as part of the CSMP. Further sampling is recommended to be undertaken prior to earthworks to ascertain the amount of asbestos present and test pits are required to obtain enough sampling volume for this testing. Depending on the results of such sampling Class A asbestos controls may not be required during the earthworks. A suitable reuse option could be developed for asbestos impacted fill with appropriate controls (such as capping and a long-term site management plan). Earthworks controls for this option could be laid out as part of the suggested CSMP. Depending on the intended use of site won material, it should be confirmed if it is geotechnically suitable.

Waste disposal

The majority of the material is likely suitable for reuse at the site provided it can be confirmed as geotechnically suitable for its intended use, is appropriately managed and there are no unexpected discoveries during the bulk earthworks. The one detection of asbestos at the site appears to be correlated with the presence of demolition fill and, if not suitable to be retained on site, this material would require disposal as Class A asbestos waste in the absence of further testing.

Fill material at the site is not cleanfill and if it is to be disposed off-site it will require disposal at a Class A Landfill facility such as Southern or Silverstream as contaminated soil.

The natural ground at the site may be considered cleanfill although this will require agreement with GWRC and cleanfill operators.

Conclusion

Based on investigations to date, the site is suitable for the proposed future use of offices and movements of goods. Risks associated with contaminants found on site should be mitigated with the implementation of appropriate management and controls guided by a CSMP.

Recommendations

- It is recommended that a CSMP be completed for the wider Parliament FAS project;
- It is recommended that a further limited test pit investigation in the areas of BH104 and BH105 be completed prior to the start of earthworks to inform the ground conditions, extent of the demolition fill and the quantity of asbestos present;
- Consideration should be given to the possible reuse of site-won spoil;
- Consideration should be given to the need for further groundwater assessment to inform disposal and management of dewatering during construction, if required; and
- To comply with GWRC's Proposed Natural Resources Plan (Rule R54 – Detailed Site Investigation – Permitted Activity), a copy of this report should be supplied to them.

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1 Introduction

1.1 Background

Parliamentary Services engaged Aurecon New Zealand Limited (Aurecon) to undertake a Detailed Site Investigation (DSI) at the existing carpark area at Ballantrae Place. The site location is shown in Figure 1 and a site plan can be found in Appendix A.

Aurecon understands that redevelopment of the site will occur to accommodate additional facilities and help improve the day to day functionality of the Parliament Precinct. At the time of completion of the ground investigation the foundation design and therefore earthworks volumes were still being finalised. It is understood that the earthworks will involve excavation for foundations, services and pedestrian tunnels with a total estimated cut volume of 17,000m^3. The maximum excavated depth of excavation for the tunnels is expected to be approximately 5 meters below ground level. The site is predominantly in use as a car park and the proposed work will result in a change of land use to offices and movement of goods.

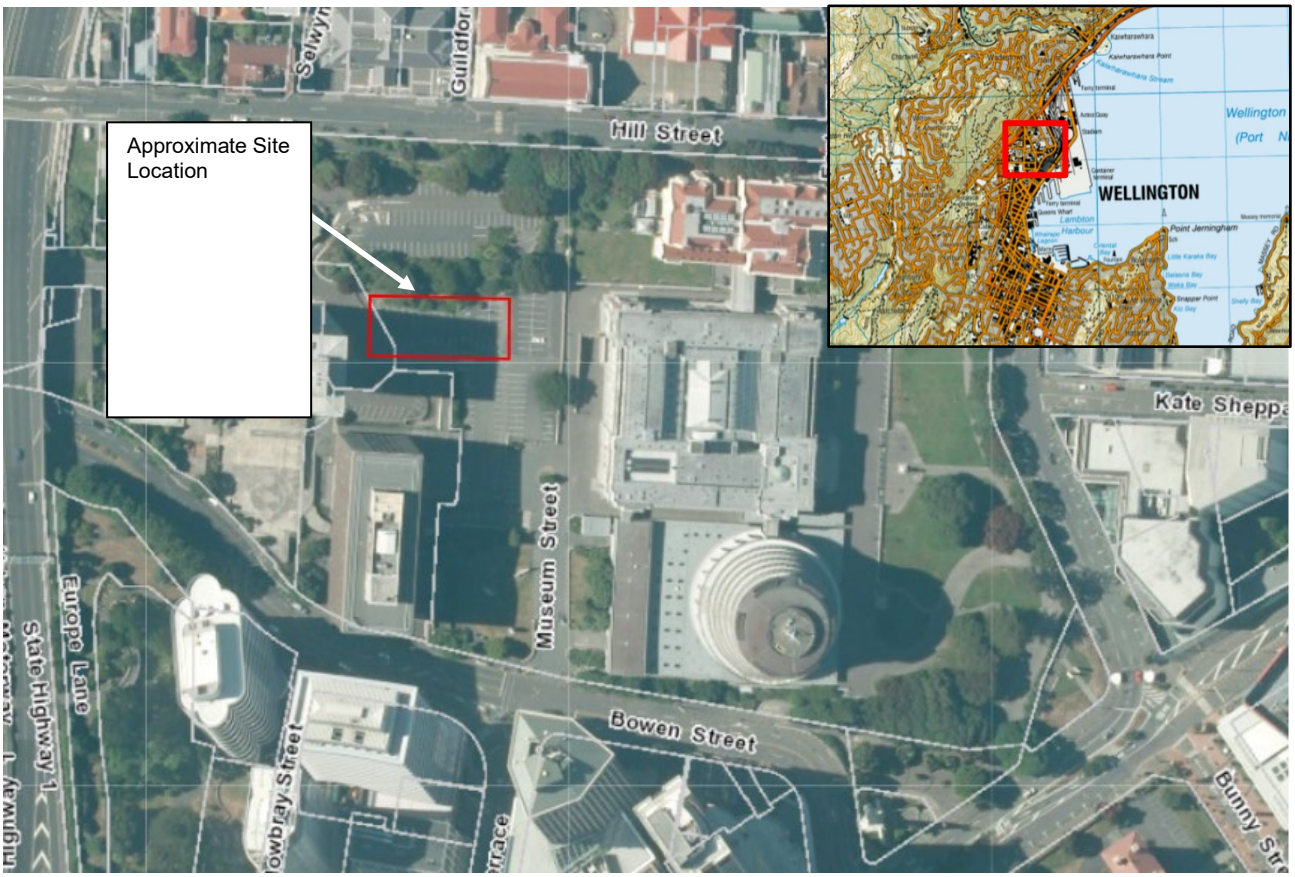


Figure 1 **Site Location (Source: LINZ Topo50map (data.linz.govt.nz))**

1.2 Previous Investigations

Previous investigations at the Parliament Precinct have been carried out by Aurecon. These investigations focussed on development to the south of the site. Relevant information from these investigations have been covered in Section 2 of this report.

1.3 Objectives

The objective of the contamination assessment is to inform implications for the proposed development with regard to current and historical activities that have had the potential to have caused contamination. These implications will include any requirement for soils management, remedial work, consenting and management of construction phase risks.

1.4 Scope

The following scope of works was undertaken:

- A site walkover by a Contaminated Land Specialist;
- A review of known environmental conditions at the site, cross-referenced with the latest development plans to adequately inform the Detailed Site Investigation (DSI) conceptual site model;
- Collection of soil samples (from fill and natural ground) from six window-sampled locations across the building footprint area;
- Laboratory analysis of approximately 18 samples (three samples per sampling location) for contaminants of concern identified in the desktop study – indicative suite included in the scope are: heavy metals, asbestos (presence/absence), Total Petroleum Hydrocarbons (TPHs), Polycyclic Aromatic Hydrocarbons (PAHs) and benzene, toluene, ethylbenzene and xylene (BTEX); and
- Preparation of this DSI report that presents the sampling results and risk assessment including the refinement of a conceptual site model and assessment of the likelihood of potentially contaminating that may pose a risk to human health or the environment during the proposed works.

This report has been prepared in general accordance with the Ministry for the Environment (MfE) *Contaminated Land Management Guideline (CLMG) No. 1: Reporting on Contaminated Sites in New Zealand (Revised 2021)* (MfE 2011a).

Soil sampling and analysis has been undertaken in general accordance with MfE's *Contaminated Land Management Guideline (CLMG) No. 5: Site Investigation and Analysis of Soils (Revised 2021)* (MfE 2011b).

The persons undertaking, managing, reviewing and certifying (verifying) this report are suitably qualified and experienced practitioners (SQEPs) as defined in the MfE's NES Users' Guide (MfE 2012).

1.5 Explanatory Statement

1.5.1 Review scope and use

- Aurecon has prepared this report for Parliamentary Services, exclusively for its use. It has been prepared in accordance with our scope of services and the instructions given by or on behalf Parliamentary Services. Data or opinions contained within the report may not be used in other contexts or for any other purposes without Aurecon's prior review and agreement.
- Aurecon accepts no responsibility or liability to any third party for the use of, or reliance on, the report by any third party and the use of, or reliance on, the report by any third party is at the risk of that party.

1.5.2 Project Specific Limitations

- Soil sampling was completed only within the extent of the indicated area of the potential building footprint as understood in February 2021 (as shown in Appendix A) and locations were limited to areas accessible around car parking and topology. Sampling was limited to borehole depth and was impacted by ground conditions at the site.

1.5.3 Limits on Investigation and Information

- Soil and rock formations are often variable, and this along with use, storage or disposal of hazardous substances on a site can result in heterogeneous distribution of contaminants across it. Contaminant concentrations may be evaluated at chosen sample locations - however, conditions between sample sites can only be inferred based on geological and hydrological conditions and the nature and the extent of identified contamination. Boundaries between zones of contamination are often indistinct, and therefore interpretation is based on available information and the application of professional judgement.
- Only a finite amount of information has been collected to meet the specific technical requirements of the Parliamentary Services' brief and this report does not purport to completely describe all the site's characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it must be appreciated that actual conditions could vary from the assumed model.
- This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should further information become available regarding the conditions at the site, including previously unknown likely sources of contamination, Aurecon reserves the right to review the report in the context of the additional information.
- This report has been prepared for Parliamentary Services for its own use and is based on information provided. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that the Parliamentary Services may suffer as a result of using or relying on any such information or recommendations contained in this report, except to the extent Aurecon expressly indicates in this report that it has verified the information to its satisfaction. This report is not to be reproduced either wholly or in part without our prior written permission.

2 Desktop Information

2.1 Previous Investigations

A Preliminary Site Investigation (PSI) and Detailed Site Investigation (DSI) were completed in 2017 as part of a previous iteration of the Ministerial and New Members Developments (reference *248221_Parliament Stage 1 and 2_PSI_rev0* and *248221_Detailed Site Investigation_Rev0*). The PSI and DSI did not directly address this development area of the Ballantrae Place Building, but did address the 'New Members Building' (currently referred to as the Museum Street Building), which would be approximately 20 m to the west of Parliament House, in close proximity to the Ballantrae Place Building.

2.1.1 PSI

Potential historical contaminating activities were noted in the PSI as possibly having taken place across the areas of interest relating to the presence of:

- asbestos (HAIL[1] category E1);
- uncontrolled fill (HAIL category G5); and
- underground fuel storage tanks (HAIL category A2).

Category E1 and G5 may be applicable to the current site, however, A2 (underground fuel storage tanks) is applicable to specific areas not covered in this DSI. It is understood that an underground storage tank is located approximately 30 m to the east or south east of the eastern most site boundary, which is considered to be hydraulically downgradient. This is recorded on the Greater Wellington Regional Council Selected Land Use Register (GWRC SLUR). The tank is currently scheduled to be removed as part of wider works at the site in accordance with the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand[2].

In the review of historical photography there is evidence of buildings on the subject site from at least 1930, where there are 'government workshop' buildings present to the north west and smaller buildings which may be along the southern site boundary, along historic Sydney Street West, which no longer exists. These are shown in Appendix B. It is unknown what the exact function of these buildings were. Further buildings have been built and demolished throughout the 1900s. The last building, located at the east of the site, was demolished sometime between 1992 and 2000, and the entire site became a carpark.

2.1.2 DSI

The 2017 DSI reported two test pit locations and one borehole location at the eastern extent of the proposed Ballantrae Place building. Five samples were analysed from the borehole (from the natural ground layer, up to 5.5 m bgl) and one from each test pit (from the fill layer up to 0.5 m bgl). Information in the DSI which is relevant/in close proximity to the Ballantrae Place Building is as follows:

- Groundwater was measured at 2.74 metres below ground level (m bgl) (9.66 metres relative level (m RL)) and was noted to be highly silty and likely perched;
- A photoionization detector (PID) was used to screen for volatile compounds in soil headspace with readings ranging from 0 to 1.0 parts per million (ppm). This is a low concentration and the soils tested during this DSI are unlikely to be impacted by volatile compounds;
- Soil samples contained contaminants above the Wellington Background Criteria[3];
- There were no exceedances of relevant human health screening criteria for commercial/industrial site use;

[1] Hazardous Activities and Industries List, Ministry for the Environment, October 2011
[2] Ministry for the Environment, 1999
[3] Determination of Common Pollutant Background Soil Concentrations for the Wellington Region, URS, 2003

- Asbestos was tested in all samples analysed and was not identified in any sample; and
- Copper concentrations were above Tier 1 criteria within perched groundwater with respect to potential natural receiving environments (based on ANZECC 2000 criteria).

2.2 Site Setting

To supplement the 2017 PSI, further information for the specific Ballantrae Place development is given in the following sections.

2.2.1 Site Identification

Table 1 Site Identification

Aspect	Description
Site Name	Ballantrae Place – Car Park
Site Location	Ballantrae Place, Parliamentary Precinct, Wellington, 6011
Legal Description/s	Section 1 SO 38114
Site Elevation	13 m RL
Site Coordinates (NZTM)	1748677 E, 5428911 N
Site Zoning (WCC District Plan)	Central Area
Heritage Area	Parliament Grounds
Current Site Use	Car Park

2.2.2 Site Layout

A site layout plan showing the latest aerial imagery sourced from LINZ Data Service is presented in Drawing 255585-0800-DRG-KF-0001-A in Appendix A. Site photos can be found in Appendix C.

Site Cover Drainage and Topography

The site is currently in use as a public carpark. The majority of the surface is asphalt which is in good condition, with the hill to the north being covered with mature trees and shrubbery.

A manhole cover and likely stormwater drainage was noted at the toe of the hill at the north east of the site. No other services were noted.

There are no surface water bodies on the site.

The car park slopes upwards to the west (approximately 3% gradient) and has a vegetated hill (approximately 50% gradient) and ramp to the north providing access to an upper carpark which is not in the scope of this study. The site is at 13 m RL.

Site Walkover Summary

Key features identified during the site walkover carried out on 10 March 2021 are recorded in Table 2. Site photography is provided in Appendix C.

Table 2 Site Features

Aspect	Description
Site boundaries	Site is bound to the south and west by a wooden unpainted fence and Ballantrae Place. To the east there are further carparks and a concrete pebble-dashed wall. To the north is a vegetated hill and a ramp to another carpark area.
Site cover	Approximately 90% asphalt with a 4 – 5 m high vegetated slope to the north.
Water bodies	There are no water bodies present on site.
Buildings present on site	There are no buildings present on site and there are no visible features of previous buildings.(See Section 4.8.1 re historical buildings and or surfaces.)
Sensitive land/water uses or cultural sensitivity	There are no known sensitive land/water uses and no known cultural sensitivity.
Hazardous substance storage tanks	None are known to be present within the site bounds, although an underground storage tank which historically held hydrocarbon product is present approximately 30 m to the south or southeast of the site. This is likely to be hydraulically downgradient from the site.
Visual evidence of contamination	None noted

2.2.3 Surrounding Land Use

The surrounding land uses are recorded in Table 3.

Table 3 Surrounding Land Use

Direction	Description
North	An upper car park (approximately 7 m above the site) and Hill Street beyond. There is a childcare centre and residential area to the north west.
East	Parliamentary buildings.
South	Carparking areas and Defence House with Bowen Street beyond.
West	Ministry for Primary Industries building and carparking beyond.

2.2.4 Site Environment

Geology

The geology of the Central Wellington area has been mapped and described as *"Alluvium, silty, peat, loess, including Haywards and Kaitoke gravels, and subsurface Moera Gravel; sand; minor tephra, principally Rangitawa Tephra on erosion surface*"[4].

Previous investigations by Aurecon have found the geology in the vicinity of the site to be comprised of silt and gravel fill overlying a similar composition of natural ground. Fill within the Parliament Precinct has been found to vary between 1.5 and 3.8 m thick with bedrock encountered at approximately 50 m bgl.

Hydrology

There are no surface water bodies present on site. Stormwater drainage is noted in the Wellington City Council online OneMap along the southern site boundary from west to east. The GWRC Web Map Viewer shows that stormwater discharges to Wellington Harbour at Lady Elizabeth Lane which is located approximately 650 m south east and downgradient of the site.

[4] 1:50,000 scale Geological Map of New Zealand – Sheet 22 – Wellington Area Map (Begg and Mazengarb, 1996)

The eastern and southern part of the site is included in the Wellington City flood hazard maps as 'possibly at risk of flooding during severe storm events (1 in 100 year)' and is recorded at the lowest interval (0.01-0.10 m).

Hydrogeology and Well Details

Based on previous reporting at boreholes within 50 m of the site, groundwater may be expected to be found at approximately 3 to 4 m bgl. Groundwater flow is likely to be in an east or south east direction towards Wellington Harbour.

The closest aquifer is the Waiwhetu aquifer which is located under Wellington Harbour approximately 650 m to the south east. There are no drinking water sources within 500 m of the site.

Using the regional council mapping software, a search of resource consents and wells was performed on 15 March 2021. There were no resource consents or wells identified within 100 m of the site.

Ecology

Under the Resource Management Act (Section 30), regional councils and unitary authorities have responsibilities to safeguard the life-supporting capacity of soil and ecosystems, and ensure any adverse effects on the environment are avoided or mitigated.

Presence of potential on and off-site ecological receptors was investigated, and the results are presented in Table 4 below.

Table 4 Ecological Assessment Checklist[1]

Ecological receptor	On site	Off-site	Comments
Marshes, swamps, tidal flats or other ecologically sensitive wetlands near[2] the site?	N	N	
Are other aquatic habitats such as rivers, lakes or streams near the site?	N	N	
Are ecologically important marine or estuarine environments near the site?	N	N	Wellington Harbour is downgradient of the site but is more than 500 m distant
Are ecologically important or sensitive environments such as national parks or nature reserves located near the site?	N	N	
Are habitats for rare, threatened or endangered species near the site?	N	N	
Are culturally important ecological receptors located near the site (including areas identified on regional council GIS mapping)?	N	N	
Are commercially or recreationally important ecological receptors located near the site?	N	N	
Are forested, grassland or other habitats of significance located near the site	N	N	
Is the site used for food production (arable or livestock)?	N	N	

1: Table adapted from Appendix 4I, MfE 2011c
2: Near is judged on a site-specific basis given the contaminant's potential for transport by wind, surface run-off, groundwater transport or preferential pathways from service lines etc and should include positive factors such as reticulation of stormwater away from the site

The site development will not result in a change of land use to a more sensitive land use and the site is not considered to be in an ecologically sensitive area.

Summary of Environmental Conditions

Based on desk study information, the expected ground conditions at the site are fill comprised of gravel and silt up to 3.8 m bgl with natural ground beneath. The water table is expected to be approximately 3 m bgl.

The nearest surface water body is Wellington Harbour and is located approximately 650 m south east downgradient of the site.

The site is topographically flat. There are no identified ecological receptors and groundwater is not considered sensitive using the MfE 2011c definition. There are no consents or abstractions within 100 m of the site.

2.3 Summary of Potentially Contaminating Activities

The 2017 DSI covers only the eastern portion of the subject site with the western portion having not been investigated. It cannot be ruled out that portions of the site may remain affected by the following HAIL categories:

- presence of asbestos (HAIL category E1); and
- presence of uncontrolled fill (HAIL category G5).

There is also potential that the historical buildings which were present on the site prior to its use as a carpark may have contained lead-based paints. Therefore lead based paint may be a specific contaminant of concern.

3 Preliminary Conceptual Site Model

3.1 Introduction

The preliminary Conceptual Site Model (CSM) outlines the potential source-pathway-receptor linkages that may be present. The CSM defines what contamination could be present at a site, how they may travel and what receptors they could affect by doing so. Establishing these factors is essential to guide the preparation of an investigation plan.

3.2 Area of Relevance

To assist with aligning fieldwork sampling with activities that could have led to contamination and the receptors of that contamination, an area of interest has been defined. This area of interest generally matches the whole development area due to the historical presence of buildings across the entirety of the site.

3.3 Potential sources

Based on the desktop review, there is potential for contamination to have occurred on the site, from these contamination sources:

- Asbestos or asbestos containing materials associated with historical building demolition;
- Lead paint used historically on site buildings; and
- Uncontrolled fill placed historically on the site.

3.4 Pathways

Pathways for contaminant exposure and offsite migration of contaminants generally include the transport of contaminants via air, solid phase, and water. The potential pathways identified from the desk information are:

- Direct contact (dermal and ingestion);
- Inhalation of contaminated dust; and
- Overland transport of contaminated sediment in surface water .

3.5 Receptors

Receptors include people and the environment (for example surface water ecosystems) that are or may be adversely affected by the identified contaminants. The potential receptors identified in the assessment include:

- Future site users;

- Maintenance and construction/excavation workers;
- Adjacent site users;
- Underground infrastructure; and
- Groundwater.

3.6 Summary

The information above has been combined into a flow chart CSM which can be found in Figure 2.

Risks to current site users are thought to be minimal as the site is currently in use as a carpark with a high integrity seal, therefore any potential exposure pathway is incomplete.

Exposure pathways between potential contaminants and a construction worker may be complete during bulk earthworks for the project, and site users and nearby site users may also have completed exposure pathways.

Exposure pathways may be complete for ecological receptors via flow of impacted stormwater to wellington harbour and to underground infrastructure and groundwater if ground conditions are found to be impacted by the presence of hydrocarbons or unexpected waste fill etc.

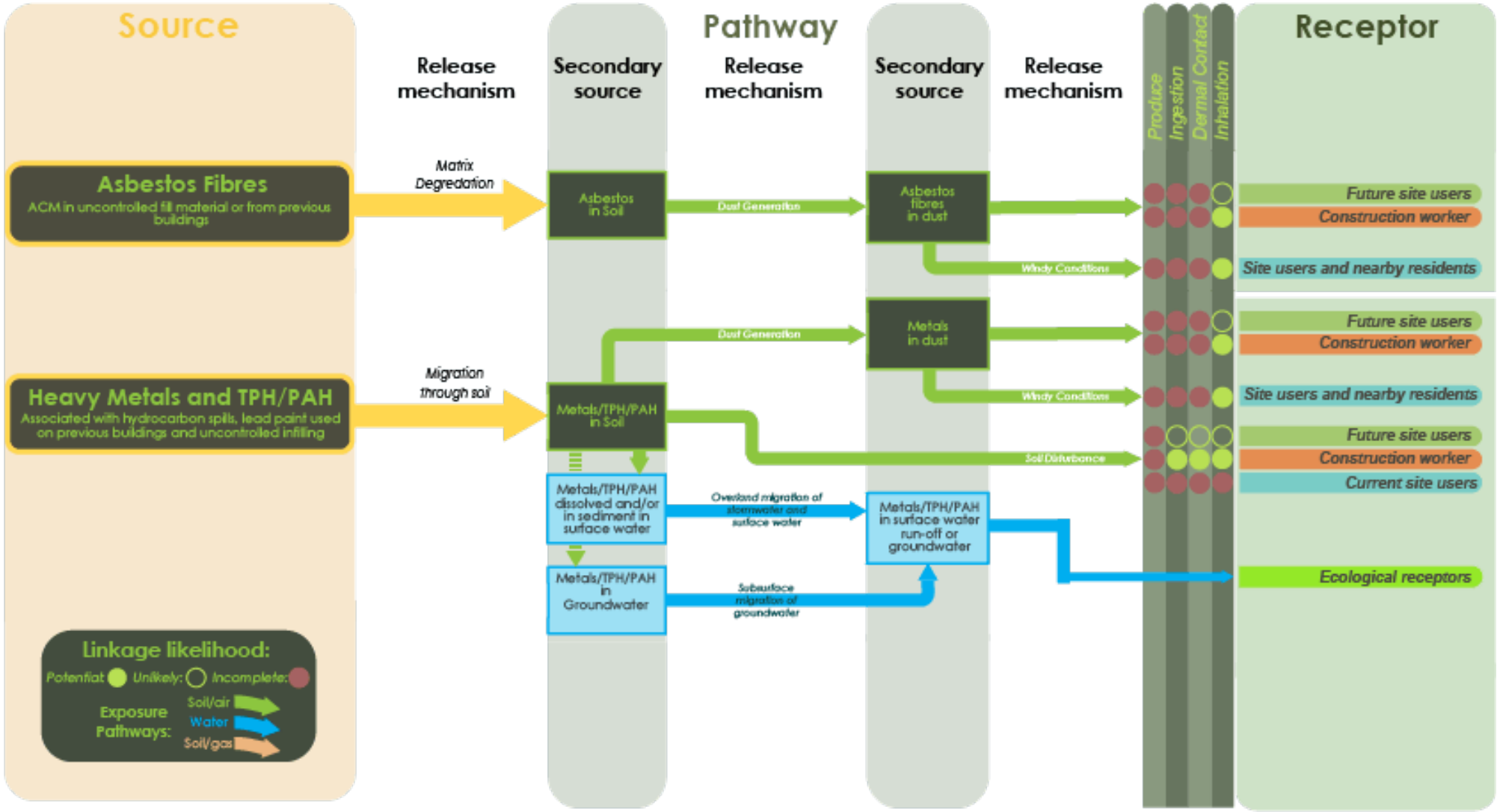


Figure 2 Preliminary Conceptual Site Model

4 Site Investigation

4.1 Investigation Rationale

The objective of the intrusive investigation was to obtain site specific ground data relevant to the proposed construction of the building at Ballantrae Place. The site's shallow soils, generally considered to be characterised as the upper 1.5 m or less of the soil profile, were investigated in detail combined with sampling of the upper most natural ground. The majority of test locations were in the carpark area, with one hand auger completed to target the slope at the north of the site.

Investigation of the type, concentration and distribution of contaminants within soil in the area where earthworks are to be undertaken will help inform the contamination linkage assessment such that the following can be considered:

- Risks to construction/excavation and maintenance workers during earthworks (bulk excavation) and building construction, and to groundwater (based on results);
- Risks to off-site users (including users of nearby buildings and residents);
- Risks to future site users; and
- Management, disposal and re-use options for bulk soil that is to be excavated from the site.

4.2 Data Quality Objectives

Ground investigation and environmental sampling methodologies completed in accordance with MfE CLMG No 5 are developing utilising specific Data Quality Objectives, a distinct seven-step process originally derived by the USEPA (2000) to assist in rationalising the approach of investigations, to maximise quality of data to make informed decisions and recommendations. A summary of the site-specific Data Quality Objectives considered to inform the DSI, based on the findings of the PSI update is presented in Table 5 below.

Table 5 Data Quality Objectives

Step	Discussion
State the Problem	The site is within the grounds of the Parliamentary Complex, proposed to be developed for commercial/office land use as part of ongoing development at the site. Previous investigations nearby the site identified potential contamination sources that may require additional management or remediation requirements as part of or prior to construction and earthworks.
Identify the Goal of the Study	The primary objective is to obtain site specific data regarding the potential contamination sources as well as the wider risks on the site. This will include collecting targeted surficial soil samples and analysis for key contaminants of concern. The results of the analyses will be compared to relevant human health and environmental based screening levels. Based on historic site use, contamination is likely to be contained within surficial topsoil and controlled fills. Deeper contamination may be present should any landfilling areas be identified.
Identify inputs into the decision	The primary contaminants of concern include asbestos, heavy metals and polycyclic aromatic hydrocarbons (PAH) from uncontrolled fill.
Define the study boundaries	The study boundaries are restricted to the site extent, as shown in Appendix A. Target populations are the earthwork contractors, future occupants, future maintenance workers and human receptors at neighbouring sites.
Develop the analytic approach	Analytical results from lab testing will be screened against Tier 1 risk screening levels for human health and environmental risk. This will aid with developing an understanding of risk for the site. Testing will also be screened against background levels and waste disposal criteria to provide an indication of likely disposal options. Contaminant concentrations exceeding Tier 1 criteria will inform the need for remediation and further work.

Step	Discussion
Specify limits on decision errors	An IANZ (International Accreditation New Zealand) laboratory will be used for the given analytes. Appropriate laboratory limits of reporting will be implemented. The laboratory provides a QA/QC report, and this will be reviewed to evaluate whether the DQOs have been achieved.
Develop the plan for obtaining data	The investigation sample locations were selected to target the identified potential contamination source activities, with 7 sample locations spread across the site.

4.3 NESCS

Sampling of soil is a Permitted Activity under Regulation 8 of the NESCS[5] provided defined requirements are met. The sampling conducted for this investigation complied with the NESCS requirements.

4.4 Site Works Undertaken

The site was visited on the 8 - 10 March 2021 for completion of field works associated with contaminated land. A borehole for geotechnical purposes (BH06) was also completed within the development area on 4 March 2021.

A plan of sampling locations is presented in Appendix A. The investigations were completed in conjunction with geotechnical investigations, resulting in the intended completion of a total of five machine drilled boreholes and one hand auger for contaminated land purposes and one machine drilled borehole for geotechnical purposes within the development area.

All borehole locations were vacuum excavated to 1.5 m bgl to ensure the avoidance of services. Where the vacuum excavation could not be completed to this depth because of unexpected ground conditions the location was abandoned. Drilling and vacuum excavation services were provided by ProDrill Ltd.

Four of the boreholes (BH102, BH103, BH105 and BH06) met the required depth of up to 5 m bgl (more than 0.5 m into natural ground), two of the boreholes encountered unexpected ground conditions during vacuum excavation (BH101 and BH104) and were not completed while the hand auger met refusal at approximately 1 m bgl while in the fill layer. Further information can be found in Section 4.8.

4.5 Investigation Methodology

Samples were collected in general accordance with Contaminated Land Management Guidelines (CLMG) *Volume 5: Site Investigation and Analysis of Soils.*

Grab samples were collected directly underneath the asphalt and at various depths from the vacuum excavation using a hand auger and samples were also taken directly from the borehole core. Due to the lack of ground exposed samples taken for asbestos analysis are on a presence/absence basis and are not analysed using the semi-quantitative method.

All the machine drilled boreholes were carried out under the observation of an Aurecon SQEP. Recovered core from the machine drilled boreholes and returned spoil from the hand auger boreholes allows assessment ex-situ only. Test pits were not completed due to the continued use of the site as a carpark and the requirement to avoid disturbing the high integrity seal. All soil was logged by Aurecon engineers in general accordance with NZGS (2005) guidelines. A copy of the logs is presented in Appendix D.

[5] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011

4.6 Sample Analysis

4.6.1 Soil

A total of 44 soil samples were collected from seven locations during the investigation; three from one hand auger borehole and 41 from machine drilled boreholes (including the geotechnical borehole BH06). The depth of samples collected ranged from surface, just below the asphalt layer, down to 5 m bgl. Soil samples were placed directly into clean containers provided by the laboratory, which were then placed in a chilled container and sent to the laboratory under Chain of Custody (CoC) documentation for analysis.

The samples were scheduled for analysis as described below, with the remaining samples 'held cold' at the laboratory for analysis if required:

- Heavy Metals (18 samples);
- Polycyclic Aromatic Hydrocarbons (PAHs) (15 samples);
- Total Petroleum Hydrocarbons/ Benzene, Toluene, Ethylbenzene, Xylene (TPH/BTEX) (6 samples); and
- Asbestos (presence/absence) (12 samples).

4.7 Quality Assurance / Quality Control

Quality assurance / quality control (QA/QC) procedures were implemented during field investigation works. All samples were collected under Aurecon chain of custody (COC) documentation procedures.

4.7.1 Sample Integrity

Prior to sampling, and between sample locations, equipment used (i.e. hand trowel/hand auger) was cleaned by washing with potable water, followed by a decontamination solution (Decon 90), and rinsing with potable water. Soil samples were collected using a clean pair of nitrile gloves for each sample and then placed into laboratory supplied sample containers. Each sample was given a unique sample identification number and the location the sample was collected from was recorded at the time of sampling.

Following collection, all samples were placed directly into chilled storage and transported, under standard chain of custody procedures, to an International Accreditation New Zealand (IANZ) laboratory for analysis. The remaining material was placed back into its original location, ensuring each area was returned to a flat condition following completion of the sampling and compliance with Regulation 8 of the NESCS.

4.7.2 Laboratory

R J Hill Laboratories Limited was selected to perform analysis of all samples. This laboratory is IANZ accredited and each of the test methods used are also IANZ accredited. Inspection of the laboratory report did not identify any QA/QC issues.

4.8 Field Observations

4.8.1 Stratigraphy

The surface of all borehole locations was covered in asphalt. In BH101 (the western most borehole) the stratigraphy from beneath the asphalt to 1.4 m bgl was gravel with cobbles and boulders. The ground conditions prevented the vacuum excavation from lifting material from any deeper than 1.4 m bgl and the drill rig was unable to begin drilling due to the likely core loss that would result from drilling through cobbles and boulders into a softer material underneath. As a result this borehole was abandoned.

The stratigraphy at BH102, BH103 and BH104 was in agreement with expected conditions - silt and gravel fill overlying a similar composition of natural ground. A terracotta pipe, likely part of the stormwater drainage

system, was encountered in BH102, which had not been apparent in any plans. The pipe was not damaged and the borehole location was shifted slightly to avoid the service.

BH105 met an obstruction at 0.5 m bgl in the form of an asphalt and concrete surface, which is possibly part of an older carpark associated with old buildings, or part of an old road surface which has been infilled. The vacuum extraction removed material from the area around this location to accommodate the borehole but could not find a suitable location where the obstruction was not present. As drilling cannot commence without service clearance to at least 1.5 m bgl this location was abandoned. Further investigative works may be required to determine the extents of the slab/asphalt in the ground which would require removal prior to construction and the conditions of the ground underneath, which are currently unknown.

The surface of the hand auger location was within the vegetated area on the slope at the north of the carpark, adjacent to a ramp leading to an upper carparking area. A hand auger was chosen for this location to avoid traffic disruption but to still gain some information about the material the hill is comprised of. The ground was not sealed and the fill layer comprised of silt and sand with some gravel. The hand auger was terminated in the fill layer at 1.0 m bgl due to refusal and natural ground was not encountered

Due to the abandonment owing to ground conditions of BH101 and BH105 it is unconfirmed what materials are present underneath. Further, it is unconfirmed at what depth natural ground is encountered underneath the ramp to the upper carpark, although due to the close proximity of this location to other investigation locations (approximately 15 m laterally from BH101 and BH06) it is assumed to be at a similar depth or a shallower relative level than the boreholes.

Groundwater was not encountered during the investigation. A stratigraphy summary can be found in Table 6 below which takes into account the information in this report and the geotechnical report (reference 255585-0600-RPT-GG-001_RevB).

Table 6 Generalised Stratigraphy

Geological Unit	Generalised Lithology	Depth below ground level to top of unit (m bgl)	Maximum thickness observed (m)
FILL	Gravel with some sand and silt; frequent boulders; infrequent anthropogenic material (bricks, plastic)	0.1 (asphalt overlying)	1.8
Undifferentiated Alluvium	Silt, clayey silt, sandy silt and gravelly silt.	1.8	51.3
Bedrock	Moderately weathered, high fractured sandstone	51.3	NA

4.8.2 Sensory Observations

There were no sheens or no asbestos containing material observed at any location during the investigation. Anthropogenic materials were observed in the fill material at four of the borehole locations and at the hand auger location.

Anthropogenic materials noted in the ground were as follows:

- BH101 - plastic bottle at 0.8 m bgl;
- BH103 – possible paint flakes at 0.6 m bgl;
- BH104 – whole bricks and bricks fragments from 0.2 to 0.5 m bgl;
- BH105 – asphalt surface at 0.5 m bgl; and
- HA101 – brick fragments from 0.2 to at least 1.0 m bgl .

In general, there were no olfactory indicators of contamination observed in any soil during borehole drilling or hand augering.

5 Tier 1 Risk Screening Assessment

5.1 Introduction

The analytical results were assessed against three categories of Tier 1 acceptance criteria / guideline values as summarised below:

- **National human health criteria:** To provide an assessment of potential adverse effects on human health based on generic, conservative exposure scenarios. Commercial / industrial land use criteria has been adopted for this site.
- **Background Concentrations:** To determine the applicability of the NESCS and to assess cleanfill disposal options.
- **Disposal Criteria:** To determine off-site disposal options should results be above background / cleanfill criteria.

These criteria with respect to the analytical results are discussed in the following sub-sections. A table displaying results assessed against these criteria is provided in Appendix E, and summarised details are provided below.

Groundwater sampling was not included as part of the scope of this investigation.

5.2 National Human Health Criteria

The national health criteria referenced in this report have been selected using the receptors identified in the conceptual site model and the hierarchy defined in the *Contaminated Land Management Guideline No. 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE 2011d).* For human health values, the *Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (MfE 2011e)* has been used. For contaminants where SCSs are not available, the hierarchy defined in MfE 2011d has been used. The results are as follows:

- None of the samples analysed exceed the applicable health criteria (commercial/industrial land use) for heavy metals, PAHs, TPHs and/or BTEX.
- A total of 12 samples were tested for asbestos (presence/absence). One sample (BH104_0.4-0.5) returned a detection of chrysotile (white asbestos) in the form of loose fibres. This sample came from an area of visible demolition waste fill in the ground comprised of brick fragments and whole bricks in a gravelly silt matrix. No other sample contained asbestos.

5.2.1 Asbestos

The asbestos concentration in soil is unable to be quantified due to the small size of sample that can be obtained from a borehole. This demolition fill will require appropriate removal to a Class A landfill such as Southern or Silverstream if it is required to be excavated for geotechnical purposes and cannot be managed onsite (see Section 5.4.3 for further information). The lateral extent of the demolition waste is unconfirmed.

Further sampling is required to quantify the amount of asbestos present in the demolition fill and therefore the level of controls required on site during the disturbance of the material. If further sampling prior to earthworks is not completed then a contaminated site management plan (CSMP) should be produced with the highest levels of control and monitoring according to the BRANZ 2017 guidelines (inclusive of, for example, air monitoring) during the bulk earthworks and removal of the demolition fill.

5.3 Background Concentrations

Background concentrations of heavy metals and PAHs in the locality were identified using Greater Wellington Regional Council (GWRC) Determination of Common Pollutant Background Soil Concentrations for the Wellington Region (greywacke) (GWRC 2003).

5.3.1 Heavy Metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)

A total of 18 samples (14 fill samples and four samples from natural material) were screened against heavy metal background concentration values. The results are summarised as follows:

- Of the fill samples analysed, 13 of 14 samples exceed background concentrations for one or more heavy metals (arsenic, cadmium, chromium, lead, nickel and zinc). BH104_1.1-1.2 was the only fill sample to return all heavy metal results below the limit of reporting.
- Of the natural samples analysed, 3 out of 4 samples have minor exceedances for chromium (BH06_2.5, BH102_2.3-2.5, BH103_2.1-2.2). BH103_2.1-2.2 also returned a minor exceedance for nickel (14 mg/kg compared to the background value of 13 mg/kg).

5.3.2 PAHs

A total of 15 samples (11 fill samples and three natural samples) were screened against PAH concentration values.

Four fill samples (BH102_0.5-0.6, BH104_0.4-0.5, HA101_0.0-0.2 and HA101_0.30.5) returned exceedances of the GWRC background concentrations for PAHs including anthracene, benzo(a)pyrene, fluoranthene, phenanthrene and pyrene.

All other results were below the limit of reporting.

5.3.3 TPHs and BTEX

A total of six samples (five fill samples and one natural sample) were analysed for TPHs and BTEX. All samples analysed returned results below the limit of reporting.

5.4 Disposal

The following section does not provide comment for deeper soils associated with BH101 and BH105. Due to unforeseen ground conditions at these locations they have not be characterised at depth. The material at these locations may require further sampling to confirm the suitability of material for landfill/cleanfill and/or reuse. This could occur prior to the removal of the carpark surface in the form of test pits. This would help to confirm the extent of the ground slab at BH105.

If such sampling is to occur in conjunction with bulk earthworks instead of prior then there may be a delay to program while test results are obtained.

5.4.1 Cleanfill

Most of the fill material returned results above background concentration values for heavy metals and PAHs. Based on these results, fill material should not be considered cleanfill.

Natural material returned minor exceedances for chromium and one minor exceedance for nickel. It is possible that the recorded concentrations are indicative of natural variation rather than contamination. In this case it is possible that the natural ground may be considered cleanfill, and a discussion with GWRC and cleanfill operators should be had to confirm this approach.

5.4.2 Class A Landfill Disposal

For comparison with landfill acceptance criteria, the screening criteria and concentrations in leachate found in the MfE *Hazardous waste guidelines: Landfill waste acceptance criteria and landfill classification* were used. A total of 18 samples (14 fill samples and four natural samples) were screened against these criteria and the results are summarised as follows:

Of the samples analysed:

- Four fill samples (BH102_0.5-0.6, BH104_0.4-0.5, HA101_0.3-0.5 and HA101_0.8-1.0) exceeded the Class A criteria for lead (100 mg/kg). Results ranged from 126 mg/kg to 290 mg/kg;
- Three of the same fill samples (BH102_0.5-0.6, HA101_0.3-0.5 and HA101_0.8-1.0) exceeded the Class A criteria for zinc (200 mg/kg). Results ranged from 210 mg/kg to 350 mg/kg;
- None of the results for PAHs, TPHs and/or BTEX exceeded Class A screening criteria;
- One sample (BH104_0.4-0.5) returned a positive result for asbestos and will require disposal to a Class A landfill should this material be disposed offsite.

Three fill samples that exceeded the Class A screening criteria were submitted for TCLP extraction followed by heavy metal analysis (lead and zinc). None of the TCLP results exceed the corresponding limits for Class A landfills (lead 5 mg/L; zinc 10 mg/L). Based on this information, fill material from the site which does not contain demolition fill should be suitable for Class A landfill disposal, should the material be removed from site. Waste which does contain demolition fill (i.e. bricks, concrete etc) should be disposed of as asbestos containing under appropriate Class A asbestos controls.

5.4.3 Reuse on site

The results of this investigation indicate that the material does not exceed applicable health guidance for metals and PAHs, however, asbestos was detected in demolition fill at BH104 which has not been able to be assessed against human health levels. This material can be retained on site with appropriate measures, such as capping and a long-term management plan. If the material cannot be retained on-site (e.g. not geotechnically suitable, or space constraints) then it will require appropriate removal and disposal at a Class A landfill.

The boulder fill encountered in the western portions of the site (at BH101 and BH06) in particular may be of use on the site. Depending on the intended use of the material, it should be confirmed if it is geotechnically suitable.

5.5 Groundwater

Groundwater was not encountered during this investigation and was not included as part of this DSI scope. Groundwater has been shown to be present at approximately 3 to 4 m bgl in previous investigations within 50 m of the site. Consideration should be given to the potential need for dewatering should earthworks be intended to be completed at such depths, and any consents/pre-treatment required for the disposal of groundwater to the trade-waste or stormwater system.

5.6 Summary and CSM revision

Heavy metals and TPH have not been identified in fill or natural ground at levels that would be harmful to human health or the environment. Asbestos has been identified at one location within a matrix of demolition fill. In relation to the conceptual site model there is potential for there to exist a complete pathway between the demolition fill and a human receptor. The lateral extent of the demolition waste is unconfirmed and this should be managed on site during bulk earthworks through adequate controls and a contaminated site management plan (CSMP).

Fill material at the site cannot be considered as cleanfill and disposal off-site would be to a Class A landfill facility which can accept contaminated soil. The majority of fill material and natural ground is likely to be suitable for reuse at the site from a contaminated land point of view, however, this will also depend on its geotechnical suitability. Material which contains demolition waste has tested positive for the presence of asbestos. This may be suitable for retention on site with appropriate measures, such as capping and a long-term management plan to remove the exposure pathway for future site users. . If the material cannot be retained on-site (e.g. not geotechnically suitable, or space constraints) then it will require appropriate removal and disposal at a Class A landfill.

5.6.1 Unconfirmed ground conditions

The following points should be noted:

- Depth to natural ground has not been confirmed at the hill at the north of the site. Quantity and quality of fill to be excavated and managed is less certain in this area and can be managed through further sampling and characterisation or through a CSMP during bulk earthworks.
- Underlying material and depth to natural ground at the BH101 and BH104 locations is unconfirmed and will either require further sampling and characterisation or management through implementation of a CSMP during bulk earthworks.
- The lateral extent of demolition fill material that contains asbestos has not been determined.

6 Conclusions and Recommendations

6.1 Conclusions

6.1.1 Overview of site conditions

Parliamentary Services engaged Aurecon New Zealand Limited (Aurecon) to undertake a Detailed Site Investigation (DSI) at the existing carpark area at Ballantrae Place. Aurecon understands that redevelopment of the site will occur to accommodate additional facilities and help improve the day to day functionality of the Parliament Precinct. The site is currently in use as a car park and the proposed work will result in a change of land use to offices and movement of goods.

The intrusive investigations were completed between February and March 2020. The investigations were completed in conjunction with geotechnical investigations, resulting in a total of six machine drilled boreholes in the carpark and one hand auger to the north of the carpark. Three of the boreholes were to at least 5 m bgl, two boreholes encountered unexpected ground conditions and were terminated in the fill layer. The hand auger was targeted on the hill at the north of the site and met refusal at approximately 1 m bgl, within the fill layer.

Fill was encountered at all locations extending to depths of up to 1.8 m bgl. The fill was comprised of silt and gravel overlying a similar composition of natural ground. Fill at BH101, the western most part of the site, also contained cobbles and boulders and prevented the progression of the borehole. Demolition fill in the form of bricks and brick fragments was encountered at BH104.

The samples collected were scheduled for analysis of heavy metals, PAHs, TPH, BTEX and presence of asbestos.

6.1.2 Suitability of site for proposed development

None of the samples returned exceedances of applicable human health criteria for heavy metals, PAHs, TPH or BTEX. The fill at BH105 has not been classified due to obstruction being reached at 0.5 m bgl and this area will require further sampling. Depth to natural ground has not been confirmed at the hill to the north of the site due to the refusal of the hand auger. Management of these materials and appropriate health and safety controls can be achieved through a Contaminated Site Management Plan (CSMP).

Asbestos

One detection of asbestos within demolition fill at BH104 could not be quantified due to insufficient sample size and means excavations of the demolition fill from this area may need to be under Class A controls (e.g. air monitoring, suitable PPE, asbestos waste), which would be documented as part of the CSMP. Further sampling could be undertaken prior to earthworks to ascertain the amount of asbestos present and test pits are required to obtain enough sampling volume for this testing. Depending on the results of such sampling Class A controls may not be required during the earthworks. A suitable reuse option could be developed for the asbestos impacted fill with appropriate controls (such as capping and a long-term site management plan). Depending on the intended use of site won material, it should be confirmed if it is geotechnically suitable.

Waste disposal

The majority of the material is likely suitable for reuse at the site provided it can be confirmed as geotechnically suitable for its intended use, is appropriately managed and there are no unexpected discoveries during the bulk earthworks. The one detection of asbestos at the site appears to be correlated with the presence of demolition fill and, if not suitable to be retained on site, this material would require disposal as Class A asbestos waste in the absence of further testing.

Fill material at the site is not cleanfill and if it is to be disposed off-site it will require disposal at a Class A Landfill facility such as Southern or Silverstream as contaminated soil.

The natural ground at the site may be considered cleanfill although this will require agreement with GWRC and cleanfill operators.

Conclusion

Based on investigations to date, the site is suitable for the proposed future use of offices and movements of goods. Risks associated with contaminants found on site should be mitigated with the implementation of appropriate management and controls guided by a CSMP.

6.1.3 Recommendations

- It is recommended that a CSMP be completed for the wider Parliament FAS project;
- It is recommended that a further limited test pit investigation in the areas of BH104 and BH105 be completed prior to the start of earthworks to inform the ground conditions, extent of the demolition fill and the quantity of asbestos present;
- Consideration should be given to the possible reuse of site-won spoil;
- Consideration should be given to the need for further groundwater assessment to inform disposal and management of dewatering during construction, if required; and
- To comply with GWRC's Proposed Natural Resources Plan (Rule R54 – Detailed Site Investigation – Permitted Activity), a copy of this report should be supplied to them.

7 Reference List

ANZECC/ARMCANZ 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality,* Australian and New Zealand Environment and Conservation Council/Agricultural and Resource Management Council of Australia and New Zealand.

BRANZ 2017, *New Zealand Guidelines for Assessing and Managing Asbestos in Soil*, BRANZ, Wellington.

Greater Wellington Regional Council (GWRC) 2003, *Determination of Common Pollutant Background Soil Concentrations for the Wellington Region.* Greater Wellington Regional Council, Wellington.

Ministry for the Environment (MfE) 2004, *Module 2 – Hazardous waste guidelines: Landfill waste acceptance criteria and landfill classification*, Ministry for the Environment, Wellington.

Ministry for the Environment (MfE) 2011a, *Contaminated Land Management Guidelines No. 1. Reporting on Contaminated Sites in New Zealand (Revised 2011),* ME number: 1071, Ministry for the Environment, Wellington.

Ministry for the Environment (MfE) 2011b, *Contaminated Land Management Guidelines No. 5. Site Investigation and Analysis of Soils (Revised 2011)*, ME number: 1073, Ministry for the Environment, Wellington.

Ministry for the Environment (MfE) 2011c, *Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand*, Ministry for the Environment, Wellington.

Ministry for the Environment (MfE) 2011d, *Contaminated Land Management Guideline No. 2. Hierarchy and Application in New Zealand of Environmental Guideline Values,* Ministry for the Environment, Wellington.

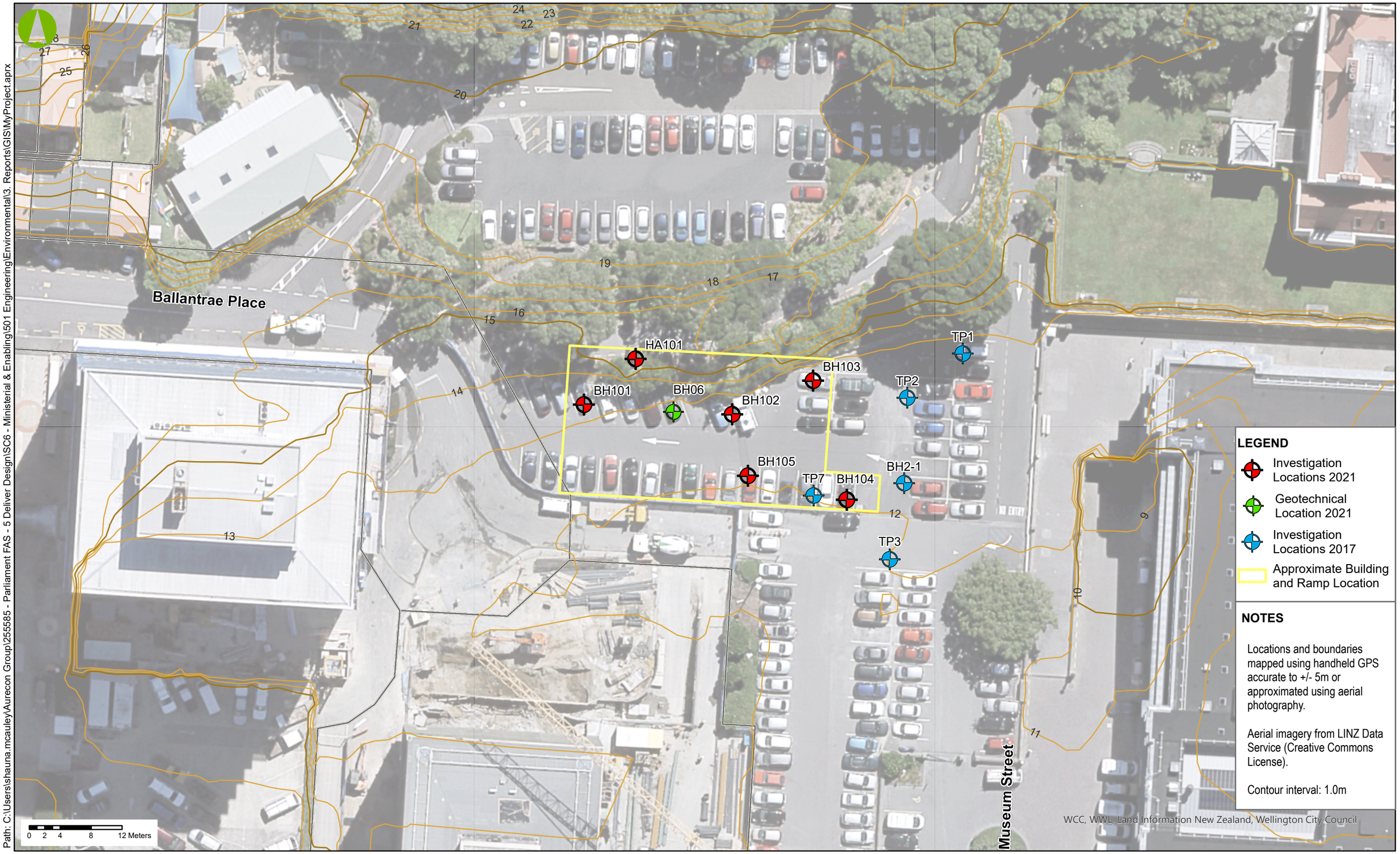
Ministry for the Environment (MfE) 2011e, *Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health,* Ministry for the Environment, Wellington.

Ministry for the Environment (MfE) 2012, *Users' Guide. National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health)*, ME number: 1092, Ministry for the Environment, Wellington.

National Environment Protection (Assessment of Site Contamination) Measure 2013. *Schedule B1. Guideline on Investigation Levels for Soil and Groundwater*. NEPC, Australia.

Appendix A
Figures

Coordinate System: New Zealand Transverse Mercator 2000
Path: C:\Users\shauna.mcauley\Aurecon Group\255585 - Parliament FAS - 5 Deliver Design\SC6 - Ministerial & Enabling\501 Engineering\Environmental\3. Reports\GIS\MyProject.aprx
Date: 30/06/2021



LEGEND

- Investigation Locations 2021
- Geotechnical Location 2021
- Investigation Locations 2017
- Approximate Building and Ramp Location

NOTES

Locations and boundaries mapped using handheld GPS accurate to +/- 5m or approximated using aerial photography.

Aerial imagery from LINZ Data Service (Creative Commons License).

Contour interval: 1.0m

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CLIENT
PARLIAMENTARY SERVICE
Te Ratonga Whare Pāremata

REV	DATE	REVISION DETAILS	APPROVED
A	30.05.21	PRELIMINARY	

SCALE	SIZE
1:450	A3

DRAWN: SMA
REVIEWED: WW
VERIFIED: RG

PRELIMINARY
NOT FOR CONSTRUCTION

APPROVED
DATE 30.06.21
APPROVER

PROJECT: PARLIAMENT FAS

TITLE: BALLANTRAE PLACE DETAILED SITE INVESTIGATION

DOCUMENT	PROJECT		WBS		TYPE		DISC		NUMBER		SHEET		REVISION
	255585	–	0800	–	FIG	–	KF	–	0001	–	01	–	A

Appendix B
Historical Photos

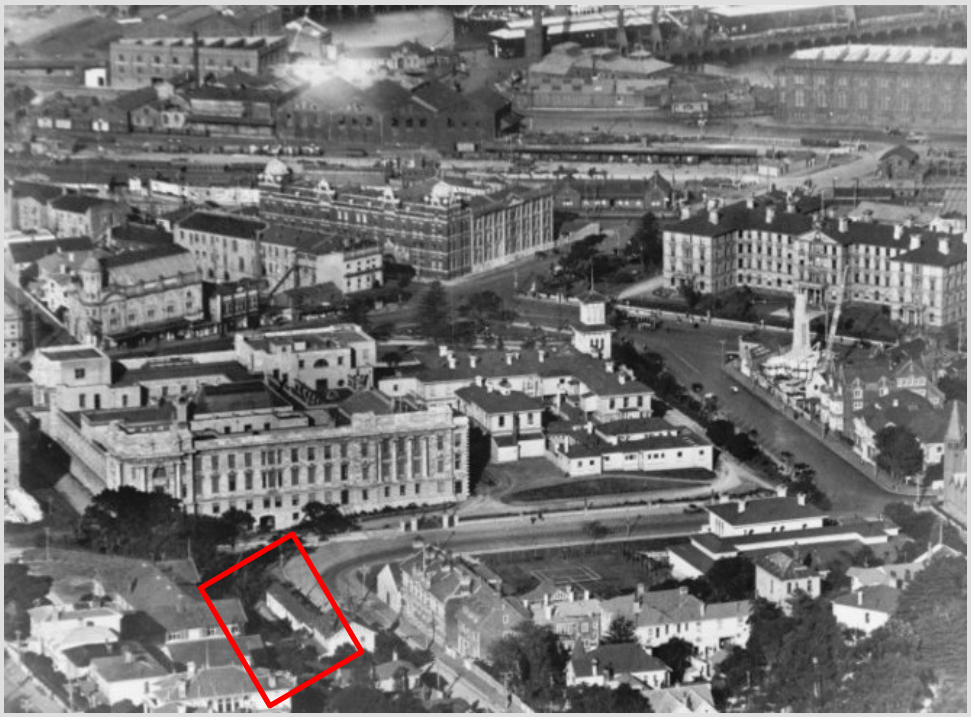

Figure 1 1930 (location approximate)

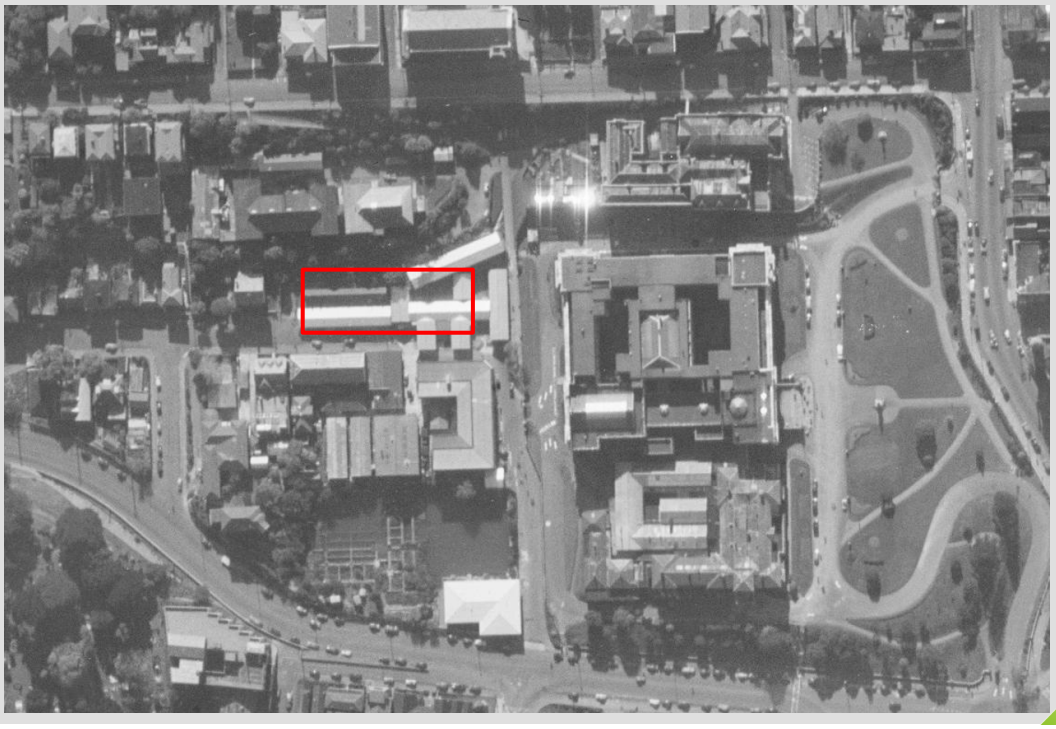

Figure 2 1951 (location approximate)

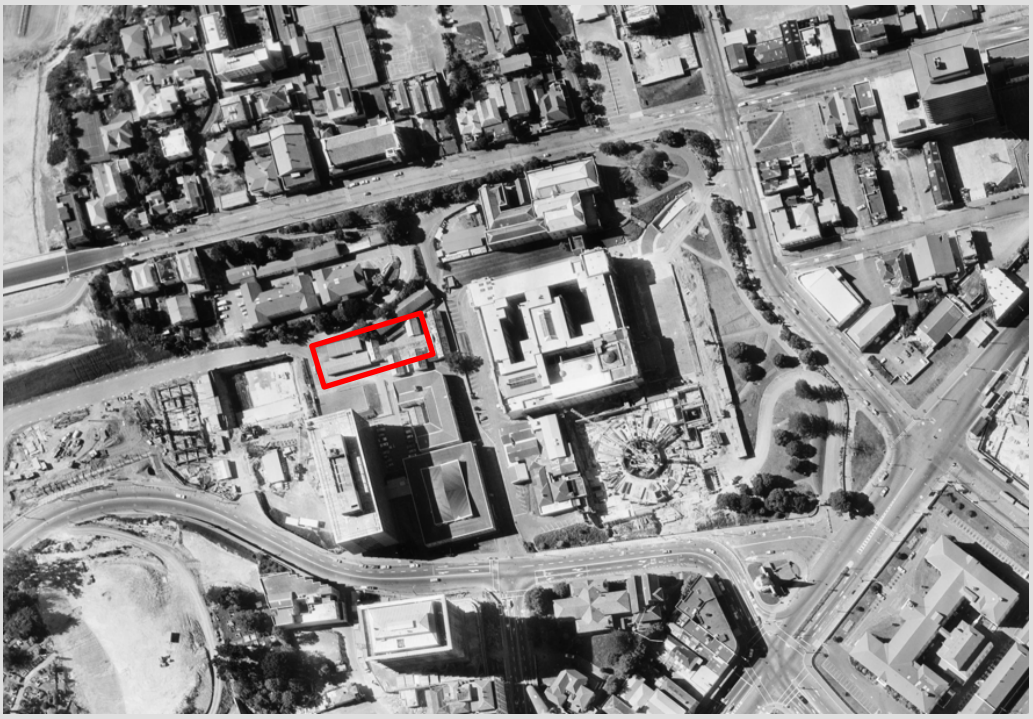

Figure 3 1971 (location approximate)

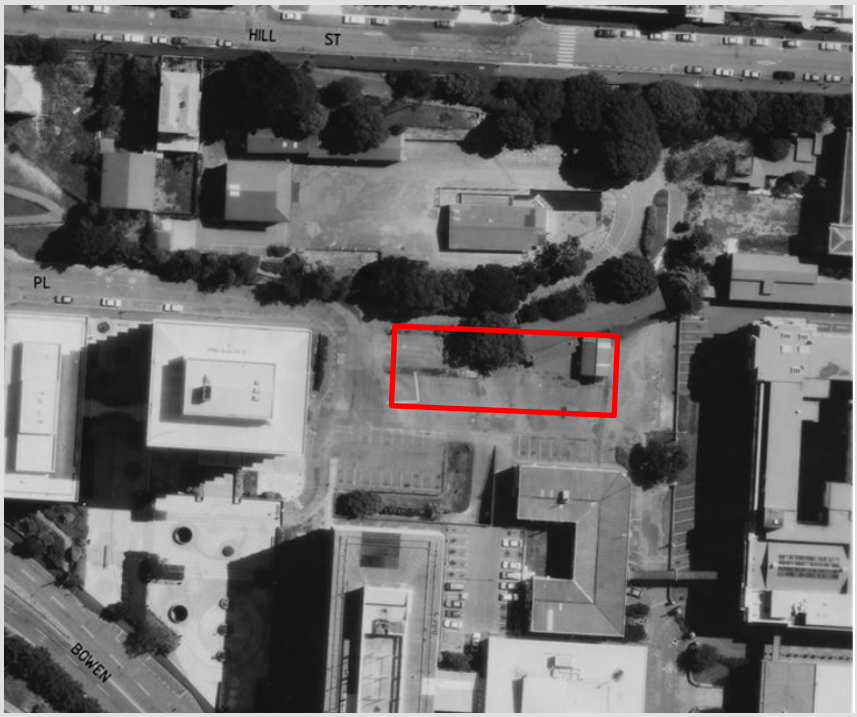

Figure 4 1992 (location approximate)

Figure 5 2000 (location approximate)

Appendix C
Site photos

Figure 1 Site – Facing West

Figure 2 Site – Facing North-West, showing the vegetated slope to the north

Figure 3 Site – Facing South-West

Figure 4 BH101 – Angular cobble/boulder fill in ground

Figure 5 BH102

Figure 6 BH102

Figure 7 BH103

Figure 8 BH103

Figure 9 BH104

Figure 10 BH104

Figure 11 BH105

Figure 12 BH105

Appendix D
Logs

aurecon
Spark Central, Lvl 8, 42-52 Willis Street
PO Box 1591, Wellington
New Zealand
Tel: +64 4 472 9589
www.aurecongroup.com

Client: **Parliamentary Services**
Project: **Ballantrae Place Detailed Site Investigation**
Location: **Refer to drawing 255585-0800-DRG-KF-0001-A**
Project Reference: **255585**

BH101

Sheet **1** of **1**

BOREHOLE INFORMATION	**CO-ORDINATES: NZTM**		
Method: Hydro Excavation	Easting: 5428913.70m	Date started: 9/03/2021	Logged by: SMcA
Equipment:	Northing: 1748656.37m	Date completed: 10/03/2021	Input by: SMcA
Contractor: ProDrill Ltd	Reduced level: N/A	Inclination: 90°	Checked by: DM
		Azimuth: N/A	Verified by: WW

Method	R.L. (m)	Depth (m)	Graphic Log	Material Description	Weathering/USC	Testing	TCR (%)	Stratigraphy Defect Description Additional Notes	Installation
HYDRO VAC EX		1		**0m:** Asphalt		0.1m to 0.2m: Environmental Samples Taken		0m to 0.2m: ASPHALT	
				0.2m: Fine to coarse GRAVEL with some sand and minor silt; brownish grey. Moist, 'loosely packed'. Angular to subangular. Sand is fine to medium. Frequent cobbles and infrequent boulders.		0.5m to 0.6m: Environmental Samples Taken		0.2m to 1.4m: FILL	
				0.8m:...Plastic bottle					
				End of borehole at 1.4m (Encountered boulders - unable to complete hydroexcavation to required depth)					

REMARKS:
1. Refer to site location plan 255585-0800-FIG-KF-0001-01-A for test location.
2. Coordinates obtained from aerial photography. Accuracy +/- 5m.
3. Logged in general accordance with NZGS Guidelines for Field Description of Soil and Rock (2005).
4. Soil strength / consistency terms in "inverted commas" are inferred from logging diagnostics.

Water Level Readings:
Date Time | Water Level | Comments
No water level recorded

aurecon
Spark Central, Lvl 8, 42-52 Willis Street
PO Box 1591, Wellington
New Zealand
Tel: +64 4 472 9589
www.aurecongroup.com

Client: **Parliamentary Services**
Project: **Ballantrae Place Detailed Site Investigation**
Location: **Refer to drawing 255585-0800-DRG-KF-0001-A**
Project Reference: **255585**

BH102

Sheet **1** of **1**

BOREHOLE INFORMATION	**CO-ORDINATES: NZTM**		
Method: Sonic Percussion	Easting: 5428911.72m	Date started: 10/03/2021	Logged by: SMcA
Equipment: Fraste MITO 8	Northing: 1748676.94m	Date completed: 10/03/2021	Input by: SMcA
Contractor: ProDrill Ltd	Reduced level: N/A	Inclination: 90°	Checked by: DM
		Azimuth: N/A	Verified by: WW

Method	R.L. (m)	Depth (m)	Graphic Log	Material Description	Weathering/USC	Testing	TCR (%)	Stratigraphy Defect Description Additional Notes	Installation
HYDRO VAC EX		0		**0m:** Asphalt				0m to 0.1m: ASPHALT	
				0.1m: Fine to coarse GRAVEL with some sand and minor silt; brownish grey. Moist, 'loosely packed'. Angular to subangular. Sand is fine to medium. Frequent cobbles.		0.1m to 0.2m: Environmental Samples Taken		0.1m to 1.7m: FILL	
						0.5m to 0.6m: Environmental Samples Taken			
		1							
				1.4m: Gravelly SILT with minor sand; orangeish-brown. 'Firm', moist, low plasticity. Gravel is angular to subrounded, fine to coarse. Sand is fine to coarse		1.5m to 1.6m: Environmental Samples Taken			
SONIC				**1.7m:** SILT with minor gravel and trace sand; Grey. 'Soft', moist, low plasticity. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse.		1.7m to 1.8m: Environmental Samples Taken		1.7m to 5m: ALLUVIUM	
		2		**1.8m:** SILT with trace gravel; brown with orangeish brown mottles. 'Firm', moist, low plasticity. Gravel is fine to coarse, subangular to subrounded.					
				2.3m: Sandy SILT; light brown with dark brown mottles. 'Firm', moist, moderately plastic. Sand is fine to medium. Infrequent cobbles.		2.3m to 2.5m: Environmental Samples Taken			
				2.5m:...with orangeish brown mottles, no cobbles		2.5m to 2.7m: Environmental Samples Taken			
				2.7m: SILT with minor sand and trace gravel; brown with dark brown mottles. 'Firm', moist, low plasticity. Sand is fine to medium. Gravel is fine to coarse, angular to subangular.					
		3							
				3.6m:...gravel minor					
		4							
						4.1m to 4.2m: Environmental Samples Taken			
				4.6m:...dark brownish black mottles, sand fine					
		5		End of borehole at 5m (Target depth of 5 meters achieved)		4.9m to 5m: Environmental Samples Taken			

REMARKS:
1. Refer to site location plan 255585-0800-FIG-KF-0001-01-A for test location.
2. Coordinates obtained from aerial photography. Accuracy +/- 5m.
3. Logged in general accordance with NZGS Guidelines for Field Description of Soil and Rock (2005).
4. Soil strength / consistency terms in "inverted commas" are inferred from logging diagnostics.

Water Level Readings:
Date Time | Water Level | Comments
No water level recorded

aurecon
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PO Box 1591, Wellington
New Zealand
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Client: **Parliamentary Services**
Project: **Ballantrae Place Detailed Site Investigation**
Location: **Refer to drawing 255585-0800-DRG-KF-0001-A**
Project Reference: **255585**

BH103

BOREHOLE INFORMATION	**CO-ORDINATES: NZTM**		
Method: Sonic Percussion	Easting: 5428916.55m	Date started: 10/03/2021	Logged by: SMcA
Equipment: Fraste MITO 8	Northing: 1748688.39m	Date completed: 10/03/2021	Input by: SMcA
Contractor: ProDrill Ltd	Reduced level: N/A	Inclination: 90°	Checked by: DM
		Azimuth: N/A	Verified by: WW

Method	R.L. (m)	Depth (m)	Graphic Log	Material Description	Weathering/USC	Testing	TCR (%)	Stratigraphy Defect Description Additional Notes	Installation
HYDRO VAC EX				**0m:** Asphalt				0m to 0.2m: ASPHALT	
				0.2m: Fine to coarse GRAVEL with minor silt and sand; grey. 'Loosely packed', moist. Angular to subangular. Sand is fine to coarse. **0.4m:**...Frequent cobbles.		0.2m to 0.3m: Environmental Samples Taken		0.2m to 1.7m: FILL	
		1		**0.6m:** SILT with minor fine to coarse sand and gravel; orangeish brown. 'Firm' , moist, low plasticity. Gravel is subangular to subrounded. Possible paint flakes.		0.6m to 0.7m: Environmental Samples Taken 1.6m to 1.7m: Environmental Samples Taken			
SONIC				**1.7m:** Sandy SILT; orange with grey mottles. 'Firm', moist, high plasticity. Sand is fine to medium. Minor rootlets		1.8m to 1.9m: Environmental Samples Taken		1.7m to 5m: ALLUVIUM	
		2		**2m:**...grey with orange mottles.					
				2.1m: SILT with some sand and trace gravel; brown with dark brown mottles. 'Firm', moist, low plasticiy. Sand is fine to medium. Gravel is fine to coarse, angular to subangular.		2.1m to 2.2m: Environmental Samples Taken			
				2.5m: Gravelly SILT with minor sand; dark brown. 'Firm', moist, low plasticity. Gravel is fine to coarse, angular to subangular. Sand is fine to coarse.					
		3		**2.9m:** SILT with minor sand and gravel; orangeish brown. 'Firm', moist, low plasticity. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.		3m to 3.1m: Environmental Samples Taken			
				3.3m: Sandy SILT with minor fine to coarse gravel; greenish blue. 'Firm', moist, low plasticity. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.					
		4				3.9m to 4m: Environmental Samples Taken			
				4.7m:...greenish brown.					
		5				4.9m to 5m: Environmental Samples Taken			

REMARKS: End of borehole at 5m (Target depth of 5 meters achieved)
1. Refer to site location plan 255585-0800-FIG-KF-0001-01-A for test location.
2. Coordinates obtained from aerial photography. Accuracy +/- 5m.
3. Logged in general accordance with NZGS Guidelines for Field Description of Soil and Rock (2005).
4. Soil strength / consistency terms in "inverted commas" are inferred from logging diagnostics.

Water Level Readings:
Date Time | Water Level | Comments
No water level recorded

aurecon
Spark Central, Lvl 8, 42-52 Willis Street
PO Box 1591, Wellington
New Zealand
Tel: +64 4 472 9589
www.aurecongroup.com

Client: **Parliamentary Services**
Project: **Ballantrae Place Detailed Site Investigation**
Location: **Refer to drawing 255585-0800-DRG-KF-0001-A**
Project Reference: **255585**

BH104

Sheet **1** of **1**

BOREHOLE INFORMATION	**CO-ORDINATES: NZTM**		
Method: Sonic Percussion	Easting: 5428904.44m	Date started: 10/03/2021	Logged by: SMcA
Equipment: Fraste MITO 8	Northing: 1748671.72m	Date completed: 11/03/2021	Input by: SMcA
Contractor: ProDrill Ltd	Reduced level: N/A	Inclination: 90°	Checked by: DM
		Azimuth: N/A	Verified by: WW

Method	R.L. (m)	Depth (m)	Graphic Log	Material Description	Weathering/USC	Testing	TCR (%)	Stratigraphy Defect Description Additional Notes	Installation
HYDRO VAC EX				**0m:** Asphalt				0m to 0.2m: ASPHALT	
				0.2m: Fine to coarse GRAVEL with some sand and minor silt; grey. 'Loosely packed', moist. Gravel is angular to subrounded. Sand is fine to coarse. Brick fragments and whole bricks. Frequent cobbles.		0.2m to 0.3m: Environmental Samples Taken 0.4m to 0.5m: Environmental Samples Taken		0.2m to 1.4m: FILL	
				0.5m: Gravelly SILT with minor sand; orangeish brown. 'Firm', moist, moderate plasticity. Gravel is fine to coarse, angular to subrounded. Sand is fine to medium. Frequent cobbles.					
		1				1.1m to 1.2m: Environmental Samples Taken			
				1.4m: Clayey SILT with trace gravel; blueish grey. 'Soft', moist, moderate plasticity. Gravel is fine, angular to subrounded.				1.4m to 5m: ALLUVIUM	
						1.6m to 1.7m: Environmental Samples Taken			
				1.8m:...firm.					
		2							
				2.2m: Sandy SILT; orangeish brown with grey mottles. 'Firm', moist, moderate plasticity. Sand is fine.		2.4m to 2.5m: Environmental Samples Taken			
				2.5m: Sandy SILT with trace gravel; greyish brown. 'Soft', moist, moderate plasticity. Gravel is fine to coarse, subangular to subrounded. Infrequent wood pieces.		2.5m to 2.6m: Environmental Samples Taken			
				2.65m: SILT with minor sand and gravel; blueish grey. 'Firm', moist, low plasticity. Sand is fine. Gravel is fine to coarse, angular to subangular.		2.7m to 2.8m: Environmental Samples Taken			
		3							
SONIC				**3.05m:** SILT with minor gravel; orange. 'Firm', moist, low plasticity. Gravel is fine to coarse, angular to subangular.					
						3.6m to 3.7m: Environmental Samples Taken			
		4		**3.9m:**...dark brown mottles		3.9m to m: Environmental Samples Taken			
						4.5m to 4.6m: Environmental Samples Taken			
				4.8m: Sandy SILT; orangeish brown. 'Firm', moist, moderate plasticity. Sand is fine to medium.					
		5				4.9m to 5m: Environmental Samples Taken			

REMARKS: End of borehole at 5m (Target depth of 5 meters achieved)
1. Refer to site location plan 255585-0800-FIG-KF-0001-01-A for test location.
2. Coordinates obtained from aerial photography. Accuracy +/- 5m.
3. Logged in general accordance with NZGS Guidelines for Field Description of Soil and Rock (2005).
4. Soil strength / consistency terms in "inverted commas" are inferred from logging diagnostics.

Water Level Readings:
Date Time | Water Level | Comments
No water level recorded

aurecon
Spark Central, Lvl 8, 42-52 Willis Street
PO Box 1591, Wellington
New Zealand
Tel: +64 4 472 9589
www.aurecongroup.com

Client: **Parliamentary Services**
Project: **Ballantrae Place Detailed Site Investigation**
Location: **Refer to drawing 255585-0800-DRG-KF-0001-A**
Project Reference: **255585**

BH105

BOREHOLE INFORMATION	**CO-ORDINATES: NZTM**		
Method: Hydro Excavation	Easting: 5428902.27m	Date started: 11/03/2021	Logged by: SMcA
Equipment:	Northing: 1748690.31m	Date completed: 11/03/2021	Input by: SMcA
Contractor: ProDrill Ltd	Reduced level: N/A	Inclination: 90°	Checked by: DM
		Azimuth: N/A	Verified by: WW

Method	R.L. (m)	Depth (m)	Graphic Log	Material Description	Weathering/USC	Testing	TCR (%)	Stratigraphy Defect Description Additional Notes	Installation
HYDRO VAC EX				**0m:** Asphalt				0m to 0.1m: ASPHALT	
				0.1m: Fine to coarse GRAVEL with minor silt and sand; Grey. 'Loosely packed', moist. Gravel is angular to subangular. Sand is fine to coarse. Frequent cobbles.		0.1m to 0.2m: Environmental Samples Taken 0.4m to 0.5m: Environmental Samples Taken		0.1m to 0.6m: FILL	
				End of borehole at 0.5m (Encountered a slab surface - unable to penetrate with equipment on site)					

REMARKS:
1. Refer to site location plan 255585-0800-FIG-KF-0001-01-A for test location.
2. Coordinates obtained from aerial photography. Accuracy +/- 5m.
3. Logged in general accordance with NZGS Guidelines for Field Description of Soil and Rock (2005).
4. Soil strength / consistency terms in "inverted commas" are inferred from logging diagnostics.

Water Level Readings:
Date Time | Water Level | Comments
No water level recorded

aurecon
Spark Central, Lvl 8, 42-52 Willis Street
PO Box 1591, Wellington
New Zealand
Tel: +64 4 472 9589
www.aurecongroup.com

Client: **Parliamentary Services**
Project: **Ballantrae Place Detailed Site Investigation**
Location: **Refer to drawing 255585-0800-DRG-KF-0001-A**
Project Reference: **255585**

HA101

Sheet **1** of **1**

BOREHOLE INFORMATION	**CO-ORDINATES: NZTM**		
Method: Hand Auger	Easting: 5428920.53m	Date started: 11/03/2021	Logged by: SMcA
Equipment: Hand Auger	Northing: 1748673.64m	Date completed: 11/03/2021	Input by: SMcA
Contractor: Aurecon	Reduced level: N/A	Inclination: 90°	Checked by: DM
		Azimuth: N/A	Verified by: WW

Method	R.L. (m)	Depth (m)	Graphic Log	Material Description	Weathering/USC	Testing	TCR (%)	Stratigraphy Defect Description Additional Notes	Installation
HA				**0m:** Sandy SILT; orangeish brown. 'Firm', moist, low plasticity. Sand is fine to medium.		0m to 0.2m: Environmental Samples Taken		0m to 0.2m: TOPSOIL	
				0.2m: Sandy SILT with minor gravel; brown. 'Firm', moist, low plasticity. Sand is fine to medium; gravel is fine to medium, angular to subangular. Infrequent brick fragments.		0.3m to 0.5m: Environmental Samples Taken		0.2m to 1m: FILL	
				0.6m:...wood pieces and infrequent rootlets.					
				0.8m: Gravelly fine to coarse SAND with some silt; brown. 'Tightly packed', moist. Gravel is fine to coarse, angular to subangular. Infrequent brick fragments.		0.8m to 1m: Environmental Samples Taken			
		1		End of borehole at 1m (Refusal)					

REMARKS:
1. Refer to site location plan 255585-0800-FIG-KF-0001-01-A for test location.
2. Coordinates obtained from aerial photography. Accuracy +/- 5m.
3. Logged in general accordance with NZGS Guidelines for Field Description of Soil and Rock (2005).
4. Soil strength / consistency terms in "inverted commas" are inferred from logging diagnostics.

Water Level Readings:
Date Time | Water Level | Comments
No water level recorded

Appendix E
Analytical Results

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	Metals									TPH				PAH																		BTEX				
	Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Lead (TCLP)	Nickel	Zinc	Zinc (TCLP)	C7-C36	C7-C9	C10-C14	C15-C36	Benzo(a)pyrene	PAHs (Sum of total)	Perylene	Benzo(a)pyrene Potency Equivalence Factor (PEF) NES	Benzo(a)pyrene Toxic Equivalence (TEF)	Benzo(b)fluoranthene + Benzo(j)fluoranthene	1-Methylnaphthalene	2-methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a) pyrene	Benzo(b,j)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/L	mg/kg	mg/kg	mg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg dry wt	mg/kg dry wt	mg/kg dry wt	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Background Soil Concentrations Wellington Region GREYWACKE[1]	*7*	*0.1*	*16*	*25*	*78.6*		*13*	*105*		190[#7]														*0.05*		*0.27*					*0.55*			*0.01*	*0.26*	*0.57*						
Hazardous Waste Guidelines - Landfill WAC & Landfill Classification - Class A[2]	100	20	100[#2]	100	100	5	200	200	10																	300								200			10	1,000	2,000	2,000[#3]	2,000[#3]
Module 4, Tier 1 Commercial / Industrial (SAND)[3]											120 | 120 | 12,000[#9#m#n]	1,500 | 1,900 | 2,100[#9#m#n]																						190 | 230 | 260[#9#SR#]			3 | 3 | 9.3[#4#m#7]	180 | 300 | 390[#5#R#]	94 | 94 | 770[#5#R#]		
0-1m											120[#5]	1,500[#5]																						190[#5]			3[#4]	180[#5]	94[#5]		
1-4m											120[#5]	1,900[#5]																						230[#5]			3[#4]	300[#5]	94[#5]		
>=4m											12,000[#5]	2,100[#5]																						260[#5]			9.3[#7]	390[#5]	770[#5]		
NESCS - Commercial / Industrial[4]	70	1,300[#9]	6,300[#10]	10,000[#11]	3,300[#12]																																					
NEPM - Commercial / Industrial[5]							3,000	35,000																																			

Field ID	Date	Fill or Natural Ground																																									
BH06_0.1-0.2	**4/03/2021**	**Fill**	*11*	<0.10	*20*	23	25	-	*19*	82	-	<70	<8	<20	<40	<0.011	<0.3	<0.011	<0.03	<0.03	0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	0.014	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.06	<0.011	<0.011	<0.05	<0.05	<0.05	<0.10	<0.05
BH06_0.5	**4/03/2021**	**Fill**	5	<0.10	*18*	25	21	-	*15*	70	-	-	-	-	-	0.049	0.6	0.019	0.11	0.11	0.096	<0.011	<0.011	<0.011	<0.011	<0.011	0.064	0.076	0.044	0.036	0.062	0.010	0.061	<0.011	0.046	<0.06	0.016	0.055	-	-	-	-	-
BH06_2.5	**4/03/2021**	**Natural Ground**	5	<0.10	*20*	11	17.9	-	13	61	-	-	-	-	-	<0.012	<0.3	<0.012	<0.03	<0.03	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.06	<0.012	<0.012	-	-	-	-	-
BH101_0.1-0.2	**10/03/2021**	**Fill**	*9*	<0.10	*20*	20	23	-	*18*	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH101_0.5-0.6	**10/03/2021**	**Fill**	6	<0.10	16	17	21	-	*14*	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH102_0.1-0.2	**10/03/2021**	**Fill**	*12*	<0.10	*20*	25	25	-	*19*	74	-	<70	<8	<20	<40	0.023	0.5	<0.011	0.05	0.05	0.044	<0.011	<0.011	<0.011	<0.011	0.019	0.041	0.033	0.030	0.015	0.038	<0.011	0.089	<0.011	0.020	<0.06	0.074	0.084	<0.05	<0.05	<0.05	<0.10	<0.05
BH102_0.5-0.6	**10/03/2021**	**Fill**	6	*0.19*	*17*	15	*126*	-	13	*220*	-	-	-	-	-	0.174	3.4	0.065	0.39	0.38	0.28	<0.012	<0.012	<0.012	0.045	*0.089*	0.21	0.26	0.199	0.116	0.23	0.039	0.53	<0.012	0.194	<0.06	*0.38*	0.54	-	-	-	-	-
BH102_0.5-0.6 [TCLP Extract]	**17/03/2021**	**Fill**	-	-	-	-	-	0.70	-	-	0.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH102_2.3-2.5	**10/03/2021**	**Natural Ground**	5	<0.10	*24*	14	15.6	-	12	56	-	-	-	-	-	<0.013	<0.4	<0.013	<0.04	<0.04	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.07	<0.013	<0.013	-	-	-	-	-
BH103_0.2-0.3	**10/03/2021**	**Fill**	*10*	<0.10	*20*	21	24	-	*18*	81	-	<70	<8	<20	<40	0.013	<0.3	<0.011	<0.03	<0.03	0.019	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	0.011	0.030	<0.011	<0.011	<0.011	0.015	<0.011	0.012	<0.06	<0.011	0.020	<0.05	<0.05	<0.05	<0.10	<0.05
BH103_0.6-0.7	**10/03/2021**	**Fill**	5	<0.10	*17*	15	53	-	9	60	-	<70	<8	<20	<40	0.020	<0.3	<0.012	0.04	0.04	0.031	<0.012	<0.012	<0.012	<0.012	<0.012	0.026	0.027	0.016	<0.012	0.019	<0.012	0.040	<0.012	0.017	<0.06	0.017	0.039	<0.05	<0.05	<0.05	<0.10	<0.05
BH103_2.1-2.2	**10/03/2021**	**Natural Ground**	6	<0.10	*23*	14	40	-	*14*	67	-	-	-	-	-	<0.013	<0.3	<0.013	<0.03	<0.03	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.07	<0.013	<0.013	-	-	-	-	-
BH104_0.2-0.3	**10/03/2021**	**Fill**	*10*	<0.10	*19*	21	23	-	*18*	81	-	-	-	-	-	<0.011	<0.3	<0.011	<0.03	<0.03	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.06	<0.011	<0.011	-	-	-	-	-
BH104_0.4-0.5	**10/03/2021**	**Fill**	4	<0.10	*17*	15	*290*		11	*106*	-	<70	<8	<20	<40	0.35	6.8	0.133	0.82	0.81	0.62	<0.012	<0.012	<0.012	0.014	0.051	*0.119*	0.52	*0.56*	0.39	0.21	0.50	0.068	*1.10*	0.023	0.39	<0.06	*0.49*	*1.21*	<0.05	<0.05	<0.05	<0.10	<0.05
BH104_0.4-0.5 [TCLP Extract]	**17/03/2021**	**Fill**	-	-	-	-	-	0.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH104_1.1-1.2	**10/03/2021**	**Fill**	3	<0.10	16	6	27	-	7	22	-	-	-	-	-	<0.012	<0.3	<0.012	<0.03	<0.03	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.06	<0.012	<0.012	-	-	-	-	-
BH104_2.4-2.5	**11/03/2021**	**Natural Ground**	<2	<0.10	11	5	8.7	-	6	26	-	-	-	-	-	<0.013	<0.3	<0.013	<0.03	<0.03	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.07	<0.013	<0.013	-	-	-	-	-
HA101_0.0-0.2	**11/03/2021**	**Fill**	6	*0.15*	*22*	21	74	-	13	*198*	-	77	<8	<20	70	0.29	5.5	0.092	0.66	0.65	0.53	<0.012	<0.012	0.016	0.029	*0.119*	0.49	*0.44*	0.26	0.20	0.43	0.064	*0.87*	0.024	0.26	<0.06	*0.44*	*0.89*	<0.05	<0.05	<0.05	<0.10	<0.05
HA101_0.3-0.5	**11/03/2021**	**Fill**	5	*0.29*	*20*	23	*134*	-	12	*350*	-	-	-	-	-	0.97	17.7	0.32	2.2	2.2	1.69	0.019	0.017	0.038	0.173	*0.29*	1.13	*1.51*	1.03	0.67	1.31	0.20	*2.8*	0.059	1.04	<0.06	*1.42*	*3.0*	-	-	-	-	-
HA101_0.3-0.5 [TCLP Extract]	**17/03/2021**	**Fill**	-	-	-	-	-	0.065	-	-	1.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA101_0.8-1.0	**11/03/2021**	**Fill**	7	*0.18*	16	25	*280*	-	11	*210*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments
#1 Value based on TPH C7-C49
#2 Refer to value for Chromium (VI)
#3 Refer to value for Xylene (m,o,p)
#4 m
#5 RSPH v
#6 RSPH x
#7 v
#8 RSPH v m
#9 Default value is for pH of 5. Concentrations increase with increasing pH (see methodology).
#10 Value for hexavalent chromium
#11 No limit. Derived value exceeds 10,000 mg/kg.
#12 Value is for inorganic lead

Environmental Standards
1. GWRC, 2003, Background Soil Concentrations Wellington Region GREYWACKE
2. MfE, 2004, Hazardous Waste Guidelines - Landfill WAC & Landfill Classification - Class A
3. Ministry for the Environment, August 1999, Module 4, Tier 1 Commercial / Industrial (SAND)
4. Ministry for the Environment, 2012, NESCS - Commercial / Industrial
5. NEPC, 2013, NEPM - Commercial / Industrial

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

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

Certificate of Analysis

Client:	Aurecon New Zealand Limited	**Lab No:**	2559958	A2Pv1
Contact:	Shauna McAuley	**Date Received:**	18-Mar-2021	
	C/- Aurecon New Zealand Limited	**Date Reported:**	31-Mar-2021	
	PO Box 1591	**Quote No:**	82714	
	Wellington 6140	**Order No:**		
		Client Reference:	255585	
		Submitted By:	Shauna McAuley	

Sample Type: Soil

Sample Name	Lab Number	As Received Weight (g)	Dry Weight (g)	<2mm Subsample Weight (g dry wt)	Asbestos Presence / Absence	Description of Asbestos Form
HA101_0.0-0.2	2559958.1	543.3	454.8	56.5	Asbestos NOT detected.	-
HA101_0.8-1.0	2559958.3	558.0	503.6	58.8	Asbestos NOT detected.	-
BH101_0.1-0.2	2559958.4	856.8	823.7	59.3	Asbestos NOT detected.	-
BH101_0.5-0.6	2559958.5	883.2	858.0	40.7	Asbestos NOT detected.	-
BH102_0.1-0.2	2559958.6	618.7	586.4	59.3	Asbestos NOT detected.	-
BH102_0.5-0.6	2559958.7	866.7	831.4	19.3	Asbestos NOT detected.	-
BH103_0.2-0.3	2559958.11	895.9	843.3	59.1	Asbestos NOT detected.	-
BH103_0.6-0.7	2559958.12	778.9	655.3	55.7	Asbestos NOT detected.	-
BH104_0.2-0.3	2559958.17	874.5	809.9	57.4	Asbestos NOT detected.	-
BH104_0.4-0.5	2559958.18	566.0	479.1	58.7	Chrysotile (White Asbestos) detected.	Loose fibres (minor)
BH06_0.1-0.2	2559958.28	355.0	341.0	35.4	Asbestos NOT detected.	-
BH06_0.5	2559958.29	347.6	334.7	26.1	Asbestos NOT detected.	-

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: Soil

Test	Method Description	Default Detection Limit	Sample No
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 3-7, 11-12, 17-18, 28-29
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 3-7, 11-12, 17-18, 28-29
<2mm Subsample Weight	Sample dried at 100 to 105°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	1, 3-7, 11-12, 17-18, 28-29

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1, 3-7, 11-12, 17-18, 28-29
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1, 3-7, 11-12, 17-18, 28-29

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

Dates of testing are available on request. 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.

Dexter Paguirigan Dip Chem Engineering Tech
Laboratory Technician - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	Aurecon New Zealand Limited	**Lab No:**	2558716	SPv2
Contact:	Shauna McAuley	**Date Received:**	17-Mar-2021	
	C/- Aurecon New Zealand Limited	**Date Reported:**	09-Apr-2021	**(Amended)**
	PO Box 1591	**Quote No:**	82714	
	Wellington 6140	**Order No:**		
		Client Reference:	255585	
		Submitted By:	Shauna McAuley	

Sample Type: Soil

Sample Name:		HA101_0.0-0.2 11-Mar-2021	HA101_0.3-0.5 11-Mar-2021	HA101_0.8-1.0 11-Mar-2021	BH101_0.1-0.2 10-Mar-2021	BH101_0.5-0.6 10-Mar-2021
Lab Number:		2558716.1	2558716.2	2558716.3	2558716.4	2558716.5
Individual Tests						
Dry Matter	g/100g as rcvd	82	85	-	-	-
TCLP Weight of Sample Taken	g	-	50	-	-	-
TCLP Initial Sample pH	pH Units	-	7.1	-	-	-
TCLP Acid Adjusted Sample pH	pH Units	-	1.5	-	-	-
TCLP Extractant Type*		-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-	-
TCLP Extraction Fluid pH	pH Units	-	5.0	-	-	-
TCLP Post Extraction Sample pH	pH Units	-	4.9	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	5	7	9	6
Total Recoverable Cadmium	mg/kg dry wt	0.15	0.29	0.18	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	22	20	16	20	16
Total Recoverable Copper	mg/kg dry wt	21	23	25	20	17
Total Recoverable Lead	mg/kg dry wt	74	134	280	23	21
Total Recoverable Nickel	mg/kg dry wt	13	12	11	18	14
Total Recoverable Zinc	mg/kg dry wt	198	350	210	82	71
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	-	-	-	-
Toluene	mg/kg dry wt	< 0.05	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.05	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.10	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.05	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	5.5	17.7	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.012	0.019	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.012	0.017	-	-	-
Acenaphthylene	mg/kg dry wt	0.029	0.173	-	-	-
Acenaphthene	mg/kg dry wt	0.016	0.038	-	-	-
Anthracene	mg/kg dry wt	0.119	0.29	-	-	-
Benzo[a]anthracene	mg/kg dry wt	0.49	1.13	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.44	1.51	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.66	2.2	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.65	2.2	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.53	1.69	-	-	-
Benzo[e]pyrene	mg/kg dry wt	0.29	0.97	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.26	1.03	-	-	-

Sample Type: Soil						
Sample Name:		HA101_0.0-0.2 11-Mar-2021	HA101_0.3-0.5 11-Mar-2021	HA101_0.8-1.0 11-Mar-2021	BH101_0.1-0.2 10-Mar-2021	BH101_0.5-0.6 10-Mar-2021
Lab Number:		2558716.1	2558716.2	2558716.3	2558716.4	2558716.5
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Benzo[k]fluoranthene	mg/kg dry wt	0.20	0.67	-	-	-
Chrysene	mg/kg dry wt	0.43	1.31	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	0.064	0.20	-	-	-
Fluoranthene	mg/kg dry wt	0.87	2.8	-	-	-
Fluorene	mg/kg dry wt	0.024	0.059	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.26	1.04	-	-	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	-	-	-
Perylene	mg/kg dry wt	0.092	0.32	-	-	-
Phenanthrene	mg/kg dry wt	0.44	1.42	-	-	-
Pyrene	mg/kg dry wt	0.89	3.0	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	-	-	-	-
C10 - C14	mg/kg dry wt	< 20	-	-	-	-
C15 - C36	mg/kg dry wt	70	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	77	-	-	-	-

Sample Name:		BH102_0.1-0.2 10-Mar-2021	BH102_0.5-0.6 10-Mar-2021	BH102_2.3-2.5 10-Mar-2021	BH103_0.2-0.3 10-Mar-2021	BH103_0.6-0.7 10-Mar-2021
Lab Number:		2558716.6	2558716.7	2558716.10	2558716.14	2558716.15
Individual Tests						
Dry Matter	g/100g as rcvd	93	85	78	92	83
TCLP Weight of Sample Taken	g	-	50	-	-	-
TCLP Initial Sample pH	pH Units	-	9.2	-	-	-
TCLP Acid Adjusted Sample pH	pH Units	-	1.5	-	-	-
TCLP Extractant Type*		-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-	-
TCLP Extraction Fluid pH	pH Units	-	5.0	-	-	-
TCLP Post Extraction Sample pH	pH Units	-	5.0	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	12	6	5	10	5
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.19	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	20	17	24	20	17
Total Recoverable Copper	mg/kg dry wt	25	15	14	21	15
Total Recoverable Lead	mg/kg dry wt	25	126	15.6	24	53
Total Recoverable Nickel	mg/kg dry wt	19	13	12	18	9
Total Recoverable Zinc	mg/kg dry wt	74	220	56	81	60
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	-	-	< 0.05	< 0.05
Toluene	mg/kg dry wt	< 0.05	-	-	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	< 0.05	-	-	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	< 0.10	-	-	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	< 0.05	-	-	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	0.5	3.4	< 0.4	< 0.3	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.012	< 0.013	< 0.011	< 0.012
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.012	< 0.013	< 0.011	< 0.012
Acenaphthylene	mg/kg dry wt	< 0.011	0.045	< 0.013	< 0.011	< 0.012
Acenaphthene	mg/kg dry wt	< 0.011	< 0.012	< 0.013	< 0.011	< 0.012
Anthracene	mg/kg dry wt	0.019	0.089	< 0.013	< 0.011	< 0.012
Benzo[a]anthracene	mg/kg dry wt	0.041	0.21	< 0.013	< 0.011	0.026
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.033	0.26	< 0.013	0.011	0.027
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	0.05	0.39	< 0.04	< 0.03	0.04
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	0.05	0.38	< 0.04	< 0.03	0.04
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.044	0.28	< 0.013	0.019	0.031

Sample Type: Soil						
Sample Name:		BH102_0.1-0.2 10-Mar-2021	BH102_0.5-0.6 10-Mar-2021	BH102_2.3-2.5 10-Mar-2021	BH103_0.2-0.3 10-Mar-2021	BH103_0.6-0.7 10-Mar-2021
Lab Number:		2558716.6	2558716.7	2558716.10	2558716.14	2558716.15
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Benzo[e]pyrene	mg/kg dry wt	0.023	0.174	< 0.013	0.013	0.020
Benzo[g,h,i]perylene	mg/kg dry wt	0.030	0.199	< 0.013	0.030	0.016
Benzo[k]fluoranthene	mg/kg dry wt	0.015	0.116	< 0.013	< 0.011	< 0.012
Chrysene	mg/kg dry wt	0.038	0.23	< 0.013	< 0.011	0.019
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	0.039	< 0.013	< 0.011	< 0.012
Fluoranthene	mg/kg dry wt	0.089	0.53	< 0.013	0.015	0.040
Fluorene	mg/kg dry wt	< 0.011	< 0.012	< 0.013	< 0.011	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.020	0.194	< 0.013	0.012	0.017
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.07	< 0.06	< 0.06
Perylene	mg/kg dry wt	< 0.011	0.065	< 0.013	< 0.011	< 0.012
Phenanthrene	mg/kg dry wt	0.074	0.38	< 0.013	< 0.011	0.017
Pyrene	mg/kg dry wt	0.084	0.54	< 0.013	0.020	0.039
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	-	-	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	-	-	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	-	-	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	-	-	< 70	< 70

Sample Name:		BH103_2.1-2.2 10-Mar-2021	BH104_0.2-0.3 10-Mar-2021	BH104_0.4-0.5 10-Mar-2021	BH104_1.1-1.2 10-Mar-2021	BH104_2.4-2.5 11-Mar-2021
Lab Number:		2558716.18	2558716.22	2558716.23	2558716.24	2558716.27
Individual Tests						
Dry Matter	g/100g as rcvd	78	91	85	80	82
TCLP Weight of Sample Taken	g	-	-	50	-	-
TCLP Initial Sample pH	pH Units	-	-	9.3	-	-
TCLP Acid Adjusted Sample pH	pH Units	-	-	1.6	-	-
TCLP Extractant Type*		-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-
TCLP Extraction Fluid pH	pH Units	-	-	5.0	-	-
TCLP Post Extraction Sample pH	pH Units	-	-	5.1	-	-
Total Cyanide*	mg/kg dry wt	-	-	0.14	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	10	4	3	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	23	19	17	16	11
Total Recoverable Copper	mg/kg dry wt	14	21	15	6	5
Total Recoverable Lead	mg/kg dry wt	40	23	290	27	8.7
Total Recoverable Nickel	mg/kg dry wt	14	18	11	7	6
Total Recoverable Zinc	mg/kg dry wt	67	81	106	22	26
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	-	-	< 0.05	-	-
Toluene	mg/kg dry wt	-	-	< 0.05	-	-
Ethylbenzene	mg/kg dry wt	-	-	< 0.05	-	-
m&p-Xylene	mg/kg dry wt	-	-	< 0.10	-	-
o-Xylene	mg/kg dry wt	-	-	< 0.05	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	6.8	< 0.3	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.011	< 0.012	< 0.012	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.011	< 0.012	< 0.012	< 0.013
Acenaphthylene	mg/kg dry wt	< 0.013	< 0.011	0.051	< 0.012	< 0.013
Acenaphthene	mg/kg dry wt	< 0.013	< 0.011	0.014	< 0.012	< 0.013
Anthracene	mg/kg dry wt	< 0.013	< 0.011	0.119	< 0.012	< 0.013
Benzo[a]anthracene	mg/kg dry wt	< 0.013	< 0.011	0.52	< 0.012	< 0.013
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.013	< 0.011	0.56	< 0.012	< 0.013
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	< 0.03	0.82	< 0.03	< 0.03

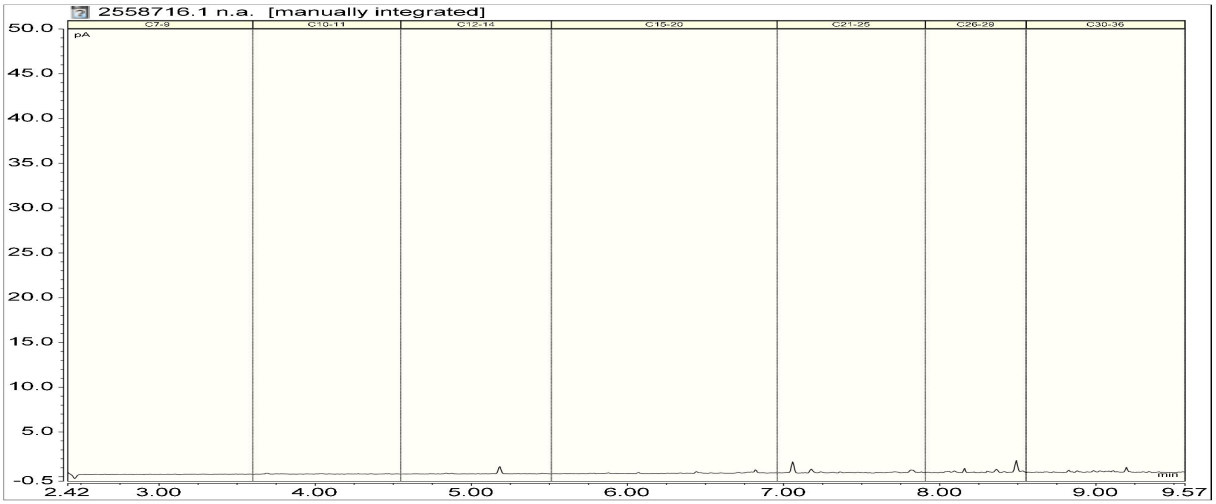
Sample Type: Soil						
Sample Name:		BH103_2.1-2.2 10-Mar-2021	BH104_0.2-0.3 10-Mar-2021	BH104_0.4-0.5 10-Mar-2021	BH104_1.1-1.2 10-Mar-2021	BH104_2.4-2.5 11-Mar-2021
Lab Number:		2558716.18	2558716.22	2558716.23	2558716.24	2558716.27
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	< 0.03	0.81	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.013	< 0.011	0.62	< 0.012	< 0.013
Benzo[e]pyrene	mg/kg dry wt	< 0.013	< 0.011	0.35	< 0.012	< 0.013
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.013	0.011	0.39	< 0.012	< 0.013
Benzo[k]fluoranthene	mg/kg dry wt	< 0.013	< 0.011	0.21	< 0.012	< 0.013
Chrysene	mg/kg dry wt	< 0.013	< 0.011	0.50	< 0.012	< 0.013
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.013	< 0.011	0.068	< 0.012	< 0.013
Fluoranthene	mg/kg dry wt	< 0.013	< 0.011	1.10	< 0.012	< 0.013
Fluorene	mg/kg dry wt	< 0.013	< 0.011	0.023	< 0.012	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.013	< 0.011	0.39	< 0.012	< 0.013
Naphthalene	mg/kg dry wt	< 0.07	< 0.06	< 0.06	< 0.06	< 0.07
Perylene	mg/kg dry wt	< 0.013	< 0.011	0.133	< 0.012	< 0.013
Phenanthrene	mg/kg dry wt	< 0.013	< 0.011	0.49	< 0.012	< 0.013
Pyrene	mg/kg dry wt	< 0.013	< 0.011	1.21	< 0.012	< 0.013
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	-	< 8	-	-
C10 - C14	mg/kg dry wt	-	-	< 20	-	-
C15 - C36	mg/kg dry wt	-	-	< 40	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	< 70	-	-

Sample Name:		BH06_0.1-0.2 04-Mar-2021	BH06_0.5 04-Mar-2021	BH06_2.5 04-Mar-2021		
Lab Number:		2558716.35	2558716.36	2558716.39		
Individual Tests						
Dry Matter	g/100g as rcvd	94	94	83	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	11	5	5	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	20	18	20	-	-
Total Recoverable Copper	mg/kg dry wt	23	25	11	-	-
Total Recoverable Lead	mg/kg dry wt	25	21	17.9	-	-
Total Recoverable Nickel	mg/kg dry wt	19	15	13	-	-
Total Recoverable Zinc	mg/kg dry wt	82	70	61	-	-
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	-	-	-	-
Toluene	mg/kg dry wt	< 0.05	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.05	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.10	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.05	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	0.6	< 0.3	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	< 0.012	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	< 0.012	-	-
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.011	< 0.012	-	-
Acenaphthene	mg/kg dry wt	< 0.011	< 0.011	< 0.012	-	-
Anthracene	mg/kg dry wt	< 0.011	< 0.011	< 0.012	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.011	0.064	< 0.012	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.011	0.076	< 0.012	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	0.11	< 0.03	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	0.11	< 0.03	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.011	0.096	< 0.012	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.011	0.049	< 0.012	-	-

Sample Type: Soil						
Sample Name:		BH06_0.1-0.2 04-Mar-2021	BH06_0.5 04-Mar-2021	BH06_2.5 04-Mar-2021		
Lab Number:		2558716.35	2558716.36	2558716.39		
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Benzo[g,h,i]perylene	mg/kg dry wt	0.014	0.044	< 0.012	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	0.036	< 0.012	-	-
Chrysene	mg/kg dry wt	< 0.011	0.062	< 0.012	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	0.010	< 0.012	-	-
Fluoranthene	mg/kg dry wt	< 0.011	0.061	< 0.012	-	-
Fluorene	mg/kg dry wt	< 0.011	< 0.011	< 0.012	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.011	0.046	< 0.012	-	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	-	-
Perylene	mg/kg dry wt	< 0.011	0.019	< 0.012	-	-
Phenanthrene	mg/kg dry wt	< 0.011	0.016	< 0.012	-	-
Pyrene	mg/kg dry wt	< 0.011	0.055	< 0.012	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	-	-	-	-
C10 - C14	mg/kg dry wt	< 20	-	-	-	-
C15 - C36	mg/kg dry wt	< 40	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	-	-	-	-

Sample Type: Aqueous						
Sample Name:		HA101_0.3-0.5 [TCLP Extract]	BH102_0.5-0.6 [TCLP Extract]	BH104_0.4-0.5 [TCLP Extract]		
Lab Number:		2558716.44	2558716.45	2558716.46		
Individual Tests						
Total Lead	g/m^3	0.065	0.70	0.36	-	-
Total Zinc	g/m^3	1.31	0.40	-	-	-

2558716.1
HA101_0.0-0.2 11-Mar-2021
Client Chromatogram for TPH by FID



Analyst's Comments

Amended Report: This certificate of analysis replaces report '2558716-SPv1' issued on 01-Apr-2021 at 2:22 pm.
Reason for amendment: Additional testing 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**
Individual Tests			

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-7, 10, 14-15, 18, 22-24, 27, 35-36, 39
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-2, 6-7, 10, 14-15, 18, 22-24, 27, 35-36, 39
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-2, 6-7, 10, 14-15, 18, 22-24, 27, 35-36, 39
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C (modified) 23rd ed. 2017.	-	23
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) 23rd ed. 2017 & Skalar Method I295-004(+P14). ISO 14403:2012(E).	0.10 mg/kg dry wt	23
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-2, 6-7, 10, 14-15, 18, 22-24, 27, 35-36, 39
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-2, 6-7, 10, 14-15, 18, 22-24, 27, 35-36, 39
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	1-7, 10, 14-15, 18, 22-24, 27, 35-36, 39
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis. Tested on as received sample. In-house based on US EPA 8260 and 5021.	0.05 - 0.10 mg/kg dry wt	1, 6, 14-15, 23, 35
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.002 - 0.05 mg/kg dry wt	1-2, 6-7, 10, 14-15, 18, 22-24, 27, 35-36, 39
TPH + PAH + BTEX profile	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1, 6, 14-15, 23, 35
TCLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1311.	-	2, 7, 23
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	8 mg/kg dry wt	1, 6, 14-15, 23, 35
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1, 6, 14-15, 23, 35
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1, 6, 14-15, 23, 35
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1, 6, 14-15, 23, 35
TCLP Profile			
TCLP Weight of Sample Taken	Gravimetric. US EPA 1311.	0.1 g	2, 7, 23
TCLP Initial Sample pH	pH meter. US EPA 1311.	0.1 pH Units	2, 7, 23
TCLP Acid Adjusted Sample pH	pH meter. US EPA 1311.	0.1 pH Units	2, 7, 23
TCLP Extractant Type*	US EPA 1311.	-	2, 7, 23
TCLP Extraction Fluid pH	pH meter. US EPA 1311.	0.1 pH Units	2, 7, 23
TCLP Post Extraction Sample pH	pH meter. US EPA 1311.	0.1 pH Units	2, 7, 23

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	44-46
Total Lead	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.0021 g/m^3	44-46
Total Zinc	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23rd ed. 2017.	0.021 g/m^3	44-45

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

Testing was completed between 29-Mar-2021 and 09-Apr-2021. For completion dates of individual analyses please contact the laboratory.

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

Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

Document prepared by

Aurecon New Zealand Limited
Spark Central
Level 8, 42-52 Willis Street
Wellington 6011

PO Box 1591
Wellington 6140
New Zealand

T +64 4 472 9589
F +64 4 472 9922
E wellington@aurecongroup.com
W aurecongroup.com

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