Contaminated Land Solutions Ltd
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ASSESSMENT OF POTENTIAL EFFECTS ON GROUNDWATER OF THE CONTAINMENT CELL AT 69 INLAND KAIKOURA ROAD

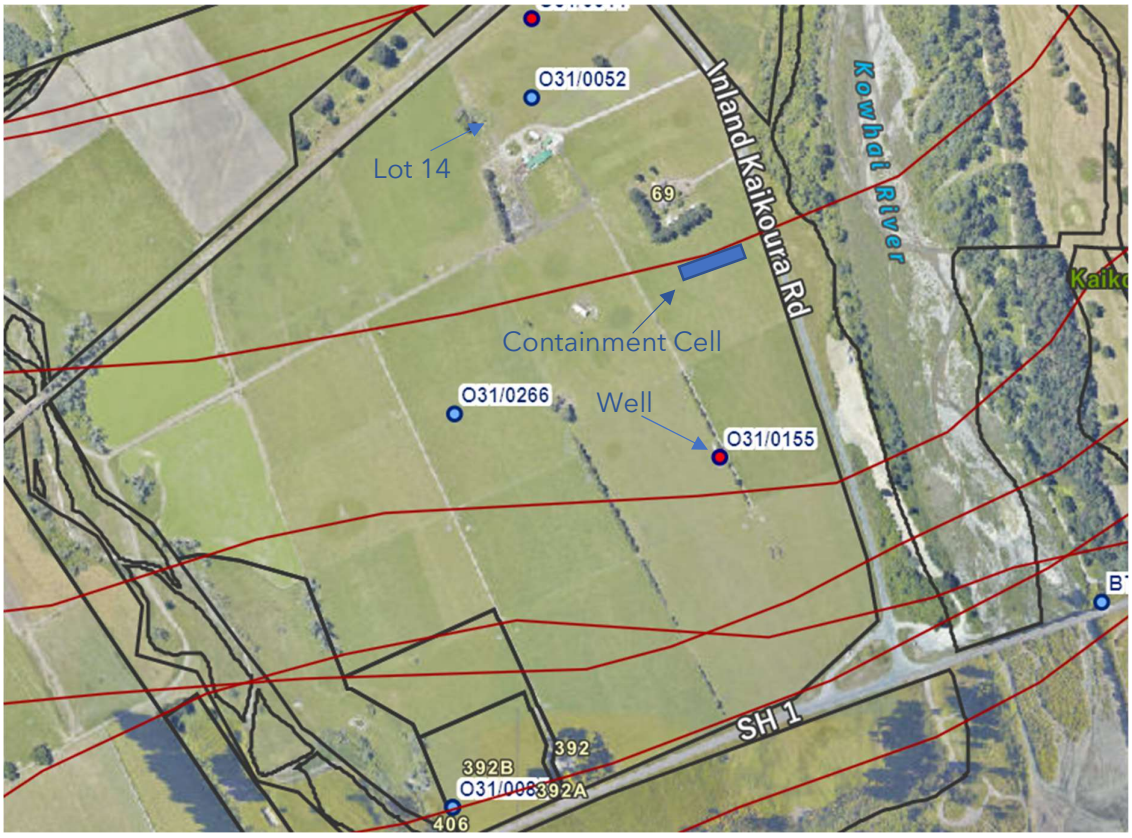
Project number	**J22021031**	Date	**26/9/2022**
Project name	**69 Inland Kaikoura Road**	Recorded by	**Helen Davies**
Record Number		Total pages	**3 plus attachments**

1.0 Introduction

At the request of Kaikoura Business Park 2021, CLS has conducted a high-level desktop assessment of the potential effects of an area of land at 69 Inland Road, Peketā, Kaikōura containing known low-level contamination on the groundwater resource beneath it. The purpose is to determine whether the contaminants in the soil could be mobilised and transported into groundwater in sufficient quantity to impact upon the quality of the water.

This assessment is being undertaken due to the proposed use of existing and downgradient well O31/0155 for community drinking-water supply purposes. The location of the well and the containment cell are shown in Figure 1.

Figure 1. Contaminated Cell and Well O31/0155. Piezometric Contours Shown in Red



2.0 Hydrological Setting

The expected near surface ground conditions at the site are gravel and clay bound gravel with depth to groundwater ranging from approximately 3.5 to 10m below ground level.

The Kowhai River is located approximately 210m east of the site and local groundwater may be in hydraulic connection with the river as well as influenced by the general direction of groundwater flow south towards the Pacific Ocean.

Well O31/0155 is recorded in Environment Canterbury's database as being 18.6m deep and is currently recorded as being used for irrigation (see well details in **Attachment 1**).

Sources of contamination within the calculated groundwater protection zone (per requirements of Schedule 1 of the Canterbury Land and Water Regional Plan) of well O31/0155 has been identified as follows:

- **Cadmium:** Cadmium is present in surface soil at low concentrations (but elevated above background) and this has been attributed to the use of the land for dairy farming and associated repeated applications of superphosphate fertiliser. CLS, 2022 recorded cadmium concentrations of 0.29mg/kg – 0.74mg/kg in surface soil samples taken from the fields at the site. The background concentration for cadmium published by Environment Canterbury (ECan 2007) is 0.19mg/kg).
- **Arsenic, cadmium and lead:** A containment cell 1.5m deep was constructed in June 2022 and used to accommodate surface soil excavated from proposed Lot 14 of the site (see Figure 1 for location). The soil was relocated to the cell due to the presence of arsenic, cadmium and lead at concentrations above the rural residential soil contaminant standards. The maximum and average recorded concentrations (CLS, 2022) in the surface soil within Lot 14 were: arsenic 25mg/kg | 9.9mg/kg, cadmium 3.3mg/kg | 0.8mg/kg, lead 166mg/kg | 55.3mg/kg. The quantity of material relocated to the containment cell is estimated to be 320m^3.
- **Septic tank discharge:** Associated with the property located at 69 Inland Kaikōura Road.

3.0 Leaching Tests

To understand the potential for the identified heavy metals contamination to leach from soil into groundwater, eight samples have been subjected to synthetic precipitation leaching procedure[1] with the resulting leachate analysed for arsenic, cadmium and lead. Three samples were from Lot 14, two from the containment cell and three from locations between the containment cell and the well (see **Attachment 2** for locations). All samples from Lot 14 and the containment cell were collected by Helen Davies of CLS, with the remaining three samples collected, under supervision, by Todd Airey of Baseline Group Ltd. All results from all samples were below 50% Maximum Acceptable Values (MAVs) listed in the Drinking-water Standards for New Zealand 2005 (revised 2018) (MoH 2008).

Summarised results are presented in Table 1 and the table of all SPLP results is presented in **Attachment 2**. Arsenic concentrations were highest in leachate in all three areas, followed by lead. Cadmium was only found above the laboratory limit of detection in samples from Lot 14. The lowest results were from samples taken from the field. The small data size is a relevant limitation.

[1] Synthetic Precipitation Leaching Procedure (SPLP) (U.S. EPA Method 1312; U.S. Environmental Protection Agency, 1986; 1994 update) is a method designed to evaluate the impact of contaminated soils on groundwater

Table 1. Summarised SPLP results

All results in mg/l	Lot 14 – remediated area (3 samples)			Containment Cell – received contaminated material from Lot 14 (2 samples)			Field samples taken from area within the groundwater protection zone (3 samples)			DWSNZ, 50% MAV
	Min	Max	Average	Min	Max	Average	Min	Max	Average	
Arsenic	<0.0011	0.00219	0.00147	0.0039	0.0039	0.0039	<0.0011	0.0012	0.00115	0.005
Cadmium	<0.000053	0.000087	0.000071	<0.000053	<0.000053	<0.000053	<0.000053	<0.000053	<0.000053	0.002
Lead	0.00203	0.00375	0.00267	0.00158	0.0025	0.00204	0.00028	0.00048	0.00039	0.005

Where one or more samples returned a result below the laboratory limit of detection (LOD) the LOD has been used to calculate the average.

4.0 Mitigation

The SPLP results indicate that the 320m^3 material with low level contamination located in a containment cell does have the potential to leach heavy metals at concentrations greater than might be expected from uncontaminated land. Since all results are below 50% MAV, no mitigation is considered to be required to protect the proposed drinking water supply sourced from existing well O31/0155.

Irrespective of this, mitigation will be provided as follows:

- The septic tank associated with the dwelling at 69 Inland Kaikōura Road will be decommissioned when the proposed wastewater treatment plant located at the southern end of the site is commissioned, eliminating the discharge of wastewater from this location.
- The site development involves capping the area accommodating the containment cell with hardstand. This will prevent stormwater from entering the containment cell and consequentially prevent leaching. It is understood that stormwater from hardstand will be directed to stormwater management structures located outside the drinking-water supply protection zone.
- The base of the containment cell is 1.5m below ground level and groundwater is at least 3.5m below ground level. Thus, the cell is at least 2m above groundwater and saturation is not likely to occur.

5.0 Recommendations

As part of the assessment of the suitability of water associated with well O31/0155 for use as a community drinking-water supply, the chemical quality should be assessed through collection and analysis of samples in accordance with the requirements of Taumata Arowai and the Drinking-water Standards for New Zealand 2005 (revised 2018) (MoH 2008). This will provide baseline data on the chemical quality of water abstracted from the well.

References

CLS, 2022. 69 Inland Kaikōura Range. Preliminary and Detailed Site Investigation.

ECan 2007. Background Concentrations of Selected Trace Elements in Canterbury Soils. Addendum 1: Additional Samples and Timaru Specific Background Levels.

Environment Canterbury 2018. Canterbury Land and Groundwater Regional Plan

Ministry of Health 2008. Drinking-water Standards for New Zealand 2005 (Revised 2018)

Attachments

Attachment 1: Well O31/0155 details accessed from Environment Canterbury's Well Search

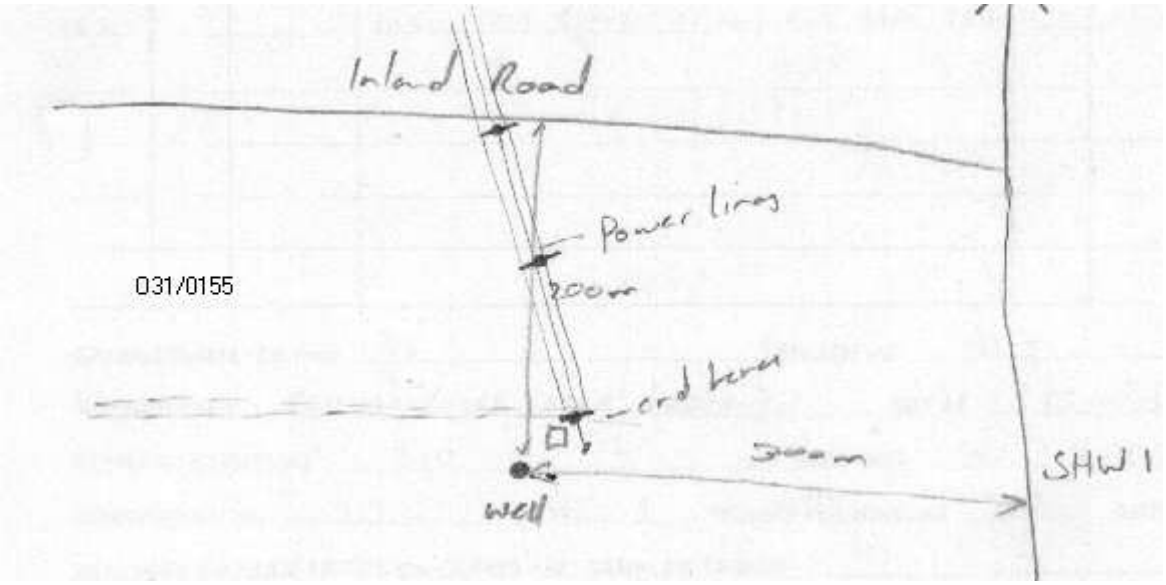
Attachment 2: SPLP Results Table and Laboratory Reports

ATTACHMENT 1

Bore or Well No	O31/0155
Well Name	392 State Highway 1
Owner	Hamish Bruce

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	O31/0155	**File Number**	CO6C/24676
Owner	Hamish Bruce	**Well Status**	Active (exist, present)
Street/Road	392 State Highway 1	**NZTM Grid Reference**	BT27:51617-04077
Locality	KOWHAI	**NZTM X and Y**	1651617 - 5304077
Location Description	access from roadside gate on Inland Road next paddock over	**Location Accuracy**	1 - 2m
CWMS Zone	Kaikoura	**Use**	Irrigation,
Groundwater Allocation Zone	Kaikoura-Kowhai	**Water Level Monitoring**	--
Depth	18.60m	**Water Level Count**	124
Diameter	250mm	**Initial Water Level**	5.69m below MP
Measuring Point Description	Top of socket on casing.	**Highest Water Level**	3.88m below MP
Measuring Point Elevation	13.83m above MSL (Lyttelton 1937)	**Lowest Water Level**	9.92m below MP
Elevation Accuracy	< 0.5 m	**First reading**	02 May 1985
Ground Level	0.40m below MP	**Last reading**	01 Jul 2015
Strata Layers	7	**Calc Min 80%**	6.24m below MP (Estimated)
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	2
Drill Date	11 Oct 1978	**Max Tested Yield**	13 l/s
Driller	A M Bisley & Co	**Drawdown at Max Tested Yield**	4 m
Drilling Method	Unknown	**Specific Capacity**	3.38 l/s/m
Casing Material	STEEL	**Last Updated**	22 Jan 2021
Pump Type	Unknown	**Last Field Check**	01 Jul 2015
Water Use Data	No		



Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	15.55	18.65				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
11 Oct 1978	1	12.5	164.9773	3.7	0

Comments

Comment Date	Comment
24 Apr 2008	routine monitoring visit measured flow at 12L/s.
22 Aug 2008	This well has an active consent so set well status to AE from NO
10 May 2011	First WL reading set as ISWL
21 Jul 2011	Previous owner DAVIDSON, M
14 Oct 2013	Set USE for Irrigation based on Consents info
21 Apr 2015	NZTM Map Reference updated from: BT27:51625-04082 shifted 0m
27 Aug 2015	NZTM Easting/Northing updated from:1651625-5304082 shifted 8m Updated grid ref and RL from surveying. See TRIM Ref C15C/127883 and TRIM Ref C15C/127884
29 Mar 2016	MP Reference Accuracy updated to DGPS <0.5 and MP QAR updated to 2. Survey in 2015 levelled in Ground Level. RL then updated by combining surveyed level and Ground Level from MP measurements. This is not accurate enough for RL QAR 1.

Borelog for well O31/0155

Grid Reference (NZTM): 1651618 mE, 5304078 mN
Location Accuracy: 1 - 2m
Ground Level Altitude: 13.4 m +MSD Accuracy: < 0.5 m
Driller: A M Bisley & Co
Drill Method: Unknown
Borelog Depth: 18.6 m Drill Date: 11-Oct-1978

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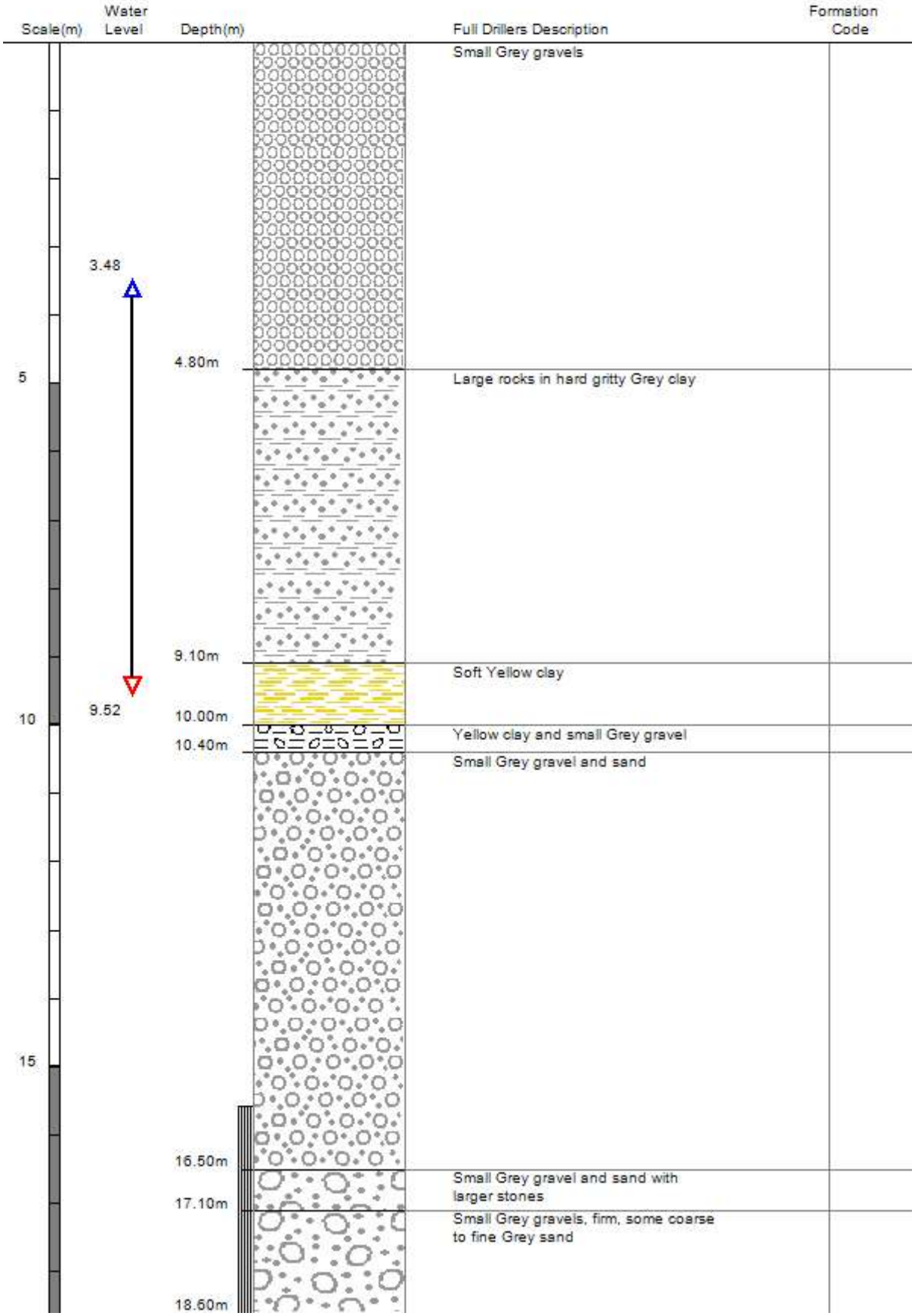

Borelog for well O31/0155

Grid Reference (NZTM): 1651618 mE, 5304078 mN
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Ground Level Altitude: 13.4 m +MSD Accuracy: < 0.5 m
Driller: A M Bisley & Co
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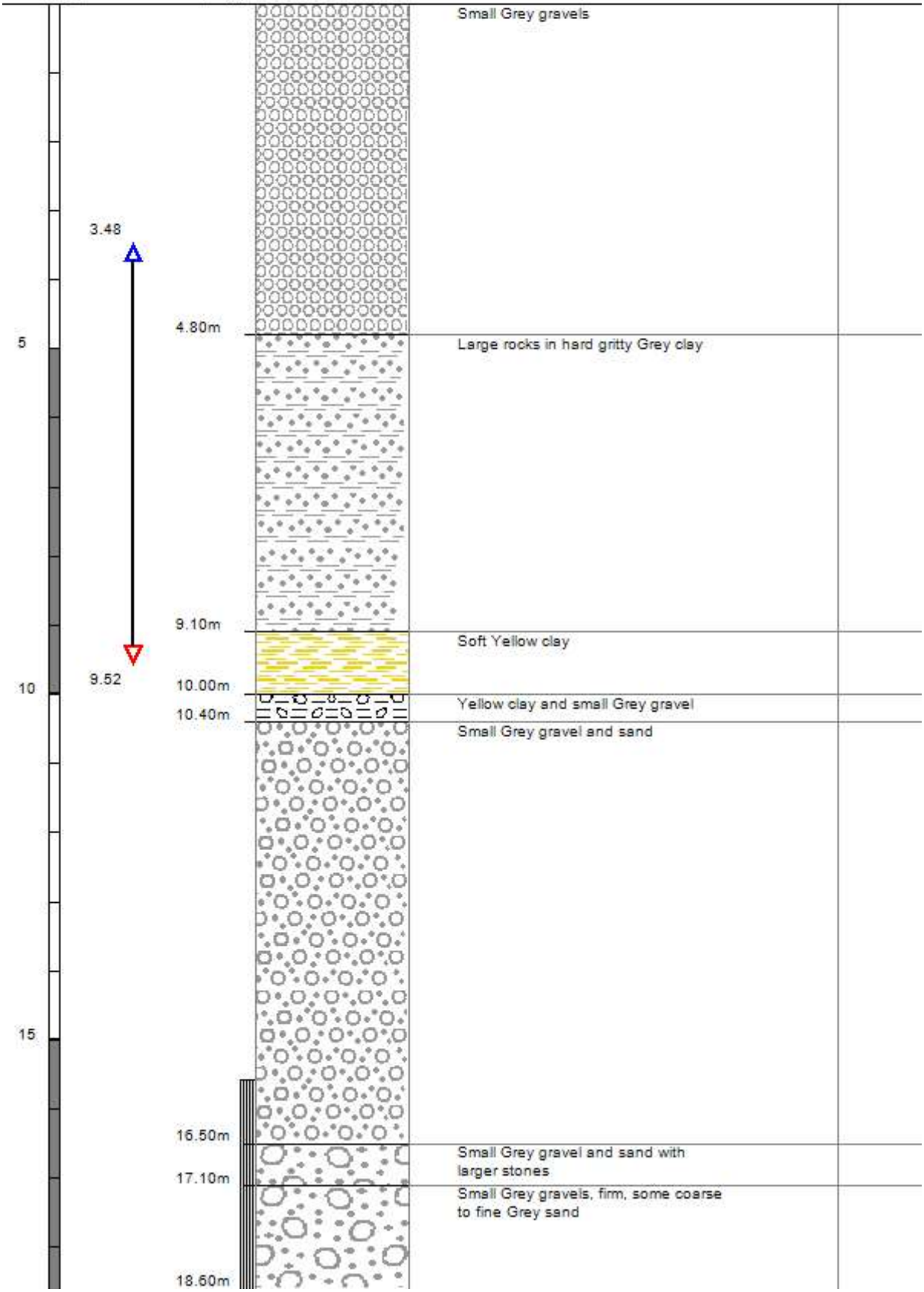

ATTACHMENT 2

Table No:	SPLP EXTRACTION AND ANALYSIS
Site:	69 Inland Kaikoura Road Remediation
Project No:	J2021031
Sample media:	Soil
Analysis:	Total Recoverable Concentrations
Date:	8/09/2022
Revision:	0

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RONGOĀ WHENUA POKE

Sample Name	VS05	VS09	VS11	SPLP01	SPLP02	LT1	LT2	LT3	DWSNZ 50% MAV[1]
Sample Depth (m bgl)	Base	Wall	Base	Surface	Surface	Surface	Surface	Surface	
Natural / Fill?			Natural / Reworked Natural						
Total Recoverable Metals Concentrations in Soil (mg/kg)									
Arsenic	6	8	8	8	9	5	5	5	-
Cadmium	0.81	0.85	1.03	0.41	0.46	0.47	0.41	0.25	-
Lead	41	30	41	25	27	13.9	14.1	13	-
Total Recoverable Metals concentrations in Extract (mg/l)									
Arsenic SPLP	0.00112	0.00219	<0.0011	0.0039	0.0039	< 0.0011	< 0.0011	0.0012	0.005
Cadmium SPLP	<0.000053	0.000074	0.000087	<0.000053	<0.000053	< 0.000053	< 0.000053	< 0.000053	0.002
Lead SPLP	0.00224	0.00203	0.00375	0.0025	0.00158	0.00028	0.00041	0.00048	0.005

Abbreviations:

m bgl = meters below ground level

Notes:

1. Drinking-water Standards for New Zealand 2005. Revised 2018. Ministry of Health


Road 1
11
2.31ha
10
2.01ha
905 c
9
2.02ha
47.4
31.0
15.5
63.1
71.6
LT1
LT2
LT3
Contaminated Material
Disposal Area

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Certificate of Analysis

Client:	Contaminated Land Solutions Limited	**Lab No:**	3023903	SUPv2
Contact:	Helen Davies	**Date Received:**	30-Jun-2022	
	C/- Contaminated Land Solutions Limited	**Date Reported:**	28-Jul-2022	**(Amended)**
	8a Huntsbury Avenue	**Quote No:**	110877	
	Huntsbury	**Order No:**		
	Christchurch 8022	**Client Reference:**	J2021031	
		Submitted By:	Helen Davies	

Sample Type: Soil

	Sample Name:	VS01 29-Jun-2022 1:55 pm	VS02 29-Jun-2022 2:00 pm	VS03 29-Jun-2022 2:05 pm	VS04 29-Jun-2022 2:08 pm
	Lab Number:	3023903.1	3023903.2	3023903.3	3023903.4
Total Recoverable Arsenic	mg/kg dry wt	6.2 ± 1.6	6.0 ± 1.6	5.7 ± 1.6	6.8 ± 1.7
Total Recoverable Cadmium	mg/kg dry wt	0.105 ± 0.067	0.492 ± 0.095	0.58 ± 0.11	0.73 ± 0.13
Total Recoverable Lead	mg/kg dry wt	15.2 ± 2.3	19.3 ± 2.9	18.3 ± 2.8	22.0 ± 3.3

	Sample Name:	VS05 29-Jun-2022 2:10 pm	VS06 29-Jun-2022 2:15 pm	VS07 29-Jun-2022 2:23 pm	VS08 29-Jun-2022 2:25 pm
	Lab Number:	3023903.5	3023903.6	3023903.7	3023903.8
SPLP Sample Weight	g	50	-	-	-
SPLP Extractant Type*		De-ionised Water, pH 5.8 +/- 0.4	-	-	-
SPLP Final pH	pH Units	8.4 ± 0.1	-	-	-
Total Recoverable Arsenic	mg/kg dry wt	6.4 ± 1.7	6.7 ± 1.7	6.6 ± 1.7	9.0 ± 1.9
Total Recoverable Cadmium	mg/kg dry wt	0.81 ± 0.13	< 0.10 ± 0.067	0.403 ± 0.086	0.365 ± 0.083
Total Recoverable Lead	mg/kg dry wt	40.9 ± 6.2	15.6 ± 2.4	38.3 ± 5.8	44.8 ± 6.8

	Sample Name:	VS09 29-Jun-2022 2:25 pm	VS10 29-Jun-2022 2:50 pm	VS11 29-Jun-2022 3:00 pm	VS12 29-Jun-2022 3:10 pm
	Lab Number:	3023903.9	3023903.10	3023903.11	3023903.12
SPLP Sample Weight	g	50	-	50	-
SPLP Extractant Type*		De-ionised Water, pH 5.8 +/- 0.4	-	De-ionised Water, pH 5.8 +/- 0.4	-
SPLP Final pH	pH Units	8.1 ± 0.1	-	9.0 ± 0.1	-
Total Recoverable Arsenic	mg/kg dry wt	7.7 ± 1.8	6.3 ± 1.7	8.3 ± 1.8	6.3 ± 1.7
Total Recoverable Cadmium	mg/kg dry wt	0.85 ± 0.14	0.58 ± 0.11	1.03 ± 0.16	0.489 ± 0.094
Total Recoverable Lead	mg/kg dry wt	30.0 ± 4.5	42.2 ± 6.4	40.7 ± 6.1	15.7 ± 2.4

	Sample Name:	VS13 29-Jun-2022 4:00 pm	VS14 29-Jun-2022 3:45 pm	VS15 29-Jun-2022 4:05 pm	VS16 29-Jun-2022 4:20 pm
	Lab Number:	3023903.13	3023903.14	3023903.15	3023903.16
Total Recoverable Arsenic	mg/kg dry wt	8.8 ± 1.9	7.6 ± 1.8	6.1 ± 1.6	5.4 ± 1.6
Total Recoverable Cadmium	mg/kg dry wt	< 0.10 ± 0.067	0.255 ± 0.075	0.245 ± 0.074	0.418 ± 0.087
Total Recoverable Lead	mg/kg dry wt	15.1 ± 2.3	16.9 ± 2.6	16.1 ± 2.5	44.9 ± 6.8

	Sample Name:	VS17 29-Jun-2022 4:25 pm	VS18 29-Jun-2022 4:30 pm	VS19 29-Jun-2022 4:32 pm	VS20 29-Jun-2022 4:35 pm
	Lab Number:	3023903.17	3023903.18	3023903.19	3023903.20
Total Recoverable Arsenic	mg/kg dry wt	4.7 ± 1.5	5.4 ± 1.6	6.0 ± 1.6	6.5 ± 1.7
Total Recoverable Cadmium	mg/kg dry wt	0.432 ± 0.089	0.63 ± 0.11	0.246 ± 0.074	0.431 ± 0.089
Total Recoverable Lead	mg/kg dry wt	19.2 ± 2.9	17.1 ± 2.6	17.0 ± 2.6	18.1 ± 2.8

Sample Type: Aqueous

Sample Type: Aqueous				
	Sample Name:	VS05 [SPLP Extract]	VS09 [SPLP Extract]	VS11 [SPLP Extract]
	Lab Number:	3023903.21	3023903.22	3023903.23
Total Arsenic	g/m³	0.00112 ± 0.00074	0.00219 ± 0.00075	< 0.0011 ± 0.00074
Total Cadmium	g/m³	< 0.000053 ± 0.000036	0.000074 ± 0.000036	0.000087 ± 0.000036
Total Lead	g/m³	0.00224 ± 0.00016	0.00203 ± 0.00015	0.00375 ± 0.00024

Analyst's Comments

Amended Report: This certificate of analysis replaces report '3023903-SUPv1' issued on 15-Jul-2022 at 12:31 pm.
Reason for amendment: SPLP metals added to 3 samples as requested.

Summary of Methods

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

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-20
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-20
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-20
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-20
Total Recoverable Cadmium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.10 mg/kg dry wt	1-20
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	1-20
SPLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1312.	-	5, 9, 11
SPLP Profile			
SPLP Sample Weight	Gravimetric. US EPA 1312.	0.1 g	5, 9, 11
SPLP Extractant Type*	US EPA 1312 (Modified for New Zealand conditions to use De-ionised Water unless otherwise specified).	-	5, 9, 11
SPLP Final pH	pH meter. US EPA 1312.	0.1 pH Units	5, 9, 11

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	21-23
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0011 g/m³	21-23
Total Cadmium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.000053 g/m³	21-23
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00011 g/m³	21-23

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

Testing was completed between 05-Jul-2022 and 28-Jul-2022. For completion dates of individual analyses please contact the laboratory.

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

Kim Harrison MSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Contaminated Land Solutions Limited	**Lab No:**	3037878	SPv2
Contact:	Helen Davies	**Date Received:**	20-Jul-2022	
	C/- Contaminated Land Solutions Limited	**Date Reported:**	29-Jul-2022	
	8a Huntsbury Avenue	**Quote No:**	110877	
	Huntsbury	**Order No:**		
	Christchurch 8022	**Client Reference:**	J2021031	
		Submitted By:	Helen Davies	

Sample Type: Soil

Sample Name:		SPLP01 18-Jul-2022 11:20 am	SPLP02 18-Jul-2022 11:25 am
Lab Number:		3037878.1	3037878.2
SPLP Sample Weight	g	50	50
SPLP Extractant Type*		De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4
SPLP Final pH	pH Units	8.2	8.3
Total Recoverable Arsenic	mg/kg dry wt	8	9
Total Recoverable Cadmium	mg/kg dry wt	0.41	0.46
Total Recoverable Lead	mg/kg dry wt	25	27

Sample Type: Aqueous

Sample Name:		SPLP01 [SPLP Extract]	SPLP02 [SPLP Extract]
Lab Number:		3037878.3	3037878.4
Total Arsenic	g/m^3	0.0039	0.0039
Total Cadmium	g/m^3	< 0.000053	< 0.000053
Total Lead	g/m^3	0.0025	0.00158

Summary of Methods

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

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-2
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-2
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-2
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-2
Total Recoverable Cadmium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.10 mg/kg dry wt	1-2
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	1-2
SPLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1312.	-	1-2
SPLP Profile			
SPLP Sample Weight	Gravimetric. US EPA 1312.	0.1 g	1-2
SPLP Extractant Type*	US EPA 1312 (Modified for New Zealand conditions to use De-ionised Water unless otherwise specified).	-	1-2
SPLP Final pH	pH meter. US EPA 1312.	0.1 pH Units	1-2

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	3-4
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0011 g/m^3	3-4
Total Cadmium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.000053 g/m^3	3-4
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00011 g/m^3	3-4

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

Testing was completed between 26-Jul-2022 and 29-Jul-2022. For completion dates of individual analyses please contact the laboratory.

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

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Contaminated Land Solutions Limited	**Lab No:**	3073980	SPv1
Contact:	Helen Davies	**Date Received:**	12-Sep-2022	
	C/- Contaminated Land Solutions Limited	**Date Reported:**	20-Sep-2022	
	8a Huntsbury Avenue	**Quote No:**	110877	
	Huntsbury	**Order No:**		
	Christchurch 8022	**Client Reference:**	J202131	
		Submitted By:	Helen Davies	

Sample Type: Soil

Sample Name:		LT1 08-09-22 08-Sep-2022	LT2 08-09-22 08-Sep-2022	LT3 08-09-22 08-Sep-2022
Lab Number:		3073980.1	3073980.2	3073980.3
SPLP Sample Weight	g	50	100	100
SPLP Extractant Type*		De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4
SPLP Final pH	pH Units	7.6	7.7	8.7
Total Recoverable Arsenic	mg/kg dry wt	5	5	5
Total Recoverable Cadmium	mg/kg dry wt	0.47	0.41	0.25
Total Recoverable Lead	mg/kg dry wt	13.9	14.1	13.0

Sample Type: Aqueous

Sample Name:		LT1 08-09-22 [SPLP Extract]	LT2 08-09-22 [SPLP Extract]	LT3 08-09-22 [SPLP Extract]
Lab Number:		3073980.4	3073980.5	3073980.6
Total Arsenic	g/m³	< 0.0011	< 0.0011	0.0012
Total Cadmium	g/m³	< 0.000053	< 0.000053	< 0.000053
Total Lead	g/m³	0.00028	0.00041	0.00048

Summary of Methods

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

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-3
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-3
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-3
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-3
Total Recoverable Cadmium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.10 mg/kg dry wt	1-3
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	1-3
SPLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1312.	-	1-3
SPLP Profile			
SPLP Sample Weight	Gravimetric. US EPA 1312.	0.1 g	1-3
SPLP Extractant Type*	US EPA 1312 (Modified for New Zealand conditions to use De-ionised Water unless otherwise specified).	-	1-3

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
SPLP Final pH	pH meter. US EPA 1312.	0.1 pH Units	1-3

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4-6
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0011 g/m^3	4-6
Total Cadmium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.000053 g/m^3	4-6
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00011 g/m^3	4-6

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

Testing was completed between 16-Sep-2022 and 20-Sep-2022. For completion dates of individual analyses please contact the laboratory.

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

Kim Harrison MSc
Client Services Manager - Environmental