

*SITE INVESTIGATION REPORT
STAGE 1
ATAWHAI CLOSED LANDFILL
NELSON*

For the Attention of:

Nelson City Council



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Executive Summary

Focus Environmental Services Limited was contracted by Nelson City Council to prepare a Site Investigation Report (SIR) for the Atawhai Closed Landfill in Nelson.

The Atawhai Closed Landfill site is considered to be the area bound by Queen Elizabeth II Drive to the north west, Atawhai Drive to the east, Weka Street to the south and Sovereign Street to the west. The site encompasses 182 land parcels forming Neale Park, Founders Park, The Whakatu Marae, a nursery, Miyazu Gardens the public road North Road, a number of private roads located within Founders Park, Komatua housing and private residential dwellings, with an area of approximately 496,026 m².

During the site investigation, an instantaneous surface monitoring (ISM) gas emission survey, a visual inspection of the surface cover and adjacent shoreline, an investigation of the thickness and quality of the existing landfill cover, sub-ground headspace monitoring for landfill gas, installation and monitoring of ten landfill gas monitoring wells, and an initial assessment of the quality of the underlying leachate/groundwater and potential tidal influence was undertaken.

During the ISM gas emission survey, the concentrations of methane were continuously monitored at the ground surface across the footprint of the Atawhai Closed Landfill.

Elevated concentrations of methane were identified within underground services and in areas where visual cracking could be observed, primarily in the northern area of the site. No positive gas readings (>100 ppm) were observed across the residential area of the site.

During the visual inspection of the surface cover of the Council owned area of the Atawhai Closed Landfill any evidence of vegetation distress, settlement, cracking, surface pooling and potential seeps/leachate were recorded.

Evidence of vegetation distress, settlement and surface pooling were identified, predominantly in the far northern area of the site. In addition, an area of a potential seep was identified along the western boundary in the far northern area of the site and two areas of visible surface cracking were noted along the north-western area of the site.

During the inspection of the adjacent shoreline any services, potential preferential pathways and potential seeps/leachate were recorded.

Evidence of a number of stormwater outlets and pipes potentially acting as preferential pathways were identified. In addition, two areas of potential seeps were identified in the northern area of the site.

During the investigation of the landfill cover, a total of fifty hand auger boreholes were completed to a maximum depth of 1.0 m below ground level (bgl) and an additional 31 boreholes were extended to a maximum depth of 2.0m bgl using a track mounted mechanical auger, across the footprint of the Atawhai Closed Landfill.

Boreholes typically encountered a thin layer of topsoil, underlain by silty clay of varying thickness, with minor gravel. Locations where the thickness of the cap materials were recorded at less than 0.3 m (less than half of that recommended), appear to be confined to the far northern area of the site, the area of the nursery and the central and south-western areas of Neale Park.

With the exception to a single hand auger location, refuse materials were not encountered across the residential area and cap thickness across this area were typically considered sufficient (>0.6 m).

During the investigation of landfill cover a total of fifty surface soil samples were collected from across the Atawhai Closed Landfill site in order to characterise the potential contamination associated with the cover materials.

Elevated concentrations of contaminants were detected in the surface soils across the site. In addition, with the exception to two samples collected within the residential zone, the concentrations of soil contaminants detected across the Atawhai Closed Landfill site were below the relevant soil guideline values.

During the investigation of the potential for landfill gas to be discharged from the Atawhai Closed Landfill site a total of ten landfill gas monitoring wells (MW01 - MW10) were installed across the site.

Landfill gas indicators were identified in all of the landfill gas monitoring wells installed at Atawhai Closed Landfill. With the exception to monitoring wells MW01, MW09 and MW10, concentrations of methane were recorded at levels exceeding the lower explosive limit (LEL). In addition, concentrations of carbon dioxide (CO₂), carbon monoxide (CO) and hydrogen sulphide (H₂S) were detected at selected locations at levels above the Workplace Exposure Standards for the short-term exposure limit (STEL) and/or the 8-hour time weighted average (TWA).

During the investigation of the leachate/groundwater at the Atawhai Closed Landfill, representative groundwater samples were collected from four of the monitoring wells installed at the site (MW02, MW03, MW04 and MW07).

Leachate indicators were identified in all of the groundwater samples sent for analysis. In addition, concentrations of specific contaminants were detected at concentrations elevated above the Australian and New Zealand Environment Conservation Council (ANZECC) Guidelines for the protection of both 95% and 80% of marine water species.

During the investigation of the tidal influence on the groundwater at the site, groundwater levels were measured from within an hour of mean high tide and mean low tide from the ten monitoring wells installed at the site (MW01 - MW10).

With the exception to monitoring wells MW01, MW05 and MW10, notable tidal influences were recorded for all of the monitoring wells at Atawhai Closed Landfill.

Due to the landfill gas, contaminated soils and contaminated leachate/groundwater identified, it is recommended that the initial site-specific risk assessment is updated and the results of this site investigation report are utilised to develop a long-term site monitoring and management plan for the Atawhai Closed Landfill.

It is recommended that Nelson City Council utilise the long-term site monitoring and management plan to monitor the natural attenuation process within the Atawhai Closed Landfill and to provide procedures and processes for any future ground-breaking works or development at the site.

Submitted By,



David O'Reilly
Principal Environmental Consultant
Focus Environmental Services Limited

1.0 Scope

- 1.1 This report has been prepared at the request of Nelson City Council (“the Client”) in terms of the Focus Environmental Services Agreement (“Agreement”).
- 1.2 The following report is based on:
 - *Information provided by the client;*
 - *The report titled ‘Preliminary Site Investigation, Atawhai Closed Landfill, Nelson’ dated October 2016 and prepared by Focus Environmental Services Limited;*
 - *An ISM gas emission survey;*
 - *A visual inspection of the site and adjacent shoreline;*
 - *Landfill gas monitoring;*
 - *Site investigation and soil sampling; and*
 - *Leachate/Groundwater sampling.*
- 1.3 We have not independently verified the information provided to us by the Client or its completeness. We do not express an opinion on the accuracy or the reliability of such information.
- 1.4 No warranties are given, intended or implied.
- 1.5 Opinion, inferences, assumptions and interpretations made in this report should not be construed as legal opinion.
- 1.6 Where an assessment is given in this report, the Client must also rely upon their own judgement, knowledge and assessment of the subject of this report before undertaking any action.
- 1.7 This report must not be used in any other context or for any other purpose other than that for which it has been prepared without the prior written consent of Focus Environmental Services.
- 1.8 This report is strictly confidential and intended for the sole use of the Client and shall not be disclosed without the prior written consent of Focus Environmental Services.

2.0 Site Identification

The Atawhai Closed Landfill site is considered to be the area bound by Queen Elizabeth II Drive to the north west, Atawhai Drive to the east, Weka Street to the south and Sovereign Street to the west as shown in Figure 1 attached. The site is located at latitude - 41.260850 and longitude 173.296022.

The site encompasses 182 land parcels forming Neale Park, Founders Park, The Whakatu Marae, a nursery, Miyazu Gardens the public road North Road a number of private roads located on Founders Park, Komatua housing and private residential dwellings with an area of approximately 496,026 m².

3.0 Geology and Hydrology

Published geological maps¹ indicate the site is underlain by anthropic deposits (landfill). Landfill materials are likely to be underlain by Port Hills Gravel in the north and Holocene river deposits in the south. A description of the underlying geologies is presented in Table 1 below.

Table 1: Geology of Atawhai Closed Landfill

Key name	OIS1 (Holocene) landfill and reclaimed land
Simple name	Holocene human-made deposits
Main rock name	Boulders
Stratigraphic age	Q1
Description	Reclaimed land with fill consisting of wood domestic waste sand and boulders
Subsidiary rocks	Gravel sand
Key group	Holocene anthropic deposits
Absolute age (min)	0.0 million years
Absolute age (max)	0.014 million years
Rock group	Fill
Rock class	Clastic sediment
QMAP sheet name	Nelson

Limited geotechnical information available for the site reports that the site is covered with a surficial layer of topsoil (typically 0.2-0.3 m) underlain with refuse materials, subsequently underlain with alluvial deposits, primarily gravels and gravelly silts.

Groundwater has previously been measured at the site at approximately 2.5 m below ground level (bgl) and is anticipated to flow in a north easterly direction, towards the Nelson Haven.

The nearest surface water bodies to the site are the onsite ponds located at Founders Park and the Miyazu Gardens, and the Nelson Haven to the immediate north west of the site.

¹ Geology of the Nelson Area (Institute of Geological & Nuclear Sciences 1:25,000 geological map 9, 1998)

4.0 Background

The history of the site has been described in detail in the report titled '*Preliminary Site Investigation, Atawhai Closed Landfill, Nelson*' dated October 2016 and prepared by Focus Environmental Services Limited (henceforth referred to as the PSI).

In brief, the site has been subject to reclamation/landfilling since before 1942, ending with the opening of the York Valley Landfill in 1987.

The Atawhai Closed Landfill site is considered to be the area bound by Queen Elizabeth II Drive to the north west, Atawhai Drive to the east, Weka Street to the south and Sovereign Street to the west.

The site encompasses 182 land parcels forming Neale Park, Founders Park, The Whakatu Marae, a nursery, Miyazu Gardens the public road North Road, a number of private roads located on Founders Park, Komatua housing and private residential dwellings with an area of approximately 496,026 m².

Atawhai Closed Landfill appears to have been formed without an underlying barrier and is contained by an earth bund on the seaward side, which has been widened to form Queen Elizabeth II Drive.

Based on the duration following the completion of landfilling activities and the information gaps identified, the PSI concluded that there was potential for discharges from the Atawhai Closed Landfill to impact on site workers, site users, residents and the neighbouring environment.

Due to the potential for landfill discharges from the Atawhai Closed Landfill and due to the information gaps identified, in order to assess the potential immediate risk associated with the site, an investigation of the potential for landfill gas and leachate discharges was recommended.

The report titled '*Site Management Plan, Atawhai Closed Landfill, Nelson*' dated November 2016 and prepared by Focus Environmental Services Limited contains and an initial risk assessment for the site and details of the investigation proposed to assess the potential for landfill discharges from the site.

This document is intended to provide Nelson City Council with the results of the Stage 1 investigation into the potential landfill discharges from the site.

5.0 Sampling and Analysis Plan and Sampling Method

5.1 Gas Emission Survey

In order to identify any landfill gas discharges from the Atawhai Closed Landfill site an instantaneous surface monitoring (ISM) gas emission survey was undertaken.

The ISM survey was completed across the footprint of the Atawhai Closed Landfill over an approximate 30 m grid pattern and targeted any buried services, site buildings, deep rooting vegetation, areas of settlement, areas of vegetation distress, cracks and areas of leachate identified.

The ISM survey was completed using a RKI Instruments Eagle portable gas detector in accordance with the Ministry for the Environment (MfE) procedures².

The level of methane was continuously monitored, with the instrument range being from 0 ppm to 50,000 ppm (5%). At all locations, the gas detector wand was held 50-100 mm above the ground surface and readings in excess of 100 ppm were recorded.

5.2 Investigation of Landfill Cover

In order to determine the thickness and quality of the existing landfill cover a total of fifty hand auger boreholes were completed on a 100 m grid pattern, to a maximum depth of 1.0 m below ground level (bgl), across the footprint of the Atawhai Closed Landfill.

Prior to the commencement of the hand auger boreholes the presence of underground services was checked using a SPX C.A.T4 service locator.

In addition, due to refusal at a number of the hand auger locations the site was re-visited and a total of 31 boreholes were extended to a maximum depth of 2.0m bgl using a track mounted mechanical auger.

Prior to the commencement of the boreholes the presence of underground services was cleared by Safety First Cable Locators Limited.

Continuous landfill gas monitoring was undertaken during the well installation works using an REA systems QRAE(II) LEL multi gas meter.

Borehole cores were photographed and logged in accordance with the NZ Geotechnical Society Guidelines. In addition, the investigation locations were inspected for visual and olfactory signs of contamination, which included a visual inspection for the presence of refuse materials, demolition debris and asbestos containing materials (ACM).

During the investigation of landfill cover, in order to characterise the potential contamination associated with the soils forming the landfill cover, a total of fifty surface samples (0.0 – 0.15 m) were collected from the fifty hand auger locations completed across the site (HA01 SUR – HA50 SUR).

Environmental Sampling was carried out in accordance with the Contaminated Land Management Guidelines No.5 (Ministry for the Environment, 2011).

² A guide for the management of closing and closed landfills in New Zealand, Ministry for the Environment, 2001.

The fifty discrete surface samples were sent under full chain of custody documentation to an IANZ accredited laboratory and analysed for:

- Total recoverable arsenic, cadmium, chromium, copper, lead, nickel and zinc;
- organo-chlorine pesticides; and
- poly-aromatic hydrocarbons.

Following the completion of each hand auger borehole, sub-ground headspace monitoring for landfill gas was carried out for methane (CH₄), carbon dioxide (CO₂), carbon monoxide (CO), hydrogen sulphide (H₂S) and oxygen (O₂) using a Telegan GA5000 infrared gas analyser. In addition, gas pressures and flow rate were recorded for each monitoring location.

The borehole location plans are presented as Figure 2-1, Figure 2-2A and Figure 2-2B.

5.3 Landfill Gas Well Installation and Monitoring

In order to determine the potential for landfill gas to be discharged from the Atawhai Closed Landfill site a total of ten Landfill Gas Wells (MW01 – MW10) were installed to a maximum depth of 6.0 m below ground level adjacent to identified sensitive receptors and the landfill boundaries.

The Landfill Gas Wells were installed by Pro-Drill, under direct supervision of Focus Environmental Services Limited, between the 2nd and 4th of May 2017 in general accordance with industry best practice and the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999).

Prior to the commencement of the Landfill Gas Well installation the presence of underground services was checked using a SPX C.A.T4 service locator and cleared by Delta Utility Services Limited and Nelmac Limited.

Continuous landfill gas monitoring was undertaken during the well installation works using an REA systems QRAE(II) LEL multi gas meter.

Landfill Gas Well boreholes were photographed and logged in accordance with the NZ Geotechnical Society Guidelines.

In addition, the Landfill Gas Well boreholes were inspected for visual and olfactory signs of contamination, which included a visual inspection for the presence of refuse materials, demolition debris and ACM.

Following the installation of the landfill gas monitoring wells the levels of methane (CH₄), carbon dioxide (CO₂), carbon monoxide (CO), hydrogen sulphide (H₂S) and oxygen (O₂) were measured using a GA5000 infrared gas analyser. In addition, gas pressures and flow rate were recorded for each monitoring well.

In order to characterise the underlying leachate/groundwater, representative groundwater samples were collected from four of the monitoring wells installed at the site (MW02, MW03, MW04 and MW07).

Prior to purging, the depth to groundwater was measured from the top of the well casings and recorded.

Groundwater samples were sent under full chain of custody documentation to an IANZ accredited laboratory and analysed for:

- Soluble arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury, calcium, iron, boron, magnesium, manganese, potassium and sodium;
- pH and electrical conductivity;
- Total alkalinity;
- Total hardness;
- Total phosphorus;
- Chloride;
- Total ammoniacal-N;
- Chemical Oxygen Demand (COD); and
- Carbonaceous Biological Oxygen Demand (cBOD).

In order to establish the tidal influence on the groundwater at the site, representative groundwater samples were collected from within an hour of mean high tide and mean low tide from the ten monitoring wells installed at the site.

The Landfill Gas Well locations are shown on Figure 3.

6.0 Field Sampling Quality Assurance

All sampling implements were triple washed between samples using clean tap water, followed by a solution of laboratory grade phosphate free detergent (Decon 90), and a final rinse with de-ionised water.

Groundwater samples were collected using dedicated PVC bailers.

Clean, latex gloves were worn when handling each sample. Samples were stored in laboratory cleaned glass jars and immediately placed in an iced cooler. The samples were transported under chain of custody documentation to an IANZ accredited laboratory for analysis

7.0 Laboratory Quality Assurance

Routine laboratory quality assurance procedures include analysis of laboratory blanks and spiked samples. All analyses were carried out using industry standard methods for soils and groundwater as follows:

7.1 Soil Analysis

- Total Recoverable Metals - Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.
- Organo-chlorine pesticides - sonication extraction - OCP Screen method, air dry, grind, sonication extraction GC-ECD.
- Poly-Aromatic Hydrocarbons - Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines.

7.2 Groundwater Analysis

- Dissolved heavy metals (trace): As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, Ca, Fe, B, Mg, Mn, K and Na - 0.45µm filtration, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.
- pH - pH meter. APHA 4500-H+ B 22nd ed. 2012.
- Electrical Conductivity (EC) - Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.
- Total Ammoniacal-N - Filtered sample. Phenol/hypochlorite colorimetry. Discrete Analyser. (NH₄-N = NH₄⁺-N + NH₃-N). APHA 4500-NH₃ F (modified from manual analysis) 22nd ed. 2012.
- Chemical Oxygen Demand - Dichromate/sulphuric acid digestion in Hach tubes, colorimetry. Trace Level method. APHA 5220 D 22nd ed. 2012.

8.0 Basis for Guideline Values

8.1 Gas Analysis

The concentrations of methane (CH₄) detected during the ISM survey and the Landfill Gas Well monitoring will be compared to the Landfill Guidelines³.

The surface emission limit adopted at the Atawhai Closed Landfill is 0.5% (5,000 ppm), which corresponds to 10% of the lower explosive limit (LEL) for methane. In addition, the results in and around the site buildings will be compared to those values presented in Table 2 below.

Table 2: Landfill Gas Guidelines (Buildings): Atawhai Closed Landfill

Methane Concentration	Action
<0.5% (< 5,000 ppm)	No immediate action required.
0.5% to 1.0% (5,000 to 10,000 ppm)	Implement gas control measures and undertake further monitoring.
>1.0% (> 10,000 ppm)	Evacuate building, switch off all ignition sources and carry out remedial work as soon as possible prior to re-occupation.

In the absence of buildings within 250 metres of the landfill boundary, the USEPA guidance value, above which gas control is required, is 5% methane in a boundary probe. Based on the proximity of the site to residential properties, a perimeter limit of 1.25% methane, which corresponds to 25% of the LEL for methane, has been adopted.

In addition, the concentrations of carbon dioxide (CO₂), carbon monoxide (CO) and hydrogen sulphide (H₂S) will be compared to the New Zealand Workplace Exposure Standards⁴, both for the short-term exposure limit (STEL) and the 8-hour time weighted average (TWA) as outlined in Table 3 below.

Table 3: New Zealand Workplace Exposure Standards for Landfill Gas.

Sample	STEL	8-hour TWA
CO ₂	3% v/v	0.5% v/v
CO	200 ppm	25 ppm
H ₂ S	15 ppm	10 ppm

³ Landfill Guidelines, Centre for Advanced Engineering, University of Canterbury, 2000.

⁴ Workplace Exposure Standards and Biological Exposure Indices, Worksafe New Zealand, 2017.

8.2 Soil Analysis

Due to the existing residential, recreational and commercial/industrial outdoor worker use of the Atawhai Closed Landfill, the guideline values of the Soil Contaminant Standards for health ($SCS_{(health)}$) for residential land use (10% produce consumption), recreational land use and commercial/industrial outdoor worker (unpaved), as outlined in the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES) are considered relevant and have been adopted as the site assessment criteria. In addition, the concentrations of heavy metals detected will be compared to the recommended cleanfill criteria for the Tasman/Nelson region⁵. The relevant values of the above guidelines have been reproduced in Table 4 below.

Table 4: Site Assessment Criteria (Soil) - Atawhai Closed Landfill (mg/kg)

Parameter	$SCS_{(health)}$ Residential	$SCS_{(health)}$ Recreational	$SCS_{(health)}$ Commercial/ Industrial	Cleanfill Criteria
Arsenic	20	80	70	12
Cadmium	3	400	1,300	0.75
Chromium	460	2,700	6,300	140
Copper	NL	NL	NL	83
Lead	210	880	3,300	86
Nickel	400 ¹	1,200 ²	6,000 ³	58
Zinc	7400 ¹	30,000 ²	400,000 ³	300
Total DDT	70	400	35	-
Dieldrin	2.6	70	70	-
BaP eq.	10	40	1,300	-

Note: NL = No Limited. This is where the derived values exceed 10,000mg/kg; 1, 2 & 3. = No Soil Contaminant Standards for health ($SCS_{(health)}$) given, guideline values derived in accordance with the Contaminated Land Management Guidelines number 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011), and taken from the National Environment Protection (Assessment of Site Contamination) Measure 1999 for Residential, Recreational or Commercial/Industrial land use.

Furthermore, the natural background levels of organo-chlorine pesticides and polycyclic aromatic hydrocarbons are considered to be below the analytical levels of detection and hence the detection of these analytes would restrict material from being classified as cleanfill material.

⁵ Background concentrations of trace elements and options for managing soil quality in the Tasman and Nelson Districts, Landcare Research, 2015

8.3 Groundwater Analysis

The trigger values of the Australian and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Water Quality (2000) for the protection of 95% and 80% of marine water species are considered relevant and have been adopted as the site assessment criteria. In addition, Groundwater parameters were chosen in reference to the Landfill Guidelines⁶ and the Ministry for the Environment (MfE) guidance⁷. The relevant values of these guidelines have been reproduced in Table 5 below.

Table 5: Site Assessment Criteria (Groundwater) - Atawhai Closed Landfill (mg/L)

Parameter	ANZECC 95%	ANZECC 80%
Arsenic	0.0045 ¹	0.0045 ¹
Cadmium	0.0055	0.036
Chromium	0.0044	0.085
Copper	0.0013	0.008
Lead	0.0044	0.012
Nickel	0.07	0.56
Zinc	0.015	0.043
Mercury	0.0004	0.0014
Boron	5.1 ¹	5.1 ¹
Iron	0.3 ¹	0.3 ¹
Manganese	0.08 ¹	0.08 ¹
Ammoniacal Nitrogen	0.03 ²	0.24 ²
Nitrate-N	7.2 ³	12 ³
Chemical Oxygen Demand	-	-
Chloride	-	100 ⁴

Note: 1 = Low reliability trigger value, ANZECC (2000); 2 = No ANZECC guidelines available, value obtained from "Derivation of indicative ammoniacal nitrogen guidelines for the National Objectives Framework", NIWA, 2014; 3 = No ANZECC guidelines available, value obtained from "Nitrate guideline values in ANZECC 2000 - correction", NIWA, 2002; 4 = No ANZECC guidelines available, value obtained from "Soil Remediation Circular 2009, Ministry of Infrastructure and the Environment".

⁶ Landfill Guidelines, Centre for Advanced Engineering, University of Canterbury, 2000.

⁷ A guide for the management of closing and closed landfills in New Zealand, Ministry for the Environment, 2001.

9.0 Results and Discussion

9.1 Gas Emission Survey

The instantaneous surface monitoring (ISM) gas emission survey was undertaken across the footprint of the Atawhai Closed Landfill using a RKI Instruments Eagle portable gas detector during the week of the 1st of May 2017.

During the ISM gas emission survey, a total of twenty-three positive gas readings were recorded. A total of five readings exceeded 1,000 ppm, with one reading exceeding 5,000 ppm (10% LEL) for methane at monitoring location (GD02).

Elevated concentrations of methane detected during the gas emission survey were generally confined to underground services and areas where visual cracking could be observed in the northern area of the site.

Summarised positive gas readings (>100 ppm) of the Gas Emission Survey are presented in Appendix A, photographs of the locations of the positive gas readings are presented as Appendix B, and the site plan illustrating the locations of the is presented as Figure 4.

9.2 Visual Inspection

A visual inspection of the surface cover across the footprint of the council owned area of the Atawhai Closed Landfill was undertaken during the week of the 1st of May 2017.

During the inspection evidence of vegetation distress, cracking, uneven/hummocky ground, surface pooling and seeps/leachate were recorded.

Evidence of vegetation distress, uneven/hummocky ground and surface pooling appeared to be limited to the far northern area of the site.

An area of a potential seep was identified along the western boundary in the far northern area of the site and two areas of visible surface cracking were noted along the north-western area of the site.

It should be noted that a number of passive ventilation towers, connected to underlying services, were identified in the area of the Miyazu Gardens and the onsite nursery.

Photographs of site features are presented in Appendix C and the visual inspection plan is presented as Figure 5.

In addition, in order to identify any potential preferential pathways or connections between the Atawhai Closed Landfill and the Nelson Haven a visual inspection of the shoreline adjacent to the Atawhai Closed Landfill was undertaken during low-tide on the 20th of July 2017.

During the inspection a number of stormwater outlets and pipes were identified. In addition, evidence of potential seeps were identified at two locations during the shoreline inspection undertaken

Photographs of the shoreline features are presented in Appendix D and the shoreline inspection plan is presented as Figure 6.

9.3 Landfill Cover Investigation

During the investigation of the landfill cover, a total of fifty hand auger boreholes were completed to a maximum depth of 1.0 m below ground level (bgl) across the footprint of the Atawhai Closed Landfill. However, due to significant gravel being present at a number of the hand auger borehole locations, which restricted the target depth from being achieved, the site was re-visited and 31 boreholes were extended to a maximum depth of 2.0m bgl using a track mounted mechanical auger.

In accordance with the Ministry for the Environment (MfE) guidance⁸ the recommended final cap should consist of the following:

- 150 mm topsoil layer for vegetation
- 600 mm compacted barrier layer ($k \leq 1 \times 10^{-7}$ m/s)
- 300 mm compacted subgrade or foundation layer.

Boreholes typically encountered a thin layer of topsoil, underlain by silty clay of varying thickness, with minor gravel.

Locations where the thickness of the cap materials were recorded at less than 0.3 m (less than half of that recommended), appear to be confined to the far northern area of the site, the area of the nursery and the central and south-western areas of Neale Park.

With the exception to a single hand auger location (HA26), refuse materials were not encountered across the residential area. In addition, cap thickness across the residential area was typically greater than 0.6 m.

Elevated concentrations of methane were detected at a number of borehole locations, predominantly where refuse materials were encountered. It should be noted that methane was not recorded at any of the borehole locations completed across the residential area of the site.

The hand auger, borehole and monitoring well logs are presented in Appendix E and the site plan illustrating the thickness of the identified capping material is presented as Figure 7-1 and Figure 7-2.

During the Investigation of Landfill Cover, in order to characterise the potential contamination associated with the cover materials, a total of fifty surface samples (0.0 – 0.1 m) were collected from fifty hand auger locations across the Atawhai Closed Landfill site (HA01 SUR – HA50 SUR).

Due to the mixed use of the site the sample results will be compared to the relevant SCS_(health) for the site zones, being residential, recreational and commercial/industrial, as presented in Figure 8.

Summarised soil sampling results are presented in Tables 6, 7 & 8 below. Laboratory transcripts are provided in Appendix F and tabulated soil sampling results are presented in Appendix G.

⁸ A guide for the management of closing and closed landfills in New Zealand, Ministry for the Environment, 2001.

Table 6: Summary Results: Residential Area - Atawhai Closed Landfill (mg/kg).

	Analyte	Min	Max	Cleanfill Criteria	SCS _(health) Residential
Heavy Metals	Arsenic	4	9	12	20
	Cadmium	0.14	0.55	0.75	3
	Chromium	40	164	140	460
	Copper	31	98	83	NL
	Lead	32	550	86	210
	Nickel	37	230	58	400
	Zinc	82	430	300	7400
OCPs	Total DDT	<0.06	5.3	-	70
	Dieldrin	<0.010	0.105	-	2.6
PAHs	BaP eq.	0.37	13.1	-	10

Note: NL = Not Limited, where the derived values exceed 10,000mg/kg. Results in **Red** exceed the SCS_(health) for residential land use. Results in **Bold** exceed the cleanfill criteria.

During the investigation of the landfill cover, a total of twelve samples were collected from within the residential zone.

The concentrations of chromium detected in one sample, copper detected in one sample, lead detected in six samples, nickel detected in ten samples and zinc detected in one sample were elevated above the cleanfill criteria.

In addition, the concentration of Total DDT detected in five samples, dieldrin detected in two samples and BaP eq. detected in all samples were elevated above the cleanfill criteria.

With the exception to a single concentration of lead detected and a single concentration of BaP eq., the concentration of contaminants detected in the residential zone were below the SCS_(health) for residential land use as outlined in the NES.

Table 7: Summary Results: Recreational Area - Atawhai Closed Landfill (mg/kg).

	Analyte	Min	Max	Cleanfill Criteria	SCS _(health) Residential
Heavy Metals	Arsenic	3	36	12	80
	Cadmium	0.1	0.4	0.75	400
	Chromium	8	240	140	2,700
	Copper	14	270	83	NL
	Lead	2.9	280	86	880
	Nickel	10	480	58	1,200
	Zinc	22	240	300	30,000
OCPs	Total DDT	<0.06	0.19	-	400
	Dieldrin	<0.010	0.017	-	70
PAHs	BAP eq.	<0.07	11.3	-	40

Note: NL = Not Limited, where the derived values exceed 10,000mg/kg. Results in **Red** exceed the SCS_(health) for recreational land use. Results in **Bold** exceed the cleanfill criteria.

During the investigation of the landfill cover, a total of thirty samples were collected from within the recreational zone.

The concentrations of arsenic detected in two samples, chromium detected in six samples, copper detected in one sample, lead detected in five samples and nickel detected in twenty samples were elevated above the cleanfill criteria.

In addition, the concentration of Total DDT detected in eight samples, dieldrin detected in one sample and BaP eq. detected in twenty samples were elevated above the cleanfill criteria.

The concentration of all contaminants detected in the recreational zone were below the SCS_(health) for recreational land use as outlined in the NES.

Table 8: Summary Results: Commercial/Industrial Area - Atawhai Closed Landfill (mg/kg).

	Analyte	Min	Max	Cleanfill Criteria	SCS _(health) Commercial/Industrial
Heavy Metals	Arsenic	5	18	12	70
	Cadmium	0.14	0.4	0.75	1,300
	Chromium	31	107	140	6,300
	Copper	42	570	83	NL
	Lead	43	920	86	3,300
	Nickel	32	167	58	6,000 ³
	Zinc	76	350	300	400,000 ³
OCPs	Total DDT	<0.06	<0.06	-	35
	Dieldrin	<0.010	<0.010	-	70
PAHs	BAP eq.	0.48	4.5	-	1,300

Note: NL = Not Limited, where the derived values exceed 10,000mg/kg. Results in **Red** exceed the SCS_(health) for commercial/industrial land use. Results in **Bold** exceed the cleanfill criteria.

During the investigation of the landfill cover, a total of nine samples were collected from within the commercial/industrial zone.

The concentrations of arsenic detected in three samples, copper detected in two samples, lead detected in three samples and nickel detected in five samples were elevated above the cleanfill criteria.

In addition, the concentrations of BaP eq. detected in all samples were elevated above the cleanfill criteria.

The concentration of all contaminants in the commercial/industrial zone were below the SCS_(health) for commercial/industrial land use as outlined in the NES.

9.4 Landfill Gas Monitoring Results

Following the completion of the fifty hand auger boreholes, sub-ground headspace monitoring for landfill gas was carried out for methane (CH₄), carbon dioxide (CO₂), carbon monoxide (CO), hydrogen sulphide (H₂S) and oxygen (O₂) using a Telegan GA5000 infrared gas analyser. Summarised sub-ground headspace monitoring results are presented in Tables 9 below.

Table 9: Summary Sub-Ground Results: Atawhai Closed Landfill.

Parameter	Min.	Max.
CH ₄ (% v/v)	0	36.3
CO ₂ (% v/v)	0.1	<u>14.9</u>
O ₂ (% v/v)	5.5	21.6
CO (ppm)	0	6
H ₂ S (ppm)	0	1

Note: Results in **red** exceed the lower explosive limit (LEL) for methane of 5% (v/v). Results in **Bold** exceed the perimeter probe limit of 1.25% for methane. Results underlined exceed the STEL. Results in *Italics* exceed the TWA.

Concentration of CH₄ were recorded at levels exceeding the perimeter probe limit in three of the monitoring locations, with concentrations of CH₄ exceeding the LEL at two of these monitoring locations (HA03 & HA15).

Concentrations of CO₂ were recorded at levels exceeding the STEL in nine of the monitoring wells. The concentrations of CO₂ in thirty-four of the monitoring locations exceeded the TWA.

No concentrations of CO or H₂S were recorded at levels elevated above the STEL or the TWA at any of the monitoring locations.

It should be noted that methane was not recorded at any of the monitoring locations completed across the residential area of the site. In addition, no concentrations of CO₂ were recorded at levels exceeding the STEL across the residential area of the site.

Gas readings could not be obtained from locations HA22 and HA24 during the sub-ground headspace monitoring event.

The sub-ground headspace monitoring results are presented in full in Appendix H and the site plan illustrating the positive methane detections is presented as Figure 9.

The landfill gas monitoring wells MW01-MW10 were installed at the site between the 2nd and 4th of May 2017 to monitor the potential for landfill gas at the Atawhai Closed Landfill.

The Landfill Gas Wells were installed by Pro-Drill, under direct supervision of Focus Environmental Services Limited, between the 2nd and 4th of May 2017 in general accordance with industry best practice and the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999).

With the exception to monitoring well MW06, where 5% LEL was detected at 1.0 m bgl, landfill gas was not detected during the installation of any of the monitoring wells using the REA systems QRAE(II) LEL multi gas meter.

The well construction details are provided in Table 10 below, the monitoring well borehole logs are presented as Appendix E and the location of the monitoring wells are presented in Figure 3.

Table 10: Well Construction Details: Atawhai Closed Landfill, Nelson

Well ID	Total Depth (m btoc)	Screen Interval (m btoc)
MW01	6.53	1.53 – 6.53
MW02	6.56	1.56 – 6.56
MW03	6.54	1.54 – 6.54
MW04	6.47	1.47 – 6.47
MW05	6.45	1.45 – 6.45
MW06	6.53	1.53 – 6.53
MW07	6.50	1.50 – 6.50
MW08	6.51	1.51 – 6.51
MW09	6.54	1.54 – 6.54
MW10	6.53	1.53 – 6.53

Note: m btoc = meters below top of casing.

Following the installation of the monitoring wells the levels of methane (CH₄), carbon dioxide (CO₂), carbon monoxide (CO), hydrogen sulphide (H₂S) and oxygen (O₂) were measured using a Telegan GA5000 infrared gas analyser. In addition, gas pressures and flow rate were recorded for each monitoring well.

Summarised gas monitoring results are presented in Table 11 below and tabulated landfill gas monitoring data is presented as Appendix I.

Table 11: Gas Monitoring Results: Atawhai Closed Landfill, Nelson

Borehole	CH ₄ (% v/v)	CO ₂ (% v/v)	O ₂ (% v/v)	CO (ppm)	H ₂ S (ppm)
MW01	0	<u>13</u>	13	0	0
MW02	33	<u>38.2</u>	0.8	0	1
MW03	32.6	<u>18</u>	4.6	71	<u>43</u>
MW04	14.2	<u>9</u>	15.4	5	6
MW05	7.4	<u>7</u>	18	0	1
MW06	9.8	2.2	13.3	30	0
MW07	7	<u>8.2</u>	4.6	2	0
MW08	39.7	<u>28.2</u>	0.2	0	0
MW09	0	<u>4.1</u>	14.6	2	0
MW10	0	<u>6.6</u>	11.3	0	0

Note: Results in **red** exceed the lower explosive limit (LEL) for methane of 5% (v/v). Results in **Bold** exceed the perimeter probe limit of 1.25% for methane. Results underlined exceed the STEL. Results in *Italics* exceed the TWA.

Landfill gas indicators were identified in all of the landfill gas monitoring wells installed at Atawhai Closed Landfill.

With the exception to monitoring wells MW01, MW09 and MW10, concentrations of CH₄ were detected at levels elevated above the LEL and the perimeter probe limit in all of the landfill gas monitoring wells installed at Atawhai Closed Landfill.

In addition, concentrations of CH₄ were recorded at levels greater than 30 % (v/v) in monitoring wells MW02, MW03 and MW08.

With the exception to monitoring wells MW06, concentrations of CO₂ were recorded at levels exceeding the STEL in all of the monitoring wells. The concentrations of CO₂ in all monitoring wells exceeded the TWA.

Concentrations of CO were recorded at levels elevated above the TWA at monitoring wells MW03 and MW06. The concentrations of CO recorded were all below the STEL.

Concentrations of H₂S were recorded at levels elevated above the STEL and TWA at monitoring well MW03.

9.5 Groundwater Monitoring Results

In order to characterise the underlying leachate/groundwater, representative groundwater samples were collected from four of the monitoring wells installed at the site (MW02, MW03, MW04 and MW07).

Groundwater monitoring results are presented in Tables 12 to 15 below and laboratory transcripts are provided in Appendix J.

Table 12: Groundwater Data: Atawhai Closed Landfill, Nelson

Well ID	Depth to SPH (m btoc)	Depth to Water (m btoc)
MW01	ND	4.52
MW02	ND	5.43
MW03	ND	3.27
MW04	ND	3.10
MW05	ND	4.05
MW06	ND	2.29
MW07	ND	1.99
MW08	ND	3.09
MW09	ND	2.04
MW10	ND	3.49

Note: m btoc = meters below top of casing. ND = Not Detected.

Table 13: pH, Conductivity and Hardness - Atawhai Closed Landfill, Nelson

Well ID	pH (pH units)	Conductivity (mS/cm)	Total Hardness (mg/l per CaCO ₃)
MW02	6.2	80.0	340
MW03	6.9	225	730
MW04	6.8	179.3	570
MW07	6.8	61.3	220

Table 14: Heavy Metal Results - Atawhai Closed Landfill, Nelson (mg/L)

Analyte	MW02	MW03	MW04	MW07
Arsenic	0.42	0.005	0.0024	0.0020
Boron	0.62	1.42	1.19	0.099
Cadmium	<0.00005	<0.00005	<0.00005	<0.00005
Chromium	0.0090	<0.0010	0.0011	<0.0005
Copper	0.0007	<0.0005	0.0013	<0.0005
Lead	<0.00010	0.00012	0.00083	<0.00010
Nickel	0.036	0.0074	0.0090	0.0151
Zinc	0.021	0.0102	0.033	0.0179
Iron	7.9	0.03	0.52	5.7
Manganese	2.9	1.54	1.61	1.1

Note: Results in **red** exceed the ANZECC 2000 guidelines for the protection of 80% of marine species. Results in **Bold** exceed ANZECC 2000 guidelines for the protection of 95% of marine species.

Table 15: Other Potential Contaminant Results - Atawhai Closed Landfill, Nelson (mg/L)

Analyte	MW02	MW03	MW04	MW07
Total Alkalinity	440	1250	1010	330
Total Ammoniacal-N	3.6	80	55	2.2
Nitrate	< 0.002	0.004	0.008	< 0.002
Chemical Oxygen Demand	130	90	170	104
Chloride	23	60	50	16.6

Note: Results in **red** exceed the ANZECC 2000 guidelines for the protection of 80% of marine species. Results in **Bold** exceed ANZECC 2000 guidelines for the protection of 95% of marine species.

The concentration of arsenic detected in groundwater samples MW02 and MW04 were elevated above the ANZECC trigger values for the protection of both 95% and 80% of marine water species.

The concentration of chromium detected in groundwater sample MW02 was elevated above the ANZECC trigger values for the protection of 95% of marine water species, but was below the ANZECC trigger values for the protection of 80% of marine water species.

The concentration of zinc detected in groundwater samples MW02, MW04 and MW07 were elevated above the ANZECC trigger values for the protection of 95% of marine water species, but were below the ANZECC trigger values for the protection of 80% of marine water species.

The concentration of iron detected in groundwater samples MW02, MW04 and MW07 were elevated above the ANZECC trigger values for the protection of 95% and 80% of marine water species.

The concentration of manganese detected in groundwater samples MW02-MW07 were elevated above the ANZECC trigger values for the protection of 95% and 80% of marine water species.

The concentration of total ammoniacal nitrogen detected in all groundwater samples were elevated above the ANZECC trigger values for the protection of 95% and 80% of marine water species.

In order to establish the tidal influence on the groundwater at the site, groundwater levels were recorded within an hour of mean high tide and mean low tide from the ten monitoring wells installed at the site (MW01 – MW10).

The tidal influence results are presented in Table 16 below and monitoring data is presented as Appendix K.

Table 16: Tidal Influence Results - Atawhai Closed Landfill, Nelson (m)

Well ID	Influence
MW01	0.065
MW02	0.110
MW03	0.780
MW04	0.100
MW05	0.020
MW06	0.200
MW07	0.155
MW08	0.490
MW09	0.160
MW10	0.000

With the exception to monitoring wells MW01, MW05 and MW10, notable tidal influence was recorded for all of the monitoring wells at Atawhai Closed Landfill.

10.0 Conclusions and Recommendations

10.1 Landfill Gas

The results of the landfill gas investigation are summarised below:

1. Elevated concentrations of methane were detected within underground services and in areas of the site where visual cracking could be observed during the ISM gas emission survey, primarily in the northern area of the site. Methane was not detected across the residential area of the site during the ISM gas emission survey.
2. During the sub-ground headspace monitoring concentrations of methane were detected at levels exceeding the perimeter probe limit in three of the monitoring locations, with concentrations exceeding the LEL at two of these monitoring locations. In addition, concentrations of CO₂ were recorded at levels exceeding the STEL in nine of the monitoring wells, with concentrations exceeding the TWA in thirty-four of the monitoring locations. No concentrations of CO or H₂S were recorded at levels elevated above the STEL or the TWA at any of the monitoring locations. Methane was not recorded at any of the monitoring locations completed across the residential area of the site. In addition, CO₂ was not recorded at levels exceeding the STEL across the residential area of the site.
3. Landfill gas indicators were identified in all of the landfill gas monitoring wells installed at Atawhai Closed Landfill. With the exception to monitoring wells MW01, MW09 and MW10, concentrations of CH₄ were detected at levels elevated above the LEL and the perimeter probe limit in all of the landfill gas monitoring wells installed at Atawhai Closed Landfill. With the exception to monitoring wells MW06, concentrations of CO₂ were recorded at levels exceeding the STEL in all of the monitoring wells. Concentrations of CO were recorded at levels below the STEL in all of the monitoring wells, with concentrations exceeding the TWA at monitoring wells MW03 and MW06. Concentrations of H₂S were recorded at levels elevated above the STEL and TWA at monitoring well MW03 only.
4. Elevated concentrations of methane were detected at a number of locations during the installation of boreholes across the site, predominantly where refuse materials were encountered. Methane was not recorded at any of the borehole locations completed across the residential area of the site.
5. A number of passive ventilation towers have been connected to underlying services in the area of the Miyazu Gardens and the onsite nursery. However, there is currently no other known ventilation system installed on the landfill. Therefore, landfill gas being produced at the Atawhai Closed Landfill is likely being passively discharged to the atmosphere through the cap/cover materials.

Due to the potential risk to site buildings and human health from landfill gas it is recommended that the initial site-specific risk assessment is updated and a long-term site monitoring and management plan is prepared to include the following:

1. Signage requirements for underground service access covers.
2. Communication procedures and health and safety procedures for working on and around the landfill, specifically including requirements for contractors, network operators and land owners.

3. Requirements for any ground-breaking works, including specific requirements for the monitoring of landfill gas.
4. Details of the proposed landfill gas monitoring programme, methodology, trigger levels and reporting requirements.
5. Contingency measures to be implemented in the event that monitoring results indicate an unacceptable level of risk.
6. Details of the development restrictions to prevent landfill gas migration into buildings, the creation of preferential flow paths and to prevent the increased production of landfill gas.

10.2 Landfill Cover

The results of the landfill cover investigation are summarised below:

1. Evidence of vegetation distress, settlement and surface pooling were identified at the Atawhai Closed Landfill, predominantly in the far northern area of the site. In addition, an area of a potential seep was identified along the western boundary in the far northern area of the site and two areas of visible surface cracking were noted along the north-western area of the site.
2. Boreholes completed across the site typically encountered a thin layer of topsoil, underlain by silty clay of varying thickness, with minor gravel. Locations where the thickness of the cap materials were recorded at less than 0.3 m (less than half of that recommended), appear to be confined to the far northern area of the site, the area of the nursery and the central and south-western areas of Neale Park.
3. With the exception to a single hand auger location, refuse materials were not encountered across the residential area and cap thickness across this area were typically considered sufficient (>0.6 m).
4. Elevated concentrations of contaminants were detected in the surface soils across the Atawhai Closed Landfill. However, with the exception to two samples collected within the residential zone, the concentrations of soil contaminants detected across the Atawhai Closed Landfill were below the relevant soil guideline values.
5. Due to elevated concentrations of contaminants detected in the surface soils, it is considered that all properties located within the Atawhai Closed Landfill site, as defined in Section 2, have been subject to the importation and use of materials containing concentrations of contaminants at levels elevated above the natural background levels. Any development on the Atawhai Closed Landfill will therefore be subject to the requirements of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES).

Due to the potential risk to site buildings, human health and the environment from settlement, exposure to contaminated soils and/or refuse and the production of landfill gas and leachate, it is recommended that the initial site-specific risk assessment is updated and a long-term site monitoring and management plan is prepared to include the following:

1. Communication procedures and health and safety procedures for working on and around the landfill, specifically including requirements for contractors, network operators and land owners.

2. Requirements for any ground-breaking works, including specific handling and disposal requirements for any excavated materials.
3. Details of the proposed monitoring programme, methodology and reporting requirements.
4. Details of the ongoing maintenance and repair requirements for the landfill cover to prevent exposure to contaminated soils and/or refuse and the increased production of landfill gas and leachate.
5. Contingency measures to be implemented in the event that monitoring results indicate an unacceptable level of risk.
6. Details of the development restrictions to prevent the exposure to contaminated soils and/or refuse, settlement and the increased production of landfill gas and leachate.

10.3 Landfill Leachate/Groundwater

The results of the landfill leachate investigation are summarised below:

1. During the inspection of the adjacent shoreline a number of potential preferential pathways and two areas of potential seeps were identified in the northern area of the site.
2. Leachate indicators were identified in all of the groundwater samples sent for analysis. In addition, concentrations of specific contaminants were detected at concentrations elevated above the Australian and New Zealand Environment Conservation Council (ANZECC) Guidelines for the protection of both 95% and 80% of marine water species.
3. During the investigation of the tidal influence on the groundwater at the site, with the exception to monitoring wells MW01, MW05 and MW10, notable tidal influences were recorded for all of the monitoring wells at Atawhai Closed Landfill.

Due to the potential risk to human health and the environment from landfill leachate it is recommended that the initial site-specific risk assessment is updated and a long-term site monitoring and management plan is prepared to include the following:

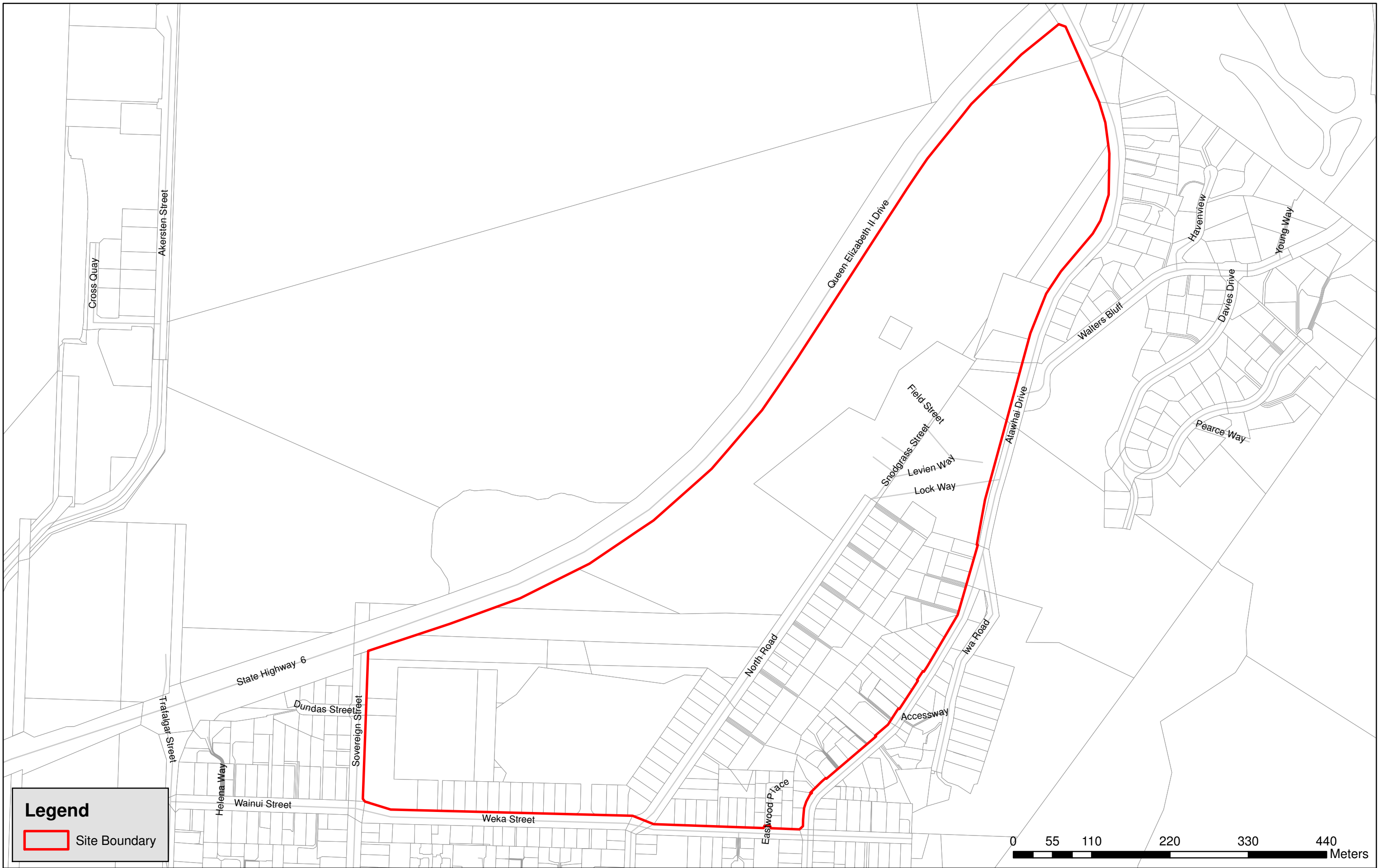
1. Communication procedures and health and safety procedures for working on and around the landfill, specifically including requirements for contractors, network operators and land owners.
2. Requirements for any ground-breaking works, including specific handling and disposal requirements, in the event that leachate is encountered, and specific requirements to prevent the infiltration of surface water.
3. Details of the proposed leachate monitoring programme, methodology, trigger levels and reporting requirements.
4. Contingency measures to be implemented in the event that monitoring results indicate an unacceptable level of risk.
5. Details of the development restrictions to prevent the creation of preferential flow paths and to prevent the increased production of leachate.

It is recommended that Nelson City Council utilise the long-term site monitoring and management plan to monitor the natural attenuation process within the Atawhai Closed Landfill and to provide procedures and processes for any future ground-breaking works or development at the site.

In addition, as the current data set is limited, it is considered that the proposed future monitoring programme will allow Nelson City Council to mitigate the potential risks associated with the Atawhai Closed Landfill site and to make informed decisions for the ongoing management of the site.

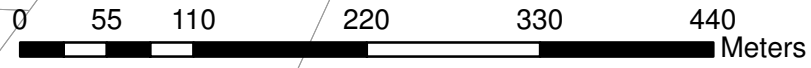
Figures

- Figure 1 - Site Location Plan**
- Figure 2-1 - Hand Auger Location Plan**
- Figure 2-2 - Borehole Location Plan**
- Figure 3 - Well Location Plan**
- Figure 4 - Gas Emission Survey**
- Figure 5 - Visual Inspection Plan**
- Figure 6 - Shoreline Inspection Plan**
- Figure 7 - Landfill Cap Thickness**
- Figure 8 - General Site Zoning**
- Figure 9 - Sub-Ground Methane**



Legend

Site Boundary




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Nelson City Council

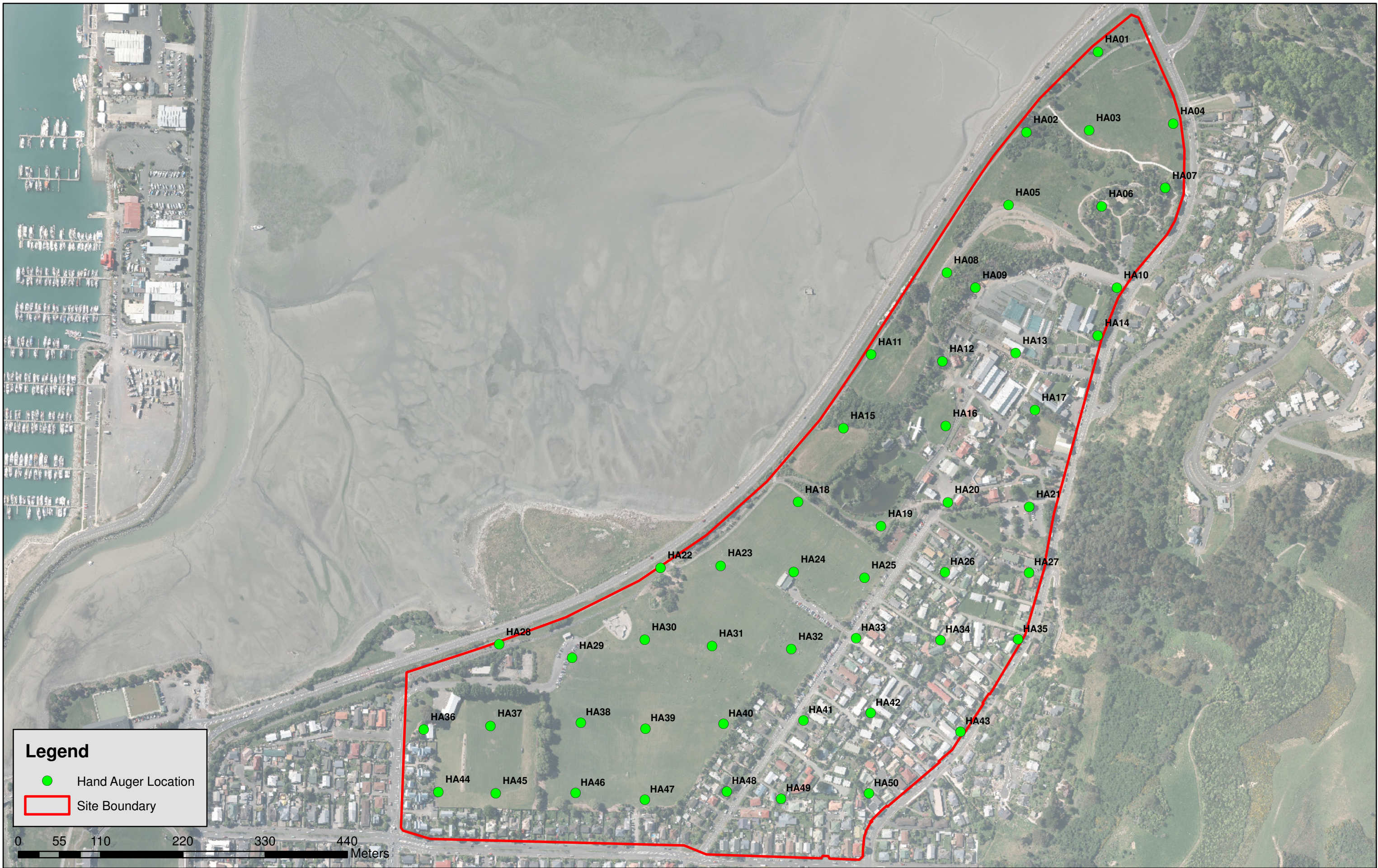
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Figure 1: Site Location Plan

Site Investigation Report




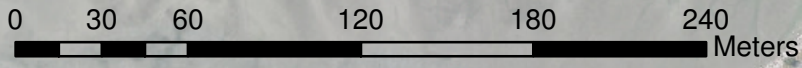
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Legend


-  Borehole Location
-  Site Boundary




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Figure 2-2A: Borehole Location Plan
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Figure 2-2B: Borehole Location Plan
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Figure 3: Well Location Plan
 Site Investigation Report


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Drawing Number: 0708.004.03
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Date: 31/05/2017



Legend

- CH4 <1,000 ppm
- CH4 1,000 - 5,000 ppm
- CH4 >5,000 ppm
- Site Boundary



Drawing Number: 0708.004.04

Drawn By: DD

Checked By: DO'R

Date: 31/05/2017

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Figure 4: Gas Emission Survey
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0708.004



Legend

- Surface Feature
- Site Boundary

ID	Observation
1	Vegetation Distress
2	Visible Cracking
3	Uneven/hummocky Ground
4	Surface Water Pooling
5	Seeps/Leachate



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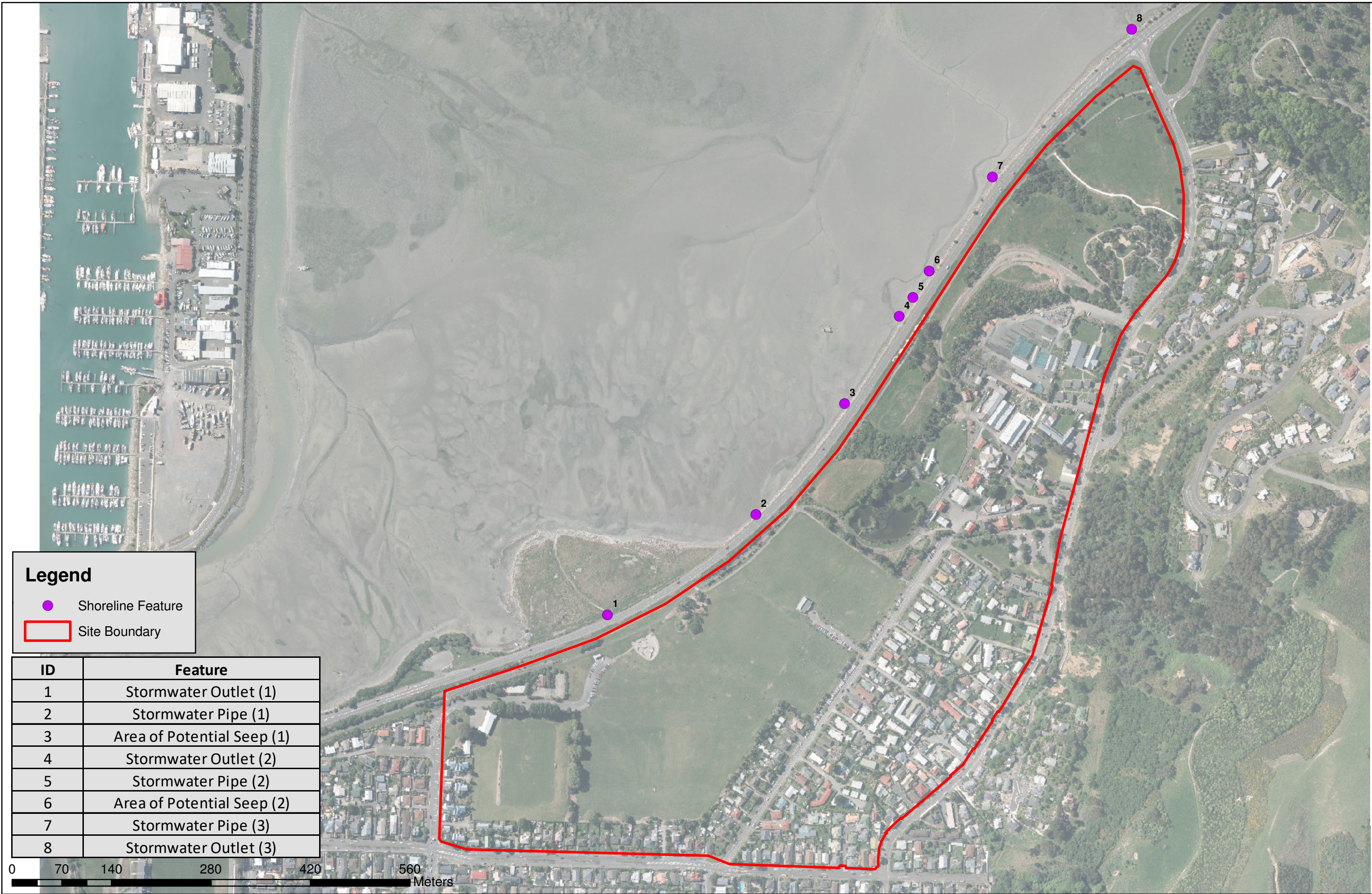
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Figure 5: Visual Inspection Plan
 Site Investigation Report



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Drawing Number: 0708.004.05
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 Date: 31/10/2017



Legend

- Shoreline Feature
- Site Boundary

ID	Feature
1	Stormwater Outlet (1)
2	Stormwater Pipe (1)
3	Area of Potential Seep (1)
4	Stormwater Outlet (2)
5	Stormwater Pipe (2)
6	Area of Potential Seep (2)
7	Stormwater Pipe (3)
8	Stormwater Outlet (3)

0 70 140 280 420 560 Meters



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Figure 6: Shoreline Inspection Plan
 Site Investigation Report



0708.004

Drawing Number: 0708.004.06

Drawn By: SW

Checked By: DO'R

Date: 31/10/2017



Legend

- Cap < 0.3m
- 0.3m > Cap < 0.6m, or Refusal < 0.5m
- Cap > 0.6m
- Site Boundary

0 60 120 240 360 480 Meters



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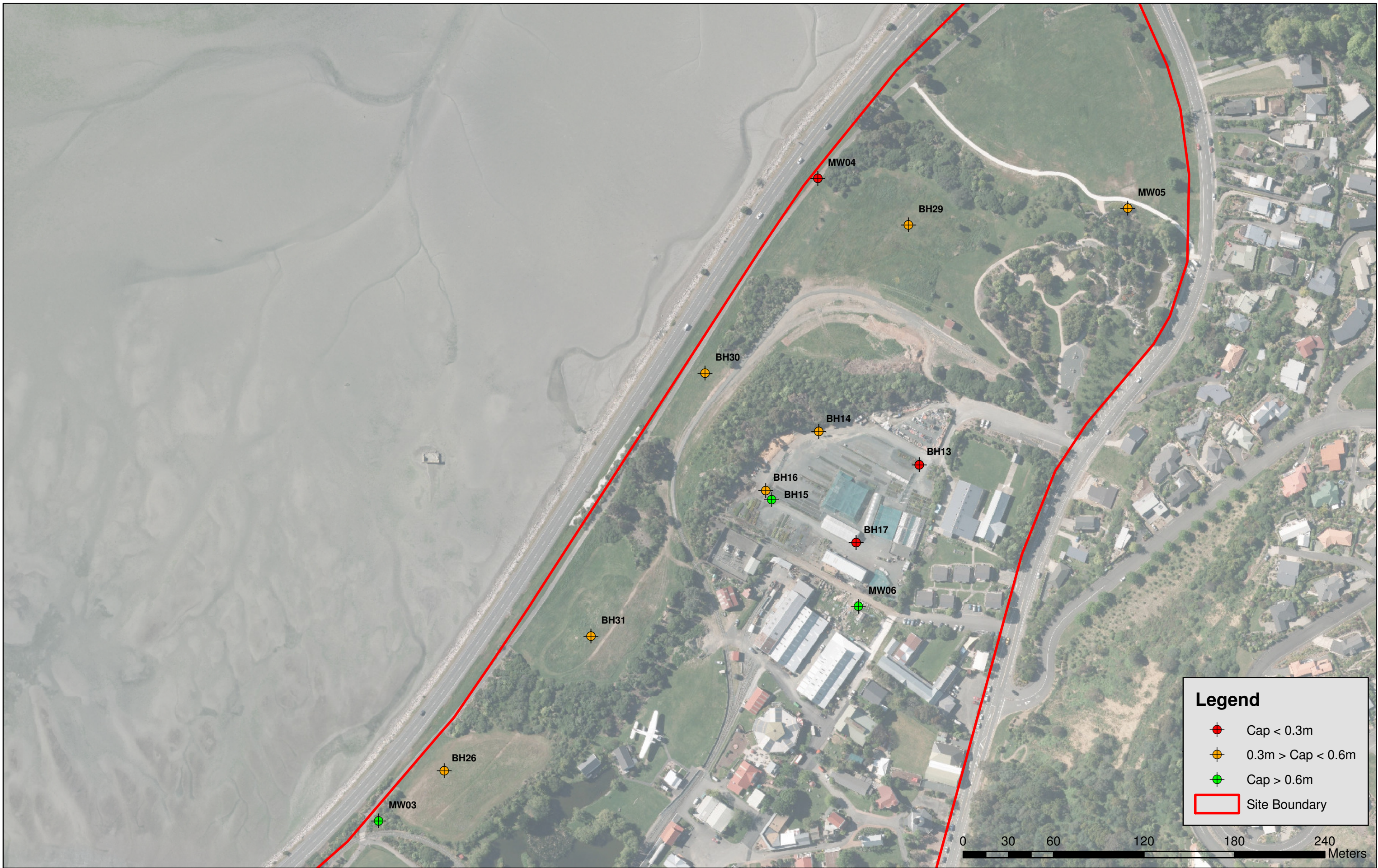
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Figure 7-1: Landfill Cap Thickness
 Site Investigation Report



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Figure 5-2A: Landfill Cap Thickness
 Site Investigation Report


 0708.004

Drawing Number: 0708.004.07
 Drawn By: SW
 Checked By: DO'R
 Date: 31/10/2017



Legend


- Cap < 0.3m
- 0.3m > Cap < 0.6m
- Cap > 0.6m
- Site Boundary




Focus Environmental Services Limited
 PO Box 11455
 Ellerslie
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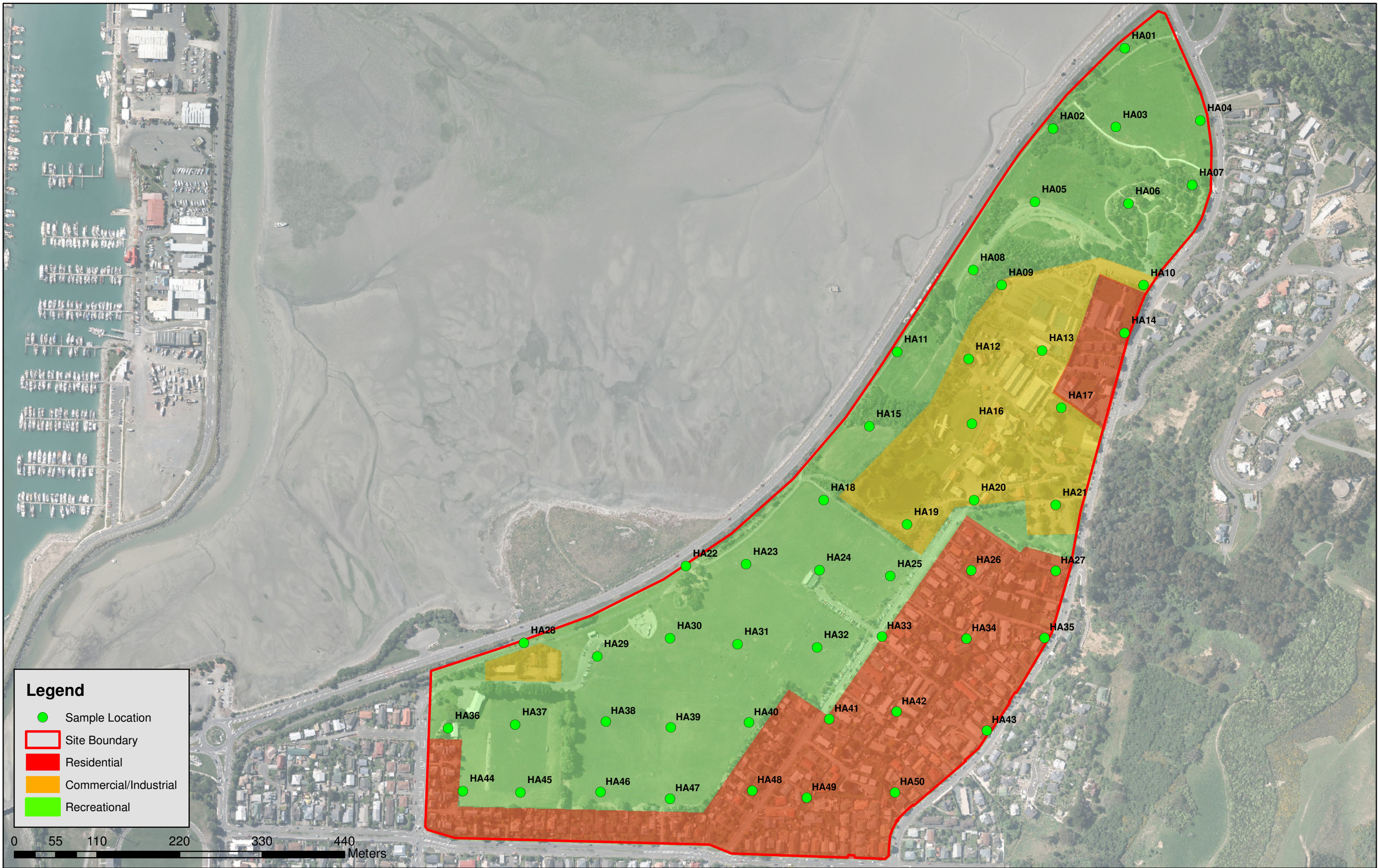
Nelson City Council
 Atawhai Closed Landfill
 Nelson

Figure 7-2B: Landfill Cap Thickness
 Site Investigation Report



0708.004

Drawing Number: 0708.004.07
Drawn By: SW
Checked By: DO'R
Date: 31/10/2017



Legend

- Sample Location
- Site Boundary
- Residential
- Commercial/Industrial
- Recreational


0 55 110 220 330 440 Meters



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Nelson City Council
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 Nelson

Figure 8: General Site Zoning
 Site Investigation Report



0708.004

Drawing Number: 0708.004.08
Drawn By: DD
Checked By: DO'R
Date: 06/06/2017



Legend

- CH4 Not Detected
- CH4 Detected
- Site Boundary

0 30 60 120 180 240 Meters



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 Nelson

Figure 9: Sub-Ground Methane
 Site Investigation Report



0708.004

Drawing Number: 0708.004.09
 Drawn By: SW
 Checked By: DO'R
 Date: 06/06/2017

Appendices

Appendix A - Gas Emission Survey Results



Gas Emission Survey Results: Atawhai Closed Landfill, Nelson

Location	Description	CH4 (ppm)
GD01	Stormwater Grate	260
GD02	Manhole	>8000
GD03	Service Manhole	670
GD04	Stump/Garden	420
GD05	Stormwater Grate	320
GD06	Stormwater Grate	430
GD07	Downpipe	450
GD08	Stormwater Grate	350
GD09	Stormwater Grate	2200
GD10	Manhole	130
GD11	Stormwater Grate	210
GD12	Stormwater Grate	1000
GD13	Manhole	1000
GD14	Downpipe	850
GD15	Drainage Pipe	3000
GD16	Manhole	550
GD17	Stormwater Grate	200
GD18	Manhole	360
GD19	Manhole	250
GD20	Cracked Ground	190
GD21	Cracked Ground	160
GD22	Cracked Ground	100
GD23	Manhole	2200

Appendix B - Gas Emission Survey Photographs

Gas Emission Survey Photographs

Atawhai Closed Landfill Nelson

by Focus Environmental Services Limited



GD01



GD02



GD03



GD04



GD05



GD06



GD07



GD08



GD09



GD10



GD11



GD12 & GD13



GD14



GD15



GD16



GD17



GD18



GD19



GD20



GD21



GD22



GD23

Appendix C - Visual Inspection Photographs

Visual Inspection Photographs

Atawhai Closed Landfill Nelson

by Focus Environmental Services Limited



Evidence of Vegetation Distress



Evidence of Surface Water Pooling



Evidence of Uneven/hummocky Ground



Evidence of Seep/Leachate

Appendix D - Shoreline Inspection Photographs

Shoreline Inspection Photographs

Atawhai Closed Landfill Nelson

by Focus Environmental Services Limited



Stormwater Outlet (1)



Stormwater Pipe (1)



Area of Potential Seep (1)



Stormwater Outlet (2)



Stormwater Pipe (2)



Area of Potential Seep (2)



Stormwater Pipe (3)




Stormwater Outlet (3)

Appendix E - Hand Auger & Borehole Core Logs


PROJECT NUMBER 0708.004	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Sonic	LOGGED BY SW
	TOTAL DEPTH 6.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations	
0.5				SILT, brown (TOPSOIL/FILL) Silty CLAY with minor gravel, brown (FILL)		
1				WOODCHIP (FILL)		
1.5						
2					GRAVEL with major silt, grey	
2.5						
3				GRAVEL with minor clay, yellow		
3.5						
4						
4.5						
5						
5.5						
6				Termination Depth: 6.0 m		
6.5						





PROJECT NUMBER 0708.004	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Sonic	LOGGED BY SW
	TOTAL DEPTH 6.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				SILT, brown (TOPSOIL/FILL) Silty CLAY with gravel inclusion, yellow (FILL)	
1					
1.5				WOODCHIP (FILL)	
2					
2.5					
3					
3.5				GRAVEL with major silt	
4					
4.5					
5				clayey SILT with major gravel, yellow	
5.5					
6				Termination Depth at: 6.0 m	
6.5					



PROJECT NUMBER 0708.004	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Sonic	LOGGED BY SW
	TOTAL DEPTH 6.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				SILT, brown (TOPSOIL/FILL) Silty CLAY with minor gravel, yellow (FILL)	
1					
1.5					
2				REFUSE in a silt matrix; plastic, woodchip, steel (FILL)	
2.5					
3					
3.5				GRAVEL with minor silt, grey/yellow	
4					
4.5					
5				Termination Depth at: 6.0 m	
5.5					
6					
6.5					














PROJECT NUMBER 0708.004	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Sonic	LOGGED BY SW
	TOTAL DEPTH 6.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				SILT, brown (TOPSOIL/FILL)	
				REFUSE, dark grey (FILL)	Hydrocarbon odour observed
1				SILT with gravel and refuse inclusions, dark grey (FILL)	Visual staining observed
1.5					
2				GRAVEL with minor silt	
2.5					
3					
3.5					
4					
4.5					
5					
5.5					
6				Termination Depth at: 6.0 m	
6.5					


PROJECT NUMBER 0708.004	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Sonic	LOGGED BY SW
	TOTAL DEPTH 6.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				SILT, minor gravel, brown (TOPSOIL / FILL)	
				Silty CLAY with red brick inclusion (FILL)	
				REFUSE; plastic, steel, glass, electrical wire, polystyrene, wood (FILL)	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5				GRAVEL with major silt, grey	
5					
5.5					
6				Termination Depth at: 6.0 m	
6.5					


PROJECT NUMBER 0708.004	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Sonic	LOGGED BY SW
	TOTAL DEPTH 6.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				Silty CLAY with minor gravel inclusions, orange (FILL)	
1				GRAVEL and boulders	
1.5				GRAVEL with minor silt, grey	
2					
2.5					
3					
3.5					
4					
4.5					
5					
5.5					
6				Termination Depth at: 6.0 m	
6.5					



PROJECT NUMBER 0708.004	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Sonic	LOGGED BY SW
	TOTAL DEPTH 6.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations			
0.5				SILT, brown (TOPSOIL/FILL) Silty CLAY with gravel inclusions, orange / brown (FILL)				
1								
1.5							Silty CLAY with shell, gravel and plastic, orange/yellow (FILL)	
2							GRAVEL with major silt, grey	
2.5							GRAVEL	
3								
3.5								
4								
4.5								
5				SILT with major gravel, grey(FILL)				
5.5								
6				Termination Depth at: 6.0 m				
6.5								


PROJECT NUMBER 0708.004	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Sonic	LOGGED BY SW
	TOTAL DEPTH 6.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations	
0.5				Silty CLAY with gravel inclusions, orange / yellow (FILL)		
1						
1.5						
2						
2.5						
3				REFUSE; electrical wire, steel, some silt (FILL)		
3.5						
4						
4.5					Strong hydrocarbon odour	
5				GRAVEL with minor silt, becoming yellow		
5.5						
6				Termination Depth at: 6.0 m		
6.5						


PROJECT NUMBER 0708.004	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Sonic	LOGGED BY SW
	TOTAL DEPTH 6.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				SILT, brown (TOPSOIL/FILL) Silty CLAY with minor gravel inclusion (FILL)	
1				GRAVEL (FILL)	
1.5				GRAVEL with minor silt (FILL)	
2				SILT, yellow/brown (FILL)	
2.5				GRAVEL with major silt	
3.5				GRAVEL with minor silt	
6				Termination Depth at: 6.0 m	
6.5					

PROJECT NUMBER 0708.004	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Sonic	LOGGED BY SW
	TOTAL DEPTH 6.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				SILT, brown (TOPSOIL/FILL) SILT with minor gravel, yellow/orange (FILL)	
1				SILT, yellow/orange (FILL)	
1.5				GRAVEL with major silt (FILL)	
2					
2.5					
3				GRAVEL with minor silt	
3.5					
4					
4.5					
5				Silty CLAY with major gravel, yellow / orange	
5.5					
6				Termination Depth at: 6.0 m	
6.5					

Environmental Hand Auger HA01


PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.8 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT, dark brown, loosely packed (TOPSOIL/FILL) Silty CLAY, with gravel inclusion, grey/orange (FILL) REFUSE in a clay matrix; plastic bags, saw dust, gravel (FILL)	
1				Termination Depth: 0.8 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.9 m	CHECKED BY DO'R


COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			SUR	SILT, brown, loosely packed (TOPSOIL/FILL)	
				silty CLAY with gravel inclusion, dark grey (FILL)	
				REFUSE in clay matrix; plastic, sawdust, gravel (FILL)	
1				Termination Depth:0.9 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA03

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.85 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			SUR	SILT with gravel inclusion, dark brown, loosely packed (TOPSOIL/FILL)	
				silty CLAY with gravel inclusion, grey/orange (FILL)	
				REFUSE in clay matrix; plastic, sawdust, gravel (FILL)	
1				Termination Depth:0.85 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.8 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT, dark brown, loosely packed (TOPSOIL/FILL)	
				SILT with major gravel, yellow/brown (FILL)	
1				Termination Depth:0.8 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA05

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.15 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	XXXX		SUR	silty CLAY with gravel inclusion, grey/orange (TOPSOIL/FILL)	
0.5				Termination Depth: 0.15 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA06

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.4 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	SILT, dark brown, minor gravel (TOPSOIL/FILL)	
				GRAVEL (FILL)	
0.5				Termination Depth: 0.4 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA07

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT with gravel inclusion, brown, (TOPSOIL/FILL)	
1				silty CLAY with gravel inclusion, yellow/orange (FILL) Termination Depth: 1.0 m	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.15 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	XXXX		SUR	SILT, with gravel inclusion, brown (FILL)	
0.5				Termination Depth: 0.15 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.5 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	SAW DUST (FILL)	
0.5				Termination Depth: 0.5 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA10

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.5 m	CHECKED BY DO'R


COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	MULCH in silt matrix (FILL)	
				SILT with major gravel inclusion, brown (FILL)	
0.5				Termination Depth: 0.5 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA11

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.8 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			SUR	SILT with gravel inclusion, light brown (TOPSOIL/FILL)	
				silty CLAY with major gravel inclusion, grey/orange, wet (FILL)	
1				Termination Depth: 0.8 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA12

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	[Cross-hatched pattern]		SUR	SILT, dark brown, loosely packed (TOPSOIL/FILL)	
				SILT with gravel inclusion, light brown (FILL)	
1				Termination Depth: 1.0 m	Refuse Odour
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA13

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.4 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	Hardstand with major silt (FILL)	
0.5				Termination Depth: 0.4 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA14

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT, dark brown (TOPSOIL/FILL)	
				Silty CLAY with minor gravel inclusion, orange (FILL)	
1				Silty CLAY with minor gravel inclusion, grey/orange (FILL)	
1.5				Termination Depth:1.0 m	
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA15

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.3 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			SUR	SILT, with minor gravel inclusion, brown (TOPSOIL/FILL)	
				SILT, with major gravel inclusion, yellow (FILL)	
0.5				Termination Depth: 0.3 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA16

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT, dark brown (TOPSOIL/FILL)	
				Silty CLAY with gravel inclusion, brown, loosely packed (FILL)	
1				Termination Depth:1.0 m	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA17

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DO'R


COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	[Cross-hatched pattern]		SUR	Silty CLAY with gravel inclusion, brown (FILL)	
				Silty CLAY with gravel inclusion, loosely packed, yellow (FILL)	
1				Termination Depth: 1.0 m	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA18

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.7 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			SUR	SILT with gravel inclusion, brown (TOPSOIL/FILL)	
				Clayey SILT with gravel inclusion, yellow/brown (FILL)	
1				Termination Depth: 0.7 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA19

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.15 m	CHECKED BY DO'R


COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	XXXX		SUR	SILT with major gravel inclusion, yellow/brown (FILL)	
0.5				Termination Depth: 0.15 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA20

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			SUR	SILT, brown (TOPSOIL/FILL)	
				Silty CLAY with gravel inclusion, grey / orange (FILL)	
				Silty CLAY with gravel and redbrick inclusion (FILL)	
1				Termination Depth: 1.0 m	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA21

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.6 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT, with gravel inclusion, brown (TOPSOIL/FILL)	
				Silty CLAY, with gravel inclusion (FILL)	
1				Termination Depth: 0.6 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA22

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.3 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	Clayey SILT, yellow / orange (FILL)	
0.5				Termination Depth: 0.3 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA23

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.4 m	CHECKED BY DO'R


COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	Clayey SILT, with gravel inclusion, brown (TOPSOIL/FILL)	
0.5				Termination Depth: 0.4 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA24

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.9 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			SUR	SILT, with gravel inclusion (TOPSOIL/FILL)	
				Clayey SILT, with gravel inclusion (FILL)	
				SILT, with major gravel inclusion, wet (FILL)	
1				Termination Depth: 0.9 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA25

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.5 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			SUR	Clayey SILT, with gravel inclusion (TOPSOIL/FILL)	
0.5					
1				Termination Depth: 0.5 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.9 m	CHECKED BY DO'R


COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	[Cross-hatched pattern]		SUR	SILT, brown with major gravel (FILL) SILT, brown with major gravel and refuse (FILL)	
1				Termination Depth: 0.9 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA27

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.8 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			SUR	SILT with minor gravel inclusion, brown (FILL)	
				SILT with minor gravel inclusion, yellow / orange (FILL)	
1				Termination Depth at 0.8 m Due to Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA28

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.3 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	SILT with gravel inclusion, brown (TOPSOIL/FILL)	
				Clayey SILT with gravel inclusion, yellow/orange (FILL)	
0.5				Termination Depth: 0.3 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA29

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.5 m	CHECKED BY DO'R


COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	SILT with gravel inclusion, brown (TOPSOIL/FILL)	
				Clayey SILT with gravel inclusion, yellow/orange (FILL)	
0.5				Termination Depth: 0.5 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA30

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.5 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			SUR	SILT with gravel inclusion, brown (TOPSOIL/FILL)	
				Clayey SILT with gravel inclusion, yellow/orange (FILL)	
				REFUSE; sawdust, woodchip (FILL)	
				Clayey SILT with gravel inclusion (FILL)	
				Termination Depth: 0.5 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA31

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.4 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			SUR	Clayey SILT with gravel inclusion (TOPSOIL/FILL)	
				REFUSE; sawdust, woodchip (FILL)	
				Clayey SILT with gravel inclusion (FILL)	
0.5				Termination Depth: 0.4 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA32

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.4 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	SILT, brown (TOPSOIL/FILL)	
				Clayey SILT, orange (FILL)	
0.5				Termination Depth: 0.4 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA33

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT with minor gravel inclusion, brown (TOPSOIL/FILL)	
				Clayey SILT with minor gravel inclusion, brown (FILL)	
1				Termination Depth: 1.0 m	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.15 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			SUR	Topsoil with gravel inclusion (TOPSOIL/FILL)	
0.5				Termination Depth: 0.15 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA35

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.6 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	[Cross-hatched pattern]		SUR	SILT with gravel inclusion, brown (TOPSOIL/FILL)	
				SILT with gravel inclusion, yellow / orange (FILL)	
1				Termination Depth: 0.6 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA36

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.3 m	CHECKED BY DO'R


COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			SUR	Clayey SILT with gravel inclusion, dark brown (TOPSOIL/FILL)	
0.5				Termination Depth: 0.3 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA37

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.4 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			SUR	SILT, brown (TOPSOIL/FILL)	
				Clayey SILT, orange (FILL)	
					GRAVEL with major silt (FILL)
0.5				Termination Dept: 0.4 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA38

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	[Cross-hatched pattern]		SUR	SILT, brown (TOPSOIL/FILL)	
				Clayey SILT, minor gravel, brown (FILL)	
1				Termination Depth: 1.0 m	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA39

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.3 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			SUR	SILT, brown (TOPSOIL/FILL)	
0.5				Termination Depth at 0.3 m Due to Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA40

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.3 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			SUR	SILT, brown (TOPSOIL/FILL)	
0.5				Termination Depth at 0.3 m Due to Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA41

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.25 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	SILT with gravel and brick inclusion, brown (TOPSOIL/FILL)	
0.5				Termination Depth: 0.25 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.3 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	SILT with minor gravel, brown (TOPSOIL/FILL)	
				SILT with major gravel inclusion, brown / yellow (FILL)	
0.5				Termination Depth: 0.3 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA43

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT with minor gravel inclusion, brown (TOPSOIL/FILL)	
				Clayey SILT with minor gravel inclusion, brown/yellow (FILL)	
1				Termination Depth: 1.0 m	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT with gravel inclusion, brown (TOPSOIL/FILL)	
				Clayey SILT with gravel inclusion (FILL)	
					SILT with ash and refuse, yellow / brown (FILL)
1				Termination Depth: 1.0 m	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA45

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.3 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	Clayey SILT with gravel inclusion, brown (TOPSOIL/FILL)	
0.5				Termination Depth at 0.3 m	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA46

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.6 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT, brown (TOPSOIL/FILL) SILT with major gravel inclusion, yellow (FILL)	
1				Termination Depth: 0.6 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA47

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT, with gravel inclusion, brown (TOPSOIL/FILL)	
1				SILT, yellow, tightly packed (FILL)	
1.5				Termination Depth: 1.0 m	
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA48

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.5 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	X		SUR	SILT, with minor gravel inclusion, brown (TOPSOIL/FILL)	
				Clayey SILT, with minor gravel inclusion, yellow (FILL)	
0.5				Termination Depth: 0.5 m - Refusal	
1					
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA49

PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.8 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	X		SUR	SILT, with minor gravel inclusion, brown (TOPSOIL/FILL)	
	X			SILT, with gravel inclusion, yellow / orange (FILL)	
1				Termination Depth: 0.8 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					

Environmental Hand Auger HA50

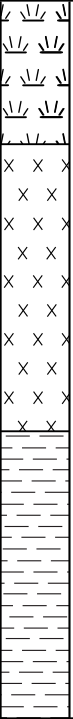
PROJECT NUMBER 0708.003	DRILLING DATE 03/05/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY -	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Hand Auger	LOGGED BY DD
	TOTAL DEPTH 0.6 m	CHECKED BY DO'R

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			SUR	SILT, with minor gravel inclusion, brown (TOPSOIL/FILL)	
				SILT, with minor gravel inclusion, becoming major, brown/yellow (FILL)	
1				Termination Depth: 0.6 m - Refusal	
1.5					
2					
2.5					
3					
3.5					
4					
4.5					




PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			<div style="border: 1px solid black; padding: 2px; width: fit-content;">No Gas Detected</div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-top: 10px;">No Gas Detected</div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-top: 10px;">No Gas Detected</div>	<p>TOPSOIL</p> <hr style="border-top: 1px dotted black;"/> <p>CLAY, yellow/orange</p> <hr/> <p>CLAY, minor gravel and shell, yellow/orange</p>	
1				Termination Depth: 1.0 m	
1.5					




PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			No Gas Detected	TOPSOIL	
			No Gas Detected	CLAY, minor gravel, yellow/orange	
0.5			No Gas Detected	CLAY, light brown	
1			No Gas Detected	Termination Depth: 1.0 m	
1.5					


PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			No Gas Detected	TOPSOIL	
			No Gas Detected	CLAY, minor gravel, yellow/orange	
0.5			No Gas Detected	silty CLAY, major gravel, yellow/orange	
1			No Gas Detected	Termination Depth: 1.0 m	
1.5					

PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.5 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			No Gas Detected	TOPSOIL	
			No Gas Detected	FILL, gravel	
			No Gas Detected	CLAY, minor gravel, yellow/orange	
1			No Gas Detected	silty CLAY, major gravel	
1.5			No Gas Detected	Termination Depth: 1.5 m	

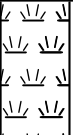
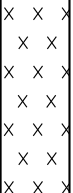
PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5	↓ ↓ ↓ ↓		No Gas Detected	TOPSOIL	
	x x x		No Gas Detected	SILT, minor gravel, dark brown	
	x x x		No Gas Detected	SILT, moderate gravel, light brown	
1	x x x		No Gas Detected	Termination Depth: 1.0 m	
1.5					





PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 2.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			No Gas Detected	TOPSOIL	
			No Gas Detected	SILT, moderate gravel, light brown	
0.5			No Gas Detected	GRAVEL, minor silt, black	
1			No Gas Detected		
1.5			No Gas Detected	GRAVEL, minor silt	
2			No Gas Detected	Termination Depth: 2.0 m	

PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 2.0 m	CHECKED BY DOR


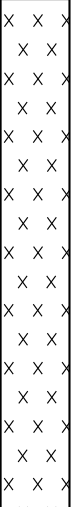
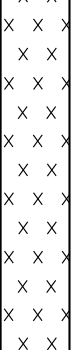

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			No Gas Detected	TOPSOIL	
			No Gas Detected	CLAY, minor gravel, yellow/orange	
0.5			No Gas Detected	silty CLAY, major gravel, dark brown	
1			No Gas Detected		
1.5				Termination Depth: 1.5 m	

ENVIRONMENTAL BOREHOLE BH08




PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.5 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			No Gas Detected	GRAVEL	
0.5			No Gas Detected	SILT, minor gravel, light brown	
1			No Gas Detected		
1.5			No Gas Detected		
				Termination Depth: 1.5 m	

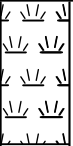

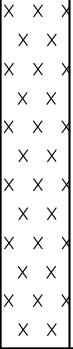
PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			No Gas Detected	Gravel (Fill)	
			No Gas Detected	clayey SILT, minor gravel, grey	
0.5			No Gas Detected	CLAY, minor gravel, light brown	
1			No Gas Detected	Termination Depth: 1.0 m	Refusal at 1.0 m
1.5					

PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR


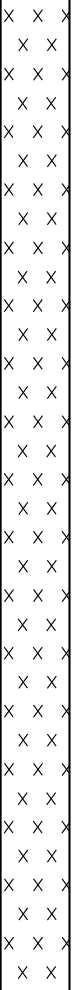
COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			No Gas Detected	TOPSOIL	
			No Gas Detected	silty CLAY, minor gravel, brown	
0.5			No Gas Detected	SILT, minor gravel and sand, grey	
1			No Gas Detected	Termination Depth: 1.0 m	Groundwater encountered at 1m
1.5					

ENVIRONMENTAL BOREHOLE BH11

PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0			No Gas Detected	TOPSOIL	
0.5			No Gas Detected	SILT, with major gravel, light brown	
1			No Gas Detected		
1.5				Termination Depth: 1.0 m	

PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
				TOPSOIL	
			No Gas Detected		
				SILT, minor gravel, dark grey	
0.5			No Gas Detected		
				REFUSE, minor clay and gravel, brown	Refuse: rope, wire, etc.
1			Gas Detected 12% of LEL (refuse odour)		
				Termination Depth: 1.0 m	
1.5					


PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 0.5 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			No Gas Detected	Gravel (Fill)	
				REFUSE, minor clay, dark grey	Refuse: rope, plastic (refuse odour)
0.5			No Gas Detected		
				Termination Depth: 0.5 m	
1					
1.5					






PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 0.8 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			No Gas Detected	Gravel (Fill)	
			No Gas Detected	CLAY, minor gravel, light brown	
				REFUSE, minor clay, dark grey	Refuse: rope, plastic (refuse odour)
1				Termination Depth: 0.8 m	
1.5					



PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.5 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			No Gas Detected	Gravel (Fill)	
0.5			No Gas Detected	GRAVEL, dark brown	
			No Gas Detected	silty CLAY, minor gravel, grey	
1			No Gas Detected		
			No Gas Detected	REFUSE, minor clay, grey	Refuse: plastic, steel etc.
1.5			40% LEL	Termination Depth: 1.5 m	

PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR


COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			No Gas Detected	Gravel (FILL)	Groundwater encountered at 0.5m
			No Gas Detected	silty CLAY, minor gravel, dark grey	
1				Termination Depth: 1.0 m	
1.5					

ENVIRONMENTAL BOREHOLE BH17

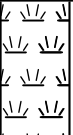




PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			No Gas Detected	Gravel (FILL)	
			No Gas Detected	silty GRAVEL, grey	
				REFUSE, minor silt and gravel, grey	Refuse: newspaper, wood, plastic
1			22% LEL	Termination Depth: 1.0 m	
1.5					


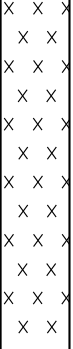

PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 2.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
			No Gas Detected	TOPSOIL	
0.5			No Gas Detected	silty GRAVEL, brown	
1			No Gas Detected		
1.5				SILT, major sawdust, yellow/brown	
2			No Gas Detected	Termination Depth: 2.0 m	

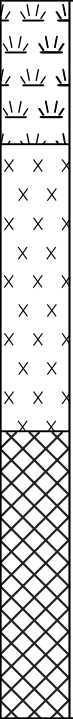
PROJECT NUMBER 0708.005	DRILLING DATE 25/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.2 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				TOPSOIL	
				SILT, minor gravel, yellow/orange	
1			<div style="border: 1px solid black; padding: 2px; width: fit-content;">No Gas Detected</div>		
1.5				REFUSE, minor silt and gravel, yellow/orange	Refuse: wood, sawdust, porcelain inclusions. Refuse odour.
				Termination Depth: 1.5 m	

PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 0.6 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			<div style="border: 1px solid black; padding: 2px; width: fit-content;">No Gas Detected</div>	TOPSOIL	
				SILT, minor gravel, brown/orange	
1			<div style="border: 1px solid black; padding: 2px; width: fit-content;">No Gas Detected</div>	REFUSE, minor silt and gravel	Refuse: porcelain inclusions, electrical wire. No odour.
1.5				Termination Depth: 0.6 m	

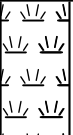


PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
	\ \ \ \ \			TOPSOIL	
	\ \ \ \ \		No Gas Detected		
	\ \ \ \ \				
	\ \ \ \ \			clayey SILT, minor gravel, yellow/orange	
	x x x				
	x x				
	x x x				
	x x				
	x x x		No Gas Detected		
0.5	x x x				
	x x x			REFUSE, minor silt and gravel, dark brown	Refuse - glass, electrical wire
	x x x				
	x x x		No Gas Detected		
1	x x x			Termination Depth: 1.0 m	
	x x x				
	x x x				
1.5	x x x				

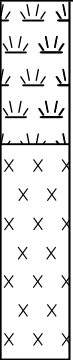
PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
				TOPSOIL	
				silty CLAY, minor gravel, brown/orange/yellow	
0.5			No Gas Detected	REFUSE, minor clayey silt, dark grey	Refuse - plastic, wire. No odour
1			No Gas Detected	Termination Depth: 1.0 m	
1.5					



PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				TOPSOIL	
				SILT, minor gravel, brown/grey	
				REFUSE, minor silt and gravel, dark grey	
1			23% LEL	Termination Depth: 1.0 m	Refuse - plastic, cardboard, slight hydrocarbon odour and staining from 0.8m.
1.5					

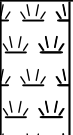
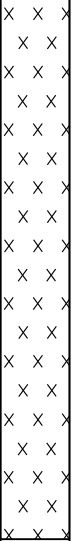
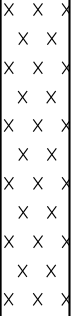

PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				TOPSOIL	
				SILT, minor gravel, brown/grey	
1			9% LEL	REFUSE, minor silt, dark grey	Refuse - sawdust, wood chippings, plastic, black colouration, no odour.
				Termination Depth: 1.0 m	
1.5					

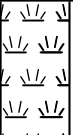
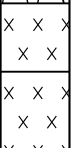
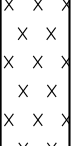
PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 2.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
				TOPSOIL	
			No Gas Detected		
0.5			No Gas Detected	SILT, moderate gravel, light brown	
1			No Gas Detected	SILT, minor gravel, light brown.	
1.5					Due to instrument difficulties, could not log correctly below 1.5m.
2				Termination Depth: 2.0 m	



PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Drill	LOGGED BY AB
	TOTAL DEPTH 2.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5			No Gas Detected	TOPSOIL	
				clayey SILT, major wood chip, light brown	
				clayey SILT, major wood chip, minor gravel, brown	
1			No Gas Detected		
1.5			4% LEL		No odour
2				Termination Depth: 2.0 m	



PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.5 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				TOPSOIL	
				silty CLAY, minor gravel, dark grey	
			No Gas Detected		
				GRAVEL, major silt, grey	
1			No Gas Detected		Water encountered at 1m
1.5				REFUSE, minor silt and gravel, dark grey	Refuse - plastic, electrical case, sawdust
			48% LEL		Strong odour
				Termination Depth: 1.5 m	


PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.0 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				TOPSOIL	
				silty CLAY, minor gravel, brown	
				REFUSE, minor clay and gravel, dark grey	
1			47% LEL	REFUSE - plastic, sawdust, wood chips; odour at 0.7 m	Water encountered at 0.7m
1.5				Termination Depth: 1.0 m	

PROJECT NUMBER 0708.005	DRILLING DATE 26/09/2017	COORDINATES -
PROJECT NAME Detailed Site Investigation	DRILLING COMPANY Pro-Drill	COORD SYS NZTM
CLIENT Nelson City Council	DRILLER -	SURFACE ELEVATION -
ADDRESS Atawhai Closed Landfill	DRILLING METHOD Mechanical Auger	LOGGED BY DD
	TOTAL DEPTH 1.5 m	CHECKED BY DOR

COMMENTS

Depth (m)	Graphic Log	Moisture	Samples	Material Description	Additional Observations
0.5				TOPSOIL	
				silty CLAY, minor gravel, brown	
			40% LEL	clayey SILT, minor gravel, dark brown/grey	
1			40% LEL	REFUSE, minor silt and gravel, dark grey	Refuse - plastic, glass, wood chips, hydrocarbon staining and odour, rope
1.5					
			28% LEL	Termination Depth: 1.5 m	

Appendix F - Laboratory Transcripts: Soil



ANALYSIS REPORT

Client:	Focus Environmental Services Limited	Lab No:	1770941	SPV1
Contact:	Sam Woolley C/- Focus Environmental Services Limited PO Box 11455 Ellerslie Auckland 1542	Date Received:	06-May-2017	
		Date Reported:	16-May-2017	
		Quote No:	80876	
		Order No:		
		Client Reference:	0708.004	
		Submitted By:	David Dwyer	

Sample Type: Soil

Sample Name:	HA01 Sur 03-May-2017	HA02 Sur 03-May-2017	HA03 Sur 03-May-2017	HA04 Sur 03-May-2017	HA05 Sur 03-May-2017
Lab Number:	1770941.1	1770941.2	1770941.3	1770941.4	1770941.5

Individual Tests

Dry Matter	g/100g as rcvd	77	73	75	81	74
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	1.40	1.10	6.2	11.3	1.82

Heavy Metals, Screen Level

Total Recoverable Arsenic	mg/kg dry wt	7	3	8	11	7
Total Recoverable Cadmium	mg/kg dry wt	0.18	< 0.10	0.12	0.13	0.12
Total Recoverable Chromium	mg/kg dry wt	57	23	166	59	48
Total Recoverable Copper	mg/kg dry wt	53	27	270	62	48
Total Recoverable Lead	mg/kg dry wt	53	23	47	99	69
Total Recoverable Nickel	mg/kg dry wt	52	21	90	42	49
Total Recoverable Zinc	mg/kg dry wt	102	55	88	122	95

Organochlorine Pesticides Screening in Soil

Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010



Sample Type: Soil						
Sample Name:	HA01 Sur 03-May-2017	HA02 Sur 03-May-2017	HA03 Sur 03-May-2017	HA04 Sur 03-May-2017	HA05 Sur 03-May-2017	
Lab Number:	1770941.1	1770941.2	1770941.3	1770941.4	1770941.5	
Organochlorine Pesticides Screening in Soil						
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	0.04	< 0.03
Acenaphthylene	mg/kg dry wt	0.13	0.11	0.54	1.18	0.16
Anthracene	mg/kg dry wt	0.16	0.12	0.81	1.17	0.32
Benzo[a]anthracene	mg/kg dry wt	0.76	0.71	3.7	6.2	1.29
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.88	0.71	4.1	7.6	1.18
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	1.30	0.95	4.9	9.5	1.72
Benzo[g,h,i]perylene	mg/kg dry wt	0.75	0.56	3.1	5.0	0.79
Benzo[k]fluoranthene	mg/kg dry wt	0.57	0.32	2.0	3.8	0.69
Chrysene	mg/kg dry wt	0.81	0.57	3.0	5.1	1.08
Dibenzo[a,h]anthracene	mg/kg dry wt	0.14	0.10	0.49	0.98	0.15
Fluoranthene	mg/kg dry wt	1.65	1.37	8.2	12.7	2.7
Fluorene	mg/kg dry wt	0.04	< 0.03	0.17	0.27	0.10
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.94	0.68	3.5	5.7	0.92
Naphthalene	mg/kg dry wt	< 0.14	< 0.15	0.19	0.25	< 0.15
Phenanthrene	mg/kg dry wt	0.66	0.55	3.5	4.8	1.50
Pyrene	mg/kg dry wt	1.69	1.42	7.8	12.3	2.6
Sample Name:	HA06 Sur 03-May-2017	HA07 Sur 03-May-2017	HA08 Sur 03-May-2017	HA09 Sur 04-May-2017	HA10 Sur 04-May-2017	
Lab Number:	1770941.6	1770941.7	1770941.8	1770941.9	1770941.10	
Individual Tests						
Dry Matter	g/100g as rcvd	81	79	89	39	60
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.86	< 0.07	1.81	< 0.3	4.5
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	7	4	5	8	6
Total Recoverable Cadmium	mg/kg dry wt	0.40	0.17	0.14	< 0.19	0.17
Total Recoverable Chromium	mg/kg dry wt	42	30	115	8	31
Total Recoverable Copper	mg/kg dry wt	83	23	51	14	42
Total Recoverable Lead	mg/kg dry wt	280	61	98	2.9	43
Total Recoverable Nickel	mg/kg dry wt	37	20	191	10	32
Total Recoverable Zinc	mg/kg dry wt	240	80	130	22	76
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	0.010	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	0.010
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	0.017	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	0.021	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	0.074	0.011

Sample Type: Soil						
Sample Name:		HA06 Sur 03-May-2017	HA07 Sur 03-May-2017	HA08 Sur 03-May-2017	HA09 Sur 04-May-2017	HA10 Sur 04-May-2017
Lab Number:		1770941.6	1770941.7	1770941.8	1770941.9	1770941.10
Organochlorine Pesticides Screening in Soil						
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.11	< 0.04
Acenaphthylene	mg/kg dry wt	0.05	< 0.03	0.13	< 0.11	0.47
Anthracene	mg/kg dry wt	0.17	< 0.03	0.15	< 0.11	0.29
Benzo[a]anthracene	mg/kg dry wt	0.64	< 0.03	0.90	< 0.11	2.1
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.55	< 0.03	1.17	< 0.11	2.9
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	0.72	< 0.03	1.94	< 0.11	4.1
Benzo[g,h,i]perylene	mg/kg dry wt	0.38	< 0.03	0.83	< 0.11	2.6
Benzo[k]fluoranthene	mg/kg dry wt	0.25	< 0.03	0.82	< 0.11	1.70
Chrysene	mg/kg dry wt	0.45	< 0.03	0.95	< 0.11	1.69
Dibenzo[a,h]anthracene	mg/kg dry wt	0.08	< 0.03	0.15	< 0.11	0.43
Fluoranthene	mg/kg dry wt	1.47	< 0.03	1.90	< 0.11	3.8
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.11	0.06
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.52	< 0.03	0.96	< 0.11	3.3
Naphthalene	mg/kg dry wt	< 0.14	< 0.14	< 0.13	< 0.6	< 0.19
Phenanthrene	mg/kg dry wt	0.41	< 0.03	0.48	< 0.11	0.84
Pyrene	mg/kg dry wt	1.19	< 0.03	2.0	< 0.11	4.2
Sample Name:		HA11 Sur 04-May-2017	HA12 Sur 04-May-2017	HA13 Sur 04-May-2017	HA14 Sur 04-May-2017	HA15 Sur 04-May-2017
Lab Number:		1770941.11	1770941.12	1770941.13	1770941.14	1770941.15
Individual Tests						
Dry Matter	g/100g as rcvd	76	82	82	77	85
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	1.36	2.4	1.18	13.1	< 0.07
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	7	7	18	8	7
Total Recoverable Cadmium	mg/kg dry wt	0.13	0.21	0.16	0.26	< 0.10
Total Recoverable Chromium	mg/kg dry wt	60	48	94	63	123
Total Recoverable Copper	mg/kg dry wt	41	45	67	50	70
Total Recoverable Lead	mg/kg dry wt	42	250	67	146	8.2
Total Recoverable Nickel	mg/kg dry wt	67	51	167	81	106
Total Recoverable Zinc	mg/kg dry wt	106	177	110	164	89
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil

Sample Name:		HA11 Sur 04-May-2017	HA12 Sur 04-May-2017	HA13 Sur 04-May-2017	HA14 Sur 04-May-2017	HA15 Sur 04-May-2017
Lab Number:		1770941.11	1770941.12	1770941.13	1770941.14	1770941.15
Organochlorine Pesticides Screening in Soil						
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	0.012	< 0.010
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	0.012	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	0.017	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	0.03	< 0.03
Acenaphthylene	mg/kg dry wt	0.08	0.12	0.10	0.81	< 0.03
Anthracene	mg/kg dry wt	0.13	0.17	0.13	1.18	< 0.03
Benzo[a]anthracene	mg/kg dry wt	0.95	1.44	0.69	7.4	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.85	1.50	0.78	8.6	< 0.03
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	1.43	2.6	1.12	12.2	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	0.57	1.15	0.57	6.2	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	0.52	1.07	0.40	4.7	< 0.03
Chrysene	mg/kg dry wt	0.86	1.26	0.59	6.0	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	0.12	0.18	0.10	1.12	< 0.03
Fluoranthene	mg/kg dry wt	2.1	2.2	1.18	13.3	< 0.03
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	0.14	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.77	1.27	0.67	7.1	< 0.03
Naphthalene	mg/kg dry wt	< 0.14	< 0.13	< 0.13	0.28	< 0.13
Phenanthrene	mg/kg dry wt	0.76	0.68	0.28	4.6	< 0.03
Pyrene	mg/kg dry wt	2.1	2.5	1.27	13.3	< 0.03
Sample Name:		HA16 Sur 04-May-2017	HA17 Sur 04-May-2017	HA18 Sur 04-May-2017	HA19 Sur 04-May-2017	HA20 Sur 04-May-2017
Lab Number:		1770941.16	1770941.17	1770941.18	1770941.19	1770941.20
Individual Tests						
Dry Matter	g/100g as rcvd	72	80	77	82	84
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.54	0.66	0.54	3.7	0.48
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	9	8	8	16
Total Recoverable Cadmium	mg/kg dry wt	0.16	0.16	0.21	0.40	0.14
Total Recoverable Chromium	mg/kg dry wt	51	79	69	107	73
Total Recoverable Copper	mg/kg dry wt	570	57	51	94	64
Total Recoverable Lead	mg/kg dry wt	65	99	72	920	56
Total Recoverable Nickel	mg/kg dry wt	44	144	76	155	66
Total Recoverable Zinc	mg/kg dry wt	200	133	103	350	131
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		HA16 Sur 04-May-2017	HA17 Sur 04-May-2017	HA18 Sur 04-May-2017	HA19 Sur 04-May-2017	HA20 Sur 04-May-2017
Lab Number:		1770941.16	1770941.17	1770941.18	1770941.19	1770941.20
Organochlorine Pesticides Screening in Soil						
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	0.012	0.013	0.018	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	0.024	0.010	< 0.010	0.021	< 0.010
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	0.16	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.04	0.04	0.04	0.30	0.04
Anthracene	mg/kg dry wt	0.08	0.08	0.04	0.33	0.07
Benzo[a]anthracene	mg/kg dry wt	0.37	0.39	0.24	2.6	0.29
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.33	0.42	0.33	2.4	0.30
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.59	0.57	0.52	3.1	0.40
Benzo[g,h,i]perylene	mg/kg dry wt	0.19	0.34	0.28	1.59	0.25
Benzo[k]fluoranthene	mg/kg dry wt	0.22	0.21	0.17	1.34	0.15
Chrysene	mg/kg dry wt	0.29	0.37	0.27	1.79	0.23
Dibenzo[a,h]anthracene	mg/kg dry wt	0.05	0.07	0.06	0.32	0.05
Fluoranthene	mg/kg dry wt	0.65	0.76	0.54	3.9	0.65
Fluorene	mg/kg dry wt	0.11	< 0.03	< 0.03	0.07	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.30	0.42	0.38	2.1	0.32
Naphthalene	mg/kg dry wt	< 0.16	< 0.14	< 0.15	< 0.14	< 0.14
Phenanthrene	mg/kg dry wt	0.35	0.27	0.18	1.43	0.29
Pyrene	mg/kg dry wt	0.60	0.79	0.57	4.0	0.63
Sample Name:		HA21 Sur 04-May-2017	HA22 Sur 04-May-2017	HA23 Sur 04-May-2017	HA24 Sur 04-May-2017	HA25 Sur 04-May-2017
Lab Number:		1770941.21	1770941.22	1770941.23	1770941.24	1770941.25
Individual Tests						
Dry Matter	g/100g as rcvd	78	79	77	79	78
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	2.6	0.70	< 0.08	< 0.07	0.19
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	6	5	13	36
Total Recoverable Cadmium	mg/kg dry wt	0.15	0.12	< 0.10	0.12	0.14
Total Recoverable Chromium	mg/kg dry wt	68	188	30	178	240
Total Recoverable Copper	mg/kg dry wt	42	47	24	46	77
Total Recoverable Lead	mg/kg dry wt	57	31	16.2	103	39
Total Recoverable Nickel	mg/kg dry wt	50	260	28	320	370
Total Recoverable Zinc	mg/kg dry wt	84	98	51	73	64
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		HA21 Sur 04-May-2017	HA22 Sur 04-May-2017	HA23 Sur 04-May-2017	HA24 Sur 04-May-2017	HA25 Sur 04-May-2017
Lab Number:		1770941.21	1770941.22	1770941.23	1770941.24	1770941.25
Organochlorine Pesticides Screening in Soil						
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	0.019	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	0.055	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	0.011	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	0.077	< 0.010	< 0.010	< 0.010
Total DDT Isomers	mg/kg dry wt	< 0.06	0.16	< 0.06	< 0.06	< 0.06
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	0.04	0.07	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	0.14	0.06	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	2.1	0.45	< 0.03	< 0.03	0.10
Benzo[a]pyrene (BAP)	mg/kg dry wt	1.65	0.47	0.03	0.03	0.12
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	2.2	0.46	< 0.03	< 0.03	0.14
Benzo[g,h,i]perylene	mg/kg dry wt	1.12	0.34	< 0.03	< 0.03	0.10
Benzo[k]fluoranthene	mg/kg dry wt	0.79	0.21	< 0.03	< 0.03	0.06
Chrysene	mg/kg dry wt	1.67	0.34	< 0.03	< 0.03	0.09
Dibenzo[a,h]anthracene	mg/kg dry wt	0.23	0.07	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	3.6	0.73	0.03	0.03	0.22
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	1.44	0.43	< 0.03	< 0.03	0.14
Naphthalene	mg/kg dry wt	< 0.14	< 0.15	< 0.15	< 0.14	< 0.15
Phenanthrene	mg/kg dry wt	0.33	0.32	< 0.03	< 0.03	0.09
Pyrene	mg/kg dry wt	3.6	0.76	0.03	0.03	0.24
Sample Name:		HA26 Sur 04-May-2017	HA27 Sur 05-May-2017	HA28 Sur 05-May-2017	HA29 Sur 05-May-2017	HA30 Sur 05-May-2017
Lab Number:		1770941.26	1770941.27	1770941.28	1770941.29	1770941.30
Individual Tests						
Dry Matter	g/100g as rcvd	80	79	78	81	75
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	7.0	1.32	0.19	0.16	< 0.07
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	7	8	5	6	5
Total Recoverable Cadmium	mg/kg dry wt	0.18	0.19	0.13	0.16	0.12
Total Recoverable Chromium	mg/kg dry wt	83	49	90	230	87
Total Recoverable Copper	mg/kg dry wt	50	43	35	54	49

Sample Type: Soil						
Sample Name:		HA26 Sur 04-May-2017	HA27 Sur 05-May-2017	HA28 Sur 05-May-2017	HA29 Sur 05-May-2017	HA30 Sur 05-May-2017
Lab Number:		1770941.26	1770941.27	1770941.28	1770941.29	1770941.30
Heavy Metals, Screen Level						
Total Recoverable Lead	mg/kg dry wt	200	44	32	26	15.1
Total Recoverable Nickel	mg/kg dry wt	138	45	115	480	147
Total Recoverable Zinc	mg/kg dry wt	260	125	85	89	74
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	0.017	0.012	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	0.016	0.029	< 0.010	< 0.010	< 0.010
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	0.05	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	0.74	0.14	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	0.57	0.16	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	2.4	0.68	0.09	0.09	0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	4.7	0.89	0.13	0.11	0.04
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	4.7	1.06	0.15	0.12	0.04
Benzo[g,h,i]perylene	mg/kg dry wt	4.8	0.61	0.10	0.07	0.03
Benzo[k]fluoranthene	mg/kg dry wt	1.79	0.43	0.05	0.05	< 0.03
Chrysene	mg/kg dry wt	2.1	0.62	0.09	0.10	0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	0.93	0.13	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	3.9	1.49	0.18	0.20	0.07
Fluorene	mg/kg dry wt	0.12	0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	4.9	0.69	0.12	0.09	0.03
Naphthalene	mg/kg dry wt	0.55	< 0.14	< 0.14	< 0.14	< 0.14
Phenanthrene	mg/kg dry wt	2.1	0.72	0.06	0.09	< 0.03
Pyrene	mg/kg dry wt	3.7	1.55	0.20	0.23	0.07
Sample Name:		HA31 Sur 05-May-2017	HA32 Sur 05-May-2017	HA33 Sur 05-May-2017	HA34 Sur 05-May-2017	HA35 Sur 05-May-2017
Lab Number:		1770941.31	1770941.32	1770941.33	1770941.34	1770941.35
Individual Tests						
Dry Matter	g/100g as rcvd	78	81	76	80	78
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.07	< 0.07	0.66	1.35	2.1

Sample Type: Soil						
Sample Name:		HA31 Sur 05-May-2017	HA32 Sur 05-May-2017	HA33 Sur 05-May-2017	HA34 Sur 05-May-2017	HA35 Sur 05-May-2017
Lab Number:		1770941.31	1770941.32	1770941.33	1770941.34	1770941.35
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	6	8	7	4
Total Recoverable Cadmium	mg/kg dry wt	0.13	0.11	0.26	0.55	0.14
Total Recoverable Chromium	mg/kg dry wt	122	91	64	63	69
Total Recoverable Copper	mg/kg dry wt	38	28	47	98	61
Total Recoverable Lead	mg/kg dry wt	22	11.0	44	550	63
Total Recoverable Nickel	mg/kg dry wt	230	137	80	90	71
Total Recoverable Zinc	mg/kg dry wt	75	49	95	430	118
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	0.024	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	0.032	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	0.047	2.7	0.31	0.152
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	0.49	0.062	0.027
4,4'-DDT	mg/kg dry wt	< 0.010	0.015	2.1	0.29	0.137
Total DDT Isomers	mg/kg dry wt	< 0.06	0.06	5.3	0.66	0.32
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	0.16	0.09	0.30
Anthracene	mg/kg dry wt	< 0.03	< 0.03	0.11	0.08	0.26
Benzo[a]anthracene	mg/kg dry wt	0.04	< 0.03	0.32	0.57	1.05
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.05	< 0.03	0.44	0.91	1.42
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.06	0.03	0.48	1.02	1.46
Benzo[g,h,i]perylene	mg/kg dry wt	0.04	< 0.03	0.32	0.70	0.93
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	0.18	0.39	0.63
Chrysene	mg/kg dry wt	0.04	< 0.03	0.36	0.63	1.06
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	0.07	0.14	0.21
Fluoranthene	mg/kg dry wt	0.08	0.04	1.03	1.26	2.5
Fluorene	mg/kg dry wt	< 0.03	< 0.03	0.06	< 0.03	0.08
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.04	< 0.03	0.39	0.81	1.14
Naphthalene	mg/kg dry wt	< 0.15	< 0.14	< 0.15	< 0.14	0.15
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	0.76	0.42	1.30
Pyrene	mg/kg dry wt	0.08	0.04	1.00	1.42	2.6

Sample Type: Soil						
Sample Name:		HA36 Sur 05-May-2017	HA37 Sur 05-May-2017	HA38 Sur 05-May-2017	HA39 Sur 05-May-2017	HA40 Sur 05-May-2017
Lab Number:		1770941.36	1770941.37	1770941.38	1770941.39	1770941.40
Individual Tests						
Dry Matter	g/100g as rcvd	40	77	79	79	79
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.49	1.08	0.22	0.34	2.6
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	8	7	4	10
Total Recoverable Cadmium	mg/kg dry wt	0.23	0.16	0.19	0.15	0.10
Total Recoverable Chromium	mg/kg dry wt	21	146	122	64	48
Total Recoverable Copper	mg/kg dry wt	26	39	37	27	37
Total Recoverable Lead	mg/kg dry wt	37	31	29	45	30
Total Recoverable Nickel	mg/kg dry wt	20	173	132	74	54
Total Recoverable Zinc	mg/kg dry wt	144	81	84	86	83
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	0.025	0.098	0.065	0.053
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	0.019	0.091	0.017	0.035
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	0.19	0.08	0.09
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.06	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	0.06	0.08	< 0.03	0.04	0.33
Anthracene	mg/kg dry wt	0.09	0.08	< 0.03	0.04	0.28
Benzo[a]anthracene	mg/kg dry wt	0.26	0.49	0.10	0.16	1.25
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.32	0.72	0.15	0.23	1.78
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.34	0.81	0.17	0.24	1.91
Benzo[g,h,i]perylene	mg/kg dry wt	0.22	0.55	0.12	0.17	1.12
Benzo[k]fluoranthene	mg/kg dry wt	0.13	0.30	0.06	0.09	0.71
Chrysene	mg/kg dry wt	0.25	0.52	0.11	0.18	1.36
Dibenzo[a,h]anthracene	mg/kg dry wt	0.06	0.12	< 0.03	0.03	0.27
Fluoranthene	mg/kg dry wt	0.72	0.91	0.23	0.34	3.4
Fluorene	mg/kg dry wt	< 0.06	< 0.03	< 0.03	< 0.03	0.09
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.26	0.64	0.12	0.17	1.40
Naphthalene	mg/kg dry wt	< 0.3	< 0.14	< 0.15	< 0.14	< 0.14

Sample Type: Soil						
Sample Name:	HA36 Sur 05-May-2017	HA37 Sur 05-May-2017	HA38 Sur 05-May-2017	HA39 Sur 05-May-2017	HA40 Sur 05-May-2017	
Lab Number:	1770941.36	1770941.37	1770941.38	1770941.39	1770941.40	
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Phenanthrene	mg/kg dry wt	0.44	0.27	0.10	0.16	1.87
Pyrene	mg/kg dry wt	0.75	1.08	0.25	0.39	3.2
Sample Name:	HA41 Sur 05-May-2017	HA42 Sur 05-May-2017	HA43 Sur 05-May-2017	HA44 Sur 05-May-2017	HA45 Sur 05-May-2017	
Lab Number:	1770941.41	1770941.42	1770941.43	1770941.44	1770941.45	
Individual Tests						
Dry Matter	g/100g as rcvd	82	76	87	77	75
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.46	3.3	5.1	1.17	0.88
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	9	9	6	9	8
Total Recoverable Cadmium	mg/kg dry wt	0.37	0.21	0.27	0.12	0.20
Total Recoverable Chromium	mg/kg dry wt	70	84	164	79	110
Total Recoverable Copper	mg/kg dry wt	51	50	57	42	36
Total Recoverable Lead	mg/kg dry wt	104	46	210	39	32
Total Recoverable Nickel	mg/kg dry wt	76	83	230	92	135
Total Recoverable Zinc	mg/kg dry wt	187	158	260	88	116
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	0.011	0.010	0.039	0.048	0.038
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	0.015	< 0.010	0.043	0.021	0.019
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	0.08	0.07	< 0.06
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	0.105	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	0.06	0.44	0.32	0.21	0.10
Anthracene	mg/kg dry wt	0.04	0.29	1.36	0.24	0.08
Benzo[a]anthracene	mg/kg dry wt	0.21	1.63	2.8	0.65	0.41
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.31	2.2	3.4	0.78	0.59
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.35	2.5	3.7	0.88	0.67
Benzo[g,h,i]perylene	mg/kg dry wt	0.25	1.42	2.0	0.50	0.43
Benzo[k]fluoranthene	mg/kg dry wt	0.14	0.96	1.43	0.33	0.25

Sample Type: Soil						
Sample Name:		HA41 Sur 05-May-2017	HA42 Sur 05-May-2017	HA43 Sur 05-May-2017	HA44 Sur 05-May-2017	HA45 Sur 05-May-2017
Lab Number:		1770941.41	1770941.42	1770941.43	1770941.44	1770941.45
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Chrysene	mg/kg dry wt	0.24	1.49	2.4	0.66	0.46
Dibenzo[a,h]anthracene	mg/kg dry wt	0.05	0.37	0.51	0.11	0.09
Fluoranthene	mg/kg dry wt	0.50	3.1	5.2	1.79	0.99
Fluorene	mg/kg dry wt	< 0.03	0.05	0.08	0.10	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.26	1.81	2.6	0.60	0.52
Naphthalene	mg/kg dry wt	< 0.13	< 0.15	< 0.13	< 0.15	< 0.15
Phenanthrene	mg/kg dry wt	0.20	1.07	2.4	1.34	0.39
Pyrene	mg/kg dry wt	0.54	3.1	5.3	1.74	1.06
Sample Name:		HA46 Sur 05-May-2017	HA47 Sur 05-May-2017	HA48 Sur 05-May-2017	HA49 Sur 05-May-2017	HA50 Sur 05-May-2017
Lab Number:		1770941.46	1770941.47	1770941.48	1770941.49	1770941.50
Individual Tests						
Dry Matter	g/100g as rcvd	77	75	75	78	80
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.22	0.59	1.37	2.2	0.37
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	8	6	7	6	7
Total Recoverable Cadmium	mg/kg dry wt	0.23	0.21	0.14	0.25	0.14
Total Recoverable Chromium	mg/kg dry wt	81	90	128	87	40
Total Recoverable Copper	mg/kg dry wt	37	44	59	43	31
Total Recoverable Lead	mg/kg dry wt	31	95	32	100	47
Total Recoverable Nickel	mg/kg dry wt	84	119	99	108	37
Total Recoverable Zinc	mg/kg dry wt	96	145	91	162	82
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	0.054	0.048	< 0.010	< 0.010	0.130
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	0.089	0.030	< 0.010	< 0.010	0.071
Total DDT Isomers	mg/kg dry wt	0.14	0.08	< 0.06	< 0.06	0.20
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	0.07	0.11	0.08	< 0.03
Anthracene	mg/kg dry wt	< 0.03	0.06	0.45	0.17	0.04

Sample Type: Soil						
Sample Name:	HA46 Sur 05-May-2017	HA47 Sur 05-May-2017	HA48 Sur 05-May-2017	HA49 Sur 05-May-2017	HA50 Sur 05-May-2017	
Lab Number:	1770941.46	1770941.47	1770941.48	1770941.49	1770941.50	
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Benzo[a]anthracene	mg/kg dry wt	0.09	0.28	0.87	0.94	0.20
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.15	0.39	0.91	1.55	0.25
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	0.17	0.47	0.94	1.50	0.29
Benzo[g,h,i]perylene	mg/kg dry wt	0.12	0.29	0.64	1.00	0.15
Benzo[k]fluoranthene	mg/kg dry wt	0.06	0.17	0.37	0.54	0.09
Chrysene	mg/kg dry wt	0.11	0.31	0.95	1.09	0.20
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	0.06	0.14	0.21	0.03
Fluoranthene	mg/kg dry wt	0.20	0.64	2.8	2.2	0.47
Fluorene	mg/kg dry wt	< 0.03	< 0.03	0.04	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.12	0.30	0.69	1.14	0.19
Naphthalene	mg/kg dry wt	< 0.14	< 0.15	< 0.15	< 0.15	< 0.14
Phenanthrene	mg/kg dry wt	0.07	0.30	2.7	0.81	0.22
Pyrene	mg/kg dry wt	0.22	0.69	2.8	2.6	0.53

Analyst's Comments

It was observed that the containers for samples 1770941/6, 8, 10, 15 & 22 were not completely filled. Volatile loss may have occurred due to the headspace created in the container.

It has been noted that the duplicate for the PAH analysis on sample 1770941.48, which was run as part of our in-house QC procedure, showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-50
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.06 mg/kg dry wt	1-50
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.010 - 0.05 mg/kg dry wt	1-50
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis). US EPA 3550.	0.10 g/100g as rcvd	1-50
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(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 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + 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	1-50

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

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

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

Appendix G - Tabulated Soil Sampling Results



Sample Results: Residential Zone - Atawhai Closed Landfill, Nelson

Parameter	HA14 (SUR)	HA26 (SUR)	HA27 (SUR)	HA33 (SUR)	HA34 (SUR)	HA35 (SUR)	HA41 (SUR)	HA42 (SUR)	HA43 (SUR)	HA48 (SUR)	HA49 (SUR)	HA50 (SUR)
Total Recoverable Arsenic	8	7	8	8	7	4	9	9	6	7	6	7
Total Recoverable Cadmium	0.26	0.18	0.19	0.26	0.55	0.14	0.37	0.21	0.27	0.14	0.25	0.14
Total Recoverable Chromium	63	83	49	64	63	69	70	84	164	128	87	40
Total Recoverable Copper	50	50	43	47	98	61	51	50	57	59	43	31
Total Recoverable Lead	146	200	44	44	550	63	104	46	210	32	100	47
Total Recoverable Nickel	81	138	45	80	90	71	76	83	230	99	108	37
Total Recoverable Zinc	164	260	125	95	430	118	187	158	260	91	162	82
Total DDT	< 0.06	< 0.06	< 0.06	5.3	0.66	0.32	< 0.06	< 0.06	0.08	< 0.06	< 0.06	0.2
Dieldrin	0.012	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.105	< 0.010	< 0.010	< 0.010
BaP eq.	13.1	7	1.32	0.66	1.35	2.1	0.46	3.3	5.1	1.37	2.2	0.37

Note: All results in mg/kg. Results in **Red** exceed the SCS(health) for residential land use. Results in **Bold** exceed the cleanfill criteria.



Sample Results: Recreational Zone - Atawhai Closed Landfill, Nelson

Parameter	HA01 (SUR)	HA02 (SUR)	HA03 (SUR)	HA04 (SUR)	HA05 (SUR)	HA06 (SUR)	HA07 (SUR)	HA08 (SUR)	HA09 (SUR)	HA11 (SUR)	HA15 (SUR)	HA18 (SUR)	HA22 (SUR)	HA23 (SUR)	HA24 (SUR)
Total Recoverable Arsenic	7	3	8	11	7	7	4	5	8	7	7	8	6	5	13
Total Recoverable Cadmium	0.18	< 0.10	0.12	0.13	0.12	0.4	0.17	0.14	< 0.19	0.13	< 0.10	0.21	0.12	< 0.10	0.12
Total Recoverable Chromium	57	23	166	59	48	42	30	115	8	60	123	69	188	30	178
Total Recoverable Copper	53	27	270	62	48	83	23	51	14	41	70	51	47	24	46
Total Recoverable Lead	53	23	47	99	69	280	61	98	2.9	42	8.2	72	31	16.2	103
Total Recoverable Nickel	52	21	90	42	49	37	20	191	10	67	106	76	260	28	320
Total Recoverable Zinc	102	55	88	122	95	240	80	130	22	106	89	103	98	51	73

Total DDT	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.16	< 0.06	< 0.06
Dieldrin	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.017	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
BaP eq.	1.4	1.1	6.2	11.3	1.82	0.86	< 0.07	1.81	< 0.3	1.36	< 0.07	0.54	0.7	< 0.08	< 0.07

Parameter	HA25 (SUR)	HA28 (SUR)	HA29 (SUR)	HA30 (SUR)	HA31 (SUR)	HA32 (SUR)	HA36 (SUR)	HA37 (SUR)	HA38 (SUR)	HA39 (SUR)	HA40 (SUR)	HA44 (SUR)	HA45 (SUR)	HA46 (SUR)	HA47 (SUR)
Total Recoverable Arsenic	36	5	6	5	6	6	5	8	7	4	10	9	8	8	6
Total Recoverable Cadmium	0.14	0.13	0.16	0.12	0.13	0.11	0.23	0.16	0.19	0.15	0.1	0.12	0.2	0.23	0.21
Total Recoverable Chromium	240	90	230	87	122	91	21	146	122	64	48	79	110	81	90
Total Recoverable Copper	77	35	54	49	38	28	26	39	37	27	37	42	36	37	44
Total Recoverable Lead	39	32	26	15.1	22	11	37	31	29	45	30	39	32	31	95
Total Recoverable Nickel	370	115	480	147	230	137	20	173	132	74	54	92	135	84	119
Total Recoverable Zinc	64	85	89	74	75	49	144	81	84	86	83	88	116	96	145
Total DDT	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.06	< 0.06	< 0.06	0.19	0.08	0.09	0.07	< 0.06	0.14	0.08
Dieldrin	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
BaP eq.	0.19	0.19	0.16	< 0.07	< 0.07	< 0.07	0.49	1.08	0.22	0.34	2.6	1.17	0.88	0.22	0.59

Note: All results in mg/kg. Results in Red exceed the SCS(health) for recreational land use. Results in Bold exceed the cleanfill criteria.



Sample Results: Commercial/Industrial Zone - Atawhai Closed Landfill, Nelson

Parameter	HA10 (SUR)	HA13 (SUR)	HA12 (SUR)	HA13 (SUR)	HA16 (SUR)	HA17 (SUR)	HA19 (SUR)	HA20 (SUR)	HA21 (SUR)
Total Recoverable Arsenic	6	18	7	18	6	9	8	16	5
Total Recoverable Cadmium	0.17	0.16	0.21	0.16	0.16	0.16	0.4	0.14	0.15
Total Recoverable Chromium	31	94	48	94	51	79	107	73	68
Total Recoverable Copper	42	67	45	67	570	57	94	64	42
Total Recoverable Lead	43	67	250	67	65	99	920	56	57
Total Recoverable Nickel	32	167	51	167	44	144	155	66	50
Total Recoverable Zinc	76	110	177	110	200	133	350	131	84
Total DDT	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Dieldrin	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
BaP eq.	4.5	1.18	2.4	1.18	0.54	0.66	3.7	0.48	2.6

Note: All results in mg/kg. Results in **Red** exceed the SCS(health) for commercial/industrial land use. Results in **Bold** exceed the cleanfill criteria.

Appendix H - Sub-Ground Gas Monitoring Results



Sub-Ground Gas Monitoring Results: Atawhai Closed Landfill, Nelson

Borehole	CH4 (% v/v)	CO2 (% v/v)	O2 (% v/v)	CO (ppm)	H2S (ppm)	Bal. (% v/v)	Flow (l/h)	Rel. P (kPa)
HA01	0	<u>4.2</u>	14.3	0	0	81.5	1	6.32
HA02	4	<u>5.2</u>	20.6	3	0	75.6	1.1	6.41
HA03	36.3	<u>14.9</u>	5.5	2	0	48.5	1.1	6.39
HA04	0.6	<i>1.2</i>	20.4	0	0	77.8	1	-6.27
HA05	0	<i>0.9</i>	20.4	0	0	79.7	1.2	6.41
HA06	0	<i>1.5</i>	20.4	1	0	78.4	0.8	-6.27
HA07	0	<i>0.5</i>	21.1	0	1	78.4	0.8	-6.27
HA08	0	<i>0.2</i>	21.2	0	0	78.6	0.7	-6.25
HA09	0	<i>1.2</i>	20.5	1	0	78.3	-	-6.22
HA10	0.6	<i>1.2</i>	20.4	0	0	77.8	0.8	-6.29
HA11	0	<i>0.6</i>	20	0	1	79.4	1.1	-6.43
HA12	0.4	<u>3.6</u>	16.5	1	0	79.5	0.9	-6.31
HA13	0	<i>0.5</i>	20.9	0	0	78.6	0.7	-6.63
HA14	0	<i>0.2</i>	20.8	1	0	79	0.9	-7.17
HA15	5.5	<u>4.7</u>	17.5	6	0	72.3	1.4	-6.44
HA16	0	<i>2</i>	19.6	1	0	78.4	0.9	-6.31
HA17	0	<i>0.7</i>	20.8	0	0	78.5	0.7	-6.27
HA18	0	<i>0.2</i>	21.4	0	0	78.4	0.6	-6.2
HA19	0	<i>0.2</i>	20.8	0	0	79	0.9	-5.89
HA20	0	<i>0.1</i>	20.8	1	0	79	0.97	0.9
HA21	0	<i>0.5</i>	20.9	0	0	78.6	0.6	-6.19
HA22	-	-	-	-	-	-	-	-
HA23	0	<i>0.5</i>	20.7	1	0	78.4	0.5	-6.19
HA24	-	-	-	-	-	-	-	-
HA25	0	<i>0.5</i>	21.1	0	0	78.4	0.7	-6.22
HA26	0	<i>1.9</i>	18.7	1	0	79.4	0	0.02
HA27	0	<i>1.2</i>	20.4	0	0	78.4	0.4	0.17
HA28	0	<i>0.3</i>	21.4	0	0	78.3	0.8	-5.58
HA29	0	<u>12.4</u>	9	1	0	78.6	0.4	-6.08
HA30	0	<u>12.1</u>	10.1	1	0	78.2	0.5	-6.32
HA31	0	<i>1.9</i>	20.3	0	0	78.1	0.6	-6.25
HA32	0	<i>1.4</i>	20.5	0	0	78.2	0.6	-6.24
HA33	0	<i>1</i>	19.9	1	0	79.1	0.7	0.12
HA34	0	<i>2.6</i>	18.8	0	0	78.6	0.4	0.19
HA35	0	<i>1.7</i>	19.9	0	0	78.4	0.4	0.17
HA36	0	<u>3.8</u>	15.7	0	0	78.2	0.8	-6.24
HA37	0	<i>0.4</i>	21.5	0	0	78.1	0.7	-6.39
HA38	0	<i>0.6</i>	20.7	1	0	78.7	0.8	0.1
HA39	0	<i>0.7</i>	20.5	1	0	78.8	0.16	0.9
HA40	0	<i>0.7</i>	20.5	1	0	78.9	0.7	0.14
HA41	0	<i>1.6</i>	19.5	1	0	78.9	0.6	0.17
HA42	0	<i>0.6</i>	20.5	1	0	78.9	0.6	0.14
HA43	0	<i>1.6</i>	19.5	1	0	78.9	0.3	0.19
HA44	0	<u>3.4</u>	16.3	4	0	80.3	0.7	-6.24
HA45	0	<i>0.3</i>	21.6	1	0	78.1	0.7	-6.19
HA46	0	<i>0.17</i>	20.4	0	0	78.8	0.6	0.17
HA47	0	<i>0.7</i>	20.7	0	0	78.6	0.8	0.09
HA48	0	<i>1.1</i>	20	0	0	78.1	0.5	0.26
HA49	0	<i>1.7</i>	19.3	1	0	79	0.4	0.19
HA50	0	<i>1.1</i>	20.2	1	0	78.7	0.3	0.19

Note: Results in **red** exceed the lower explosive limit (LEL) for methane of 5% (v/v). Results in **Bold** exceed the perimeter probe limit of 1.25% for methane. Results underlined exceed the STEL. Results in *Italics* exceed the TWA.

Appendix I - Gas Well Monitoring Results



Gas Well Monitoring Results: Atawhai Closed Landfill

Borehole	CH4 (% v/v)	CO2 (% v/v)	O2 (% v/v)	CO (% v/v)	H2S (ppm)	Bal. (% v/v)	Flow (l/h)	Rel. P (kPa)
MW01	0	13	13	0	0	74	-0.07	1.3
MW02	33	38.2	0.8	0	1	28	-0.03	1.2
MW03	32.6	18	4.6	71	43	44.8	-0.19	1
MW04	14.2	9	15.4	5	6	61.4	0.02	-2.3
MW05	7.4	7	18	0	1	67.6	-0.24	-7.3
MW06	9.8	2.2	13.3	30	0	74.7	0.5	0.16
MW07	7	8.2	4.6	2	0	80.2	-0.03	1.1
MW08	39.7	28.2	0.2	0	0	31.7	0.05	1
MW09	0	4.1	14.6	2	0	81.3	-0.03	1.1
MW10	0	6.6	11.3	0	0	82.1	-0.1	1

Appendix J - Laboratory Transcripts: Groundwater



ANALYSIS REPORT

Client:	Focus Environmental Services Limited	Lab No:	1770147	SPv1
Contact:	Sam Woolley C/- Focus Environmental Services Limited PO Box 11455 Ellerslie Auckland 1542	Date Received:	05-May-2017	
		Date Reported:	17-May-2017	
		Quote No:	85090	
		Order No:		
		Client Reference:	GW	
		Submitted By:	Sam Woolley	

Sample Type: Aqueous

Sample Name:	MW02	MW03	MW04	MW07	
	04-May-2017 10:45 am	04-May-2017 9:35 am	04-May-2017 10:00 am	04-May-2017 10:25 am	
Lab Number:	1770147.1	1770147.2	1770147.3	1770147.4	

Individual Tests						
Sum of Anions	meq/L	9.4	27	22	7.2	-
Sum of Cations	meq/L	9.0	25	18.8	6.0	-
pH	pH Units	6.2	6.9	6.8	6.8	-
Total Alkalinity	g/m ³ as CaCO ₃	440	1,250	1,010	330	-
Bicarbonate	g/m ³ at 25°C	530	1,530	1,230	400	-
Total Hardness	g/m ³ as CaCO ₃	340	730	570	220	-
Electrical Conductivity (EC)	mS/m	80.0	225	179.3	61.3	-
Dissolved Boron	g/m ³	0.62	1.42	1.19	0.099	-
Dissolved Calcium	g/m ³	64	184	147	60	-
Dissolved Iron	g/m ³	7.9	0.03	0.52	5.7	-
Dissolved Magnesium	g/m ³	44	67	50	16.9	-
Dissolved Manganese	g/m ³	2.9	1.54	1.61	1.10	-
Dissolved Potassium	g/m ³	12.3	51	35	4.5	-
Dissolved Sodium	g/m ³	29	71	55	25	-
Chloride	g/m ³	23	60	50	16.6	-
Total Ammoniacal-N	g/m ³	3.6	80	55	2.2	-
Nitrite-N	g/m ³	0.004	< 0.002	0.003	0.005 #1	-
Nitrate-N	g/m ³	< 0.002	0.004	0.008	< 0.002	-
Nitrate-N + Nitrite-N	g/m ³	0.004	0.005	0.010	0.004 #1	-
Sulphate	g/m ³	1.5	3.1	3.5	6.6	-
Carbonaceous Biochemical Oxygen Demand (cBOD ₅)	g O ₂ /m ³	3	4	5	4	-
Chemical Oxygen Demand (COD)	g O ₂ /m ³	130	90	170	104	-
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m ³	0.42	0.005	0.0024	0.0020	-
Dissolved Cadmium	g/m ³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	-
Dissolved Chromium	g/m ³	0.0090	< 0.0010	0.0011	< 0.0005	-
Dissolved Copper	g/m ³	0.0007	< 0.0005	0.0013	< 0.0005	-
Dissolved Lead	g/m ³	< 0.00010	0.00012	0.00083	< 0.00010	-
Dissolved Nickel	g/m ³	0.036	0.0074	0.0090	0.0151	-
Dissolved Zinc	g/m ³	0.021	0.0102	0.033	0.0179	-



Analyst's Comments

The initial result for carbonaceous Biochemical Oxygen Demand (cBOD₅) was below detection limit due to over-dilution of samples 1770147.1,2,3 and 4. In order to achieve a lower detection limit the cBOD₅ analyses were repeated on a sub-sample that had been stored frozen, using a larger volume.

#1 It has been noted that the result for Nitrite-N was greater than that for Nitrate-N + Nitrite-N, but within the analytical variation of these methods.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00005 - 0.0010 g/m ³	1-4
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-4
Total anions for anion/cation balance check	Calculation: sum of anions as mEq/L calculated from Alkalinity (bicarbonate), Chloride and Sulphate. Nitrate-N, Nitrite-N. Fluoride, Dissolved Reactive Phosphorus and Cyanide also included in calculation if available. APHA 1030 E 22 nd ed. 2012.	0.07 meq/L	1-4
Total cations for anion/cation balance check	Sum of cations as mEq/L calculated from Sodium, Potassium, Calcium and Magnesium. Iron, Manganese, Aluminium, Zinc, Copper, Lithium, Total Ammoniacal-N and pH (H ⁺) also included in calculation if available. APHA 1030 E 22 nd ed. 2012.	0.05 meq/L	1-4
pH	pH meter. APHA 4500-H ⁺ B 22 nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field.	0.1 pH Units	1-4
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (Modified for alk <20) 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	1-4
Bicarbonate	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 22 nd ed. 2012.	1.0 g/m ³ at 25°C	1-4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	1-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22 nd ed. 2012.	0.1 mS/m	1-4
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-4
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.005 g/m ³	1-4
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.05 g/m ³	1-4
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.02 g/m ³	1-4
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.02 g/m ³	1-4
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-4
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.05 g/m ³	1-4
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.02 g/m ³	1-4
Chloride	Filtered sample. Ferric thiocyanate colorimetry. Discrete Analyser. APHA 4500 Cl ⁻ E (modified from continuous flow analysis) 22 nd ed. 2012.	0.5 g/m ³	1-4
Total Ammoniacal-N	Filtered sample. Phenol/hypochlorite colorimetry. Discrete Analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ F (modified from manual analysis) 22 nd ed. 2012.	0.010 g/m ³	1-4
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₂ ⁻ I 22 nd ed. 2012 (modified).	0.002 g/m ³	1-4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-4
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I 22 nd ed. 2012 (modified).	0.002 g/m ³	1-4
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B 22 nd ed. 2012.	0.5 g/m ³	1-4
Carbonaceous Biochemical Oxygen Demand (cBOD ₅)	Incubation 5 days, DO meter, nitrification inhibitor added, dilutions, seeded. Analysed at Hill Laboratories - Microbiology; 1 Clow Place, Hamilton. APHA 5210 B (modified) 22 nd ed. 2012.	2 g O ₂ /m ³	1-4

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Chemical Oxygen Demand (COD), trace level	Dichromate/sulphuric acid digestion in Hach tubes, colorimetry. Trace Level method. APHA 5220 D 22 nd ed. 2012.	6 g O ₂ /m ³	1-4

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

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

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

Appendix K - Tidal Influence Results



Tidal Influence Results: Atawhai Closed Landfill

Date 25/09/2017

Tide Low: 07:23 (0.8m)

High: 13:41 (3.9m)

Well	Time	Depth to Water	Time	Depth to Water	Diff.
MW01	06:48	1.650	13:28	1.585	0.065
MW02	06:53	3.170	13:34	3.060	0.110
MW03	07:00	3.965	13:42	3.185	0.780
MW04	07:08	1.800	13:49	1.700	0.100
MW05	07:13	1.415	13:54	1.395	0.020
MW06	07:25	4.410	14:04	4.210	0.200
MW07	07:35	2.840	14:15	2.685	0.155
MW08	07:30	5.345	14:10	4.855	0.490
MW09	07:42	3.130	14:24	2.970	0.160
MW10	07:46	2.955	14:28	2.955	0.000