

Soil Contamination Risk Site Validation Report

***511 Halswell Road,
Halswell, Christchurch***

April 2020



Malloch Environmental Ltd

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QUALITY CONTROL AND CERTIFICATION SHEET

Client: Your Section Ltd

Date of issue: 22 March 2020

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Signed: 

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Signed: 



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1 Executive Summary

The subject site involves two rural lots with street address 511 Halswell Road, Christchurch. It is proposed to subdivide and develop the site for a residential use, including extensive stormwater basins. This will change the use of the land and result in disturbance of soils. The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Health) Regulations 2011 (NESCS) require an assessment of the likelihood of soil contamination being present. It is noted also that Malloch Environmental Ltd is obligated to consider the requirements of Section 10 (4) of the Health and Safety at Work (Asbestos) Regulations 2016. This report details the work undertaken to assess the risks.

Preliminary and Detailed Site Investigations completed by Malloch Environmental Ltd in October 2019 Identified three areas of contamination on the subject site:

- **Arsenic Contaminated Paddock Area**

Arsenic contamination is present in the corner of one of the paddocks on the subject site. The delineated area is approximately 1,360m² and the highest arsenic result was 28.9mg/kg. Under the current Outline Development Plan this area is to be part of a stormwater basin and reserve area. Therefore, the land-use scenario most applicable to the affected soils is recreational. Although the 'residential 10% produce' soil guideline value (SGV) was exceeded at SS13 the recreational SGV of 80 mg/kg was not and these soils were not considered to pose a risk to human health in a reserve/recreational use. Additionally, if any of the affected soils remain within the basin there is unlikely to be any adverse effect since SPLP testing showed negligible quantities of arsenic leaches from the soils, with results below the laboratory limit of detection. Therefore, remediation of this area was not deemed necessary under the current Outline Development Plan.

- **Burn Pile Area**

Sampling of the soils in the burn pile area was not possible due to restricted access to the soils, however, experience with similar waste disposal at other sites indicates the area is highly likely to be contaminated with arsenic and potentially polycyclic aromatic hydrocarbons (PAHs). It was recommended that the existing waste materials should be removed from the subject site and then the soils should be tested and remediated as required.

- **Sheep Drafting Yard**

A small hotspot of arsenic contamination above the 'residential 10% produce' SGV is present around a sheep drafting yard on the north of the subject site. Elevated copper and chromium were also detected suggesting that the contamination is due to the use of treated timber to construct the yard. It was recommended that the treated timber be removed and the area remediated prior to development of the subject site for a residential use.

Subsequently the client chose to remediate all three contaminated areas by full excavation and removal of the soils. Remediation of the contaminated areas on site were undertaken in conjunction with XRF testing to ensure the contaminated soils were removed while minimising the volumes requiring disposal. The identified contaminated soils were remediated by excavating the soils and disposal at either Kate Valley or Burwood Landfill. A total of 43.04 tonnes of soil was disposed of at Kate Valley and 874.67 tonnes of soil was disposed of at Burwood Landfill. Post remediation, eight validation samples were submitted to the lab for arsenic analysis and five validation samples were submitted to the lab for seven heavy metal analysis. The results were generally at or below expected background levels and well below the 'residential 10% produce' SGV.

The remediation actions have successfully remediated the identified contaminated areas. The site is considered to be suitable for its proposed residential use with no further actions required.

2 Objectives of the Report

The objective of the report is to detail the remedial actions undertaken which will ensure the site is suitable for future residential use. It also describes the validation sampling undertaken and results received. It has been completed in accordance with the Ministry for the Environment's (MfE) "Contaminated Land Management Guidelines No 1: Reporting on Contaminated Sites in New Zealand".

3 Scope of Work Undertaken

This report includes all requirements for a Stage 4 Validation report and includes:

- A summary of the site and the results of previous reports
- Details of the remedial works undertaken
- Details of the validation sampling undertaken and results analysis
- Preparation of report in accordance with MfE guidelines

4 Site Identification

The site is located at 511 Halswell Road in the Halswell area of Christchurch as shown on the plan in **Figure 1** below. The site is legally described as RS 772 and Part RS 1593 and has a total area of approximately 14.8097Ha.

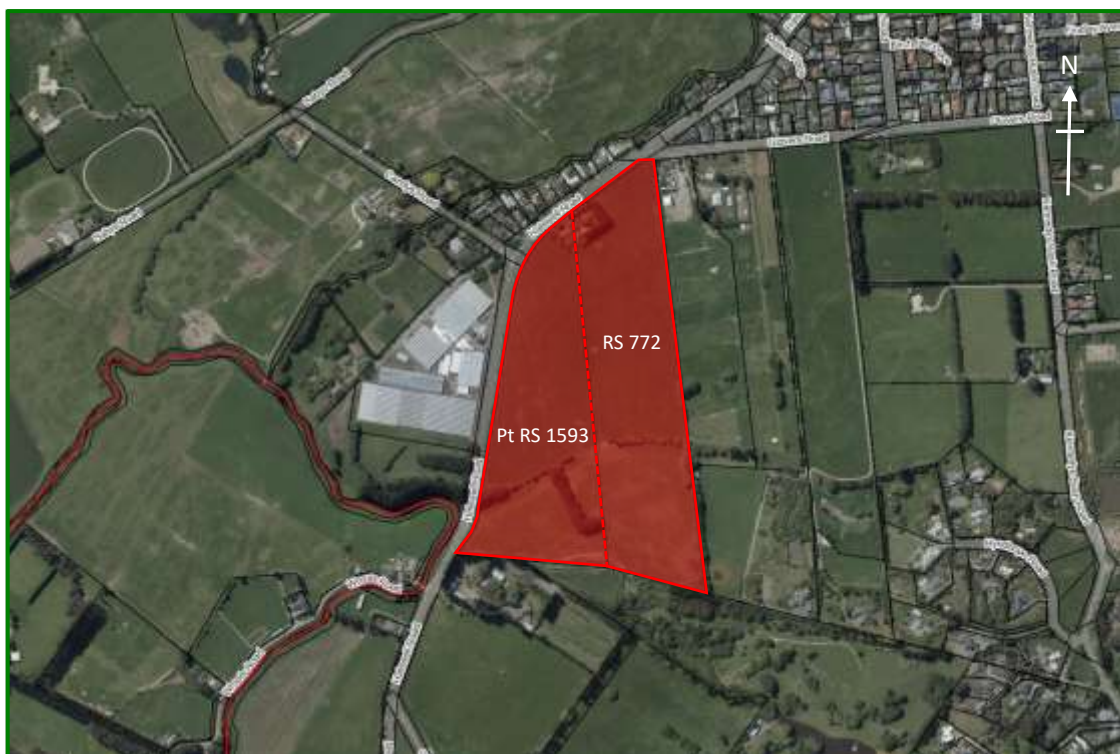
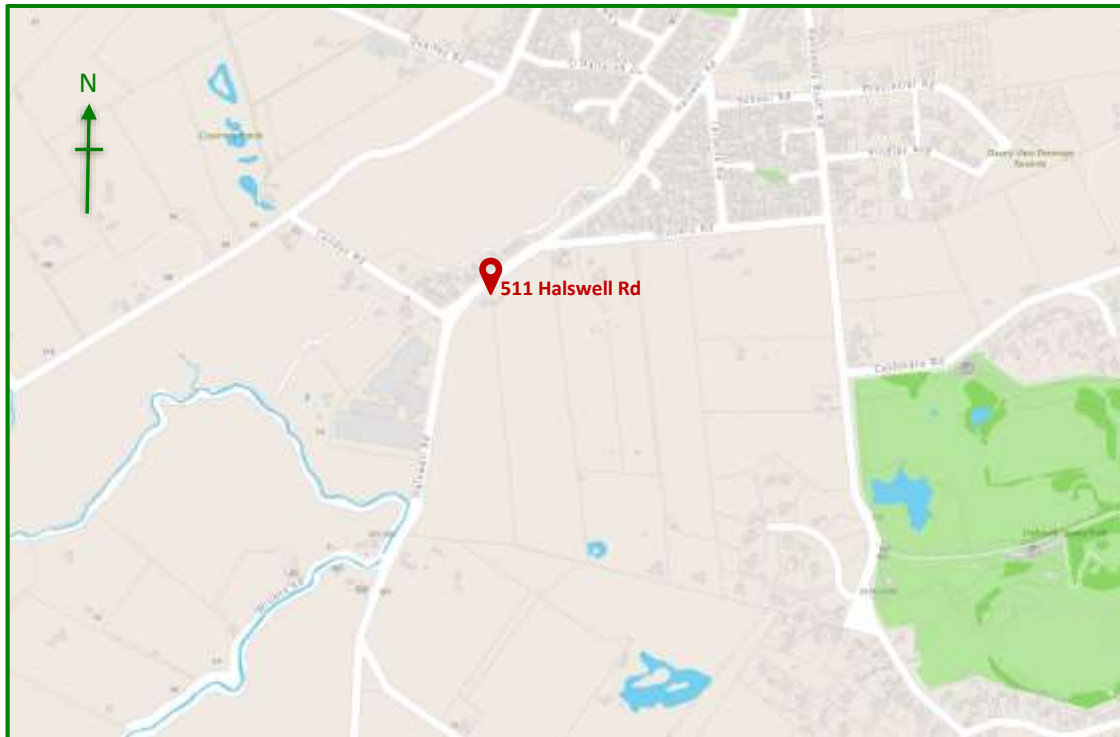


Figure 1 – Location Plan

5 Site Description and Surrounding Environment

The subject site is generally flat rural land on Halswell Road in Christchurch. There is a dwelling, garage and shed on the north of the subject site. The rest of the subject site is pasture farmland. The subject site is clearly defined by existing hedges and fences. It is bounded by residential lots to the north. The land to the west has a commercial horticultural use. The land to the south and east is rural residential.

6 Geology and Hydrology

The ECan GIS describes the soils as a combination of Waimakariri deep loam, Kaiapoi deep silty loam, Matapihi deep silty loam and Highclif stony silty loam. Trace elements are a combination of 'Regional, Recent', 'Regional, Gley' and 'Regional, BGC/BGL'. The soil types and trace elements are shown on the plan in **Figure 2** below. White lines indicate the soil type boundaries, coloured shading indicates the three different trace element areas. Wells in the area indicate that topsoils are underlain by layers of clay, peat with clay, sand, sandy gravels and gravels.

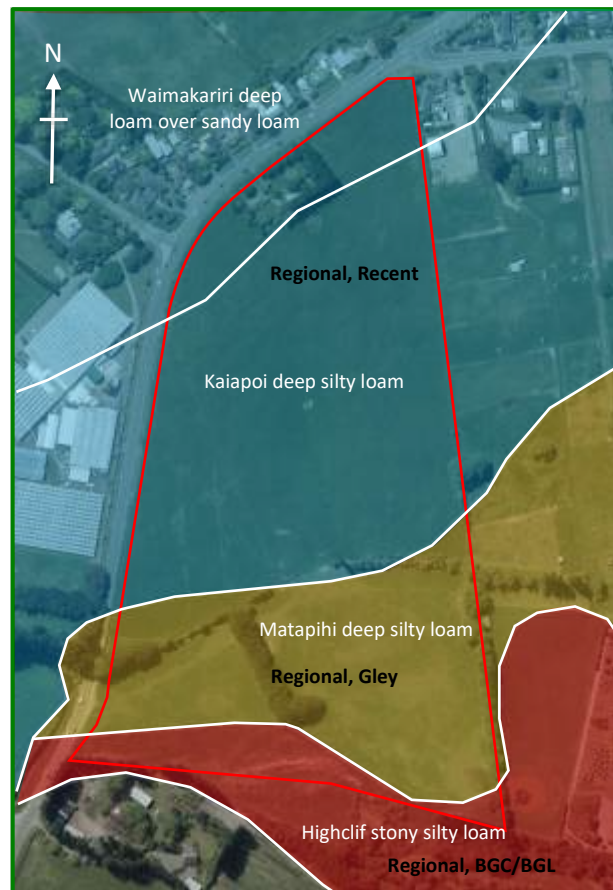


Figure 2 – Soil Type Plan

The site lies over the coastal confined gravel aquifer system. Ground water levels recorded on nearby bore logs are between 0.86 and 2.44m deep. The direction of ground water flow is generally in a south-easterly direction. The nearest down gradient well is approximately 175m to the south.

An open drain flows across the subject site. Part of the Halswell River lies to the west of the south-west corner of the subject site, on the opposite side of Halswell Road. Nottingham Stream lies approximately 60m north of the subject site.

7 Basis for Guideline Values

7.1 Activity Description

This report has been written for the following potential activities:

- Subdivision and development of the site for residential use,
- Soil disturbance activities associated with the above use and development.

7.2 Zoning

The subject site is currently zoned Residential New Neighbourhood Zone.

7.3 Soil Guideline Values

Human health soil contaminant standards for a group of 12 priority contaminants were derived under a set of five land-use scenarios and are legally binding under The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Health) Regulations 2011 (NES). These standards have been applied where applicable. The regulations describe these as Soil Contaminant Standards. For contaminants other than the 12 priority contaminants, the hierarchy as set out in the Ministry for the Environment Contaminated Land Management Guidelines No 2 has been followed. These are generally described as Soil Guideline Values. For simplicity, this report uses the terminology Soil Guideline Values (SGV) when referring to the appropriate soil contaminant standard or other derived value from the hierarchy. For soil, guideline values are predominantly risk based, in that they are typically derived using designated exposure scenarios that relate to different land uses. For each exposure scenario, selected pathways of exposure are used to derive guideline values. These pathways typically include soil ingestion, inhalation and dermal adsorption. The guideline values for the appropriate land use scenario relate to the most critical pathway.

Under the current Outline Development Plan the land-use scenarios applicable for this site would be:

- ‘Residential 10% produce’ for the land to the north of the open drain.
- The land to the south of the drain is a proposed stormwater basin and reserve area. For the reserve and any landscaping around the stormwater basin the recreational land-use scenario is applicable. For the stormwater basin, residential 10% produce guideline values will be used as a first trigger for assessment of effects, and if triggered, leachate testing will be conducted and compared with relevant trigger values.
- The ‘commercial/industrial/outdoor maintenance workers’ soil guideline values should be used as a proxy for construction workers disturbing soils.

8 Summary of DSI Results

Preliminary and Detailed Site Investigations were completed by Malloch Environmental Ltd in October 2019. The majority of the subject site has been used for pastoral activities for its known history. A farm shed was present on the south of the site in the 1941 aerial but removed by 1955. A dwelling was built on the north of the site in the late 1950s.

Soil sampling has shown no evidence of widespread arsenic contamination like that seen at other nearby sites. However, three isolated areas of soil contamination have been found on the subject site:

Arsenic Contaminated Paddock Area

Arsenic contamination is present in the corner of one of the paddocks on the subject site. The delineated area is approximately 1,360m² and the highest arsenic result was 28.9mg/kg. Under the current Outline Development Plan this area is to be part of a stormwater basin and reserve area. Therefore, the land-use scenario most applicable to the affected soils is recreational. Although the residential SGV was exceeded at SS13 the recreational SGV of 80 mg/kg was not and these soils are not considered to pose a risk to human health in a reserve/recreational use. Also, it is likely that the topsoils in this area will be scraped off and the basin dug out. This will likely mix and dilute the affected soils. The removed soils will then be re-spread around the basin. If any of the affected soils remain within the basin there is unlikely to be any adverse effect since SPLP testing showed negligible quantities of arsenic leaches from the soils, with results below the laboratory limit of detection. Therefore, remediation of this area was not deemed necessary under the current Outline Development Plan.

Burn Pile Area

Although sampling of the soils in the burn pile area was not possible due to restricted access to the soils, experience with similar waste disposal at other sites indicates the area is highly likely to be contaminated with arsenic and potentially PAHs. The current burn pile measures approximately 65m². However, the burn pile in the 2011 aerial appears to be slightly further south. If the pile has moved over time, the affected area could be approximately 165m². Any contamination, if present, is likely to be limited to the top 300mm of soils. It was recommended that the existing waste materials should be removed from the subject site and then the soils should be tested and remediated as required.

Sheep Drafting Yard

A small hotspot of arsenic contamination above the residential SGV is present around a sheep drafting yard on the north of the subject site. Elevated copper and chromium were also detected at this location. This suggests that the contamination is due to the use of treated timber to construct the yard. It was recommended that the treated timber be removed and the area remediated prior to development of the subject site for a residential use.

A copy of the DSI Sampling Plans are included in **Appendix A**.

9 Summary of Remediation Action Plan

The remediation options considered for the both the burn pile area and the sheep yard included excavating and removing all contaminated soils with disposal to an approved landfill, and excavating and mixing with 'clean' site soils to dilute contaminants.

The laboratory results indicate the soils from the rest of the site could be used to mix and dilute the contaminated soils. However, this would result in a larger area being identified as having contamination above background levels, and may have implications on future development or subdivision. For the soils around the sheep drafting yard, excavation and disposal of the soils to Burwood Landfill is an option as the levels of arsenic are within the waste acceptance criteria. The contamination levels for the burn pile area have not yet been determined. Potentially these could exceed Burwood Landfill acceptance criteria and if so, the soils will require disposal at

Kate Valley landfill. Excavation and disposal of the contaminated soils was considered the most viable remediation option for the two areas.

The remedial goals included:

- Ensuring that the remaining soils have arsenic concentrations below the residential 10% produce SGV of 20mg/kg.
- If soil sampling within the burn pile area identifies any additional contamination types, ensure all contaminants are below the relevant residential 10% produce SGVs.
- Ensure that any contaminated soil removed off-site is disposed of to an approved facility

Burn Pile Area Proposed Methodology

The waste material should be removed from the subject site. The green waste could be separated and sent to a green waste facility. The treated timber and any other waste found within the pile will require disposal as general waste. If any suspected asbestos containing material is found within the pile during removal, the work should cease until the material has been assessed by a Suitably Qualified and Experienced Practitioner (SQEP).

Once the waste material has been removed, delineation of the area using a portable XRF can be performed in conjunction with the remediation. If the XRF shows significant levels of heavy metal contamination, then additional lab testing may be recommended as determined by the SQEP which may include PAH and/or asbestos testing. Results of any testing will determine the appropriate disposal location. The contaminated soils will be excavated and disposed of at an approved facility. Once the XRF indicates the contaminated soils have been removed, validation of the excavated area using laboratory sampling will be undertaken. Samples will be analysed for heavy metals and PAH/asbestos as required.

Sheep Drafting Yard Proposed Methodology

The treated timber sheep yard should be removed and the timber disposed of as general waste. Soils from the yard area and up to 1m around to a depth of 200mm should be excavated and disposed of at Burwood landfill. A portable XRF will be used during remediation to ensure the minimum volume of soil is removed from the site whilst also ensuring the remediation goal is met. Following removal of the contaminated soils, validation of the excavated area using portable XRF and laboratory sampling will be undertaken. Samples will be analysed for arsenic.

10 Remediation Actions and Validation Sampling

The remediation took place over several weeks in February and March 2020. In addition to remediating the burn pile and sheep drafting yard the client decided to also remediate the arsenic found at SSS13 to 'residential 10% produce' guideline values by excavation and disposal at Burwood Landfill. Malloch Environmental Ltd (MEL) visited the site four times during the remediation.

17th February 2020: Following the removal of the waste material from the burn pile area, MEL visited the site to XRF the underlying soils. The XRF readings indicated that arsenic and lead over the 'residential 10% produce' SGV was present but levels were likely below Burwood Landfill acceptance criteria. However, broken pieces of suspected asbestos containing cement board (ACM) were also noted on the southern half of the burn pile area. As Burwood cannot accept any asbestos it was recommended that the top 100mm of soils from the visible extent of the burn pile be excavated and sent to Kate Valley for disposal.



Examples of the ACM pieces noted on the southern half of the burn pile after waste material was removed

26th February 2020: The area around SS13 had been excavated to a depth of 200-400mm. XRF testing indicated the area was successfully remediated except for a small area approximately at SS13 where arsenic was measured as 32mg/kg. The soils in this area were a darker, reddish colour which has been seen at other nearby sites with potentially natural elevated arsenic. The area was marked out for additional 100mm depth excavation or until visually different soils were removed.



Area at SS13 with arsenic contaminated soils above 20mg/kg



A 3-4m grid of XRF tests showed arsenic well below the SGV across the rest of the excavation.

The sheep drafting yard had been excavated to approximately 200-300mm depth. XRF testing indicated the area had successfully been remediated with readings either below the instrument limit of detection or below expected background levels.



Excavated sheep drafting yard area, 'O' marks XRF test locations with arsenic below SGV

Pieces of ACM and high arsenic levels were still present along the southern wall of the burn pile excavation. It was recommended the excavation should be extended until all visible ash and ACM is removed with disposal at Kate Valley Landfill.



Southern wall of burn pile excavation, 'X' marks high arsenic



Southern wall of burn pile excavation, pale area includes ACM pieces

9th March 2020: The additional excavation around SS13 had been completed and XRF testing indicated the area was successfully remediated. Six validation samples were taken and submitted to Analytica Laboratories for arsenic analysis.



Arsenic below SGV at SS13 following extra excavation

XRF testing of the burn pile excavation indicated arsenic above the 'residential 10% produce' SGV was still present. The XRF was used to delineate the additional area requiring excavation. No remaining pieces of ACM were seen. Two field composite samples, one from locations on the wall and one from locations on the base of the excavation, were collected and submitted to Analytica Laboratories for asbestos presence analysis. Asbestos was not detected in either sample. Therefore, the remaining arsenic contaminated soils qualified for disposal at Burwood Landfill.



Delineation of elevated arsenic at burn pile, 'O' is below SGV



Delineation of elevated arsenic at burn pile, 'X' indicates arsenic above SGV

16th March 2020: This was the final validation visit to the site. The extended burn pile area had been excavated to a depth of 200mm. XRF testing indicated the burn pile area was now successfully remediated. Five validation samples were taken from the base and walls of the excavation and submitted to Analytica Laboratories for seven heavy metal analysis.





Final extent of excavation in burn pile area, 'O' marks XRF readings below SGV

A total of 43.04 tonnes of soil was disposed of at Kate Valley and 874.67 tonnes of soil was disposed of at Burwood Landfill. Disposal documentation is attached in **Appendix F**.

The validation sample plans included in **Appendix B** show the extent of the remediated areas and the validation sample locations. A table of XRF results is included in **Appendix C**. A table of laboratory results is included in **Appendix D**, with the full laboratory report in **Appendix E**.

11 Field Quality Assurance and Quality Control

The Contaminated Land Management Guidelines No 5, Ministry for the Environment was followed for all aspects of the investigation. Field quality control procedures included ensuring decontamination procedures were followed. Samples were taken using a stainless steel trowel or fresh disposable nitrile gloves. All equipment was decontaminated between samples using Decon 90 and rinsed with tap water.

Samples were collected in laboratory supplied containers and immediately placed in chilled bins. Following sampling, the samples were delivered to Analytica Laboratories under chain-of-custody documentation.

12 Laboratory Quality Assurance and Quality Control

All samples were submitted to Analytica Laboratories in Hamilton for analysis. Analytica Laboratories hold IANZ accreditation. As part of holding accreditation the laboratory follows appropriate testing and quality control procedures. No quality control issues were identified.

13 Results Summary

More than 200 XRF tests were performed during the remediation activities. Results for the soils remaining in situ were predominantly below the limit of detection of the device for arsenic, and generally averaging 15-60 mg/kg for lead within the burn pile area. The laboratory results show all arsenic and lead concentrations well below the 'residential 10% produce' soil guideline values (SGVs). For arsenic, the results ranged from 2.3 to 17.2 mg/kg. For lead, the results

ranged from 19.8 to 26.8 mg/kg. Sample VS12 contained arsenic and chromium slightly above the expected background levels for 'Regional, Recent' soils. Sample VS6 contained arsenic slightly above the expected background level for 'Regional, Gley' soils. When the multiple XRF results below limit of detection are taken into account as well, these minor exceedances are not considered significant and the remediated areas are considered to be at or below expected background levels on average.

14 Site Characterisation and Conclusion

Remediation of the contaminated areas on site were undertaken in conjunction with XRF testing to ensure the contaminated soils were removed while minimising the volumes requiring disposal. The identified contaminated soils were remediated by excavating the soils and disposal at either Kate Valley or Burwood Landfill. A total of 43.04 tonnes of soil was disposed of at Kate Valley and 874.67 tonnes of soil was disposed of at Burwood Landfill. Post remediation, eight validation samples were submitted to the lab for arsenic analysis and five validation samples were submitted to the lab for seven heavy metal analysis. The results were generally at or below expected background levels and well below the 'residential 10% produce' SGV.

The remediation actions have successfully remediated the identified contaminated areas. The site is considered to be suitable for its proposed residential use with no further actions required.

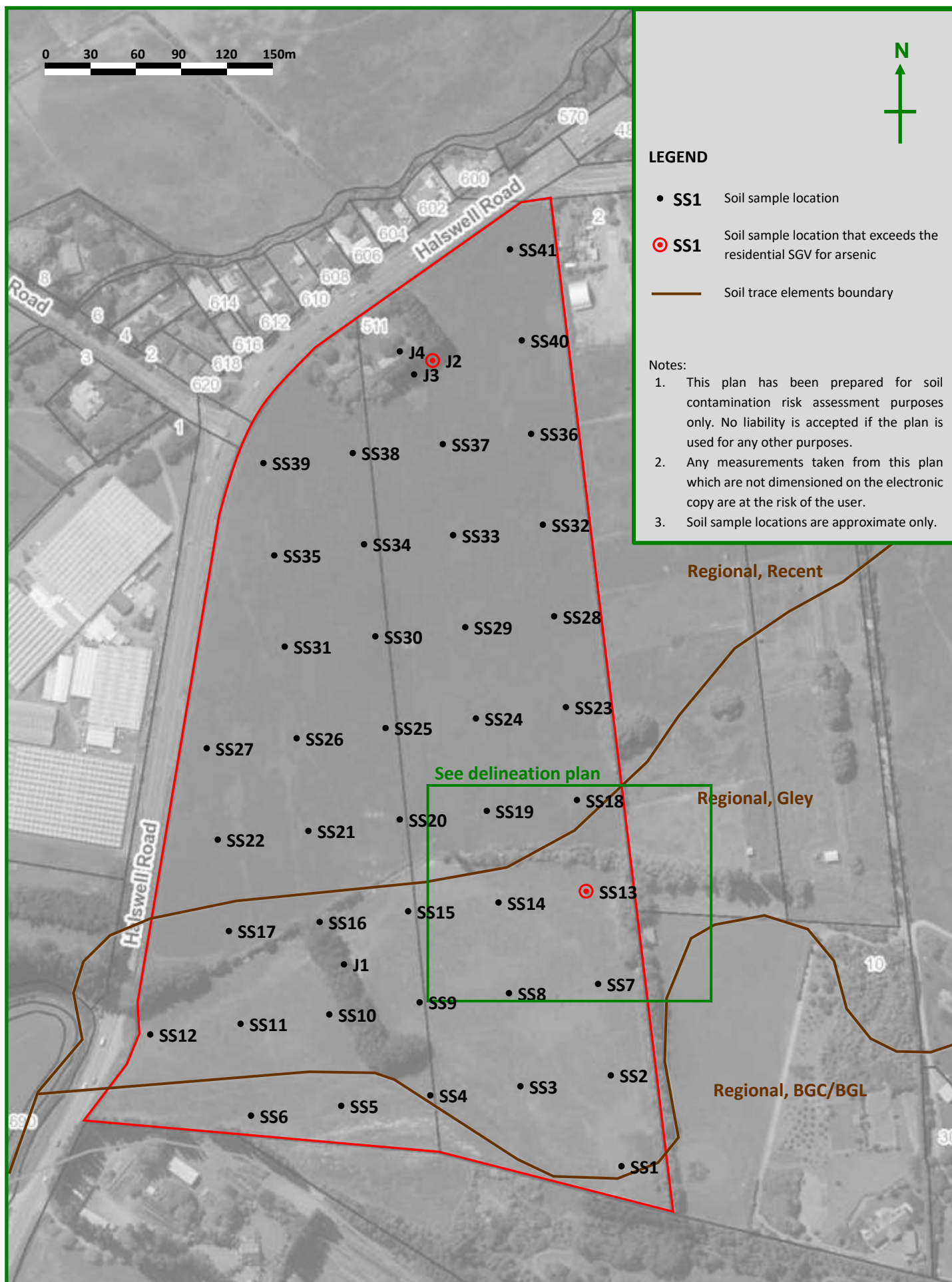
15 Limitations

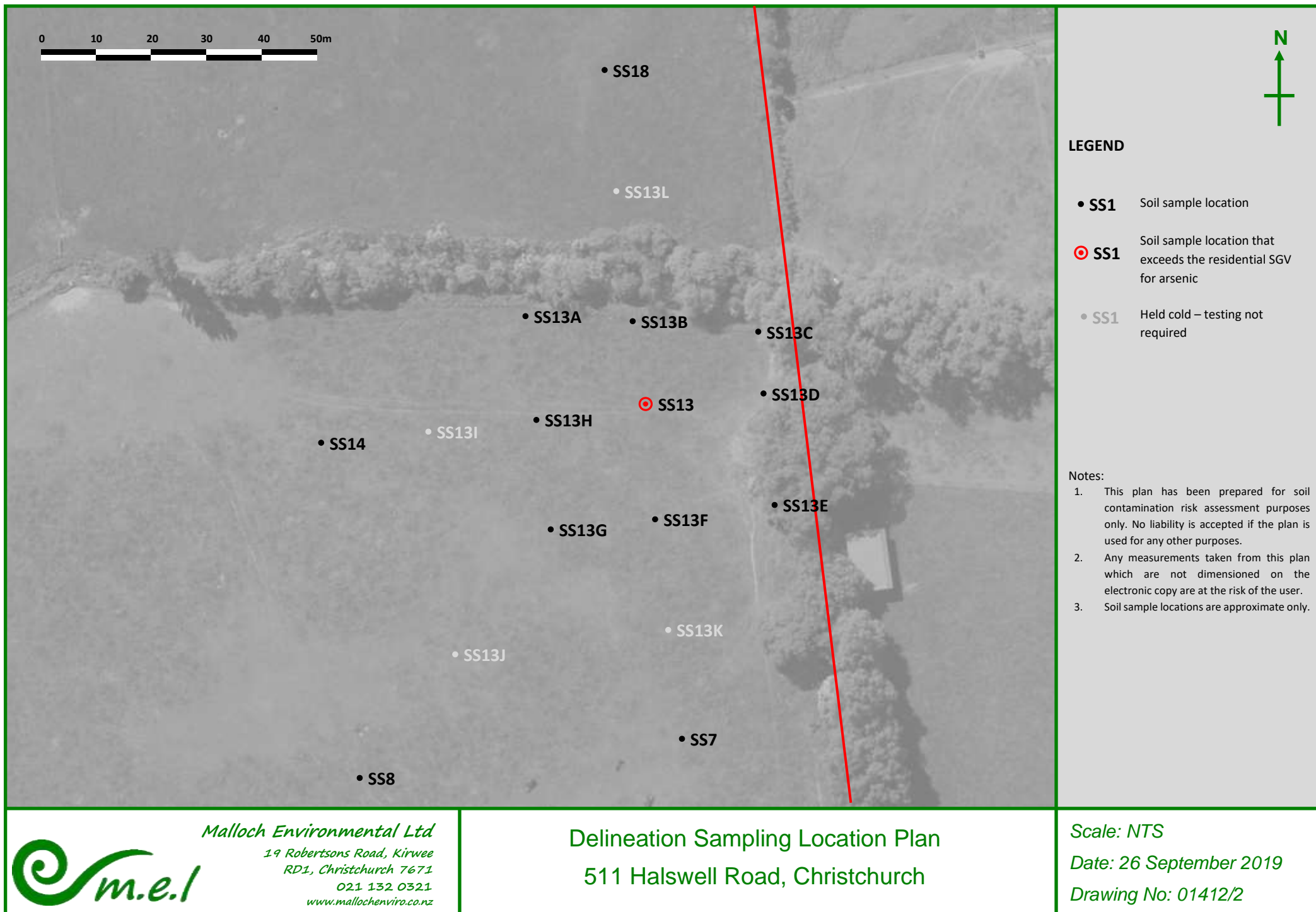
Malloch Environmental Limited has performed services for this project in accordance with current professional standards for environmental site assessments, and in terms of the client's financial and technical brief for the work. Any reliance on this report by other parties shall be at such party's own risk. It does not purport to completely describe all the site characteristics and properties. Where data is supplied by the client or any third party, it has been assumed that the information is correct, unless otherwise stated. Malloch Environmental Limited accepts no responsibility for errors or omissions in the information provided. Should further information become available regarding the conditions at the site, Malloch Environmental Limited reserves the right to review the report in the context of the additional information.

Opinions and judgments expressed in this report are based on an understanding and interpretation of regulatory standards at the time of writing and should not be construed as legal opinions. As regulatory standards are constantly changing, conclusions and recommendations considered to be acceptable at the time of writing, may in the future become subject to different regulatory standards which cause them to become unacceptable. This may require further assessment and/or remediation of the site to be suitable for the existing or proposed land use activities. There is no investigation that is thorough enough to preclude the presence of materials at the site that presently or in the future may be considered hazardous.

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Appendix A – DSI Sample Location Plans





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Delineation Sampling Location Plan 511 Halswell Road, Christchurch

Scale: NTS

Date: 26 September 2019

Drawing No: 01412/2

Appendix B – Validation Sample Location Plans



LEGEND

- **VS1** Validation soil sample location
- **ASB1** Composite asbestos soil sample locations
- Approx. area of excavation with disposal to Kate Valley
- Approx. area of excavation with disposal to Burwood after testing confirmed no more asbestos present.

Notes:

1. This plan has been prepared for soil contamination risk assessment purposes only. No liability is accepted if the plan is used for any other purposes.
2. Any measurements taken from this plan which are not dimensioned on the electronic copy are at the risk of the user.
3. Soil sample locations are approximate only.



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**Validation Sample Location Plan - Burn Pile & Sheep
 Drafting Yard**
 511 Halswell Road, Christchurch

Scale: NTS

Date: 24 March 2020


Drawing No: 01412/3

0 10 20 30 40 50m



LEGEND

• **VS1** Validation soil sample location

 Approx. extent of excavation

Approx. extent of site shown on plan

• VS6
• VS3
• VS4
• VS5
• VS8
• VS7

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Validation Sample Location Plan - Arsenic Area
511 Halswell Road, Christchurch

Scale: NTS

Date: 24 March 2020

Drawing No: 01412/4

Appendix C – Table of XRF Results

Table of XRF Results - 511 Halswell Road

Area of Site	Reading No	Time	Type	Duration	Units	Pb	Pb Error	As	As Error
17th February 2020									
Burn Pile Area	351	17/02/2020 11:30	excavated to Kate Valley due to ACM	30.02	ppm	69.77	11.29	20.18	8.79
Burn Pile Area	352	17/02/2020 11:32	excavated to Kate Valley due to ACM	30.08	ppm	126.05	14.1	29.26	11.01
Burn Pile Area	353	17/02/2020 11:42	excavated to Kate Valley due to ACM	30.4	ppm	122.65	13.76	34.18	10.92
Burn Pile Area	354	17/02/2020 11:46	excavated to Kate Valley due to ACM	30.56	ppm	136.96	14.53	<LOD	16.23
Burn Pile Area	355	17/02/2020 11:52	excavated to Kate Valley due to ACM	30.06	ppm	450.21	22.77	<LOD	25.18
Burn Pile Area	356	17/02/2020 11:54	excavated to Kate Valley due to ACM	30.08	ppm	372.42	20.18	<LOD	21.27
Burn Pile Area	357	17/02/2020 11:56	excavated to Kate Valley due to ACM	30.05	ppm	285.33	19.62	25.35	14.69
Burn Pile Area	358	17/02/2020 11:56	excavated to Kate Valley due to ACM	30.39	ppm	184.36	16.14	32.2	12.43
Burn Pile Area	359	17/02/2020 11:58	excavated to Kate Valley due to ACM	30.07	ppm	407.67	19.59	<LOD	21.59
Burn Pile Area	360	17/02/2020 11:59	excavated to Kate Valley due to ACM	30.29	ppm	80.49	10.5	17.39	8.05
Burn Pile Area	361	17/02/2020 12:03	excavated to Kate Valley due to ACM	30.08	ppm	<LOD	10.9	<LOD	7.37
Burn Pile Area	362	17/02/2020 13:35	excavated to Kate Valley due to ACM	30.2	ppm	29.49	11.93	27.46	10.06
Burn Pile Area	363	17/02/2020 13:36	excavated to Kate Valley due to ACM	34.95	ppm	13.48	7.6	17.16	6.18
Burn Pile Area	364	17/02/2020 13:40	excavated to Kate Valley due to ACM	30.08	ppm	11.34	6.06	<LOD	6.7
Burn Pile Area	365	17/02/2020 13:41	excavated to Kate Valley due to ACM	30.08	ppm	<LOD	10.44	<LOD	7.89
Burn Pile Area	366	17/02/2020 13:42	excavated to Kate Valley due to ACM	30.17	ppm	<LOD	9.01	16.56	5.01
Burn Pile Area	367	17/02/2020 13:42	excavated to Kate Valley due to ACM	30.11	ppm	34.49	7.74	141.98	9.62
Burn Pile Area	368	17/02/2020 13:43	excavated to Kate Valley due to ACM	30.08	ppm	<LOD	9.23	<LOD	6.64
Burn Pile Area	369	17/02/2020 13:44	excavated to Kate Valley due to ACM	30.07	ppm	<LOD	5.87	<LOD	4.2
Burn Pile Area	370	17/02/2020 13:45	excavated to Kate Valley due to ACM	30.29	ppm	33.01	6.37	93.29	7.04
Burn Pile Area	371	17/02/2020 13:47	excavated to Kate Valley due to ACM	30.07	ppm	34.29	8.05	18.66	6.43
Burn Pile Area	372	17/02/2020 13:48	excavated to Kate Valley due to ACM	30.33	ppm	43.75	7.49	76.04	7.57
Burn Pile Area	373	17/02/2020 13:51	excavated to Kate Valley due to ACM	30.07	ppm	<LOD	6.07	7.38	3.12
Burn Pile Area	374	17/02/2020 13:52	excavated to Kate Valley due to ACM	30.08	ppm	<LOD	7.81	18.72	4.44
Burn Pile Area	375	17/02/2020 13:58	excavated to Kate Valley due to ACM	30.08	ppm	<LOD	7.75	<LOD	5.43
Burn Pile Area	376	17/02/2020 13:59	excavated to Kate Valley due to ACM	30.08	ppm	<LOD	10.12	9.71	5.29
26th February 2020									
SS13 Area	727	26/02/2020 13:08	remains in-situ	30.08	ppm	<LOD	10.96	<LOD	7.73
SS13 Area	728	26/02/2020 13:09	remains in-situ	31.35	ppm	<LOD	10.84	<LOD	7.68
SS13 Area	729	26/02/2020 13:10	remains in-situ	32.94	ppm	15.44	9.52	<LOD	10.89
SS13 Area	730	26/02/2020 13:11	remains in-situ	30.07	ppm	<LOD	11.54	<LOD	8.22
SS13 Area	731	26/02/2020 13:11	remains in-situ	30.08	ppm	14.06	7.51	<LOD	7.68
SS13 Area	732	26/02/2020 13:12	remains in-situ	30.07	ppm	<LOD	11.55	<LOD	8.12
SS13 Area	733	26/02/2020 13:13	remains in-situ	30.07	ppm	<LOD	11.81	<LOD	8.16
SS13 Area	734	26/02/2020 13:14	remains in-situ	30.07	ppm	<LOD	12.9	<LOD	9.04
SS13 Area	735	26/02/2020 13:14	remains in-situ	30.08	ppm	<LOD	10.82	<LOD	7.82
SS13 Area	736	26/02/2020 13:15	remains in-situ	30.07	ppm	11.93	7.44	<LOD	7.87
SS13 Area	737	26/02/2020 13:16	remains in-situ	30.08	ppm	<LOD	9.62	<LOD	6.59
SS13 Area	738	26/02/2020 13:16	remains in-situ	30.08	ppm	<LOD	10.31	<LOD	7.47
SS13 Area	739	26/02/2020 13:17	remains in-situ	30.07	ppm	<LOD	9.83	<LOD	6.84
SS13 Area	740	26/02/2020 13:18	remains in-situ	30.08	ppm	11.3	6.63	<LOD	7.16
SS13 Area	741	26/02/2020 13:19	remains in-situ	30.08	ppm	<LOD	11.32	<LOD	7.91
SS13 Area	742	26/02/2020 13:19	remains in-situ	30.08	ppm	<LOD	9.34	<LOD	6.76
SS13 Area	743	26/02/2020 13:20	remains in-situ	30.07	ppm	<LOD	11.05	<LOD	8.19
SS13 Area	744	26/02/2020 13:21	remains in-situ	30.56	ppm	<LOD	11.14	<LOD	8.47
SS13 Area	745	26/02/2020 13:21	remains in-situ	30.08	ppm	<LOD	9.97	<LOD	7.34
SS13 Area	746	26/02/2020 13:22	remains in-situ	21.69	ppm	<LOD	13.38	<LOD	9.17
SS13 Area	747	26/02/2020 13:23	remains in-situ	23.29	ppm	<LOD	12.11	<LOD	9.14
SS13 Area	748	26/02/2020 13:23	remains in-situ	23.3	ppm	16.46	8.78	<LOD	9.16
SS13 Area	749	26/02/2020 13:24	remains in-situ	19.3	ppm	<LOD	12.85	<LOD	8.77
SS13 Area	750	26/02/2020 13:24	remains in-situ	21.69	ppm	<LOD	12.62	<LOD	8.54
SS13 Area	751	26/02/2020 13:25	remains in-situ	22.5	ppm	<LOD	12.5	<LOD	8.9
SS13 Area	752	26/02/2020 13:25	remains in-situ	21.69	ppm	<LOD	12.3	<LOD	9.01
SS13 Area	753	26/02/2020 13:26	remains in-situ	20.9	ppm	<LOD	11.73	<LOD	8.42
SS13 Area	754	26/02/2020 13:26	remains in-situ	24.09	ppm	<LOD	12.52	<LOD	8.92
SS13 Area	755	26/02/2020 13:27	remains in-situ	30.08	ppm	<LOD	11.14	<LOD	8.04
SS13 Area	756	26/02/2020 13:28	remains in-situ	21.7	ppm	<LOD	12.25	<LOD	8.97
SS13 Area	757	26/02/2020 13:28	remains in-situ	24.89	ppm	<LOD	12.28	<LOD	9.09
SS13 Area	758	26/02/2020 13:29	remains in-situ	22.49	ppm	14.41	8.77	<LOD	8.88
SS13 Area	760	26/02/2020 13:30	remains in-situ	25.68	ppm	<LOD	12.88	<LOD	9.08
SS13 Area	761	26/02/2020 13:30	remains in-situ	28.08	ppm	<LOD	12.71	<LOD	9.3
SS13 Area	762	26/02/2020 13:31	remains in-situ	27.29	ppm	20.67	8.57	<LOD	8.61
SS13 Area	763	26/02/2020 13:32	remains in-situ	30.07	ppm	<LOD	10.54	<LOD	7.76
SS13 Area	764	26/02/2020 13:33	excavated to Burwood	30.56	ppm	<LOD	11.57	31.95	7.1
SS13 Area	765	26/02/2020 13:36	remains in-situ	22.49	ppm	<LOD	12.8	<LOD	8.81
SS13 Area	766	26/02/2020 13:36	remains in-situ	16.91	ppm	<LOD	12.75	<LOD	9.05
SS13 Area	767	26/02/2020 13:37	remains in-situ	36.95	ppm	<LOD	11.94	9.81	6.15
SS13 Area	768	26/02/2020 13:38	remains in-situ	22.5	ppm	<LOD	12.92	<LOD	8.84
SS13 Area	769	26/02/2020 13:39	remains in-situ	24.09	ppm	<LOD	13.31	<LOD	9.16
SS13 Area	770	26/02/2020 13:39	remains in-situ	22.49	ppm	<LOD	12.59	<LOD	8.9
SS13 Area	771	26/02/2020 13:40	remains in-situ	21.69	ppm	<LOD	11.34	<LOD	8.43
SS13 Area	772	26/02/2020 13:40	remains in-situ	24.08	ppm	<LOD	12.35	<LOD	8.98

SS13 Area	773	26/02/2020 13:41	remains in-situ	30.07	ppm	<LOD	11.01	9.83	5.69
SS13 Area	774	26/02/2020 13:42	remains in-situ	30.08	ppm	<LOD	10.51	<LOD	7.58
SS13 Area	775	26/02/2020 13:42	remains in-situ	20.1	ppm	<LOD	13.22	<LOD	9.32
SS13 Area	776	26/02/2020 13:43	remains in-situ	24.88	ppm	<LOD	12.2	<LOD	8.91
SS13 Area	777	26/02/2020 13:44	remains in-situ	24.1	ppm	<LOD	13.25	<LOD	9.13
SS13 Area	778	26/02/2020 13:44	remains in-situ	25.69	ppm	<LOD	11.2	<LOD	7.86
SS13 Area	779	26/02/2020 13:45	remains in-situ	20.1	ppm	<LOD	11.36	<LOD	8.31
SS13 Area	780	26/02/2020 13:47	remains in-situ	60.08	ppm	<LOD	8.44	15.96	4.59
SS13 Area	781	26/02/2020 13:48	remains in-situ	56.9	ppm	<LOD	11.82	12.98	6.29
SS13 Area	782	26/02/2020 13:49	remains in-situ	30.96	ppm	<LOD	15.78	<LOD	12.2
SS13 Area	783	26/02/2020 13:50	remains in-situ	60.09	ppm	<LOD	9.52	12.33	5.01
SS13 Area	784	26/02/2020 13:52	remains in-situ	60.09	ppm	9.47	5.84	14.95	4.72
SS13 Area	785	26/02/2020 13:52	remains in-situ	30.07	ppm	17.68	7.55	10.86	5.84
SS13 Area	786	26/02/2020 13:53	remains in-situ	30.34	ppm	17.14	7.96	10.14	6.13
SS13 Area	787	26/02/2020 13:54	remains in-situ	30.08	ppm	18.51	9.38	<LOD	10.54
SS13 Area	788	26/02/2020 13:55	remains in-situ	30.06	ppm	13.83	7.74	10.69	6.01
SS13 Area	789	26/02/2020 13:56	remains in-situ	30.08	ppm	<LOD	10.96	<LOD	8.31
SS13 Area	790	26/02/2020 13:56	remains in-situ	29.27	ppm	<LOD	12.39	<LOD	9.25
SS13 Area	791	26/02/2020 13:57	remains in-situ	17.7	ppm	<LOD	12.49	<LOD	9.22
SS13 Area	792	26/02/2020 13:57	remains in-situ	28.49	ppm	<LOD	11.41	9.9	5.87
SS13 Area	793	26/02/2020 13:58	remains in-situ	23.7	ppm	<LOD	12.53	<LOD	9.1
SS13 Area	794	26/02/2020 13:59	remains in-situ	23.69	ppm	<LOD	12.26	<LOD	8.95
SS13 Area	795	26/02/2020 13:59	remains in-situ	21.7	ppm	<LOD	12.22	<LOD	9.18
SS13 Area	796	26/02/2020 14:00	remains in-situ	30.07	ppm	12.8	7.82	11.15	6.09
SS13 Area	797	26/02/2020 14:01	remains in-situ	30.06	ppm	14.73	7.64	9.98	5.86
SS13 Area	798	26/02/2020 14:02	remains in-situ	30.08	ppm	<LOD	12.08	<LOD	8.94
SS13 Area	799	26/02/2020 14:03	remains in-situ	30.08	ppm	<LOD	11.16	10.17	5.8
SS13 Area	800	26/02/2020 14:03	remains in-situ	30.08	ppm	<LOD	11.88	13.3	6.28
Sheep Drafting Yard	802	26/02/2020 14:15	remains in-situ	26.49	ppm	<LOD	11.45	<LOD	8.85
Sheep Drafting Yard	803	26/02/2020 14:16	remains in-situ	25.29	ppm	<LOD	13.13	<LOD	9.77
Sheep Drafting Yard	804	26/02/2020 14:17	remains in-situ	30.08	ppm	<LOD	12.53	<LOD	9.35
Sheep Drafting Yard	805	26/02/2020 14:17	remains in-situ	20.49	ppm	<LOD	12.52	<LOD	9.23
Sheep Drafting Yard	806	26/02/2020 14:17	remains in-situ	19.7	ppm	<LOD	12.2	<LOD	9.19
Sheep Drafting Yard	807	26/02/2020 14:18	remains in-situ	22.5	ppm	13.69	7.9	<LOD	8.97
Sheep Drafting Yard	808	26/02/2020 14:19	remains in-situ	21.69	ppm	<LOD	12.4	<LOD	9.24
Sheep Drafting Yard	809	26/02/2020 14:19	remains in-situ	23.29	ppm	<LOD	10.54	8.4	5.38
Sheep Drafting Yard	810	26/02/2020 14:20	remains in-situ	26.08	ppm	<LOD	10.69	8.6	5.44
Sheep Drafting Yard	811	26/02/2020 14:20	remains in-situ	18.51	ppm	<LOD	11.94	<LOD	9.12
Sheep Drafting Yard	812	26/02/2020 14:21	remains in-situ	26.09	ppm	19.46	8.12	<LOD	8.99
Sheep Drafting Yard	813	26/02/2020 14:22	remains in-situ	30.08	ppm	19.81	8.92	<LOD	9.6
Sheep Drafting Yard	814	26/02/2020 14:22	remains in-situ	22.1	ppm	16.17	8.2	<LOD	8.39
Sheep Drafting Yard	815	26/02/2020 14:23	remains in-situ	22.09	ppm	<LOD	11.38	<LOD	8.27
Sheep Drafting Yard	816	26/02/2020 14:23	remains in-situ	20.49	ppm	17.32	9.07	<LOD	10.16
Sheep Drafting Yard	817	26/02/2020 14:23	remains in-situ	18.9	ppm	16.46	9.19	<LOD	9.95
Sheep Drafting Yard	818	26/02/2020 14:24	remains in-situ	21.7	ppm	12.75	8.44	<LOD	9.06
Sheep Drafting Yard	819	26/02/2020 14:25	remains in-situ	24.89	ppm	19.36	9.14	<LOD	10.18
Sheep Drafting Yard	820	26/02/2020 14:25	remains in-situ	20.1	ppm	18.67	8.71	<LOD	9.33
Sheep Drafting Yard	821	26/02/2020 14:25	remains in-situ	19.3	ppm	<LOD	12.66	<LOD	9.16
Burn Pile Area	822	26/02/2020 14:27	excavated to Kate Valley due to ACM	23.69	ppm	<LOD	12.27	<LOD	9.21
Burn Pile Area	823	26/02/2020 14:28	excavated to Kate Valley due to ACM	20.1	ppm	15.76	8.82	<LOD	9.91
Burn Pile Area	824	26/02/2020 14:28	excavated to Kate Valley due to ACM	15.71	ppm	54.98	13.97	66.5	13.14
Burn Pile Area	825	26/02/2020 14:29	excavated to Kate Valley due to ACM	8.87	ppm	50.53	18.24	154.03	21.95
Burn Pile Area	826	26/02/2020 14:29	excavated to Kate Valley due to ACM	20.11	ppm	30.48	10.5	<LOD	11.58
Burn Pile Area	827	26/02/2020 14:30	excavated to Kate Valley due to ACM	22.89	ppm	15.66	8.87	<LOD	9.66
Burn Pile Area	828	26/02/2020 14:31	excavated to Kate Valley due to ACM	16.11	ppm	<LOD	12.37	<LOD	9.17
Burn Pile Area	829	26/02/2020 14:32	excavated to Kate Valley due to ACM	30.07	ppm	<LOD	12.6	13.54	6.86
Burn Pile Area	830	26/02/2020 14:32	excavated to Kate Valley due to ACM	23.69	ppm	12.48	8.24	<LOD	9.1
Burn Pile Area	831	26/02/2020 14:32	excavated to Kate Valley due to ACM	21.3	ppm	<LOD	12.83	<LOD	9.35
Burn Pile Area	832	26/02/2020 14:33	excavated to Kate Valley due to ACM	22.09	ppm	20.41	9.22	<LOD	9.24
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Burn Pile Area	145	9/03/2020 10:55	remains in-situ	30.33	ppm	14.84	8.31	12.23	6.49
Burn Pile Area	146	9/03/2020 10:56	excavated to Burwood	27.39	ppm	36.75	9.02	48.98	8.29
Burn Pile Area	147	9/03/2020 10:56	excavated to Burwood	27.28	ppm	<LOD	11.91	19.33	6.73
Burn Pile Area	148	9/03/2020 10:57	remains in-situ	30.08	ppm	<LOD	10.5	9.42	5.39
Burn Pile Area	149	9/03/2020 10:58	excavated to Burwood	28.46	ppm	16.13	8.05	20.55	6.65
Burn Pile Area	150	9/03/2020 10:59	remains in-situ	30.08	ppm	15.02	7.67	<LOD	8.47
Burn Pile Area	151	9/03/2020 11:00	remains in-situ	30.07	ppm	13.08	7.14	<LOD	7.71
Burn Pile Area	152	9/03/2020 11:00	remains in-situ	30.08	ppm	22.63	7.57	<LOD	8.33
Burn Pile Area	153	9/03/2020 11:01	excavated to Burwood	10.92	ppm	22.05	13.63	49.26	13.04
Burn Pile Area	154	9/03/2020 11:01	remains in-situ	30.07	ppm	15.11	7.65	<LOD	8.14
Burn Pile Area	155	9/03/2020 11:02	remains in-situ	28.08	ppm	21.45	8.14	<LOD	8.62
Burn Pile Area	156	9/03/2020 11:03	remains in-situ	30.39	ppm	18.61	7.87	14.89	6.24
Burn Pile Area	157	9/03/2020 11:03	excavated to Burwood	16.12	ppm	32.95	10.2	35	8.92
Burn Pile Area	158	9/03/2020 11:04	excavated to Burwood	11.72	ppm	67.53	15.03	75.51	14.28
Burn Pile Area	159	9/03/2020 11:04	excavated to Burwood	19.27	ppm	24.12	10.76	48.31	10.21
Burn Pile Area	160	9/03/2020 11:05	excavated to Burwood	10.93	ppm	23.05	13.54	40.83	12.43

Burn Pile Area	161	9/03/2020 11:06	remains in-situ	30.03	ppm	21.06	8.18	10.72	6.25
Burn Pile Area	162	9/03/2020 11:07	excavated to Burwood	30.27	ppm	18.5	7.58	20.91	6.28
Burn Pile Area	163	9/03/2020 11:07	remains in-situ	30.08	ppm	27.98	8.61	12.04	6.63
Burn Pile Area	164	9/03/2020 11:11	excavated to Burwood	18.51	ppm	25.22	10.52	26.87	8.94
Burn Pile Area	165	9/03/2020 11:13	remains in-situ	30.08	ppm	<LOD	10.12	<LOD	7.72
Burn Pile Area	166	9/03/2020 11:18	remains in-situ	30.08	ppm	26.8	8.72	10.51	6.65
Burn Pile Area	167	9/03/2020 11:20	remains in-situ	30.08	ppm	56.49	9.31	15.15	7.18
Burn Pile Area	168	9/03/2020 11:22	excavated to Burwood	12.52	ppm	31.96	12.7	24.37	10.55
Burn Pile Area	169	9/03/2020 11:23	remains in-situ	30.07	ppm	24.79	8.52	<LOD	9.51
Burn Pile Area	170	9/03/2020 11:24	remains in-situ	30.07	ppm	<LOD	10.98	10.32	5.74
Burn Pile Area	171	9/03/2020 11:27	remains in-situ	30.07	ppm	<LOD	11.69	<LOD	8.99
Burn Pile Area	172	9/03/2020 11:28	excavated to Burwood	30.08	ppm	14.89	6.45	18.34	5.31
Burn Pile Area	173	9/03/2020 11:29	excavated to Burwood	20.1	ppm	21.04	9.73	17.97	7.91
Burn Pile Area	174	9/03/2020 11:31	remains in-situ	30.08	ppm	14.2	7.64	<LOD	8.8
Burn Pile Area	175	9/03/2020 11:35	excavated to Burwood	30.08	ppm	<LOD	11.41	17.03	6.26
Burn Pile Area	176	9/03/2020 11:36	remains in-situ	30.08	ppm	15.29	7.43	<LOD	8.28
Burn Pile Area	177	9/03/2020 11:39	remains in-situ	30.07	ppm	59.21	9.18	<LOD	9.98
SS13 Area	178	9/03/2020 12:03	remains in-situ	30.07	ppm	<LOD	8.1	<LOD	5.88
SS13 Area	179	9/03/2020 12:07	remains in-situ	30.08	ppm	<LOD	9.39	<LOD	6.95
SS13 Area	180	9/03/2020 12:11	remains in-situ	16.9	ppm	<LOD	12.33	<LOD	8.99
SS13 Area	181	9/03/2020 12:11	remains in-situ	20.5	ppm	<LOD	12.08	<LOD	8.62
SS13 Area	182	9/03/2020 12:12	remains in-situ	18.51	ppm	<LOD	13.04	<LOD	9.03
SS13 Area	183	9/03/2020 12:12	remains in-situ	15.71	ppm	<LOD	12.61	<LOD	8.74
SS13 Area	184	9/03/2020 12:13	remains in-situ	20.1	ppm	<LOD	12.06	<LOD	8.2
SS13 Area	185	9/03/2020 12:13	remains in-situ	20.89	ppm	<LOD	10.99	<LOD	8.05
SS13 Area	186	9/03/2020 12:14	remains in-situ	21.71	ppm	<LOD	11.88	<LOD	8.2
SS13 Area	187	9/03/2020 12:14	remains in-situ	24.1	ppm	<LOD	10.94	<LOD	7.53
SS13 Area	188	9/03/2020 12:15	remains in-situ	20.9	ppm	<LOD	11.52	<LOD	8.32
SS13 Area	189	9/03/2020 12:15	remains in-situ	20.1	ppm	13.05	8.45	<LOD	8.79
SS13 Area	190	9/03/2020 12:16	remains in-situ	21.3	ppm	<LOD	11.41	<LOD	8.13
SS13 Area	191	9/03/2020 12:16	remains in-situ	21.3	ppm	<LOD	11.62	<LOD	8.22
SS13 Area	192	9/03/2020 12:17	remains in-situ	25.68	ppm	<LOD	10.95	<LOD	7.65
SS13 Area	193	9/03/2020 12:17	remains in-situ	20.89	ppm	<LOD	11.61	<LOD	8.29
SS13 Area	194	9/03/2020 12:18	remains in-situ	22.09	ppm	<LOD	12.69	<LOD	8.68
SS13 Area	195	9/03/2020 12:19	remains in-situ	21.69	ppm	<LOD	11.77	<LOD	8.06
SS13 Area	196	9/03/2020 12:19	remains in-situ	20.89	ppm	<LOD	11.06	<LOD	7.78
SS13 Area	197	9/03/2020 12:20	remains in-situ	21.3	ppm	<LOD	11.5	<LOD	8.22
SS13 Area	198	9/03/2020 12:20	remains in-situ	19.31	ppm	<LOD	12.73	<LOD	9.15
SS13 Area	199	9/03/2020 12:21	remains in-situ	20.49	ppm	<LOD	11.36	<LOD	8.02
SS13 Area	200	9/03/2020 12:22	remains in-situ	20.9	ppm	<LOD	10.81	<LOD	7.83
SS13 Area	201	9/03/2020 12:28	remains in-situ	23.29	ppm	<LOD	11.47	<LOD	7.93
SS13 Area	202	9/03/2020 12:29	remains in-situ	30.57	ppm	<LOD	10.07	<LOD	7.31
SS13 Area	203	9/03/2020 12:29	remains in-situ	23.28	ppm	<LOD	10.55	<LOD	7.58
SS13 Area	204	9/03/2020 12:32	remains in-situ	20.9	ppm	<LOD	10.89	<LOD	7.83
SS13 Area	205	9/03/2020 12:56	remains in-situ	17.71	ppm	<LOD	12.86	<LOD	9.02
SS13 Area	206	9/03/2020 12:56	remains in-situ	21.29	ppm	<LOD	12.18	<LOD	8.65
SS13 Area	207	9/03/2020 12:57	remains in-situ	22.1	ppm	<LOD	11.35	<LOD	7.96
SS13 Area	208	9/03/2020 12:57	remains in-situ	20.1	ppm	<LOD	12.45	<LOD	8.66
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Burn Pile Area	225	16/03/2020 11:16	remains in-situ	30.07	ppm	14.67	7.83	<LOD	8.66
Burn Pile Area	226	16/03/2020 11:18	remains in-situ	30.07	ppm	28.16	8.66	21.61	7.15
Burn Pile Area	227	16/03/2020 11:19	remains in-situ	30.08	ppm	26.55	8.07	14.59	6.35
Burn Pile Area	228	16/03/2020 11:20	remains in-situ	30.08	ppm	18.65	7.59	22.2	6.33
Burn Pile Area	229	16/03/2020 11:21	remains in-situ	30.08	ppm	15.67	6.91	12.75	5.44
Burn Pile Area	230	16/03/2020 11:21	remains in-situ	30.07	ppm	15.04	8.37	<LOD	9.62
Burn Pile Area	231	16/03/2020 11:22	remains in-situ	30.01	ppm	16.36	7.86	10.68	6.05
Burn Pile Area	232	16/03/2020 11:23	remains in-situ	30.07	ppm	16.5	7.88	<LOD	8.8
Burn Pile Area	233	16/03/2020 11:24	remains in-situ (XRF <LOD immediately around this spot)	23.39	ppm	23.23	9.84	35.97	8.77
Burn Pile Area	234	16/03/2020 11:24	remains in-situ	30.08	ppm	20.18	8.41	<LOD	9.48
Burn Pile Area	235	16/03/2020 11:25	remains in-situ	30.08	ppm	16.61	7.91	<LOD	8.76
Burn Pile Area	236	16/03/2020 11:26	remains in-situ	30.07	ppm	15.17	7.64	13.55	6.05
Burn Pile Area	237	16/03/2020 11:27	remains in-situ	30.07	ppm	11.92	7.41	<LOD	8.34
Burn Pile Area	238	16/03/2020 11:27	remains in-situ	30.08	ppm	<LOD	12.45	<LOD	9.47
Burn Pile Area	239	16/03/2020 11:28	remains in-situ	49.32	ppm	14.85	6.93	13.47	5.5
Burn Pile Area	240	16/03/2020 11:29	remains in-situ	30.07	ppm	<LOD	11.44	9.71	5.85
Burn Pile Area	241	16/03/2020 11:30	remains in-situ	26.09	ppm	<LOD	11.28	<LOD	8.46
Burn Pile Area	242	16/03/2020 11:31	remains in-situ	30.03	ppm	14.2	8.03	<LOD	9.14
Burn Pile Area	243	16/03/2020 11:31	remains in-situ	30.08	ppm	19.46	7.99	<LOD	8.58
Burn Pile Area	244	16/03/2020 11:32	remains in-situ	30.08	ppm	36.91	9.01	<LOD	10.07
Burn Pile Area	245	16/03/2020 11:33	remains in-situ	30.07	ppm	66.05	9.65	<LOD	10.45
Burn Pile Area	246	16/03/2020 11:34	remains in-situ	30.38	ppm	21.86	7.46	15.12	5.92
Burn Pile Area	247	16/03/2020 11:35	remains in-situ	30.05	ppm	16.74	7.61	13.47	5.99
Burn Pile Area	248	16/03/2020 11:35	remains in-situ	30.07	ppm	19.99	8.9	<LOD	10.11
Burn Pile Area	249	16/03/2020 11:36	remains in-situ	30.05	ppm	13.54	7.52	9.05	5.75
Burn Pile Area	250	16/03/2020 11:36	remains in-situ	20.09	ppm	<LOD	12.42	<LOD	9.22

Burn Pile Area	251	16/03/2020 11:37	remains in-situ	30.08	ppm	19.74	8.1	<LOD	8.84
Burn Pile Area	252	16/03/2020 11:38	remains in-situ	28.08	ppm	22.5	8.67	<LOD	9.25
Burn Pile Area	253	16/03/2020 11:39	remains in-situ	21.29	ppm	<LOD	12.34	<LOD	9.22
Burn Pile Area	254	16/03/2020 11:51	remains in-situ	30.01	ppm	23.13	8.57	12.33	6.61
Burn Pile Area	255	16/03/2020 11:54	remains in-situ	21.69	ppm	<LOD	11.99	<LOD	8.82
Burn Pile Area	256	16/03/2020 11:57	remains in-situ	19.7	ppm	<LOD	11.93	<LOD	8.84
Burn Pile Area	257	16/03/2020 12:04	remains in-situ	28.45	ppm	16.69	8.86	13.85	7

Appendix D – Table of Validation Results

Table of Laboratory Results - 511 Halswell Road

Date of testing: 9th & 16th March 2020

Analyte	Sample Name:	VS1	VS2	VS9	VS10	VS11	VS12	VS13	Soil Guideline Values					
Soil results	Lab Number: Depth (mm)	20-10514-1 base	20-10514-2 wall	20-11638-1 base	20-11638-2 base	20-11638-3 wall	20-11638-4 wall	20-11638-5 wall	Residential 10% produce	Commercial/ Outdoor Worker	Reference	Ecological receptors	Reference	Background - Regional Recent
Heavy Metals														
Arsenic	mg/kg dry wt	5.7	5.1	9.7	6.5	5.3	14.2	8.8	20	70	NES	70	ANZWQ	12.58
Cadmium	mg/kg dry wt	-	-	0.073	0.11	0.15	0.14	0.17	3	1,300	NES	10	ANZWQ	0.19
Chromium	mg/kg dry wt	-	-	22.7	20.6	18.1	24.2	22.5	770	6,300	NES	370	ANZWQ	22.70
Copper	mg/kg dry wt	-	-	13.7	12.7	11.2	17.8	15.1	>10,000	>10,000	NES	270	ANZWQ	20.30
Lead	mg/kg dry wt	-	-	23.5	19.8	19.5	26.8	24.7	210	3,300	NES	220	ANZWQ	40.96
Nickel	mg/kg dry wt	-	-	18.9	17.5	14.6	18.3	18	400	6,000	NEPM	52	ANZWQ	20.70
Zinc	mg/kg dry wt	-	-	71	63.3	63.7	82.2	74.9	7,400	400,000	NEPM	410	ANZWQ	93.94

Analyte	Sample Name:	VS3	VS4	VS5	VS6	VS7	VS8	Soil Guideline Values					
Soil results	Lab Number: Depth (mm)	20-10514-3 base	20-10514-4 base	20-10514-5 wall	20-10514-6 wall	20-10514-7 wall	20-10514-8 wall	Residential 10% produce	Commercial/ Outdoor Worker	Reference	Ecological receptors	Reference	Background - Regional Gley
Heavy Metals													
Arsenic	mg/kg dry wt	2.3	1.7	11	17.2	8.5	8.7	20	70	NES	70	ANZWQ	11.0

Asbestos Presence Analysis			Description of Asbestos Form
Sample Name:	Lab Number	Location	
ASB1	20-10328-9	Base	No asbestos detected
ASB2	20-10328-10	Walls	No asbestos detected

Indicates result exceeds residential guideline value
Indicates result exceeds ecological guideline value
Indicates result exceeds background value for soil type

NES - National Environmental Standard for Assessing and Managing Contaminants in Soils, MfE
NEPM - National Environmental Protection Measures 2013, Formerly NEPC, Australia
ANZWQ - Australian and New Zealand - Guidelines for Fresh and Marine Water Quality (online)- Sediment GV-high
1 Concentrations for specified soil group from Background concentrations in Canterbury soils, Tonkin and Taylor, July 2007

Appendix E – Laboratory Reports



Certificate of Analysis

Malloch Environmental Ltd
19 Robertsons Road, Kirwee
Christchurch 7671
Attention: Nicola Peacock
Phone: 021 132 0321
Email: nicola@mallochenviro.co.nz

Lab Reference: 20-10328
Submitted by: Nicola Peacock
Date Received: 10/03/2020
Date Completed: 11/03/2020
Order Number:
Reference: 412

Sampling Site: 511 Halswell Rd
Description of Work: PA500 - 511 Halswell Rd

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.

Asbestos in Soil (Qualitative-500)

Sample Details

Laboratory ID	Client Sample ID	Sample Location	Sample Description	Date Sampled	Date Analysed
Units					
20-10328-9	AsB1 (base)		Soil	9/03/2020	11/03/2020
20-10328-10	AsB2 (wall)		Soil	9/03/2020	11/03/2020

Information in the above table supplied by the client: Client Sample ID, Sample Location, Date Sampled.

Analysis Results

Laboratory ID	Client Sample ID	ACM Weight*	ACM Types*	Fibre Types	Trace Asbestos (Presence / Absence)	Asbestos (Presence / Absence)
Units		g				
20-10328-9	AsB1 (base)	0.0000	No Asbestos Detected	Asbestos NOT Detected. Organic Fibres	Absent	Absent
20-10328-10	AsB2 (wall)	0.0000	No Asbestos Detected	Asbestos NOT Detected. Organic Fibres	Absent	Absent

Information in the above table supplied by the client: Client Sample ID

Asbestos in Soil (Qualitative-500) Approver:

Jenny Nichols, M.Sc.
Christchurch Lab Coordinator

Method Summary

Asbestos Fibres in Soil (Qualitative)

Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with AS4964-2004 Method for the qualitative identification of asbestos in bulk samples.

Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques.

Note 2: Trace asbestos is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased on site. This is not the sole indicator for the friable nature of the asbestos present.

Note 3: If mineral fibres of unknown type are detected, by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised.

Note 4: The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description.



Certificate of Analysis

Malloch Environmental Ltd
19 Robertsons Road, Kirwee
Christchurch 7671

Attention: Nicola Peacock
Phone: 0210527731
Email: nicola@mallochenviro.co.nz

Sampling Site: 511 Halswell Road

Lab Reference: 20-10514
Submitted by: Fran Hobkirk
Date Received: 11/03/2020
Testing Initiated: 11/03/2020
Date Completed: 13/03/2020
Order Number: N/A
Reference: 412

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Elements in Soil

Client Sample ID			VS1 Surf	VS2 Surf	VS3 Surf	VS4 Surf	VS5 Surf
Date Sampled			9/03/2020	9/03/2020	9/03/2020	9/03/2020	9/03/2020
Analyte	Unit	Reporting Limit	20-10514-1	20-10514-2	20-10514-3	20-10514-4	20-10514-5
Arsenic	mg/kg dry wt	0.125	5.7	5.1	2.3	1.7	11

Elements in Soil

Client Sample ID			VS6 Surf	VS7 Surf	VS8 Surf
Date Sampled			9/03/2020	9/03/2020	9/03/2020
Analyte	Unit	Reporting Limit	20-10514-6	20-10514-7	20-10514-8
Arsenic	mg/kg dry wt	0.125	17.2	8.5	8.7

Method Summary

Elements in Soil

Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

Elizabeth Fitzgerald, B.Sc.
Senior Technician



Certificate of Analysis

Malloch Environmental Ltd
19 Robertsons Road, Kirwee
Christchurch 7671

Attention: Fran Hobkirk
Phone: 0210527731
Email: nicola@mallochenviro.co.nz

Sampling Site: 511 Halswell Road

Lab Reference: 20-11638
Submitted by: Fran Hobkirk
Date Received: 18/03/2020
Testing Initiated: 18/03/2020
Date Completed: 23/03/2020
Order Number: N/A
Reference: 412

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Heavy Metals in Soil

Client Sample ID			VS9 Surface	VS10 Surface	VS11 Surface	VS12 Surface	VS13 Surface
Date Sampled			16/03/2020	16/03/2020	16/03/2020	16/03/2020	16/03/2020
Analyte	Unit	Reporting Limit	20-11638-1	20-11638-2	20-11638-3	20-11638-4	20-11638-5
Arsenic	mg/kg dry wt	0.125	9.7	6.5	5.3	14.2	8.8
Cadmium	mg/kg dry wt	0.005	0.073	0.11	0.15	0.14	0.17
Chromium	mg/kg dry wt	0.125	22.7	20.6	18.1	24.2	22.5
Copper	mg/kg dry wt	0.075	13.7	12.7	11.2	17.8	15.1
Lead	mg/kg dry wt	0.25	23.5	19.8	19.5	26.8	24.7
Nickel	mg/kg dry wt	0.05	18.9	17.5	14.6	18.3	18.0
Zinc	mg/kg dry wt	0.05	70.6	63.3	63.7	82.2	74.9

Method Summary

Elements in Soil

Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

Emily Hanna, B.Sc.
Trace Elements Team Leader

Appendix F – Disposal Documentation

Account	Tran	Dock	Manifest_N	Special_F	Date	Vehicle Id	Product	Net Weight
Frews	443972	657015	20/026	43882	HAD124	CCC Special Soil Class A		10.4
Frews	443973	657015	20/026	43882	HAD124T	CCC Special Soil Class A		13.26
Frews	443982	657015	20/026	43882	EZD938	CCC Special Soil Class A		16.1
Frews	443989	657015	20/026	43882	HAD124	CCC Special Soil Class A		9.74
Frews	443990	657015	20/026	43882	HAD124T	CCC Special Soil Class A		14.38
Frews	443997	657015	20/026	43882	EZD938	CCC Special Soil Class A		16.58
Frews	443998	657015	20/026	43882	FTZ336	CCC Special Soil Class A		12.33
Frews	443999	657015	20/026	43882	FTZ336T	CCC Special Soil Class A		13.74
Frews	444000	657015	20/026	43882	CYG345	CCC Special Soil Class A		10.02
Frews	444001	657015	20/026	43882	CYG345T	CCC Special Soil Class A		14.62
Frews	444004	657015	20/026	43882	DZC883	CCC Special Soil Class A		10.92
Frews	444005	657015	20/026	43882	DZC883T	CCC Special Soil Class A		17.9
Frews	444006	657015	20/026	43882	EZD938	CCC Special Soil Class A		16.94
Frews	444011	657015	20/026	43882	FTZ336	CCC Special Soil Class A		13.27
Frews	444012	657015	20/026	43882	FTZ336T	CCC Special Soil Class A		13.66
Frews	444013	657015	20/026	43882	CYG345	CCC Special Soil Class A		11.32
Frews	444014	657015	20/026	43882	CYG345T	CCC Special Soil Class A		13.84
Frews	444017	657015	20/026	43882	GUW157	CCC Special Soil Class A		11.56
Frews	444018	657015	20/026	43882	GUW157T	CCC Special Soil Class A		15.88
Frews	444020	657015	20/026	43882	EZD938	CCC Special Soil Class A		16.44
Frews	444021	657015	20/026	43882	GZU415	CCC Special Soil Class A		17.44
Frews	444022	657015	20/026	43882	DZC883	CCC Special Soil Class A		11.6
Frews	444023	657015	20/026	43882	DZC883T	CCC Special Soil Class A		17.36
Frews	444026	657015	20/026	43882	JMT839	CCC Special Soil Class A		13.24
Frews	444027	657015	20/026	43882	JMT839T	CCC Special Soil Class A		17.1
Frews	444029	657015	20/026	43882	CYG345	CCC Special Soil Class A		10.94
Frews	444030	657015	20/026	43882	CYG345T	CCC Special Soil Class A		14.46
Frews	444031	657015	20/026	43882	FTZ336	CCC Special Soil Class A		13.01
Frews	444032	657015	20/026	43882	FTZ336T	CCC Special Soil Class A		13.36
Frews	444035	657015	20/026	43882	GUW157	CCC Special Soil Class A		11.32
Frews	444036	657015	20/026	43882	GUW157T	CCC Special Soil Class A		16.24
Frews	444037	657015	20/026	43882	HAD124	CCC Special Soil Class A		11.1
Frews	444038	657015	20/026	43882	HAD124T	CCC Special Soil Class A		14.18
Frews	444041	657015	20/026	43882	HMN942	CCC Special Soil Class A		11.8
Frews	444042	657015	20/026	43882	HMN942T	CCC Special Soil Class A		14.68
Frews	444044	657015	20/026	43882	EZD938	CCC Special Soil Class A		16.1
Frews	444057	657015	20/026	43885	GZU415	CCC Special Soil Class A		25.04
Frews	444063	657015	20/026	43885	JRC814	CCC Special Soil Class A		14.08
Frews	444064	657015	20/026	43885	JRC814T	CCC Special Soil Class A		16.78
Frews	444067	657015	20/026	43885	KDU550	CCC Special Soil Class A		11.72
Frews	444068	657015	20/026	43885	KDU550T	CCC Special Soil Class A		17.38
Frews	444069	657015	20/026	43885	HMN942	CCC Special Soil Class A		13.44
Frews	444070	657015	20/026	43885	HMN942T	CCC Special Soil Class A		16.9
Frews	444080	657015	20/026	43885	JRC814	CCC Special Soil Class A		12.42
Frews	444081	657015	20/026	43885	JRC814T	CCC Special Soil Class A		14.32
Frews	444084	657015	20/026	43885	HMN942	CCC Special Soil Class A		12.14

[illegible]

CWS Kate Valley Landfill**WEIGHING DOCKET 951867**

27 Feb 2020 8:06 am

Reg TRUCKD Frews Contracting Ltd

Tag Id 092809

Frews Isuzu

1st Load: Special Waste

Permit Number : B1084

Billing Customer : Frews (HD Asbestos)

Manifest Number : 30103

Gross 21,280 Kg
Tare 16,420 K
Net 4,860 K

8.18

**Special Waste Manifest**

MANIFEST No. 30103

ails

Permit No. B1084

Contracting Ltd
Halswell road
Harewood

Contact Phone

Fax

027 224 3251

Details (If different from Permit Holder above)

above

Halswell road

Contact Phone

Fax

D Asbestos

Lab. Test No. (where applicable)

Batch I.D.

Date of Collection

One or two bins (circle)

1

2

27/2/20

D Waste Transporter DetailsImmediate Container Turnaround Requested ☐

Transporter Name

AS Above

Address

Contact Person

Driver Name

Nick

Contact Phone

Fax

Truck Registration

Container No.

TRUCKD

H606

E To be completed at LandfillPermit Verified ☐

Date of Arrival

Time of Arrival

Special handling ☐

Weighbridge Docket No.

Weight

GPS Disposal Location

N

E

RL

Disposal Time

Operator / Technician

Notes

Generator Copy

November 2016

Issue: 6

LMP 4-3 F

CWSCanterbury
Waste Services

PO Box 142 Amberley 7441

Phone: 0800 66 44 33

Email: landfill@cws.co.nz

King Parren
1KV
CWS Kate Valley Landfill

WEIGHING DOCKET 951718
26 Feb 2020 8:08 am

Reg FTZ337 Frews Contracting Ltd

Tag Id 092397
Frews Isuzu (NEW TAG)

1st Load: Special Waste

Manifest Number : 38546
Permit Number : B1084
Billing Customer : Frews (HD Asbestos)

Gross 19,500 Kg
Tare 15,520 K
Net 3,980 K

6-84
Wheeler
511 Halswell Rd

WEIGHING DOCKET 951719
26 Feb 2020 8:08 am

Reg FTZ337 Frews Contracting Ltd

Tag Id 092397
Frews Isuzu (NEW TAG)

Trailer Q498E

2nd Load: Special Waste

Permit Number : B1084
Billing Customer : Frews (HD Asbestos)
Manifest Number : 38546

Gross 17,840 Kg
Tare 6,020 K
Net 11,820 K

1048

Special Waste Manifest

MANIFEST No. 38546

ils

Permit No. *B1084*

Frews Contracting

Contact Phone

Fax

etails (If different from Permit Holder above)

Frews

511 Halswell Rd

Contact Phone

Fax

2 x 15m Bins

HD ASBESTO

One or two bins (circle)

1

2

Immediate Container Turnaround Requested ☐

Frews

Driver Name *Gay M.*

Fax

Container No. *26/29*

II

Permit Verified ☐

Time of Arrival

Special handling ☐

Weight

E

RL

Notes

CWS Kate Valley Landfill

Special Waste Manifest

WEIGHING DOCKET 953212

MANIFEST No. **40589**

11 Mar 2020 8:28 am

Reg MBM655 Frews Contracting Ltd

Tag Id 152134
Frews Isuzu #708

1st Load: Special Waste

Permit Number : C6039
Billing Customer : Frews (HD TCLP)
Manifest Number : 40589

Gross 22,940 Kg
Tare 14,980 K
Net 7,960 K

511 Halswell St

ails

Permit No. **C6039**

Frews Contracting Ltd
61 Springs Road
Halswell

Contact Phone

Fax

027224 3251

Details (If different from Permit Holder above)

As Above

Contact Phone

Fax

Continuation from
511 Halswell Road

Lab. Test No. (where applicable)

Batch I.D.

Date of Collection

One or two bins (circle)

1

2

10/3/20

D Waste Transporter Details

Immediate Container Turnaround Requested ☐

Transporter Name

Address

Contact Person

Driver Name

Contact Phone

Fax

Truck Registration

Container No.

MBM655

H3 22

E To be completed at Landfill

Permit Verified ☐

Date of Arrival

Time of Arrival

Special handling ☐

Weighbridge Docket No.

Weight

GPS Disposal Location

N

E

RL

Disposal Time

Operator / Technician

Notes

Generator Copy

June 2019

Issue: 7

LMP 4-3 F

CWS

Canterbury
Waste Services

PO Box 142 Amberley 7441

Phone: 03 359 1800

Email: kvpad@cws.co.nz

WEIGHING DOCKET 953125

10 Mar 2020 11:40 am

Special Waste ManifestMANIFEST No. **40587**

Reg MBM655 Frews Contracting Ltd

Tag Id 152134
Frews Isuzu #708

Trailer FrewT1

2nd Load: Special Waste

Permit Number: C6039
Billing Customer: Frews (HD TCLP)
Manifest Number: 40587Gross 18,880 Kg
Tare 9,300 K
Net **9,580 K**33227
S11 Hanson Reno

ails

Permit No. **C6039**Frews Contracting Ltd
61 Scivills Road
Hawke's Bay

Contact Phone

Fax

027224 3251

Details (If different from Permit Holder above)

AS Arden

Contact Phone

Fax

Continuation of
S11 Hanson Reno

Lab. Test No. (where applicable)

Batch I.D.

Date of Collection

6/3/20

One or two bins (circle)

1 2**D Waste Transporter Details**Immediate Container Turnaround Requested ☐

Transporter Name

Address

Contact Person

Driver Name

Contact Phone

Fax

Truck Registration

Container No.

MBM655

1 Bin 23

E To be completed at LandfillPermit Verified ☐

Date of Arrival

Time of Arrival

Special handling ☐

Weighbridge Docket No.

Weight

GPS Disposal Location

N

E

RL

Disposal Time

Operator / Technician

Notes

Generator Copy

June 2019

Issue: 7

LMP 4-3 F

CWSCanterbury
Waste Services

PO Box 142 Amberley 7441

Phone: 03 359 1800

Email: kvpad@cws.co.nz