REPORT

Tonkin+Taylor

Redcliffs Park

Ground Contamination Investigation

Prepared for
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Table of contents

1 Introduction 1
1.1 Background and objectives 1
1.2 Scope of work 2
2 Site description 3
2.1 Site description 3
2.2 Site condition 3
2.2.1 Public toilets 3
2.2.2 Former Redcliffs Table Tennis Club 3
2.2.3 Orion substation 3
2.2.4 Former water reservoirs 4
2.2.5 Redcliffs Park sports fields 4
2.2.6 Bark 4
2.3 Surrounding land use 4
2.4 Geology 4
2.5 Hydrogeology 4
3 Site history 6
3.1 Historical aerial photographs 6
3.2 Property files 6
3.3 Listed Land Use Register statement 6
3.4 Certificates of Titles 6
4 Site contamination characterisation 7
4.1 Potential for contamination 7
5 Field investigation for soil contamination 9
5.1 Investigation scope 9
5.2 Sampling procedures 9
5.2.1 Soil sampling procedures for chemical contaminants 9
5.2.2 Quantitative asbestos risk assessment sampling procedure 10
5.3 Observations 10
6 Analytical results 11
6.1 Selection of assessment criteria 11
6.2 Data quality 11
6.3 Results summary 12
6.4 Conceptual site model 12
7 Development implications 14
7.1 Summary of assessment findings 14
7.2 Regulatory implications 14
7.2.1 NES Soil 14
7.2.2 Regional plans 15
7.3 Soil management 16
7.4 Remediation requirements 16
7.5 Health and safety 17
8 Conclusions 18
9 Applicability 19

Appendix A : Figures

Appendix B : Site photograph

Appendix C : **Site history information**

Appendix D : **Historical aerial photographs**

Appendix E : **Listed Land Use Register**

Appendix F : **Excavation logs**

Appendix G : **Tabulated results**

Appendix H : **Laboratory transcripts**

1 Introduction

Tonkin & Taylor Ltd (T+T) has been engaged by the Ministry of Education (MoE) to undertake a ground contamination investigation at Redcliffs Park in Christchurch (the site), which is shown in **Figure 1** (below).

This report should be read in conjunction with the T+T geotechnical investigation report (March 2017) for the site.

This report has been prepared in general accordance with the requirements for a PSI and DSI (Preliminary and Detailed Site Investigation) referred to in the NES Soil regulations[1], and as outlined in the Ministry for the Environment's (MfE) Contaminated Land Management Guidelines[2].

The persons undertaking, managing, reviewing and certifying this investigation are suitably qualified and experienced practitioners as defined in the NES Soil.

This investigation was undertaken in accordance with our proposal dated 17 November 2016[3].

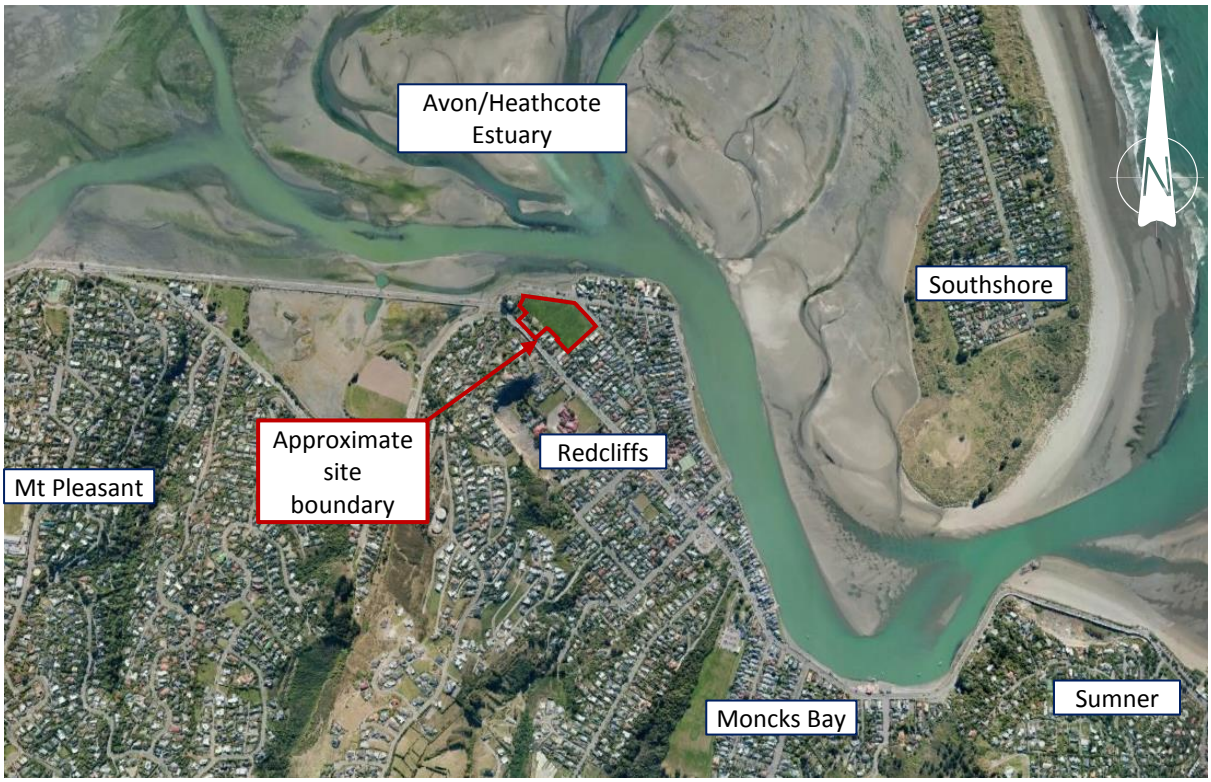


Figure 1: Site location (image source: Google Earth, 2017).

1.1 Background and objectives

We understand that the MoE is looking to relocate Redcliffs School to a new location at Redcliffs Park and is currently undertaking their due diligence process for this new site. Proposed development on the site will likely include typical educational facilities such as single and two storey lightweight timber-framed buildings, outdoor paved areas and car parks.

[1] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.
[2] Ministry for the Environment, updated 2011, Contaminated land management guidelines No. 1: *Reporting on Contaminated Sites in New Zealand*.
[3] Tonkin & Taylor Ltd., Proposal for Geotechnical, Rockfall Hazard and Ground Contamination Investigation and Assessment (1001107). 17 November 2016.

A preliminary assessment completed by T+T in July 2016 highlighted that part of the site was identified on Christchurch City Council (CCC) records as a former landfill. The MoE therefore engaged T+T to complete a ground contamination investigation at the site to inform contamination-related development aspects and resource consenting considerations for the proposed school.

1.2 Scope of work

The scope of work for this investigation comprised:

- Review of CCC property files, Environment Canterbury's (ECan) Listed Land Use Register (LLUR) and historical aerial photographs.
- Site walkover inspection.
- The collection of nine surficial soil samples from hand augured boreholes to assess for contaminants associated with the sports fields.
- The collection of deeper soil samples from nine mechanically excavated test pits to test for contaminants associated with landfilling.
- Screening for the presence of methane, carbon dioxide, and oxygen concentrations using a landfill gas (LFG) analyser, during excavation of the test pits.
- The collection of five surface samples from within the former water reservoir area of the site (Main Road frontage) to assess for potential asbestos contamination associated with building demolition.
- Comparison of detected contaminant concentrations against relevant risk-based land use and health and safety criteria, and disposal facilities acceptance criteria.
- The preparation of this report.

2 Site description

2.1 Site description

The site is bordered by Main Road, Beachville Road and Celia Street and comprises three parcels of land with legal titles of *Res 4601, Lot 2 DP 47479* and *Lot 3 DP 47479* (refer **Figure 2**, **Appendix A**). The total land area of these three parcels is approximately 1.9 ha.

The majority of the site is flat and lies at an elevation of approximately 1.7 m relative to the 1937 Lyttelton vertical datum (LVD). The portion of the site closest to Main Road slopes up towards the road, where it reaches an elevation of approximately 5.0 mLVD. The lower lying area of the site, which currently forms Redcliffs Park, is essentially flat and comprises grassed areas (sports fields) and two children's playgrounds. There are three buildings on the Main Road portion of the site comprising an Orion substation (still in use), a small community hall/clubroom (no longer in use) and a public toilet block (still in use). There are also paved areas and paths within this raised Main Road portion.

A review of the CCC district planning maps indicates that the site is zoned as 'Open Space 2' under the operative and proposed district plans. The site (and surrounding area) is also included in a 'Flood Management Area' overlay.

2.2 Site condition

A T+T environmental scientist completed a site walkover on 1 December 2016. Relevant observations made at the time of the inspection are included in **Figure 2, Appendix A** and are summarised in the following sub-sections.

2.2.1 Public toilets

A public toilet block is located along the south-western boundary of the site i.e. on the Main Road frontage (**Photograph 1**, **Appendix B**). The block is constructed with brick and tile and a tin roof. Pipework appears to be plumbed to the sewage mains rather than to an on-site septic tank. No obvious indications of ground contamination (staining, vegetation stress, etc.) were noted during the walkover.

2.2.2 Former Redcliffs Table Tennis Club

A single level building that housed the Redcliffs Table Tennis Club is present on the site. The building is constructed with weatherboard panels and has a tin roof. The building stood on short concrete piles but has shifted to the south and fallen off the piles (**Photograph 2**, **Appendix B**). No obvious indications of ground contamination (staining, vegetation stress, etc.) were noted during the walkover.

2.2.3 Orion substation

This building is of concrete and timber construction with a tin roof (**Photograph 3**, **Appendix B**). This building appears to be of relatively modern construction, which was corroborated by anecdotal evidence from a local resident who confirmed that the substation was built in circa 2010. However, aerial photographs indicate that it was constructed no earlier than 2011. It is understood that this building was constructed on the footprint of a previous substation (operated by Southpower). No obvious indications of ground contamination (staining, vegetation stress, etc.) were noted during the walkover.

2.2.4 Former water reservoirs

Two former in-ground concrete water reservoirs were located directly north-west of the former Redcliffs Table Tennis Club (**Photograph 4**, **Appendix B**). Discussions with a local resident indicated that the reservoirs have been filled in with rocks "decades ago". Plastic fragments and crushed concrete was observed on the ground surface in this area at the time of the site walkover.

2.2.5 Redcliffs Park sports fields

The majority of Redcliffs Park is occupied by sports fields. At the time of the walkover, the sports fields were covered by well-maintained healthy grass (**Photograph 5**, **Appendix B**). Four football goal posts were observed as well as a children's playground area located directly south-west of the sports fields. A preliminary desktop review, which included viewing aerial photographs, identified surface scaring along the centre of the sports field extending from the Celia Street and Beachville Road intersection to the playground. At the time of the walkover, the scaring was not visible however paint marks applied by the underground services locator (**Photograph 6**, **Appendix B**) indicated the presence of two services at 0.35 m and 1.0 m below ground level (bgl). The discolouration and scaring appears to be associated with the laying of these services. No obvious indications of ground contamination were noted during the walkover.

2.2.6 Bark

A 20 m x 25 m area on the north-western portion of the sports fields was covered in minor amounts of bark (**Photograph 7**, **Appendix B**). At the time of the site walkover, visual examination of the surficial soils (0-0.2 m depth) in the area did not indicate any variation from conditions observed elsewhere within the sports fields. It appears that some bark was stored in the area and then later removed (likely used as a staging area during the construction of the playground, where bark is used as surface cover).

2.3 Surrounding land use

The land uses in the area surrounding the site include:

- North: Beachville Road with residential properties and the Avon Heathcote Estuary beyond.
- East: Residential property (1 Main Road) currently undergoing repairs with Beachville Road and the Avon Heathcote Estuary beyond.
- South: Main Road with residential properties beyond.
- West: Residential properties and Celia Street.

2.4 Geology

Published geological information[4] indicates that the site is generally underlain by sandy soils of the Christchurch Formation, most likely deposited in a sand beach environment in the past 1,000 to 3,000 years. These deposits are likely to be underlain at depth by volcanic materials of the Mt Pleasant Formation.

2.5 Hydrogeology

Groundwater information is available on the NZGD[5], which is based on the medium-term monitoring of piezometers at hundreds of locations across Christchurch. This indicates that the median

[4] Brown, L. J. and Weeber, J. H. (1992), *Geology of the Christchurch Urban Area.* Institute of Geological & Nuclear Sciences Limited Geological Map 1. Scale 1:25,000.
[5] New Zealand Geotechnical Database.

groundwater elevation at the site is approximately 0.5 mLVD (i.e. approximately 0.5 m above mean sea level).

Groundwater levels at the site will fluctuate in response to tides, rainfall and due to yearly and seasonal variation. A piezometer installed approximately 90 m east of the site indicates that the reported 15th and 85th percentile groundwater elevations vary either side of the median by approximately 0.3 m. Maximum and minimum recorded values vary either side of the median by up to 1 m.

During the T+T geotechnical investigation completed in December 2016, groundwater appeared to be encountered between 0.8 and 2.2 mbgl within the lower lying portion of the site. Whereas groundwater was encountered at approximately 5 mbgl in the Main Road portion of the site. During the test pit investigations in January 2017, groundwater was encountered between 0.9 and 1.35 mbgl in the lower lying portion of the site.

3 Site history

The following sources were consulted to identify historical activities with the potential to have caused ground contamination at the site:

- Historical aerial photographs available on the ECan database.
- Statements held by ECan's Listed Land Use Register (LLUR).
- Property files held by the CCC.
- Certificates of Titles (COTs).

The information that has been reviewed is summarised in this section, with a more detailed description of the findings provided in **Appendix C**.

3.1 Historical aerial photographs

The Beachville Road site frontage has been a park/open space since at least 1941, although the south-eastern and south-western portions were occupied by dwellings and fenced paddocks. These dwellings were removed in 1955 and the current configuration of the park established. Surface scaring on the south-eastern half of the current sports fields is visible in 1946. A few small patches of surface scaring are also visible along the Beachville Road frontage of the site. This may be associated with the historical 113 Beachville Road Landfill, which closed in the early 1950s. The Main Road site frontage was occupied by structures (which correspond to the location of in-ground water reservoirs described by a nearby resident) since at least 1941. The structures appear to have been decommissioned by the 1984 and 2016 historical aerial photographs, respectively. The building corresponding to the former Redcliffs Table Tennis Club first appeared in the 1955 historical aerial photograph and still remains. The new Orion substation was built sometime after 2011, over the location of the former Southpower substation. Refer to **Appendix D** for copies of historical aerial photographs.

3.2 Property files

The CCC property files contained the following pertinent information regarding the historical use of the site:

- Based on a resource consent application by Fulton Hogan Ltd to CCC in February 2014, the Main Road frontage of the site (7 Main Road) was used by infrastructure contractors as a laydown area for plant and materials involved in local repair works within the Main Road corridor.
- The site has been used for multiple public events.
- The current toilet block replaced previous toilet facilities demolished in the late 1990s.

3.3 Listed Land Use Register statement

LLUR reports were obtained for each of the three land parcels that comprise the site. The LLUR reports indicate that ECan does not hold any information for Lot 2 DP 47479 and Lot 3 DP47479. The report for RES 4601 (the northern portion of the site) states that the area is identified as Landfill #43 on the CCC Landfill Map, and operated from the late 1940s to early 1950s and accepted domestic rubbish. Refer to **Appendix E** for copies of the LLUR statements.

3.4 Certificates of Titles

The Certificates of Title (COTS) make no mention of business ownerships that could pose a potential ground contaminating risk associated with the site.

4 Site contamination characterisation

The potential for ground contamination was assessed based on visual observations made during the site walkover and a review of available aerials, LLUR statements and property files.

4.1 Potential for contamination

The potential location and nature of contamination associated with activities undertaken on the site is summarised below in **Table 4.1**.

Table 4.1: Redcliffs Park – summary of potential ground contaminants of concern

Activity	Potential contaminants of concern	Comments
Former landfill (1940s-1950s)	Range of inorganic and organic contaminants including metals and hydrocarbons. Potential for putrescible domestic waste to generate landfill gases (methane, CO_2, hydrogen sulphide).	Given the proximity of the site to the Avon/Heathcote Estuary, groundwater is likely to be shallow (less than 2 m below ground level) around high tide. It is considered that if the site was used as a landfill, waste would have been placed at relatively shallow depths to avoid excavating into waterlogged soils. The landfill is thought to have ceased operation prior to the widespread use of asbestos products in New Zealand. Therefore, it is considered unlikely that asbestos containing materials would have been disposed in the landfill.
Sports field/recreational space	Inorganic and organic persistent pesticides and herbicides including metal compounds, organochlorine pesticides and acid herbicides.	ECan typically considers that all parks and sports fields meet the HAIL[6] definition of a 'sports turf', meaning that there is the potential for ground contaminations associated with historic pesticide use or storage to have occurred on such sites. There is no direct evidence of regular pesticide and/or herbicide use at the site. However, it is likely that in common with other CCC-owned parks and school sports fields, periodic or intermittent use of such substances has occurred as pest management circumstances required. Pesticide application is likely to have been applied to the ground surface using sprays, with application being relatively uniform across the site. Residual pesticide contamination (if present) is therefore likely to be limited to the upper soil profile (i.e. top 300 mm).
Operation of substation	Hydrocarbons, polychlorinated biphenyls (PCBs).	The current Orion substation is located on the footprint of the former Southpower substation that was present during the period when the use of PCBs in transformers and other electrical equipment was common. If a loss of PCB-containing transformer oil had occurred historically, ground contamination would be relatively shallow and localised to the substation. Such contamination (if present) is likely to have been removed during the construction of the current substation building.

[6] Hazardous activities and Industries List.

Use of 7 Main Road for contractor laydown	Hydrocarbons	It appears that the current gravel covered area on the Main Road frontage (the former reservoir area) was used in 2014 as a laydown area for contractors undertaking infrastructure repairs in Redcliffs. This area is likely to have been used for the storage of plant and materials. The potential for ground contamination is likely to have been limited to oil/fuel losses from plant and equipment. No evidence of surface staining was noted by T+T during the site walkover. Therefore it is considered that the potential is low for ground contamination to have occurred as a result of this activity.
Demolition of buildings following the Canterbury Earthquake Sequence	Asbestos	Some building demolition appears to have occurred on the Main Road portion of the site following the 2011 Canterbury Earthquake Sequence (CES). Given the likely age of the buildings it is possible that asbestos-containing materials were present in their structure. If this is the case, it is possible that ground contamination by asbestos occurred during demolition. Unless demolition materials have been used to fill void spaces, asbestos contamination would generally be limited to the near surface (top 100 mm).

5 Field investigation for soil contamination

5.1 Investigation scope

The T+T ground contamination investigation scope comprised:

- The collection of near surface soil samples (0-100 mm depth) from 10 locations across the site using a hand auger on 1 December 2016 to investigate for contaminants associated with the use of the site as a sports field.
  - 10 soil samples (TP1, TP2, TP3, TP6, TP8, TP9, TP10, TP11, TP13 and TP14) were analysed for metals and organochlorine pesticides.
- The collection of sub-surface soil samples from nine machine-excavated test pits (TP1, TP2, TP3, TP6, TP8, TP9, TP10, TP11 and TP13) on 17 January 2017, principally to assess for the presence and extent of landfill materials.
  - Test pits were located within and outside of the area of former landfilling indicated on the ECan LLUR report, and were excavated to a maximum depth of 2.5 m.
  - A landfill gas analyser and photo-ionisation detector (PID) was used to screen each test pit for the presence of landfill gases (methane, hydrogen sulphide) and volatile organic compounds, respectively, during test pit excavation.
  - Soil samples were collected from various depths within the encountered soil profile and were submitted for metals and polycyclic aromatic hydrocarbon (PAH) analysis.
- The collection of five surface soil samples (TP13 andSS1 – SS4) on 17 and 26 January 2017 from the vicinity of TP13 (i.e. Main Road site frontage) for semi-quantitative asbestos analysis according to the WA Guidelines[7] based on the observation of crushed concrete (potential building demolition material) in this area.

The test pit investigations were observed by an archaeologist from Underground Overground Archaeology Ltd and cultural monitors from Te Ngāi Tūāhuriri Rūnanga and Te Hapū o Ngāti Wheke.

Sampling locations are shown on **Figure 3**, **Appendix A**. All soil sample analyses were completed by an IANZ[8]-accredited laboratory.

5.2 Sampling procedures

All sampling was completed by a suitably qualified and experienced practitioner as required by the NES Soil and as described in the NES Soil Users Guide (as referenced previously in this report). Sampling was undertaken in general accordance with MfE Guideline No. 5. The following sub-sections detail the two different soil sampling procedures adopted during the investigation.

5.2.1 Soil sampling procedures for chemical contaminants

Soil samples to be tested for chemical contaminants (i.e. non-asbestos) were collected from 10 locations across the site as set out in the following procedures:

- Samples were collected from the surface after removing organic materials (i.e. grass).
- A hand auger was used to collect near surface soil samples and a mechanical excavator was used to excavate each test pit down to a maximum depth of 2.5 m to sample sub-surface soils.
- The material encountered was logged in general accordance with industry guidelines.

[7] Western Australia Department of Health, May 2009. Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.
[8] International Accreditation New Zealand.

- Each test pit was screened for volatile compounds using a PID and for landfill gases using a LFG meter (GA5000).
- Freshly gloved hands were used to collect soil samples. All samples were placed immediately into laboratory supplied sample containers.
- Samples were selected for testing based on field observations e.g. presence of fill materials with significantly different compositions.
- All sampling equipment (e.g. trowel, hand auger) were decontaminated between sampling locations using clean water and Decon 90 (a phosphate-free detergent).
- Samples were couriered in chilled containers to Analytica Laboratories (Analytica) for metals, PAHs and OCPs analysis under chain of custody documentation.

5.2.2 Quantitative asbestos risk assessment sampling procedure

Soil samples to be tested for asbestos were collected from five locations across the site as set out in the following procedures:

- A 10 L surface soil (0 – 0.1 m bgl) sample taken from a 1 m^2 area was collected from each sample location and placed into a clean bucket. A 500 ml sub-sample was collected from the bucket sample and placed into a 500 ml plastic container to be submitted for semi-quantitative asbestos analysis.
- The remaining bucket sample was passed through a 7 mm aperture sieve. All material >7 mm was visually inspected. No fragments of suspected asbestos containing material (ACM) were identified.
- A fresh disposable plastic insert was placed into the bucket between each sample location to eliminate potential cross-contamination.
- Samples were submitted to IANZ accredited Precise Consulting and Laboratory (Precise), under chain of custody documentation, for semi-quantitative analysis of asbestos content.

5.3 Observations

The generalised geological sequence encountered at the site comprised topsoil overlying fill materials interpreted to comprise reworked silty sands and sandy silts. These are inferred to overly natural silts and sands. No evidence of waste disposal (rubbish) was observed within any of the investigation test pits. Fragments of porcelain and glass observed at 0.25 m depth in TP11 were the only anthropogenic materials observed with the test pits. Test pit logs are included in **Appendix F**.

With the exception of the ground surface at TP13 (near the Orion substation) no visual indications of potential contamination (waste material, staining, stressed vegetation), above background PID readings or detectable methane or hydrogen sulphide were measured during the investigation.

At TP13, the ground surface was covered with a thin (100 mm) veneer of angular gravel that contained small fragments of plastic and crushed concrete.

6 Analytical results

6.1 Selection of assessment criteria

The T+T investigation data has been evaluated against guidance documents and standards that have been selected in accordance with the MfE CLMG No. 2 and are presented in **Table 6.1**:

Table 6.1: Selected assessment criteria

Assessment criteria	Source
Remediation criteria Soil contaminant standards or guidelines protective of human health in a recreational land use scenario (adopted for a school site). Soils containing contaminant concentrations above the remediation criteria will require removal and disposal or in situ management.	• NES Soil Contaminant Standards (SCS) for metals and hydrocarbons (Recreational land use). • WA Guidelines 'all site uses' criteria for fibrous asbestos and asbestos fines (0.001% w/w). • WA Guidelines 'recreational' criteria for ACM (0.02% w/w).
Environmental protection Risk-based environmental assessment criteria to assess potential risks to environmental receptors from site-derived contamination.	• ANZECC 2000: Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Interim Sediment Quality Guidelines (LOW – Trigger).
Disposal criteria Criteria used to determine the suitability of material for acceptance for disposal at clean fill, managed fill or licensed landfill facilities.	• Published background concentrations for the Canterbury Region to assess suitability for disposal to a cleanfill facility. • Burwood Resource Recovery Park (BRRP) acceptance criteria. The BRRP acceptance criteria are based on the NES Soil SCS for recreational land use. In addition, the BRRP criteria does not allow the presence of any detectable concentration of asbestos. • For materials known or suspected to contain asbestos, disposal is dependent on amount of asbestos present: – > 0.001 % w/w – Kate Valley Landfill; or – < 0.001 % w/w – Frews Contracting facility, Hororata.
Health & safety criteria Standards or guidelines to protect the health of workers on the site during construction, and to determine H&S controls to be implemented during site development.	• NES Soil SCS for: – Commercial land use (protective of construction workers). • WA Guidelines 'all site uses' criteria for fibrous asbestos (FA) and asbestos fines (AF) (0.001% w/w).

6.2 Data quality

A quality assurance and quality control (QA/QC) program was implemented as part of field procedures, which included:

- Sampling equipment decontamination between sampling locations.
- Transportation of samples with accompanying chain of custody documentation.

The laboratory testing was undertaken by Analytica and Precise, which are both accredited and audited annually by IANZ. The quality control measures adopted by the laboratories include testing of blanks with all batches of samples and frequent replicates and spikes, along with peer review of worksheets.

6.3 Results summary

The laboratory results are summarised below:

- All surface soil samples (0-100 mm depth) contained concentrations of metals (typically chromium, cadmium and lead) above published background levels but below soil contamination standards for the protection of the health of both construction works and future users of the site.
- Subsurface soil samples (> 100 mm depth) generally contained metal concentrations below background concentrations, the exceptions being deeper samples from TP3 and TP8 for chromium.
- Organochlorine pesticides were not detected in surface soil samples.
- Polycyclic aromatic hydrocarbons were detected in four of the seven samples analysed but at concentrations well below published background concentrations.
- Trace asbestos fibres (<0.001% weight/weight (w/w)) were detected within two of the five samples analysed from the gravel covered area on the Main Road frontage. Based on field observations asbestos is confined to this gravel material that forms a thin veneer across a clearly identifiable area of approximately 350 m^2.

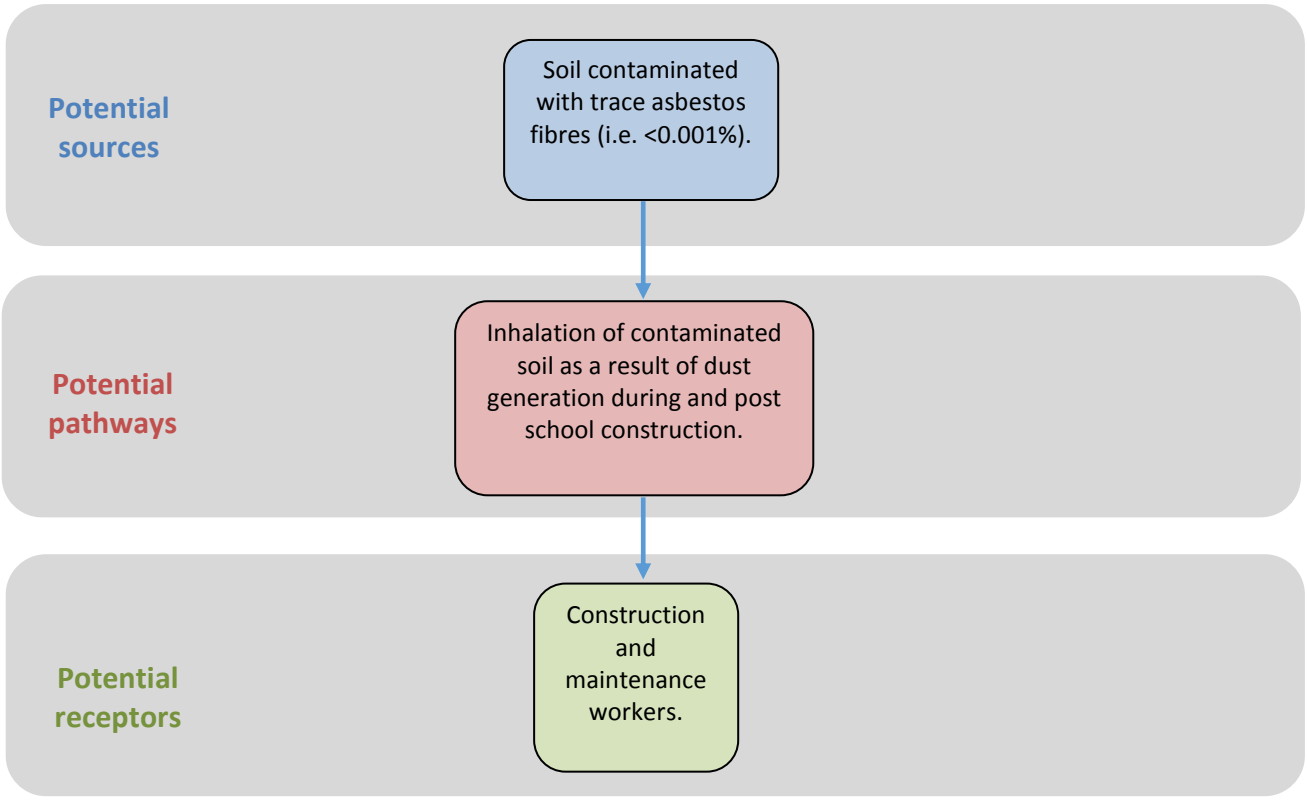
The tabulated results and full laboratory transcripts, as received from Analytica and Precise, are available in **Appendix G** and **Appendix H**, respectively.

6.4 Conceptual site model

Based on the findings of the investigation, T+T has developed a conceptual model (CSM) for the site summarising potentially complete pollutant linkages that could result in a credible adverse risk to human health or the environment in the context of site development for a school.

For there to be an effect from the proposed activity there has to be a contamination source and a mechanism (pathway) for contamination to affect human health or the environment (receptor).

The CSM has identified that asbestos in soils presents a potential risk to earthworks contractors during construction. This is shown diagrammatically below. Implications for the management of this material are discussed in **Section 7** below.


Potential sources
Soil contaminated with trace asbestos fibres (i.e. <0.001%).
Potential pathways
Inhalation of contaminated soil as a result of dust generation during and post school construction.
Potential receptors
Construction and maintenance workers.

7 Development implications

7.1 Summary of assessment findings

The findings from T+T's ground contamination investigation at Redcliffs Park are as follows:

- There is no evidence of waste (landfill) disposal at the site. With the exception of a small amount of glass and porcelain observed in one test pit, anthropogenic material was not observed in the area of the suspected landfill. Landfill gas and volatile compounds were not detected during the excavation of the test pits within the suspected landfill area.
- There is no evidence of residual persistent pesticide contamination in near-surface soils.
- Metals have been detected above background concentrations in near surface soils at most investigation locations and a very limited number of locations at depth. The detected concentrations are well below soil contaminant standards appropriate to the future use of the site as a school.
- Trace asbestos fibres were detected within surface materials collected from a clearly identifiable open gravel-covered area fronting onto Main Road. Concrete and plastic fragments were observed within this material, which may indicate the presence of demolition fill materials. Whilst asbestos was only detected within two of the five samples of this material, there is no reliable way to laterally segregate material containing asbestos from visually identical adjacent materials that may not contain asbestos. For this reason, it should be assumed that all of this material (approximately 100 mm thick over an area of approximately 350 m^2) contains asbestos fibres below 0.001% w/w.

7.2 Regulatory implications

The rules relating to the control of contaminated sites and potentially contaminated sites in the Christchurch region are specified in the following documents:

- NES Soil.
- ECan regional plans, including:
  - Land and Water Regional Plan (LWRP).
  - Natural Resources Regional Plan (NRRP).
  - Proposed Canterbury Air Regional Plan (pCARP).

The NES Soil contains provisions relating to land use and the protection of human health. The ECan regional plans contain provisions relating to the protection of the general environment including ecological receptors. A summary of potential resource consent requirements under each of these regulatory instruments is set out below.

7.2.1 NES Soil

The NES Soil came into effect on 1 January 2012. The NES Soil aims to establish nationally consistent planning controls appropriate to district and city councils for assessing contaminants in soil with regard to human health. The NES Soil prevails over district plan rules, except where the rules permit or restrict effects that are not related to contaminants in soil to protect human health. The NES Soil does not apply to any functions of regional councils and does not affect rules in regional plans (Regulation 4(b)).

The NES Soil applies to specific activities on land where a HAIL activity is known to have occurred, or is more likely than not to have occurred. Activities covered under the NES Soil include soil disturbance, soil sampling, fuel systems removal, subdivision and land use change. **Table 7.1**

(below), which is based on the NES Soil Users Guide (April 2012), confirms that the NES Soil applies to the site.

Table 7.1: PSI checklist

NES Soil requirement	Applicability
Is an activity described on the HAIL currently being undertaken on the piece of land to which this application applies? *The site is currently used as a sports field to which HAIL activity A10 (use and storage of persistent is commonly assigned.*	Yes
Has an activity described on the HAIL ever been undertaken on the piece of land to which this application applies? *The ECan LLUR records the site as historically being used as a landfill (HAIL activity G3).*	Yes
Is it more likely than not that an activity described on HAIL is being or has been undertaken on the piece of land to which this application applies?	Yes
If 'Yes' to any of the above, then the NES Soil may apply. **The five activities to which the NES applies are:**	
Is the activity you propose to undertake removing or replacing a fuel storage system or parts of it?	No
Is the activity you propose to undertake sampling soil?	No
Is the activity you propose to undertake disturbing soil?	Yes
Is the activity you propose to undertake subdividing land?	No
Is the activity you propose to undertake changing the use of the land?	Yes
Conclusion: NES Soil applies to the proposed development of the site.	

Specific details of the site redevelopment are not available at this time therefore we cannot assess specific resource consent requirements.

However, based on the T+T geotechnical report and experience with similar sorts of development within Christchurch, soil disturbance and associated excavation for the development is expected to be relatively modest, should either of the suggested foundation options be chosen (surface/shallow foundations or piled foundations). The site has an approximate total area of 1.9 ha, which equates to a permitted activity soil disturbance volume of 950 m^3. Should soil removal down to 0.2 mbgl be required then the permitted activity soil disturbance volume threshold would likely be exceeded.

Resource consent will therefore likely be required under the NES Soil. Further assessment of the activity status can be provided upon confirmation of site redevelopment details, however based on the data presented the activity status is likely to be a *controlled activity*.

7.2.2 Regional plans

The following regional plans contain objectives, policies and rules that may be relevant to any earthworks, including disturbance of contaminated soil, undertaken on the site:

- The LWRP has been developed to manage the effects of activities on land or water within the Canterbury Region. The LWRP became partially operative on 1 September 2015 and the rules that relate to earthworks and contaminated land at this site are operative.
- The provisions in the NRRP that relate to land and water have been partially superseded by the LWRP. The provisions that relate to air quality remain operative.
- The pCARP seeks to implement a new air quality management framework for Canterbury and was publicly notified in February 2015 with the rules having legal effect as of that date.

Resource consent requirements will depend on details of the proposed works (e.g. volume and depth of soil disturbance).

The proposed works may require resource consent from ECan under the rules in the LWRP for the construction and operational phase discharge of stormwater from a contaminated site to land or to water, excavation beyond the permitted depth over an aquifer, discharge of contaminants to land, and any dewatering required during earthworks (although, at this stage, construction dewatering is not expected unless trenches for site services are deeper than approximately 1 to 1.5 m below the current ground surface). Any discharges of dust may require consent under the NRRP and/or pCARP.

A full planning review against the regional plans should be undertaken once design/development details are confirmed.

7.3 Soil management

The following soil management options are available:

- Shallow (0-0.1 m depth) soils across the park/sports field areas contain concentrations of metals above published background and are therefore not suitable for disposal to cleanfill. The concentrations detected do however meet BRRP acceptance criteria.
- Subsurface materials generally contain contaminant concentrations below published background levels and are likely to be suitable for disposal to cleanfill (at the operators discretion), particularly if deeper soils containing above background concentrations are blended with soils containing below background concentrations.
- Subsurface soil comprising of a bluish grey organic silt was encountered within TP8 at a depth ranging from 0.4 m to 1.1 m bgl. This soil type may not be geotechnically suitable if left in-situ and could be excavated, unless piled foundations be required. If excavated, it would need to be disposed at BRRP as it contained various metals at concentrations exceeding the published background concentrations.
- Off-site disposal of soils containing asbestos may be carried out, with materials able to be received at two facilities within the Canterbury Region, subject to the asbestos concentration within the soils, namely:
  - Frews Plantation Road facility in Hororata (for materials with less than 0.001 %w/w asbestos fines/fibrous asbestos (AF/FA)).
  - The Kate Valley landfill, which can accept materials with greater than 0.001% w/w AF/FA.

  Based on the analytical results, asbestos-containing materials in the former water reservoir area of the site (Main Road frontage) are likely to be suitable for disposal to the Frews facility in Hororata.

7.4 Remediation requirements

From a contamination perspective all soils/fill with the exception of surface gravel in the former water reservoir area of the site (Main Road frontage) can be retained on site for reuse and there is no requirement for remediation to enable the future school development.

Asbestos fibres have been detected in samples of surface gravel within the former water reservoir area of the site (Main Road frontage). The amount of asbestos fibres detected is less than the risk-based 'all site uses' guideline value of 0.001% w/w, and would therefore be suitable for retention (e.g. sequestered under hard surface) onsite without remediation. However, working with and retaining asbestos-containing materials on site would require health and safety and management controls to be implemented both during and following construction that are greater than would be the case for a site without asbestos contamination. In order to facilitate construction and remove

the need for the ongoing management of asbestos containing materials, the MoE may wish to consider the removal of this material to a suitably licenced facility. In the interim (prior to development and removal of this material) as a precautionary measure the MoE may wish to fence this area and to apply a stabilising polymer to control access and potential generation of airborne asbestos fibres.

7.5 Health and safety

With the exception of the area of asbestos containing gravel materials in the former water reservoir area of the site (Main Road frontage) no specific health and safety controls, other than those that would normally be expected to be implemented for a development of this nature, are required to protect workers during site earthworks from ground contamination.

The presence of asbestos fines in the former water reservoir area of the site means the Health and Safety at Work (Asbestos) Regulations (2016) and the Worksafe NZ Code of Practice (CoP) - Management and Removal of Asbestos (September 2016) need to be considered. The management of asbestos in soils under the Regulations is currently under development. However, the key requirements of the CoP are that works must be undertaken with appropriate asbestos controls in place and that contaminated soil removed must be disposed of as asbestos waste to an approved disposal site. In practice, we have found that WorkSafe may support a reduced level of control if soil sampling shows that asbestos concentrations in soil are below 0.001% w/w.

Based on the available data and our experience of working with WorkSafe on other asbestos-related projects in Christchurch, it is considered likely that works involving the gravel fill material in the former water reservoir area of the site would be deemed unlicensed asbestos removal works by Worksafe, due to the presence of asbestos <0.001% w/w.

Worksafe has not provided clear direction regarding the controls required for 'unlicensed asbestos removal works', but our interpretation is that Class A controls (including dust controls, air monitoring, provision of lined bins, decontamination units and worker PPE) would apply but without the requirement for notification and supervision. Good communication with Worksafe prior to and during the works will reduce potential development risk around controls and requirements.

8 Conclusions

Tonkin & Taylor Ltd (T+T) has been commissioned by the Ministry of Education (MoE) to undertake a ground contamination assessment at Redcliffs Park. We understand that the MoE proposes to redevelop the site as the new Redcliffs School. This investigation has been undertaken to identify onsite activities that have the potential to cause ground contamination at the site, and the implications of this for the proposed development, as part of the Ministry's due diligence processes associated with site selection and acquisition. The ground contamination investigation indicated that:

- The site is predominantly used as a public park/sports field, both currently and historically.
- The north of the site is identified on ECan and CCC records as a domestic landfill, which operated in the late 1940s/early 1950s.
- There has been minor building demolition on the Main Road frontage of the site. Evidence of demolition materials was noted on the ground surface in this area during the site walkover carried out as part of this assessment.
- There is no obvious evidence of waste disposal at the site. With the exception of a small amount of glass and porcelain observed in one investigation pit, anthropogenic material was not observed within the test pits excavated in the area of the suspected landfill. Landfill gas and volatile compounds were not detected during the excavation of the test pits.
- There is no evidence of residual persistent pesticide contamination in near surface soils across the site.
- Shallow soils (0-0.1 m depth) should be assumed to contain either trace levels of asbestos (former reservoir area on Main Road Frontage) or metals above background concentrations (remainder of site), and therefore do not meet cleanfill disposal criteria. These materials are suitable for disposal to the Frews facility in Hororata and BRRP, respectively, should the materials be removed from the site.
- Deeper soils may be suitable for disposal as cleanfill, following appropriate blending.
- The levels of asbestos detected in surface materials from a specific location on the Main Road frontage are below land use guidelines and therefore this material could be retained onsite. However, the MoE may wish to consider the removal of these materials to facilitate development and remove the requirement for ongoing soil management (which would be the case if the materials were retained on site).
- NES Soil consent is likely to be required for earthworks associated with the school development. Additional contamination-related earthworks and land use consents may be required under the regional and district plans. A full planning review should be undertaken once development details are available.
- The presence of asbestos fines in the former water reservoir area of the site means the Health and Safety at Work (Asbestos) Regulations (2016) and the Worksafe NZ Code of Practice (COP) - Management and Removal of Asbestos (September 2016) need to be considered. Based on experience of working with NZ, it is likely that work with this material would be deemed 'unlicensed asbestos removal work' by Worksafe and that relevant asbestos related worker health and safety controls would apply.
- Development earthworks across the remainder of the site could be undertaken without the need for contamination-specific health and safety controls.

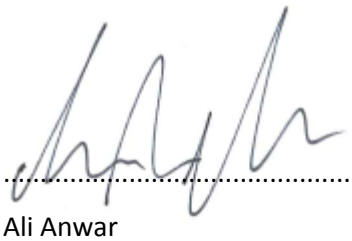
9 Applicability

This report has been prepared for the exclusive use of our client the Ministry of Education, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions in this report are based on visual inspections and a limited number of discrete data points. The nature and continuity of the subsoil away from the sample locations is inferred and it must be appreciated that the actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Report prepared by:



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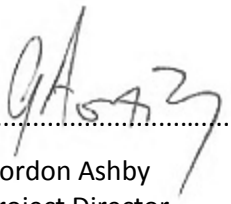
Ali Anwar
Environmental Scientist

Authorised for Tonkin & Taylor Ltd by:



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Gordon Ashby
Project Director

Report certified by a suitably qualified and experienced practitioner as prescribed under the NES Soil User's Guide (April 2012).

.....

Paul Walker
Senior Contaminated Land Specialist

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Appendix A: Figures

- **Figure 2: Site layout**
- **Figure 3: Ground contamination investigation locations**

Notes:
1. Aerial image sourced from Google Earth 2016, copyright Google Earth Image 2017 DigitalGlobe, image date 26/4/2012

Approx Scale 1:2000
0 20 40 60 80 100 (m)

LEGEND
- RES 4601
- Lot 3 DP 47479
- Lot 2 DP 47479

Tonkin+Taylor
www.tonkintaylor.co.nz

DRAWN	AA	Jan. 17
DRAFTING CHECKED		
APPROVED		Apr 17
FILE :	1001107 – Figure2pptx	
APPROX. SCALE (AT A4 SIZE)	1:2000	
PROJECT No.	1001107	
FIG. No.	Figure 2	
REV.	0	

MINISTRY OF EDUCATION
PROPOSED REDCLIFFS SCHOOL SITE
REDCLIFFS PARK, CHRISTCHURCH
Site Layout

Notes:
1. Aerial image sourced from Google Earth 2016, copyright Google Earth Image 2017 DigitalGlobe, image date 26/4/2012

Approx Scale 1:2000
0 20 40 60 80 100 (m)

LEGEND
- Test pit location
- Surface sample location

Tonkin+Taylor
www.tonkintaylor.co.nz

DRAWN	AA	Jan. 17
DRAFTING CHECKED		Feb 17
APPROVED		Apr 17
FILE :	1001107 – Figure3pptx	
APPROX. SCALE (AT A4 SIZE)	1:2000	
PROJECT No.	1001107	

MINISTRY OF EDUCATION
PROPOSED REDCLIFFS SCHOOL SITE
REDCLIFFS PARK, CHRISTCHURCH
Ground Contamination Investigation Locations

FIG. No. Figure 3

REV. 0

Appendix B: Site photographs

- **Photograph 1: Toilet block**
- **Photograph 2: Redcliffs Table Tennis Club**
- **Photograph 3: Orion substation**
- **Photograph 4: Former water reservoirs**
- **Photograph 5: Sports field**
- **Photograph 6: Underground services**
- **Photograph 7: Bark**

Appendix B: Site photographs

Photograph 1: Looking south-west at the toilet block

Appendix B: Site photographs

Photograph 2: Looking south-west at the Redcliffs Table Tennis Club

Appendix B: Site photographs

Photograph 3: Looking north at the Orion substation

Appendix B: Site photographs

Photograph 4: Looking south-east at the former water reservoirs

Appendix B: Site photographs

Photograph 5: Looking north-west at the sports field

Appendix B: Site photographs

Photograph 6: Looking north-east at the underground services marks

Appendix B: Site photographs

Photograph 7: Bark on surface of sports field

Appendix C: Site history information

- **C1: Historical aerial photographs**
- **C2: Property files**
- **C3: LLUR statements**
- **C4: Certificates of Titles**

C1: Historical aerial photographs

Historical aerial photographs from ECan's online GIS (sourced from New Zealand Aerial Mapping, NZAM) and other sources have been reviewed as stated in **Table C1**. Relevant features of the site and surrounding land are summarised from each aerial photograph in **Table C1**. Copies of the aerial photographs are included in **Appendix D**.

Table C1: Historical aerial photographs

Date and source	Site features	Surrounding land features
1941 – ECan (NZAM)	• The south-eastern corner of the site's sports field appears to be occupied by fenced paddocks. • The north-eastern corner of the site's sports field appears to be occupied by two residential properties. • The building which housed the Waterworks pumping station associated with the water reservoirs and the Southpower substation are is on the Main Road frontage of the site. • Present-day Redcliffs Table Tennis Club building or toilet block have not been built yet.	• Residential properties occupy the northern half of Main Road. • Southern half on Main Road is mainly vacant with the notable exception of the presence of the Redcliffs School.
1946 – ECan (NZAM)	• Surface scaring on the south-eastern half of the site's sports field is visible. A few small patches of surface scaring is also visible along Beachville Road frontage of the site. • An unidentified small shed is visible directly north-east of the pumping/substation.	• Two glass houses are present around the south-eastern corner of the site.
1955 – ECan (NZAM)	• The Redcliffs Table Tennis Club building is now visible. • The fenced paddocks and residential properties on the south-eastern and north-eastern corners of the site's sports fields have been removed and the current configuration of the park has been established.	• Redcliffs School extended.
1965 – ECan (NZAM)	• No significant change.	• More residential properties visible along the southern half of Main Road. • A third glass house appears to be in the process of being built next to the glass houses identified in the 1946 photograph.
1973 – ECan (NZAM)	• No significant change.	• The new glass house identified in the 1965 photograph has been decommissioned.

		• A driveway leading from Celia Street and along the south-eastern boundary of the site is visible. • Redcliffs School property and buildings extended. • Majority of surrounding land now occupied by residential properties.
1984 – ECan (NZAM)	• No significant change. • The reservoirs appear to have been decommissioned.	• Former location of the new glass house is now occupied by a dwelling. • Further expansion of the Redcliffs School.
1994 – ECan (NZAM)	• First children's playground is visible. • An unidentified structure has been built directly in front of the unidentified shed.	• The two glass houses have been decommissioned and the area is now occupied by dwellings. • Car park along Celia Street is now visible.
2004 – ECan (NZAM)	• No significant change.	• Further expansion of the Redcliffs School.
2011 – ECan (NZAM)	• Second children's playground is visible.	• Evidence of landslip along Puriwheriro Lane as a result of the February 2011 earthquake. • Further expansion of the Redcliffs School.
2016 – Google Earth	• The pump house, Southpower substation and the unidentified structure have been removed. • The new Orion substation has been built.	• Further expansion of the Redcliffs School.

*Note: Due to the historical photographs' low resolutions, the building date of the toilet block could not be estimated. However, a Code Compliance Certificate for the demolition of a toilet block and building of the current toilet block was dated 3 January 1997 (refer to **Section C2** for more details).*

C2: Property Files

The following pertinent information associated with the Redcliffs Park were obtained from the CCC property records:

- An application to the CCC by Waterworks to build a garage to house vehicles and plant was lodged in June 1978. It appears that the application was denied as no acceptance letter was found and no garage was identified during the review of the historical aerial photographs.
- An application to demolish a public toilet block and replace it by a new toilet block was lodged to the CCC on 7 October 1994. The application was accompanied by architectural drawing that did not indicate the use of potentially ground contaminating materials (e.g. ACM).
- An approval letter from the CCC to Kingston Morrison (consulting engineers) to be exempted from Building Consent for seismic strengthening of the Southpower substation. The letter is dated 10 July 1996.
- An application (12 February 2012) to the CCC by Fulton Hogan to use 7 Main Road (within the site boundary) to keep plant and tools off the carriageway during the McCormacks Bay and Redcliffs wastewater, storm water and roading repair works (SCIRT project 11130). The application was subsequently accepted on 18 February 2014. The application indicated that

Fulton Hogan intended to use the 7 Main Road for approximately five months from March 2014 – July 2014, however it appears they used in mid to late 2015. Fulton Hogan placed a shipping container of the property to store their tools which was then removed at some point after September 2015; and

- An application made by Hirepool in November 2015 to erect temporary marquees for the Canterbury's Fun Run & Walk. The CCC approved the application and the event took place on 29 November 2015.

C3: LLUR Statements

The site occupies three different land parcels as follows:

- RES 4601.
- Lot 2 DP 47479.
- Lot 3 DP 47479.

The LLUR statements for each of the land parcels were obtained from ECan on 15 February 2017. HAIL activities are discussed below in **Table C2**. The LLUR statements are provided in **Appendix E**.

Table C2: LLUR statement

	Site ID	Site name	Location	HAIL activity	Category
RES 4601	10950	113 Beachville Road Landfill (Landfill Map #43)	113 Beachville Road, Redcliffs	G3 – Landfill site	Not investigated
Lot 2 DP 47479	Land parcel is not listed on the LLUR				
Lot 3 DP 47479	Land parcel is not listed on the LLUR				

The following notes are held by ECan about each site:

- <u>Site 10950</u>
  - This area is identified and Landfill # 43 on the CCC Landfill Map (age late 40s to early 50s, domestic rubbish). Information sources: CCC Webmap, Landfill map #40, 1946 and 1955 aerial photos, CCC rating unit properties, CCC RMA Hazard sheet. Ground disturbance and depression visible on 1946 aerial photograph. Requires groundtruthing.

C4: Certificates of Titles

	Ownership history
RES 4601	• Land parcel RES 4601 (i.e. northern half of the site's sports field) was procured on 29 July 1954 by the Mayor Councillors and Citizens of the City of Christchurch as an estate in fee simple in trust of Recreational Purposes.
Lot 2 DP 47479	• Lot 2 DP 16691, part Lots 51 and 52 DP 1178, and Lot 1 DP 14305 part Rural Sections 309 and 37763 were procured by the Mayor Councillors and Citizens of the City of Christchurch on 29 July 1954. • Lot 2 DP 47479 (i.e. former water reservoirs area of the site) was procured by the Christchurch City Council on 12 July 1985.
Lot 3 DP 47479	• Lots 53, 54 and 55 DP 1178 part of Rural Section 309 were procured on 17 December 1920 by the Mayor Councillors and Burgesses of the Borough of Sumner. • Lot 3 DP 47479 (i.e. southern half of site's sports field including the Redcliffs Table Tennis Club and toilet block) was procured by the Christchurch City Council on 12 July 1985.

The Certificates of Title make no mention of business ownerships that could pose a potential ground contamination risk.

Appendix D: Historical aerial photographs

- **1941 historical aerial photograph**
- **1946 historical aerial photograph**
- **1955 historical aerial photograph**
- **1965 historical aerial photograph**
- **1973 historical aerial photograph**
- **1984 historical aerial photograph**
- **1994 historical aerial photograph**
- **2004 historical aerial photograph**
- **2011 historical aerial photograph**
- **2016 historical aerial photograph**

canterbury maps

1941 Historical Aerial Photograph

N

0 0.02 0.04 0.06 0.08 Kilometres

Scale: 1:2,000 @ A4

Map Created by Tonkin & Taylor Ltd. on 2:28:24 p.m.

canterbury maps

1946 Historical Aerial Photograph

N

0 0.02 0.04 0.06 0.08 Kilometres

Scale: 1:2,000 @ A4

Map Created by Tonkin & Taylor Ltd. on 2:29:52 p.m.

canterbury maps

1955 Historical Aerial Photograph

N

0 0.02 0.04 0.06 0.08 Kilometres

Scale: 1:2,000 @A4

Map Created by Tonkin & Taylor Ltd. on 2:30:30 p.m.

canterbury maps

1965 Historical Aerial Photograph

N

0 0.02 0.04 0.06 0.08 Kilometres

Scale: 1:2,000 @A4

Map Created by Tonkin & Taylor Ltd. on 2:32:14 p.m.

canterbury maps

1973 Historical Aerial Photograph

N

0 0.02 0.04 0.06 0.08 Kilometres

Scale: 1:2,000 @ A4

Map Created by Tonkin & Taylor Ltd. on 2:37:02 p.m.

canterbury maps

1984 Historical Aerial Photograph

N

0 0.02 0.04 0.06 0.08 Kilometres

Scale: 1:2,000 @A4

Map Created by Tonkin & Taylor Ltd. on 2:37:57 p.m.

canterbury maps

1994 Historical Aerial Photograph

N

0 0.02 0.04 0.06 0.08 Kilometres

Scale: 1:2,000 @A4

Map Created by Tonkin & Taylor Ltd. on 2:41:33 p.m.

canterbury maps

2004 Historical Aerial Photograph

N

0 0.02 0.04 0.06 0.08 Kilometres

Scale: 1:2,000 @ A4

Map Created by Tonkin & Taylor Ltd. on 2:42:32 p.m.

canterbury maps

2011 Historical Aerial Photograph

N

0 0.02 0.04 0.06 0.08 Kilometres

Scale: 1:2,000 @A4

Map Created by Tonkin & Taylor Ltd. on 2:43:08 p.m.


2016 Historical Aerial Photograph
Google earth
Image © 2016 DigitalGlobe
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100 m

Appendix E: Listed Land Use Register

- **Land parcel RES 4601 LLUR reference: ENQ157637 (produced on 15/02/2017)**
- **Land parcel Lot 2 DP 47479 LLUR reference: ENQ157462 (produced on 15/02/2017)**
- **Land parcel Lot 3 DP 47479 LLUR reference: ENQ157640 (produced on 15/02/2017)**

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

P. 03 365 3828
F. 03 365 3194
E. ecinfo@ecan.govt.nz

www.ecan.govt.nz

Dear Sir/Madam

Thank you for submitting your property enquiry in regards to our Listed Land Use Register (LLUR) which holds information about sites that have been used, or are currently used for activities which have the potential to have caused contamination.

The LLUR statement provided indicates the location of the land parcel(s) you enquired about and provides information regarding any LLUR sites within a radius specified in the statement of this land.

Please note that if a property is not currently entered on the LLUR, it does not mean that an activity with the potential to cause contamination has never occurred, or is not currently occurring there. The LLUR is not complete, and new sites are regularly being added as we receive information and conduct our own investigations into current and historic land uses.

The LLUR only contains information held by Environment Canterbury in relation to contaminated or potentially contaminated land; other information relevant to potential contamination may be held in other files (for example consent and enforcement files).

If your enquiry relates to a farm property, please note that many current and past activities undertaken on farms may not be listed on the LLUR. Activities such as the storage, formulation and disposal of pesticides, offal pits, foot rot troughs, animal dips and underground or above ground fuel tanks have the potential to cause contamination.

Please contact and Environment Canterbury Contaminated Sites Officer if you wish to discuss the contents of the LLUR statement, or if you require additional information.
For any other information regarding this land please contact Environment Canterbury Customer Services.

Yours sincerely

Contaminated Sites Team

Property Statement
from the Listed Land Use Register

Visit www.ecan.govt.nz/HAIL for more information about land uses.

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

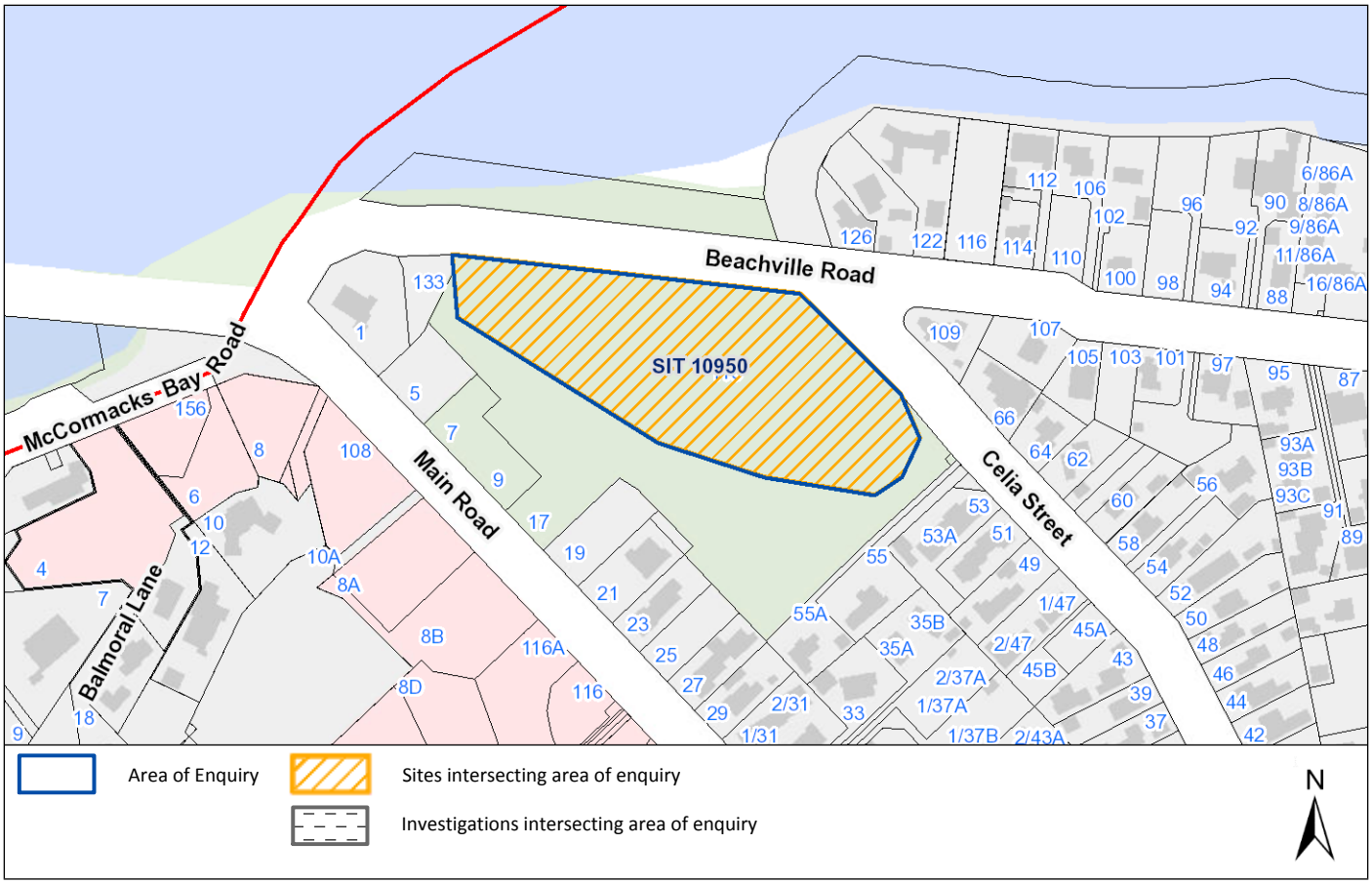
Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

P. 03 365 3828
F. 03 365 3194
E. ecinfo@ecan.govt.nz

www.ecan.govt.nz

Date:	15 February 2017
Land Parcels:	RES 4601 Valuation No(s): 2290029000



The information presented in this map is specific to the property you have selected. Information on nearby properties may not be shown on this map, even if the property is visible.

Summary of sites:

Site ID	Site Name	Location	HAIL Activity(s)	Category
10950	113 Beachville Road Landfill, Christchurch Landfill Map #43	113 Beachville Road, Redcliffs, Christchurch	G3 - Landfill sites;	Not Investigated

Please note that the above table represents a summary of sites and HAILs intersecting the area of enquiry only.

Information held about the sites on the Listed Land Use Register

Site 10950: 113 Beachville Road Landfill, Christchurch Landfill Map #43 (Intersects enquiry area.)

Site Address:	113 Beachville Road, Redcliffs, Christchurch
Legal Description(s):	RES 4601

Site Category:	Not Investigated
Definition:	Verified HAIL has not been investigated.

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1940s	early 1950s	Landfill sites

Notes:

30 Apr 2012 This area is identified and Landfill # 43 on the CCC Landfill Map (age late 40s to early 50s, domestic rubbish). Information sources: CCC Webmap, Landfill map #40, 1946 and 1955 aerial photos, CCC rating unit properties, CCC RMA Hazard sheet. Ground disturbance and depression visible on 1946 aerial photograph. Requires groundtruthing.

Investigations:

There are no investigations associated with this site.

Information held about other investigations on the Listed Land Use Register

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ157637.

Disclaimer:

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know

Everything is connected

What is the Listed Land Use Register (LLUR)?

The LLUR is a database that Environment Canterbury uses to manage information about land that is, or has been, associated with the use, storage or disposal of hazardous substances.

Why do we need the LLUR?

Some activities and industries are hazardous and can potentially contaminate land or water. We need the LLUR to help us manage information about land which could pose a risk to your health and the environment because of its current or former land use.

Section 30 of the Resource Management Act (RMA, 1991) requires Environment Canterbury to investigate, identify and monitor contaminated land. To do this we follow national guidelines and use the LLUR to help us manage the information.

The information we collect also helps your local district or city council to fulfil its functions under the RMA. One of these is implementing the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil, which came into effect on 1 January 2012.

For information on the NES, contact your city or district council.

How does Environment Canterbury identify sites to be included on the LLUR?

We identify sites to be included on the LLUR based on a list of land uses produced by the Ministry for the Environment (MfE). This is called the Hazardous Activities and Industries List (HAIL)[1]. The HAIL has 53 different activities, and includes land uses such as fuel storage sites, orchards, timber treatment yards, landfills, sheep dips and any other activities where hazardous substances could cause land and water contamination.

We have two main ways of identifying HAIL sites:

- We are actively identifying sites in each district using historic records and aerial photographs. This project started in 2008 and is ongoing.
- We also receive information from other sources, such as environmental site investigation reports submitted to us as a requirement of the Regional Plan, and in resource consent applications.

[1] The Hazardous Activities and Industries List (HAIL) can be downloaded from MfE's website www.mfe.govt.nz, keyword search HAIL

How does Environment Canterbury classify sites on the LLUR?

Where we have identified a HAIL land use, we review all the available information, which may include investigation reports if we have them. We then assign the site a category on the LLUR. The category is intended to best describe what we know about the land use and potential contamination at the site and is signed off by a senior staff member.

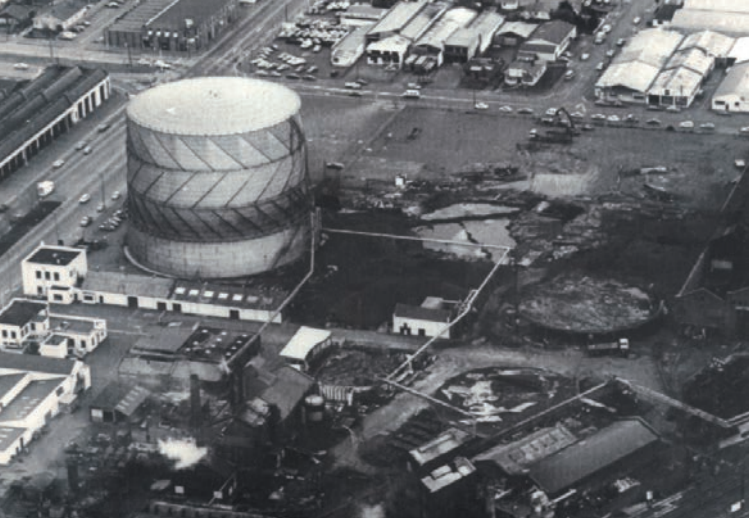
Please refer to the Site Categories and Definitions factsheet for further information.

What does Environment Canterbury do with the information on the LLUR?

The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list of any investigation reports.

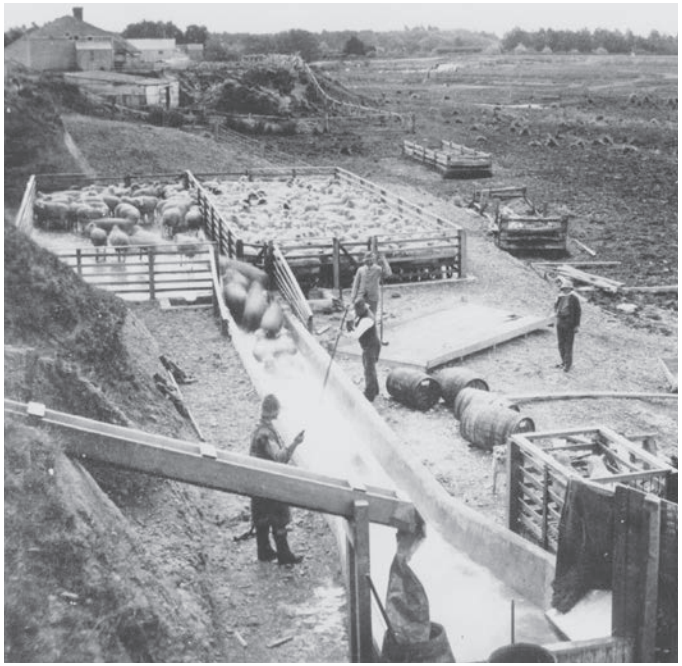
We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

If you are conducting an environmental investigation or removing an underground storage tank at your property, you will need to comply with the rules in the Regional Plan and send us a copy of the report. This means we can keep our records accurate and up-to-date, and we can assign your property an appropriate category on the LLUR. To find out more, visit www.ecan.govt.nz/HAIL.



IMPORTANT!

The LLUR is an online database which we are continually updating. A property may not currently be registered on the LLUR, but this does not necessarily mean that it hasn't had a HAIL use in the past.



Sheep dipping (ABOVE) and gas works (TOP) are among the former land uses that have been identified as potentially hazardous. (Photo above by Wheeler & Son in 1987, courtesy of Canterbury Museum.)

My land is on the LLUR – what should I do now?

IMPORTANT! Just because your property has a land use that is deemed hazardous or is on the LLUR, it doesn't necessarily mean it's contaminated. The only way to know if land is contaminated is by carrying out a detailed site investigation, which involves collecting and testing soil samples.

You do not need to do anything if your land is on the LLUR and you have no plans to alter it in any way. It is important that you let a tenant or buyer know your land is on the Listed Land Use Register if you intend to rent or sell your property. If you are not sure what you need to tell the other party, you should seek legal advice.

You may choose to have your property further investigated for your own peace of mind, or because you want to do one of the activities covered by the National Environmental Standard for Assessing and Managing Contaminants in Soil. Your district or city council will provide further information.

If you wish to engage a suitably qualified experienced practitioner to undertake a detailed site investigation, there are criteria for choosing a practitioner on www.ecan.govt.nz/HAIL.

I think my site category is incorrect – how can I change it?

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If we have incorrectly identified that a HAIL activity has occurred at a site, it will be not be removed from the LLUR but categorised as Verified Non-HAIL. This helps us to ensure that the same site is not re-identified in the future.

Contact us

Property owners have the right to look at all the information Environment Canterbury holds about their properties.

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If you don't have access to the internet, you can enquire about a specific site by phoning us on (03) 353 9007 or toll free on 0800 EC INFO (32 4636) during business hours.

Contact Environment Canterbury:

Email: ecinfo@ecan.govt.nz

Phone:
Calling from Christchurch: (03) 353 9007
Calling from any other area: 0800 EC INFO (32 4636)

Environment Canterbury Regional Council
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Everything is connected

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www.ecan.govt.nz E13/101

Listed Land Use Register

Site categories and definitions

When Environment Canterbury identifies a Hazardous Activities and Industries List (HAIL) land use, we review the available information and assign the site a category on the Listed Land Use Register. The category is intended to best describe what we know about the land use.

If a site is categorised as **Unverified** it means it has been reported or identified as one that appears on the HAIL, but the land use has not been confirmed with the property owner.

If the land use has been confirmed but analytical information from the collection of samples is not available, and the presence or absence of contamination has therefore not been determined, the site is registered as:

Not investigated:

- A site whose past or present use has been reported and verified as one that appears on the HAIL.
- The site has not been investigated, which might typically include sampling and analysis of site soil, water and/or ambient air, and assessment of the associated analytical data.
- There is insufficient information to characterise any risks to human health or the environment from those activities undertaken on the site. Contamination may have occurred, but should not be assumed to have occurred.

If analytical information from the collection of samples is available, the site can be registered in one of six ways:

At or below background concentrations:

The site has been investigated or remediated. The investigation or post remediation validation results confirm there are no hazardous substances above local background concentrations other than those that occur naturally in the area. The investigation or validation sampling has been sufficiently detailed to characterise the site.

Below guideline values for:

The site has been investigated. Results show that there are hazardous substances present at the site but indicate that any adverse effects or risks to people and/or the environment are considered to be so low as to be acceptable. The site may have been remediated to reduce contamination to this level, and samples taken after remediation confirm this.

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Managed for:

The site has been investigated. Results show that there are hazardous substances present at the site in concentrations that have the potential to cause adverse effects or risks to people and/or the environment. However, those risks are considered managed because:

- the nature of the use of the site prevents human and/or ecological exposure to the risks; and/or
- the land has been altered in some way and/or restrictions have been placed on the way it is used which prevent human and/or ecological exposure to the risks.

Partially investigated:

The site has been partially investigated. Results:

- demonstrate there are hazardous substances present at the site; however, there is insufficient information to quantify any adverse effects or risks to people or the environment; or
- do not adequately verify the presence or absence of contamination associated with all HAIL activities that are and/or have been undertaken on the site.

Significant adverse environmental effects:

The site has been investigated. Results show that sediment, groundwater or surface water contains hazardous substances that:

- have significant adverse effects on the environment; or
- are reasonably likely to have significant adverse effects on the environment.

Contaminated:

The site has been investigated. Results show that the land has a hazardous substance in or on it that:

- has significant adverse effects on human health and/or the environment; and/or
- is reasonably likely to have significant adverse effects on human health and/or the environment.

If a site has been included incorrectly on the Listed Land Use Register as having a HAIL, it will not be removed but will be registered as:

Verified non-HAIL:

Information shows that this site has never been associated with any of the specific activities or industries on the HAIL.

Please contact Environment Canterbury for further information:

(03) 353 9007 or toll free
on 0800 EC INFO (32 4636)
email ecinfo@ecan.govt.nz

Environment Canterbury Regional Council
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E13/102

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

P. 03 365 3828
F. 03 365 3194
E. ecinfo@ecan.govt.nz

www.ecan.govt.nz

Dear Sir/Madam

Thank you for submitting your property enquiry in regards to our Listed Land Use Register (LLUR) which holds information about sites that have been used, or are currently used for activities which have the potential to have caused contamination.

The LLUR statement provided indicates the location of the land parcel(s) you enquired about and provides information regarding any LLUR sites within a radius specified in the statement of this land.

Please note that if a property is not currently entered on the LLUR, it does not mean that an activity with the potential to cause contamination has never occurred, or is not currently occurring there. The LLUR is not complete, and new sites are regularly being added as we receive information and conduct our own investigations into current and historic land uses.

The LLUR only contains information held by Environment Canterbury in relation to contaminated or potentially contaminated land; other information relevant to potential contamination may be held in other files (for example consent and enforcement files).

If your enquiry relates to a farm property, please note that many current and past activities undertaken on farms may not be listed on the LLUR. Activities such as the storage, formulation and disposal of pesticides, offal pits, foot rot troughs, animal dips and underground or above ground fuel tanks have the potential to cause contamination.

Please contact and Environment Canterbury Contaminated Sites Officer if you wish to discuss the contents of the LLUR statement, or if you require additional information.
For any other information regarding this land please contact Environment Canterbury Customer Services.

Yours sincerely

Contaminated Sites Team

Property Statement
from the Listed Land Use Register

Visit www.ecan.govt.nz/HAIL for more information about land uses.

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

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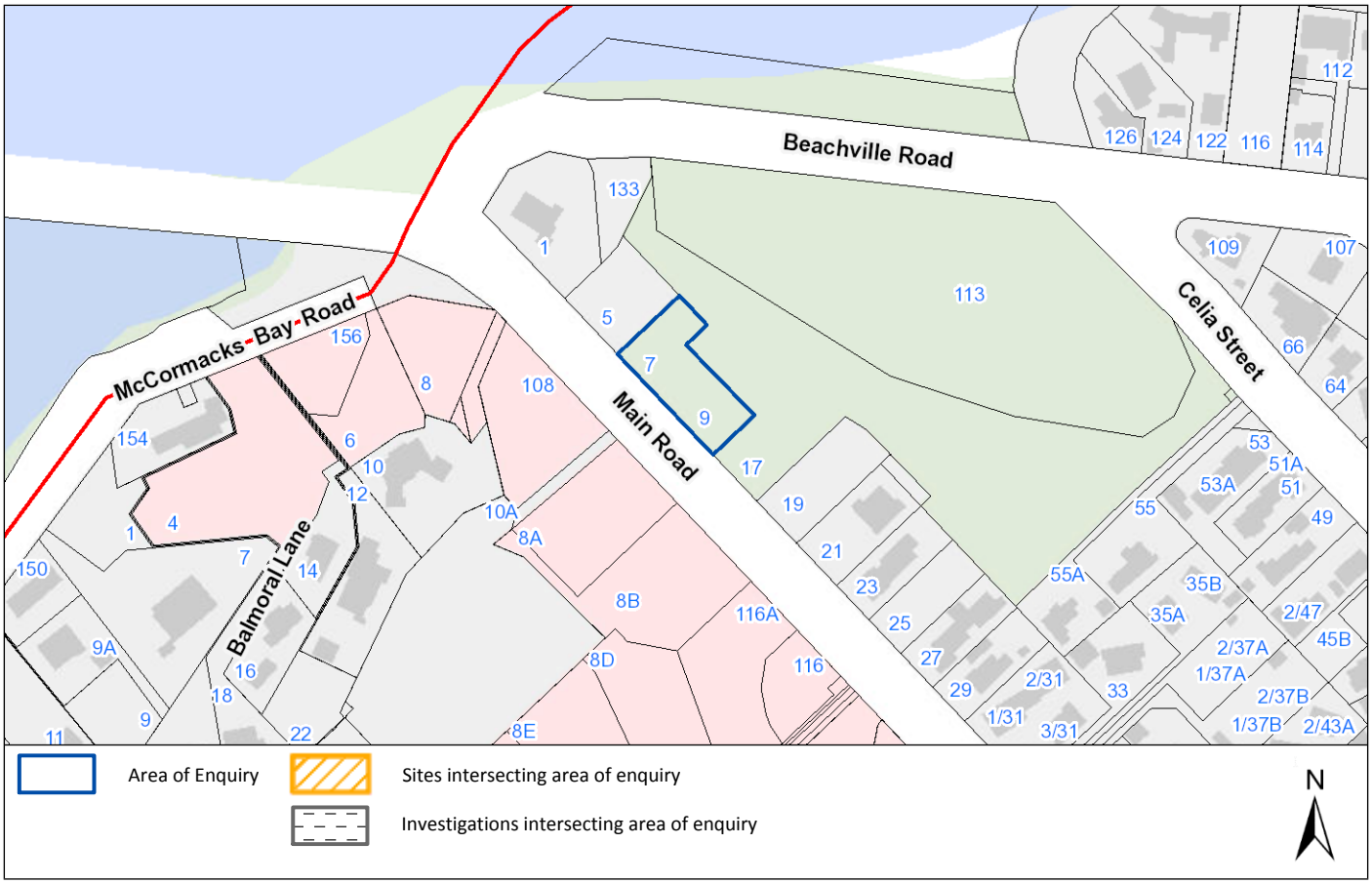
Date:	15 February 2017
Land Parcels:	Lot 2 DP 47479 Valuation No(s): 2290029000



The information presented in this map is specific to the property you have selected. Information on nearby properties may not be shown on this map, even if the property is visible.

Summary of sites:

There are no sites associated with the area of enquiry.

Information held about the sites on the Listed Land Use Register

There are no sites associated with the area of enquiry.

Information held about other investigations on the Listed Land Use Register

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ157642.

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The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness of this information. It is released only as a copy of Environment Canterbury's records and is not intended to provide a full, complete or totally accurate assessment of the site. It is provided on the basis that Environment Canterbury makes no warranty or representation regarding the reliability, accuracy or completeness of the information provided or the level of contamination (if any) at the relevant site or that the site is suitable or otherwise for any particular purpose. Environment Canterbury accepts no responsibility for any loss, cost, damage or expense any person may incur as a result of the use, reference to or reliance on the information contained in this report.

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Listed Land Use Register

What you need to know

Everything is connected

What is the Listed Land Use Register (LLUR)?

The LLUR is a database that Environment Canterbury uses to manage information about land that is, or has been, associated with the use, storage or disposal of hazardous substances.

Why do we need the LLUR?

Some activities and industries are hazardous and can potentially contaminate land or water. We need the LLUR to help us manage information about land which could pose a risk to your health and the environment because of its current or former land use.

Section 30 of the Resource Management Act (RMA, 1991) requires Environment Canterbury to investigate, identify and monitor contaminated land. To do this we follow national guidelines and use the LLUR to help us manage the information.

The information we collect also helps your local district or city council to fulfil its functions under the RMA. One of these is implementing the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil, which came into effect on 1 January 2012.

For information on the NES, contact your city or district council.

How does Environment Canterbury identify sites to be included on the LLUR?

We identify sites to be included on the LLUR based on a list of land uses produced by the Ministry for the Environment (MfE). This is called the Hazardous Activities and Industries List (HAIL)[1]. The HAIL has 53 different activities, and includes land uses such as fuel storage sites, orchards, timber treatment yards, landfills, sheep dips and any other activities where hazardous substances could cause land and water contamination.

We have two main ways of identifying HAIL sites:

- We are actively identifying sites in each district using historic records and aerial photographs. This project started in 2008 and is ongoing.
- We also receive information from other sources, such as environmental site investigation reports submitted to us as a requirement of the Regional Plan, and in resource consent applications.

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How does Environment Canterbury classify sites on the LLUR?

Where we have identified a HAIL land use, we review all the available information, which may include investigation reports if we have them. We then assign the site a category on the LLUR. The category is intended to best describe what we know about the land use and potential contamination at the site and is signed off by a senior staff member.

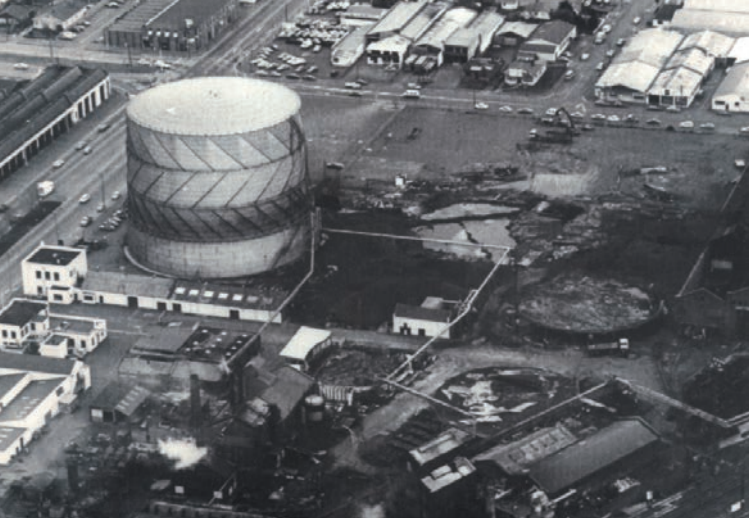
Please refer to the Site Categories and Definitions factsheet for further information.

What does Environment Canterbury do with the information on the LLUR?

The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list of any investigation reports.

We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

If you are conducting an environmental investigation or removing an underground storage tank at your property, you will need to comply with the rules in the Regional Plan and send us a copy of the report. This means we can keep our records accurate and up-to-date, and we can assign your property an appropriate category on the LLUR. To find out more, visit www.ecan.govt.nz/HAIL.



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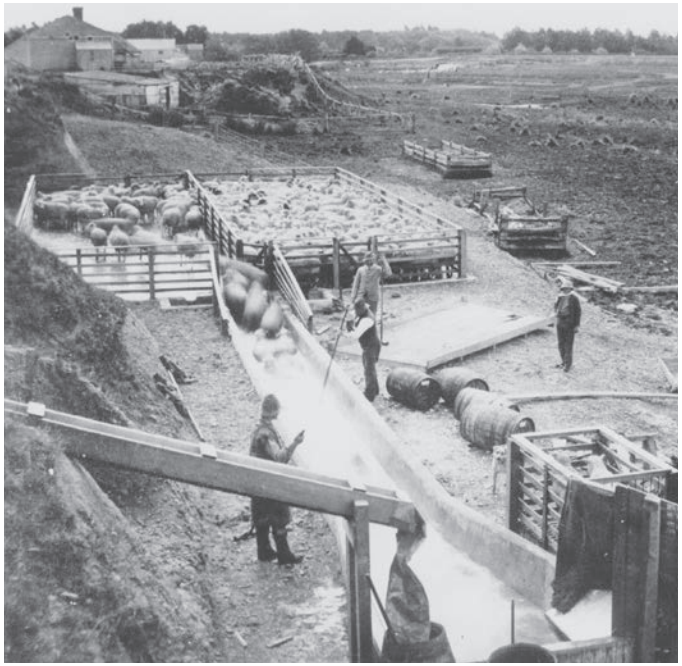

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Listed Land Use Register

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Environment Canterbury Regional Council
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email ecinfo@ecan.govt.nz

Environment Canterbury Regional Council
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E13/102

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Yours sincerely

Contaminated Sites Team

Property Statement
from the Listed Land Use Register

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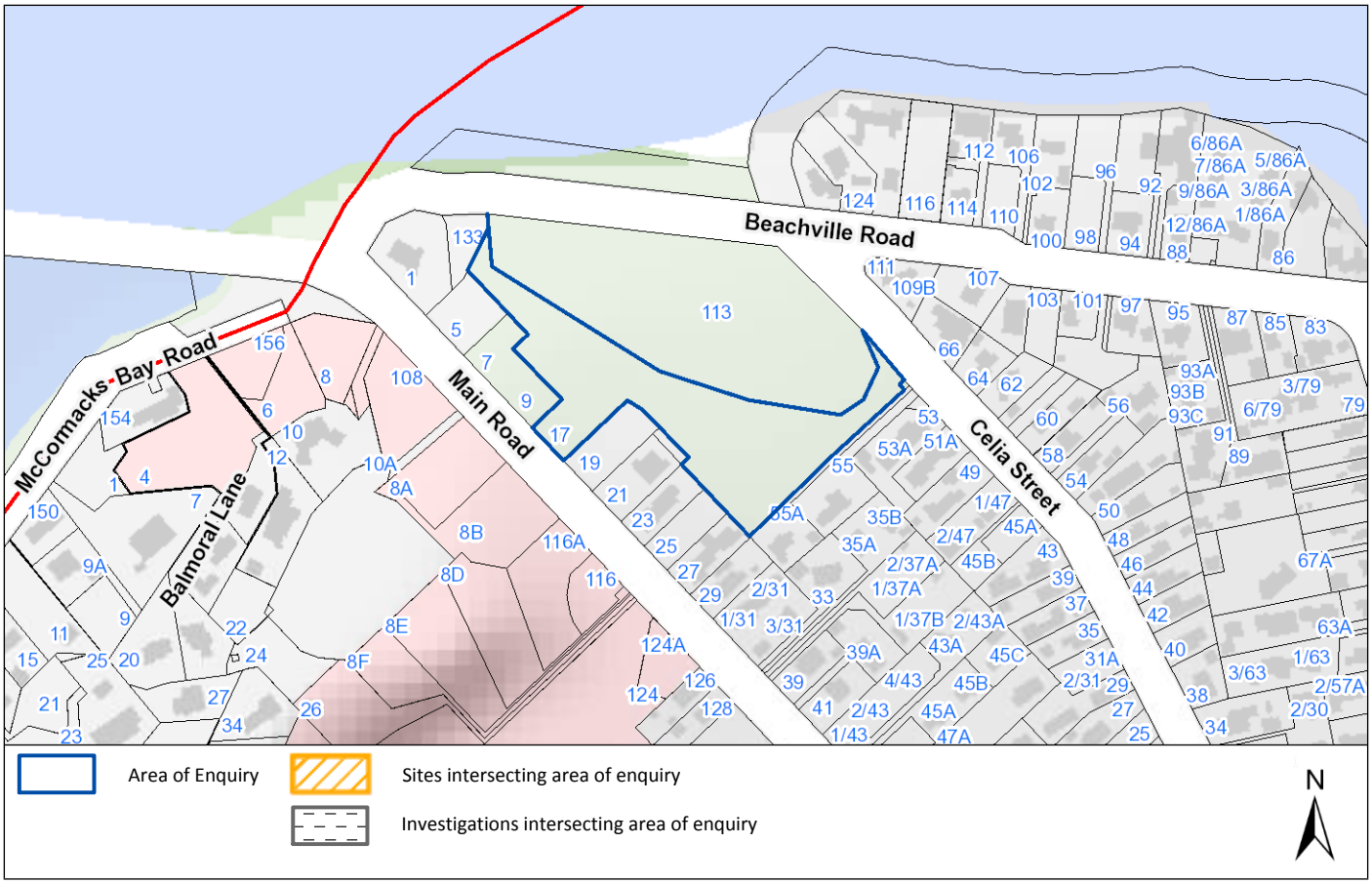
Date:	15 February 2017
Land Parcels:	Lot 3 DP 47479 Valuation No(s): 2290029000



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Summary of sites:

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Information held about other investigations on the Listed Land Use Register

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ157640.

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Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know

Everything is connected

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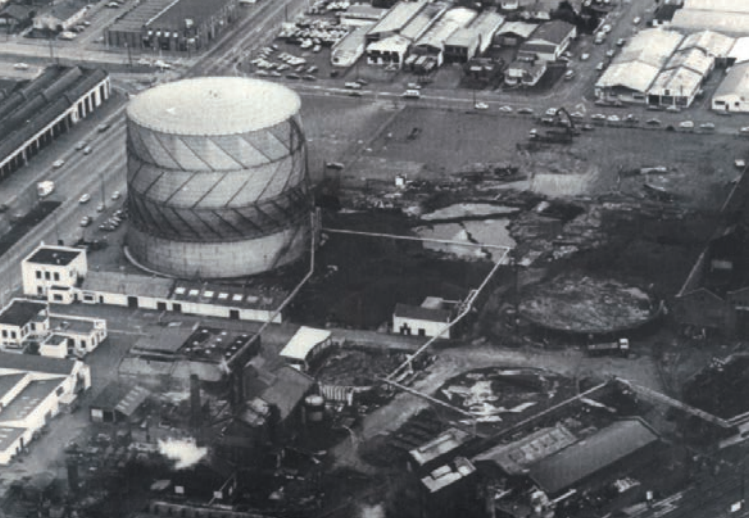

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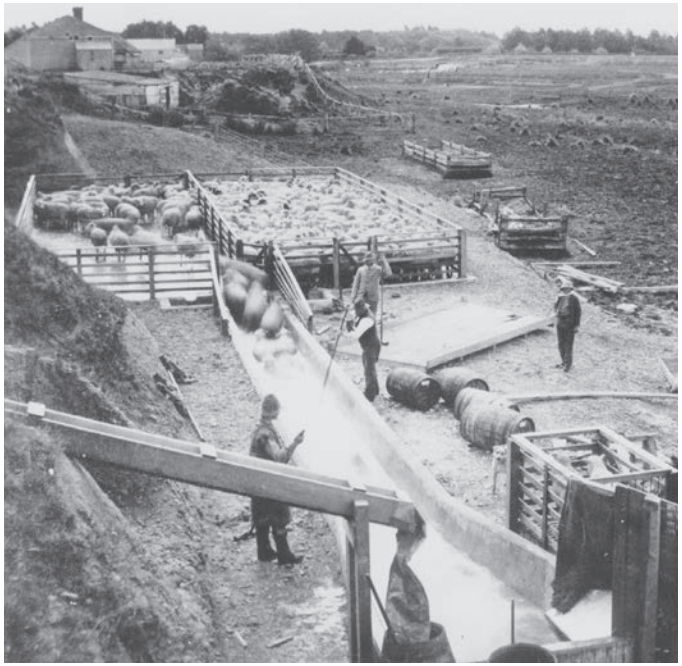

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Contact us

Property owners have the right to look at all the information Environment Canterbury holds about their properties.

It is free to check the information on the LLUR, online at www.llur.ecan.govt.nz.

If you don't have access to the internet, you can enquire about a specific site by phoning us on (03) 353 9007 or toll free on 0800 EC INFO (32 4636) during business hours.

Contact Environment Canterbury:

Email: ecinfo@ecan.govt.nz

Phone:
Calling from Christchurch: (03) 353 9007
Calling from any other area: 0800 EC INFO (32 4636)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

Listed Land Use Register

Site categories and definitions

When Environment Canterbury identifies a Hazardous Activities and Industries List (HAIL) land use, we review the available information and assign the site a category on the Listed Land Use Register. The category is intended to best describe what we know about the land use.

If a site is categorised as **Unverified** it means it has been reported or identified as one that appears on the HAIL, but the land use has not been confirmed with the property owner.

If the land use has been confirmed but analytical information from the collection of samples is not available, and the presence or absence of contamination has therefore not been determined, the site is registered as:

Not investigated:

- A site whose past or present use has been reported and verified as one that appears on the HAIL.
- The site has not been investigated, which might typically include sampling and analysis of site soil, water and/or ambient air, and assessment of the associated analytical data.
- There is insufficient information to characterise any risks to human health or the environment from those activities undertaken on the site. Contamination may have occurred, but should not be assumed to have occurred.

If analytical information from the collection of samples is available, the site can be registered in one of six ways:

At or below background concentrations:

The site has been investigated or remediated. The investigation or post remediation validation results confirm there are no hazardous substances above local background concentrations other than those that occur naturally in the area. The investigation or validation sampling has been sufficiently detailed to characterise the site.

Below guideline values for:

The site has been investigated. Results show that there are hazardous substances present at the site but indicate that any adverse effects or risks to people and/or the environment are considered to be so low as to be acceptable. The site may have been remediated to reduce contamination to this level, and samples taken after remediation confirm this.

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Managed for:

The site has been investigated. Results show that there are hazardous substances present at the site in concentrations that have the potential to cause adverse effects or risks to people and/or the environment. However, those risks are considered managed because:

- the nature of the use of the site prevents human and/or ecological exposure to the risks; and/or
- the land has been altered in some way and/or restrictions have been placed on the way it is used which prevent human and/or ecological exposure to the risks.

Partially investigated:

The site has been partially investigated. Results:

- demonstrate there are hazardous substances present at the site; however, there is insufficient information to quantify any adverse effects or risks to people or the environment; or
- do not adequately verify the presence or absence of contamination associated with all HAIL activities that are and/or have been undertaken on the site.

Significant adverse environmental effects:

The site has been investigated. Results show that sediment, groundwater or surface water contains hazardous substances that:

- have significant adverse effects on the environment; or
- are reasonably likely to have significant adverse effects on the environment.

Contaminated:

The site has been investigated. Results show that the land has a hazardous substance in or on it that:

- has significant adverse effects on human health and/or the environment; and/or
- is reasonably likely to have significant adverse effects on human health and/or the environment.

If a site has been included incorrectly on the Listed Land Use Register as having a HAIL, it will not be removed but will be registered as:

Verified non-HAIL:

Information shows that this site has never been associated with any of the specific activities or industries on the HAIL.

Please contact Environment Canterbury for further information:

(03) 353 9007 or toll free
on 0800 EC INFO (32 4636)
email ecinfo@ecan.govt.nz

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

E13/102

Appendix F: Excavation logs

- **TP1 excavation log**
- **TP2 excavation log**
- **TP3 excavation log**
- **TP6 excavation log**
- **TP8 excavation log**
- **TP9 excavation log**
- **TP10 excavation log**
- **TP11 excavation log**
- **TP13 excavation log**

EXCAVATION LOG

Excavation Id.: **TP 1**

SHEET: 1 OF 1

PROJECT: Redcliffs Park Site Investigation	LOCATION: Redcliffs Park, Christchurch	JOB No.: 1001107

CO-ORDINATES: (NZTM 2000) 5177361 mN 1578429 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 17/01/2017	
	EQUIPMENT: 8.8 T Excavator	EXCAV. FINISHED: 17/01/2017	
R.L.: 1.60m	OPERATOR: Protranz Earthmoving	LOGGED BY: OP	
DATUM: 1937 Lyttelton Vertical Datum	DIMENSIONS: 1.5m by 1m	CHECKED BY: AMMW	

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3			TP1_0.1	*	1	0.5	TS	Silty, sandy TOPSOIL with trace rootlets; brown. Dry; sand, fine.	D		10 25 50 100 200		Fill.
			TP1_0.3	*				Silty fine to medium SAND with trace gravel; greyish brown. Dry - moist.	D-M				
		17/01/2017						0.3m: Becomes moist, minor gravel present. Sandy SILT with trace amorphous organics; bluish-grey and mottled orange. Soft, moist.	M	S			
					0	1.0		Fine to coarse SAND with minor silt; bluish-grey. Wet. 1.4m: Trace silt.	W			No visual indications of contamination or contaminant odours noted. No landfill gas readings recorded.	Chch Formation
						1.5							
					-1	2.0		1.7m: EOH - Test pit sides collapsing (saturated sand).					
						2.5							

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.7m

Scale 1:25

EXCAVATION LOG

Excavation Id.: **TP 2**

SHEET: 1 OF 1

PROJECT: Redcliffs Park Site Investigation	LOCATION: Redcliffs Park, Christchurch	JOB No.: 1001107

CO-ORDINATES: (NZTM 2000)	5177325 mN 1578444 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	17/01/2017
		EQUIPMENT:	8.8 T Excavator	EXCAV. FINISHED:	17/01/2017
R.L.:	1.70m	OPERATOR:	Protranz Earthmoving	LOGGED BY:	OP
DATUM:	1937 Lyttleton Vertical Datum	DIMENSIONS:	1.5m by 1m	CHECKED BY:	AMMW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3			TP2_0.1	*	1	0.5	TS	Sandy TOPSOIL with trace rootlets; greyish-brown. Dry; sand, fine to medium.	D		10 25 50 100 200		-
								Fine to medium SAND with trace silt; greyish-brown. Dry-moist.	M				
			TP2_0.5	*				0.6m: Sand becomes fine to coarse, grey and moist.					
		17/01/2017	TP2_1.0	*		1.0						No visual indications of contamination or contaminant odours noted. No landfill gas readings recorded.	Chch Formation
					0	1.5		1.2m: EOH - Target depth achieved.					
						2.0							
					-1	2.5							

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.2m

Scale 1:25

EXCAVATION LOG

Excavation Id.: **TP 3**

SHEET: 1 OF 1

PROJECT: Redcliffs Park Site Investigation	LOCATION: Redcliffs Park, Christchurch	JOB No.: 1001107

CO-ORDINATES: (NZTM 2000)	5177351 mN 1578499 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	17/01/2017
		EQUIPMENT:	8.8 T Excavator	EXCAV. FINISHED:	17/01/2017
R.L.:	1.60m	OPERATOR:	Protranz Earthmoving	LOGGED BY:	OP
DATUM:	1937 Lyttelton Vertical Datum	DIMENSIONS:	1.5m by 1m	CHECKED BY:	AMMW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3			TP3_0.1	*	1	0.0	TS	Sandy, silty TOPSOIL with trace rootlets; brownish grey. Dry.	D		10 25 50 100 200		
								Sandy SILT with minor gravel, trace rootlets; brownish grey. Firm, dry. Gravel, fine to medium, sub-angular to sub-rounded.		F			Fill
			TP3_0.4	*				0.3m: Becomes more moist, darker grey; coarse gravel present.					
						0.5		SILT with trace fine sand; grey and mottled orange. Soft, moist, moderate plasticity.	M	S			
		17/01/2017				1.0		1.1m: Trace fibrous organics.					
			TP3_1.2	*	0			Fine to coarse SAND; grey. Wet.	W			No visual indications of contamination or contaminant odours noted. No landfill gas readings recorded.	Chch Formation
						1.4		1.4m: Minor silt; isolated pockets of dry, light brown silt throughout.					
					-1	1.5		1.5m: EOH - Target depth achieved.					
						2.0							
						2.5							

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

Scale 1:25

EXCAVATION LOG

Excavation Id.: **TP 6**

SHEET: 1 OF 1

PROJECT: Redcliffs Park Site Investigation	LOCATION: Redcliffs Park, Christchurch	JOB No.: 1001107

CO-ORDINATES: (NZTM 2000)	5177290 mN 1578484 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	17/01/2017
		EQUIPMENT:	8.8 T Excavator	EXCAV. FINISHED:	17/01/2017
R.L.:	1.70m	OPERATOR:	Protranz Earthmoving	LOGGED BY:	OP
DATUM:	1937 Lyttelton Vertical Datum	DIMENSIONS:	1.5m by 1m	CHECKED BY:	AMMW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3											10 25 50 100 200		
			TP6_0.1	*	1	0	TS	Silty, sandy TOPSOIL with trace rootlets; greyish brown. Moist; sand, fine to medium.	M				-
			TP6_0.3	*		0.5		Fine to medium SAND with trace silt; greyish-brown. Dry - moist. 0.6m: Becomes moist.	D-M				Chch Formation
		17/01/2017 ▼	TP6_0.9	*	0	1.0		0.95m: Small isolated pockets of dark brown silt throughout sand. 1.0m: EOH - Target depth achieved. Test pit sides collapsing (saturated sand).	M			No visual indications of contamination or contaminant odours noted. No landfill gas readings recorded.	
					-1	1.5							
						2.0							
						2.5							

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1m

Scale 1:25

EXCAVATION LOG

Excavation Id.: **TP 8**

SHEET: 1 OF 1

PROJECT: Redcliffs Park Site Investigation	LOCATION: Redcliffs Park, Christchurch	JOB No.: 1001107

CO-ORDINATES: (NZTM 2000)	5177295 mN 1578544 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	17/01/2017
		EQUIPMENT:	8.8 T Excavator	EXCAV. FINISHED:	17/01/2017
R.L.:	1.60m	OPERATOR:	Protranz Earthmoving	LOGGED BY:	OP
DATUM:	1937 Lyttelton Vertical Datum	DIMENSIONS:	1.5m by 1m	CHECKED BY:	AMMW

EXCAVATION TESTS					ENGINEERING DESCRIPTION						GEOLOGICAL	
PENETRATION -1 -2 -3	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) 10 25 50 100 200	DEFECTS, STRUCTURE, COMMENTS	UNIT
			TP8_0.1	*	1	0.5	TS	Sandy, silty TOPSOIL with trace of rootlets; brownish-grey. Dry; silt, low plasticity.	D				Fill.
			TP8_0.2	*				SILT; brownish-grey. Stiff, dry, low plasticity.		St			
								Fine SAND with some silt; brownish grey. Dry.					
								Organic SILT with trace gravel and wood; bluish grey and mottled orange. Soft, moist, low plasticity; organics fibrous and amorphous; gravel, medium, angular.	M	S			Chch Formation
			TP8_0.7	*		1.0		SILT with trace sand and fibrous organics, greyish blue. Soft, moist - wet, low plasticity, very slow dilatancy.	M-W				
		17/01/2017 ▼						Fine to coarse SAND with trace silt and fibrous organics; bluish grey. Moist.	M			No visual indications of contamination or contaminant odours noted. No landfill gas readings recorded.	
					0	1.5		1.3m: Wet	W				
					-1	2.0		1.5m: EOH - Test pit sides collapsing (saturated sand).					
						2.5							

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

Scale 1:25

EXCAVATION LOG

Excavation Id.: **TP 9**

SHEET: 1 OF 1

PROJECT: Redcliffs Park Site Investigation	LOCATION: Redcliffs Park, Christchurch	JOB No.: 1001107

CO-ORDINATES: (NZTM 2000)	5177312 mN 1578578 mE	EXPOSURE METHOD: TP EQUIPMENT: 8.8 T Excavator	EXCAV. STARTED: 17/01/2017 EXCAV. FINISHED: 17/01/2017
R.L.:	1.60m	OPERATOR: Protranz Earthmoving	LOGGED BY: OP
DATUM:	1937 Lyttelton Vertical Datum	DIMENSIONS: 1.5m by 1m	CHECKED BY: AMMW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3			TP9_0.1	*	1	0.0	TS	Silty TOPSOIL with trace sand and rootlets; brownish grey. Dry, non-plastic.	D		10 25 50 100 200		
			TP9_0.3	*				Fine to medium SAND with trace silt; greyish brown. Moist.	M				Fill
						0.5		Silty fine to coarse SAND; grey and mottled brown. Moist.					
						1.0		Sandy SILT; grey. Soft, moist, low plasticity.		S			Chch Formation
		17/01/2017	TP9_1.3	*	0	1.5		Fine to medium SAND with trace silt; grey and mottled brown. Wet. 1.5m: Becomes saturated.	W S			No visual indications of contamination or contaminant odours noted. No landfill gas readings recorded.	
					-1	2.0		1.7m: EOH - Test pit sides collapsing (saturated sand).					
						2.5							

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.7m

Scale 1:25

EXCAVATION LOG

Excavation Id.: **TP 10**

SHEET: 1 OF 1

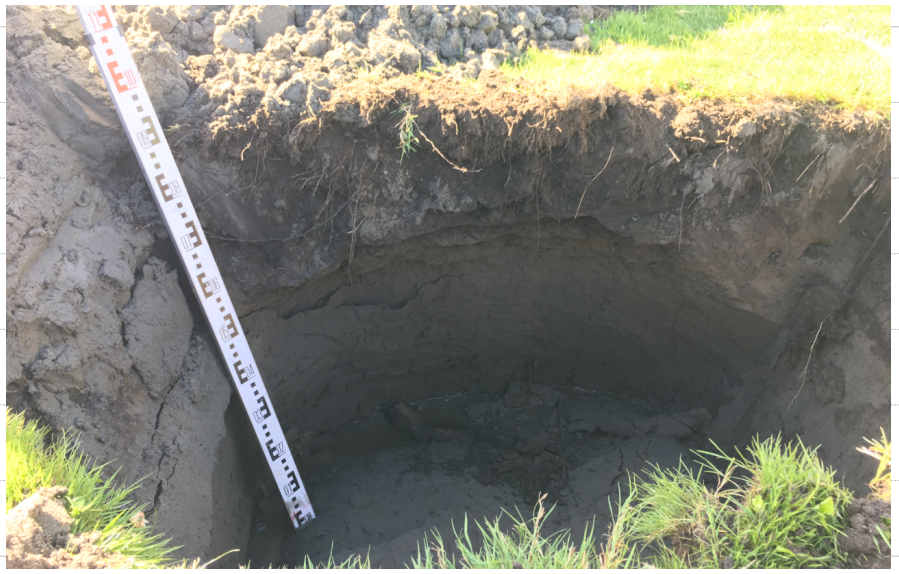
PROJECT: Redcliffs Park Site Investigation	LOCATION: Redcliffs Park, Christchurch	JOB No.: 1001107

CO-ORDINATES: (NZTM 2000)	5177239 mN 1578542 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	17/01/2017
		EQUIPMENT:	8.8 T Excavator	EXCAV. FINISHED:	17/01/2017
R.L.:	1.60m	OPERATOR:	Protranz Earthmoving	LOGGED BY:	OP
DATUM:	1937 Lyttelton Vertical Datum	DIMENSIONS:	1.5m by 1m	CHECKED BY:	AMMW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3			TP10_0.1	*			TS	Sandy TOPSOIL with minor silt, trace rootlets; blackish brown. Moist; sand, fine to medium.	M		10 25 50 100 200		-
		17/01/2017	TP10_0.5	*	1	0.5		Fine to medium SAND with trace silt; grey. Wet. 0.5m: Becomes fine to coarse.	W			No visual indications of contamination or contaminant odours noted. No landfill gas readings recorded.	Chch Formation
					0	1.0							
					-1	1.5		1.2m: EOH - Test pit sides collapsing (saturated sand).					
						2.0							
						2.5							

SKETCH / PHOTO:



COMMENTS:

Hole Depth 1.2m

Scale 1:25

EXCAVATION LOG

Excavation Id.: **TP 11**

SHEET: 1 OF 1

PROJECT: Redcliffs Park Site Investigation	LOCATION: Redcliffs Park, Christchurch	JOB No.: 1001107
CO-ORDINATES: (NZTM 2000) 5177264 mN 1578575 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 17/01/2017
	EQUIPMENT: 8.8 T Excavator	EXCAV. FINISHED: 17/01/2017
R.L.: 1.60m	OPERATOR: Protranz Earthmoving	LOGGED BY: OP
DATUM: 1937 Lyttelton Vertical Datum	DIMENSIONS: 1.5m by 1m	CHECKED BY: AMMW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3		17/01/2017	TP11_0.1	*	1	0	TS	Silty, sandy TOPSOIL with trace rootlets; greyish brown. Dry; sand, fine to medium. 0.25m: Trace shells, porcelain and glass.	D		10 25 50 100 200	Porcelain and glass fragments found from 0 - 0.25m only. No landfill gas readings recorded.	-
			TP11_0.25	*		0.5		Fine to medium SAND with minor silt; greyish brown. Dry.					
								SILT with trace sand and rootlets; grey and mottled brown. Firm, moist, moderate plasticity.	M	F			Chch Formation
			TP11_0.9	*		1.0		Silty fine to coarse SAND with trace rootlets; grey and mottled brown. Moist. 1.3m: Trace boulders, 0.1 - 0.4m, subangular to angular.	W				
					0	1.5		1.35m: EOH - Target depth achieved.					
					-1	2.0							
						2.5							

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.35m

Scale 1:25

EXCAVATION LOG

Excavation Id.: **TP 13**

SHEET: 1 OF 1

PROJECT: Redcliffs Park Site Investigation	LOCATION: Redcliffs Park, Christchurch	JOB No.: 1001107

CO-ORDINATES: (NZTM 2000)	5177302 mN 1578417 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 17/01/2017
		EQUIPMENT: 8.8 T Excavator	EXCAV. FINISHED: 17/01/2017
R.L.:	5.00m	OPERATOR: Protranz Earthmoving	LOGGED BY: OP
DATUM:	1937 Lyttelton Vertical Datum	DIMENSIONS: 1.5m by 1m	CHECKED BY: AMMW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3			TP13_0	*				Medium to coarse GRAVEL (carpark shingle). Dry. Subrounded to angular.	D			Trace amounts of plastic and crushed concrete fragments on surface. No other indication of contamination noted. No landfill gas readings recorded.	Fill.
								Fine to coarse SAND with minor gravel; greyish brown. Dry - moist. Gravel, fine to medium, subangular to subrounded.	D-M				
			TP13_0.5	*		0.5							
					4	1.0							
						1.5							Chch Formation
					3	2.0		2.2m: Sand becomes fine to medium, moist.					
									M				
			TP13_2.4	*				2.4m: Trace gravel.					
						2.5		2.5m: EOH - Test pit sides collapsing.					

SKETCH / PHOTO:

COMMENTS:

Hole Depth 2.5m

Scale 1:25

Appendix G: Tabulated soil analytical results

- **Redcliffs Park DSI – soil analytical results**

		Metals								Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides		Asbestos
		Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Benzo[a]pyrene Eq [7]	Total DDT [8]	Dieldrin	Semi-quantitative
Sample IDs	TP1_0.1	3	< 0.10*	15	10	26	< 0.10**	15	64	-	< 0.06	< 0.010	-
	TP1_0.3	2.69	0.032	14.2	6.33	10.3	0.026	12	38.6	-	-	-	-
	TP2_0.1	4	< 0.10*	15	7	31	< 0.10**	11	65	-	< 0.06	< 0.010	-
	TP2_0.5	1.2	0.022	12.4	2.54	8.27	0.026	9.15	29.9	-	-	-	-
	TP2_1.0	1.57	0.008	9.94	2.12	6.65	0.029	8.01	27.5	-	-	-	-
	TP3_0.1	5	0.1	15	10	35	< 0.10**	11	72	-	< 0.06	< 0.010	-
	TP3_0.4	2.89	0.086	18.2	10.2	46.5	0.043	18.4	62.6	0.62	-	-	-
	TP3_1.2	3.94	0.013	10.4	2.35	6.29	0.032	8	28.1	-	-	-	-
	TP6_0.1	4	0.16	14	11	30	< 0.10**	12	87	-	< 0.06	< 0.010	-
	TP6_0.3	3.28	0.017	10.1	2.07	6.64	0.036	8.11	28.4	<0.01	-	-	-
	TP6_0.9	2.12	0.011	10.6	2.38	6.78	0.035	8.27	27.7	-	-	-	-
	TP8_0.1	4	0.11	13	9	42	< 0.10**	10	72	-	< 0.06	< 0.010	-
	TP8_0.2	3.49	0.062	12.8	4.71	16.5	0.054	9.15	48.9	0.57	-	-	-
	TP8_0.7	13.7	0.059	17.7	10	17.7	0.086	17	64.1	-	-	-	-
	TP9_0.1	4	0.11	17	9	30	< 0.10**	12	87	-	< 0.06	< 0.010	-
	TP9_0.3	2.62	0.014	11.1	2.44	6.63	0.036	7.15	27	-	-	-	-
	TP9_1.3	3.54	0.014	12.3	2.27	6.6	0.028	8.79	28.8	-	-	-	-
	TP10_0.1	4	0.12	12	10	98	< 0.10**	10	75	-	< 0.06	< 0.010	-
	TP10_0.5	1.16	0.015	10.1	4.18	9.35	0.047	8.75	30.2	0.01	-	-	-
	TP11_0.1	4	0.13	15	10	44	< 0.10**	12	79	-	< 0.06	< 0.010	-
	TP11_0.25	2.65	0.014	11.3	3.01	7.43	0.034	9	29.6	<0.01	-	-	-
	TP11_0.9	2.96	0.012	10.6	3.19	8.28	0.037	9.11	31.1	<0.01	-	-	-
	TP13_0	-	-	-	-	-	-	-	-	-	-	-	<0.001%
	TP13_0.5	3.01	0.023	13.1	3.93	10.6	0.048	10	32.9	0.1	-	-	-
	TP13_2.4	2.74	0.018	12.3	3.48	8.13	0.042	9.16	28.2	-	-	-	-
	TP14_0.1	9	0.11	15	12	53	< 0.10**	15	105	-	< 0.06	< 0.010	-
	SS1	-	-	-	-	-	-	-	-	-	-	-	ND
	SS2	-	-	-	-	-	-	-	-	-	-	-	<0.001%
	SS3	-	-	-	-	-	-	-	-	-	-	-	ND
	SS4	-	-	-	-	-	-	-	-	-	-	-	ND
Guidelines	Background[1]	5.9	0.09	16.6	10.2	25.3	0.09	12.3	62.2	0.92 [2]	0.431 [9]	-	-
	ISQG[10]	20	1.5	80	65	50	0.15	21	200	430	1.6	0.02	-
	Worker[3]	70	1,300	6,300	> 10,000	3,300	4,200	6,000 [4]	400,000 [4]	35	1,000	160	0.001%
	Recreational[5]	80	400	2,700	> 10,000	880	1,800	1,200 [4]	30,000 [4]	40	400	70	0.001%
	BRRP[6]	80	400	2,700	> 10,000	880	1,800	600	14,000	40	400	70	ND

Notes:

All concentrations in mg/kg unless stated otherwise

Highlighted indicates that published or expected natural background concentrations are exceeded.

ND - Non-detect

1 ECan GIS, Trace elements Level 2.

2 Background Concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils Report No. R07/19, July 2007.

3 MfE 2011, NES Users' Guide, Soil Contaminant Standards, Outdoor worker (unpaved).

4 ASC NEPM Toolbox – Update February 2014 - http://www.scew.gov.au/node/941#hils.

5 MfE 2011, NES Users' Guide, Soil Contaminant Standards, Recreational land use.

6 CCC, Burwood Resource Recovery Park acceptance criteria.

7 BaP equivalent concentrations are calculated by taking into account the nine carcogenic PAHs.

8 Total DDT is the sum of 4,4'-DDT, 4,4'-DDD and 4,4'-DDE.

9 ECan-derived DDT ambient level for the Christchurch region.

10 ANZECC 2000. Austrlian and New Zealand Guidelines for fresh and marine water quality. Interim Sediment Quality Guidelines (low - trigger values)

* Assumed to exceed cadmium background concentration as other metals concentrations exceed background in same sample.

** Assumed to exceed mercury background concentration as other metals concentrations exceed background in same sample

Appendix H: Laboratory transcripts

- **Hill Laboratories Analysis Report – Lab No. 1690909**
- **Analytica Laboratories Certificate of Analyses – Lab Reference: 17-00882**
- **Precise Consulting & Laboratory – Job No. J119994 (1)**
- **Precise Consulting & Laboratory – Job No. J120203 (1)**

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ANALYSIS REPORT

Client:	Tonkin & Taylor	**Lab No:**	1690909	SPv3
Contact:	Ali Anwar	**Date Received:**	03-Dec-2016	
	C/- Tonkin & Taylor	**Date Reported:**	25-Jan-2017	**(Amended)**
	PO Box 13055	**Quote No:**	80842	
	Christchurch 8141	**Order No:**	1001107	
		Client Reference:	Redcliffs Park	
		Submitted By:	Ali Anwar	

Sample Type: Soil

Sample Name:		TP1_0.1 01-Dec-2016	TP2_0.1 01-Dec-2016	TP3_0.1 01-Dec-2016	TP6_0.1 01-Dec-2016	TP8_0.1 01-Dec-2016
Lab Number:		1690909.1	1690909.2	1690909.3	1690909.4	1690909.7
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	4	5	4	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	0.10	0.16	0.11
Total Recoverable Chromium	mg/kg dry wt	15	15	15	14	13
Total Recoverable Copper	mg/kg dry wt	10	7	10	11	9
Total Recoverable Lead	mg/kg dry wt	26	31	35	30	42
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	15	11	11	12	10
Total Recoverable Zinc	mg/kg dry wt	64	65	72	87	72
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		TP9_0.1 01-Dec-2016	TP10_0.1 01-Dec-2016	TP11_0.1 01-Dec-2016	TP14_0.1 01-Dec-2016	
Lab Number:		1690909.8	1690909.9	1690909.12	1690909.13	
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	4	4	9	-
Total Recoverable Cadmium	mg/kg dry wt	0.11	0.12	0.13	0.11	-
Total Recoverable Chromium	mg/kg dry wt	17	12	15	15	-
Total Recoverable Copper	mg/kg dry wt	9	10	10	12	-
Total Recoverable Lead	mg/kg dry wt	30	98	44	53	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	-
Total Recoverable Nickel	mg/kg dry wt	12	10	12	15	-
Total Recoverable Zinc	mg/kg dry wt	87	75	79	105	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	-
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	-
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-

Analyst's Comments

Amended Report: This report replaces an earlier report issued on 25 Jan 2017 at 4:14 pm
Reason for amendment: The sample names have been amended.

SUMMARY OF METHODS

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

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-4, 7-9, 12-13
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.06 mg/kg dry wt	1-4, 7-9, 12-13

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

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

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Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Tonkin + Taylor
Level 3, 60 Cashel Street, West End
Christchurch
Attention: Paul Walker
Phone: 027 509 0044
Email: aanwar@tonkintaylor.co.nz

Lab Reference: 17-00882
Submitted by: Paul Walker
Date Received: 19/01/2017
Date Completed: 26/01/2017
Order Number:
Reference: 1001107_2

Sampling Site: Redcliff Parks

Heavy Metals in Soil

		Client Sample ID	TP1_0.3	TP2_0.5	TP2_1.0	TP3_0.4	TP3_1.2
		Date Sampled	19/01/2017	19/01/2017	19/01/2017	19/01/2017	19/01/2017
Analyte	Unit	*Reporting Limit*	17-00882-1	17-00882-2	17-00882-3	17-00882-4	17-00882-5
Arsenic	mg/kg dry wt	*0.125*	2.69	1.20	1.57	2.89	3.94
Cadmium	mg/kg dry wt	*0.005*	0.032	0.022	0.008	0.086	0.013
Chromium	mg/kg dry wt	*0.125*	14.2	12.4	9.94	18.2	10.4
Copper	mg/kg dry wt	*0.075*	6.33	2.54	2.12	10.2	2.35
Lead	mg/kg dry wt	*0.05*	10.3	8.27	6.65	46.5	6.29
Mercury	mg/kg dry wt	*0.025*	0.026	0.026	0.029	0.043	0.032
Nickel	mg/kg dry wt	*0.05*	12.0	9.15	8.01	18.4	8.00
Zinc	mg/kg dry wt	*0.05*	38.6	29.9	27.5	62.6	28.1

Heavy Metals in Soil

		Client Sample ID	TP6_0.3	TP6_0.9	TP8_0.2	TP8_0.7	TP9_0.3
		Date Sampled	19/01/2017	19/01/2017	19/01/2017	19/01/2017	19/01/2017
Analyte	Unit	*Reporting Limit*	17-00882-6	17-00882-7	17-00882-8	17-00882-9	17-00882-10
Arsenic	mg/kg dry wt	*0.125*	3.28	2.12	3.49	13.7	2.62
Cadmium	mg/kg dry wt	*0.005*	0.017	0.011	0.062	0.059	0.014
Chromium	mg/kg dry wt	*0.125*	10.1	10.6	12.8	17.7	11.1
Copper	mg/kg dry wt	*0.075*	2.07	2.38	4.71	10.0	2.44
Lead	mg/kg dry wt	*0.05*	6.64	6.78	16.5	17.7	6.63
Mercury	mg/kg dry wt	*0.025*	0.036	0.035	0.054	0.086	0.036
Nickel	mg/kg dry wt	*0.05*	8.11	8.27	9.15	17.0	7.15
Zinc	mg/kg dry wt	*0.05*	28.4	27.7	48.9	64.1	27.0

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation, with the exception of tests marked *, which are not accredited.

Heavy Metals in Soil

		Client Sample ID	TP9_1.3	TP10_0.5	TP11_0.25	TP11_0.9	TP13_0.5
		Date Sampled	19/01/2017	19/01/2017	19/01/2017	19/01/2017	19/01/2017
Analyte	Unit	*Reporting Limit*	17-00882-11	17-00882-12	17-00882-13	17-00882-14	17-00882-15
Arsenic	mg/kg dry wt	*0.125*	3.54	1.16	2.65	2.96	3.01
Cadmium	mg/kg dry wt	*0.005*	0.014	0.015	0.014	0.012	0.023
Chromium	mg/kg dry wt	*0.125*	12.3	10.1	11.3	10.6	13.1
Copper	mg/kg dry wt	*0.075*	2.27	4.18	3.01	3.19	3.93
Lead	mg/kg dry wt	*0.05*	6.60	9.35	7.43	8.28	10.6
Mercury	mg/kg dry wt	*0.025*	0.028	0.047	0.034	0.037	0.048
Nickel	mg/kg dry wt	*0.05*	8.79	8.75	9.00	9.11	10.0
Zinc	mg/kg dry wt	*0.05*	28.8	30.2	29.6	31.1	32.9

Heavy Metals in Soil

		Client Sample ID	TP13_2.4
		Date Sampled	19/01/2017
Analyte	Unit	*Reporting Limit*	17-00882-16
Arsenic	mg/kg dry wt	*0.125*	2.74
Cadmium	mg/kg dry wt	*0.005*	0.018
Chromium	mg/kg dry wt	*0.125*	12.3
Copper	mg/kg dry wt	*0.075*	3.48
Lead	mg/kg dry wt	*0.05*	8.13
Mercury	mg/kg dry wt	*0.025*	0.042
Nickel	mg/kg dry wt	*0.05*	9.16
Zinc	mg/kg dry wt	*0.05*	28.2

Polycyclic Aromatic Hydrocarbons - Soil

		Client Sample ID	TP3_0.4	TP6_0.3	TP8_0.2	TP10_0.5	TP11_0.25
		Date Sampled	19/01/2017	19/01/2017	19/01/2017	19/01/2017	19/01/2017
Analyte	Unit	*Reporting Limit*	17-00882-4	17-00882-6	17-00882-8	17-00882-12	17-00882-13
1-Methylnaphthalene	mg/kg	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
2-Methylnaphthalene	mg/kg	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	mg/kg	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	mg/kg	*0.01*	0.06	<0.01	0.06	<0.01	<0.01
Anthracene	mg/kg	*0.01*	0.05	<0.01	0.04	<0.01	<0.01
Benz[a]anthracene	mg/kg	*0.02*	0.25	<0.02	0.20	<0.02	<0.02
Benzo[a]pyrene	mg/kg	*0.01*	0.41	<0.01	0.37	0.01	<0.01
Benzo[b]&[j] fluoranthene	mg/kg	*0.02*	0.45	<0.02	0.42	<0.02	<0.02
Benzo[g,h,i]perylene	mg/kg	*0.02*	0.32	<0.02	0.33	<0.02	<0.02
Benzo[k]fluoranthene	mg/kg	*0.01*	0.18	<0.01	0.17	<0.01	<0.01
Chrysene	mg/kg	*0.01*	0.31	<0.01	0.25	<0.01	<0.01
Dibenz(a,h)anthracene	mg/kg	*0.01*	0.08	<0.01	0.08	<0.01	<0.01
Fluoranthene	mg/kg	*0.02*	0.74	<0.02	0.61	0.02	<0.02
Fluorene	mg/kg	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	mg/kg	*0.01*	0.37	<0.01	0.38	0.01	<0.01
Naphthalene	mg/kg	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	mg/kg	*0.01*	0.22	<0.01	0.17	<0.01	<0.01
Pyrene	mg/kg	*0.02*	0.78	<0.02	0.62	0.02	<0.02
Benzo[a]pyrene TEQ	mg/kg	*0.01*	0.62	<0.01	0.57	0.01	<0.01
Anthracene-d10 (Surrogate)	%	*1*	111.4	109.0	111.1	105.9	103.5

Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	TP11_0.9	TP13_0.5
			Date Sampled	19/01/2017	19/01/2017
Analyte	Unit	*Reporting Limit*		17-00882-14	17-00882-15
1-Methylnaphthalene	mg/kg	*0.01*		<0.01	<0.01
2-Methylnaphthalene	mg/kg	*0.01*		<0.01	<0.01
Acenaphthene	mg/kg	*0.01*		<0.01	<0.01
Acenaphthylene	mg/kg	*0.01*		<0.01	<0.01
Anthracene	mg/kg	*0.01*		<0.01	<0.01
Benz[a]anthracene	mg/kg	*0.02*		<0.02	0.05
Benzo[a]pyrene	mg/kg	*0.01*		<0.01	0.07
Benzo[b]&[j] fluoranthene	mg/kg	*0.02*		<0.02	0.08
Benzo[g,h,i]perylene	mg/kg	*0.02*		<0.02	0.06
Benzo[k]fluoranthene	mg/kg	*0.01*		<0.01	0.03
Chrysene	mg/kg	*0.01*		<0.01	0.05
Dibenz(a,h)anthracene	mg/kg	*0.01*		<0.01	<0.01
Fluoranthene	mg/kg	*0.02*		<0.02	0.12
Fluorene	mg/kg	*0.01*		<0.01	<0.01
Indeno(1,2,3-cd)pyrene	mg/kg	*0.01*		<0.01	0.06
Naphthalene	mg/kg	*0.01*		<0.01	<0.01
Phenanthrene	mg/kg	*0.01*		<0.01	0.03
Pyrene	mg/kg	*0.02*		0.02	0.13
Benzo[a]pyrene TEQ	mg/kg	*0.01*		<0.01	0.10
Anthracene-d10 (Surrogate)	%	*1*		102.7	103.8

Moisture Content

			Client Sample ID	TP3_0.4	TP6_0.3	TP8_0.2	TP10_0.5	TP11_0.25
			Date Sampled	19/01/2017	19/01/2017	19/01/2017	19/01/2017	19/01/2017
Analyte	Unit	*Reporting Limit*		17-00882-4	17-00882-6	17-00882-8	17-00882-12	17-00882-13
Moisture Content	%	*1*		10	10	4	20	22

Moisture Content

			Client Sample ID	TP11_0.9	TP13_0.5
			Date Sampled	19/01/2017	19/01/2017
Analyte	Unit	*Reporting Limit*		17-00882-14	17-00882-15
Moisture Content	%	*1*		17	4

Method Summary

Elements in Soil	Acid digestion followed by ICP-MS analysis. US EPA method 200.8.
PAH in Soil	Solvent extraction, silica cleanup, followed by GC-MS analysis. Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Enivronment. 2011.
Moisture	Moisture content is determined gravimetrically by drying at 103 °C.

Report Comments

Samples were received by Analytica Laboratories in acceptable condition unless otherwise noted on this report.

Report 17-00882-[R02] replaces in full report 17-00882-[R01].

Karam Wadi, B.E. (Hons)
Technologist

Terry Cooney, Ph.D.
Signatory

DATE: 26th January 2017

JOB NUMBER: J119994 (1)

PRECISE
CONSULTING & LABORATORY

Tonkin and Taylor (Christchurch)

33 Parkhouse Road
Wigram
Christchurch
8042

Client Reference: 1001107

Dear Ali Anwar,

Re: Asbestos Identification Analysis – Redcliffs Park

One (1) samples received on 19th January 2017 by Sophie Bush.

The results of fibre analysis were performed by Laura Vitali of Precise Consulting and Laboratory Ltd on 26th January 2017.

The sample(s) were stated to be from Redcliffs Park .

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

The results of the fibre analysis are presented in the appended table.

Should you require further information please contact Laura Vitali.

Yours sincerely

Laura Vitali
PRECISE LABORATORY IDENTIFIER

Precise Consulting & Laboratory Ltd Limited
Unit 4, 91 Byron Street, Sydenham, Christchurch 8023
P: (03) 943 5394 W: www.preciseconsulting.co.nz

Sample Analysis Results

PRECISE
CONSULTING & LABORATORY

Job No: J119994

26 January 2017

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: If mineral fibres of unknown type are detected (UMF), 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 3: The samples in this report are "As Received".

Identified by:

Laura Vitali
Approved Identifier

Reviewed by:

Laura Vitali
Key Technical Person

Site Address: Redcliffs Park

Sample ID	Client Sample Number	Sample Location/Description/Dimensions	Analysis Results
BS067497	TP13_0	TP13_0 Non-Homogeneous Soil 970.91g	Chrysotile (White Asbestos) Organic Fibre Type

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IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Appendix 1: Soil Analysis Raw Data

PRECISE
CONSULTING & LABORATORY

Job No: J119994

Thursday, 26th January 2017

Sample ID	Client Sample Number	Sample Weights						>7mm Asbestos Containing Material (ACM)[1]		Asbestos Fines/Fibrous Asbestos[1]				Trace Asbestos Detected (Y/N)
		Total 10L (Kg)	Total 500mL Sub-Sample (g)	>7mm Fraction (g)	2-7mm Fraction (g)	<2mm Sub Sample (g)	<2mm Excess (g)	>7mm ACM (g)	Form & %[3]	2-7mm ACM (g)	Form & %[2]	<2mm ACM (g)	Form & %[3]	
BS067497	TP13_0	-	970.91g	448.07g	186.23g	100.32g	236.25g	No Asbestos Detected	N/A	No Asbestos Detected	N/A	<0.001g	Free Fibres 100%	Y

1 These results are raw weighed data presented as per the Western Australian Guidelines and may be under the reporting limit for guidelines AS4964 of 0.1g/kg
2 Asbestos percentage is determined using EPA-600-R-93-116:

Precise Consulting & Laboratory Ltd Limited

Unit 4, 91 Byron Street, Sydenham, Christchurch 8023

P: (03) 943 5394 W: www.preciseconsulting.co.nz

DATE: 2nd February 2017

JOB NUMBER: J120203 (1)

PRECISE
CONSULTING & LABORATORY

Tonkin and Taylor (Christchurch)

33 Parkhouse Road
Wigram
Christchurch
8042

Client Reference: Redcliffs Asbestos

Dear Wendi Williamson,

Re: Asbestos Identification Analysis – Redcliffs Park

Four (4) samples received on 27th January 2017 by Victoria Sheppard.

The results of fibre analysis were performed by Laura Vitali of Precise Consulting and Laboratory Ltd on 2nd February 2017.

The sample(s) were stated to be from Redcliffs Park .

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

The results of the fibre analysis are presented in the appended table.

Should you require further information please contact Laura Vitali.

Yours sincerely

Laura Vitali
PRECISE LABORATORY IDENTIFIER

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Sample Analysis Results

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CONSULTING & LABORATORY

Job No: J120203

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: If mineral fibres of unknown type are detected (UMF), 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 3: The samples in this report are "As Received".
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Identified by:

Laura Vitali
Approved Identifier

Reviewed by:

Laura Vitali
Key Technical Person

Site Address: Redcliffs Park

Sample ID	Client Sample Number	Sample Location/Description/Dimensions	Analysis Results
BS067984	SS1	Surface Sample - Soil Non-Homogeneous Soil 1013.02g	No Asbestos Detected Organic Fibre Type
BS067985	SS2	Surface Sample - Soil Non-Homogeneous Soil 944.04g	Chrysotile (White Asbestos) Organic Fibre Type

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Sample Analysis Results

PRECISE
CONSULTING & LABORATORY

Job No: J120203

Site Address: Redcliffs Park			
Sample ID	Client Sample Number	Sample Location/Description/Dimensions	Analysis Results
BS067986	SS3	Surface Sample - Soil Non-Homogeneous Soil 1048.88g	No Asbestos Detected Organic Fibre Type
BS067987	SS4	Surface Sample - Soil Non-Homogeneous Soil 630.60g	No Asbestos Detected Organic Fibre Type

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Appendix 1: Soil Analysis Raw Data

PRECISE
CONSULTING & LABORATORY

Job No: J120203

Thursday, 2nd February 2017

Sample ID	Client Sample Number	Sample Weights						>7mm Asbestos Containing Material (ACM)[1]		Asbestos Fines/Fibrous Asbestos[1]				Trace Asbestos Detected (Y/N)
		Total 10L (Kg)	Total 500mL Sub-Sample (g)	>7mm Fraction (g)	2-7mm Fraction (g)	<2mm Sub Sample (g)	<2mm Excess (g)	>7mm ACM (g)	Form & %[3]	2-7mm ACM (g)	Form & %[2]	<2mm ACM (g)	Form & %[3]	
BS067984	SS1	-	1013.02g	559.35g	198.77g	101.58g	153.32g	No Asbestos Detected	N/A	No Asbestos Detected	N/A	No Asbestos Detected	N/A	N
BS067985	SS2	-	944.04g	785.20g	98.77g	60.07g	-	No Asbestos Detected	N/A	No Asbestos Detected	N/A	<0.001g	Free Fibres 100%	Y
BS067986	SS3	-	1048.88g	704.07g	91.93g	100.27g	152.61g	No Asbestos Detected	N/A	No Asbestos Detected	N/A	No Asbestos Detected	N/A	N
BS067987	SS4	-	630.60g	99.65g	52.27g	101.85g	376.83g	No Asbestos Detected	N/A	No Asbestos Detected	N/A	No Asbestos Detected	N/A	N

1 These results are raw weighed data presented as per the Western Australian Guidelines and may be under the reporting limit for guidelines AS4964 of 0.1g/kg
2 Asbestos percentage is determined using EPA-600-R-93-116:

Precise Consulting & Laboratory Ltd Limited

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