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# Preliminary Site Investigation – 139 Grange Road, Burnham

✦ Prepared and updated for  
Burnham 2020 Ltd

✦ July 2023



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### Limitations:

See Section 9.0 for Report Limitations.

## Executive Summary

Pattle Delamore Partners Limited (PDP) has been asked by the current landowner Burnham 2020 Ltd to review and update information within a preliminary site investigation (PSI) report<sup>1</sup> prepared by PDP in 2020 for the property located at 139 Grange Road, Burnham. The original report was prepared for a due diligence process for the purchase of the site. The site has since been purchased and it is understood Burnham 2020 Ltd intend to continue with the farming operations whilst also progressively quarry the property to provide aggregate for construction projects. This PSI has been prepared to support the consenting process for the quarrying activity.

No additional site visit has been undertaken to assess current conditions since 2020, as it has been reported that there has been no change in land use activities onsite (i.e. the site is continuing to operate as a farm). Data sources used within the original PSI have been reviewed and updated, as required. This included reviewing the Environment Canterbury Listed Land Use Register (LLUR), current active wells / boreholes and current active consents.

The site history review shows the site was used as a forestry plantation from at least the 1940's until circa 2005. In 2005 the farm was converted to an irrigated cropping/cattle fattening farm and since 2010, the property has operated as an irrigated heifer grazing farm. Key land use activities that may have resulted in contaminating soils/groundwater (based on site walkover observations) include:

- ∴ An above ground diesel tank in the yard of the former forestry block (anecdotal information);
- ∴ Two above ground fuel storage tanks for refuelling farm vehicles;
- ∴ Storage of bulk fertilisers and other materials such as fence posts and used tyres which are used in the general operational aspects of the farm; and
- ∴ Waste pits/infill pits relating to past land use (anecdotal information) and current farming practices.

Based on the above, the following HAIL<sup>2</sup> activities have been identified for the site:

- ∴ 'Landfill sites' (HAIL Reference G3)
- ∴ 'Waste disposal to land' (HAIL Category G5)
- ∴ 'Bulk storage of fertilizer' (HAIL Category A6)
- ∴ 'Storage tanks or drums for fuel' (HAIL Category A17)

No sampling of soils around the current operational yard area or known pit locations was considered necessary at this stage as these areas will continue to be used for the ongoing operation of the farm. However, broad-acre sampling of surface soils outside of identified the HAIL areas were undertaken to provide an initial indication to the presence of contaminants (if any) in the near surface soils. The sampling results showed the likely key indicator contaminants (i.e. heavy metals and organochlorine pesticides (OCPs)) at background levels for the area. The site history review and sample results suggest that although a number of potentially contaminating activities have been identified at the site, they are in discrete areas only and should not be interpreted across the wider site. These contamination sources were considered to be typical for a large forestry/farming operation.

As the site is currently being used as 'production land', the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soils to Protect Human Health) Regulations 2011* (referred to as the NESCS) is not applicable for the current soil disturbance activities and general operation for the current use of the site. However, the proposed change in land use as a quarry is not defined as 'production land' and therefore the NESCS regulations (soil disturbance and change in land use) will need to be taken into consideration for the proposed quarry development. Given these HAIL areas will continue to be used for the short to medium term, a detailed site investigation (DSI) has not been undertaken so the consent application will need to proceed down the **discretionary activity** process.

The recommended approach to managing the identified contamination source areas during the proposed future quarrying operations is through the development and implementation of a Site Management Plan (SMP). This would include the requirement to further investigate the HAIL areas identified in this PSI prior to any quarrying activities taking place in the sections of the quarry identified. It is recommended that this is included as a condition of the land use consent issued for the operation of the quarrying activities.

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## 1.0 Introduction

Pattle Delamore Partners Limited (PDP) has been engaged to undertake a review and updating of a preliminary site investigation (PSI; site history review) completed in February 2020 for the property located at 139 Grange Road, Burnham. It is understood the new landowner Burnham 2020 Ltd intends to continue with the farming operations whilst also progressively quarry the property to provide aggregate for construction projects in the region. This PSI has been prepared to support the consenting process for the quarrying activity.

The desktop assessment has been conducted through the inspection of relevant historical records including historical aerial photographs, council documentation as well as undergoing a site inspection in 2020. In addition, a limited soil sampling exercise was completed as part of the original assessment to provide contamination status (if any) of the near surface soils across the wider site.

The objectives of this PSI are to:

- ∴ Review the available information to determine the history of the site and whether any activities on the HAIL<sup>1</sup> have been undertaken at the site from past or present land use practises;
- ∴ Determine the key contaminants of concern associated with any identified potential sources of contamination and HAIL activities;
- ∴ Determine an indication of the contamination status of the near surface soils through a limited soil sampling investigation (broad-acre sampling only);
- ∴ Assess the applicability of the NESCS for the soil disturbance activities associated with the proposed quarry; and
- ∴ Assess if any new potentially contaminating activities have been undertaken at the site since February 2020.

This assessment has been carried out in general accordance with *Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand* (MfE, 2011) and *Contaminated Land Management Guidelines No. 5: Site Investigation and Analysis of Soils (Revised 2011)*. This PSI has been certified by suitably qualified and experienced practitioner as required by the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soils to Protect Human Health) Regulations 2011* (referred to as the NESCS).

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<sup>1</sup> *Hazardous Activities and Industries List* (Ministry for the Environment; MfE, 2011).

## 2.0 Site Details

The site proposed to be progressively quarried is the triangle shaped area of land bound by Grange Road to the south, Aylesbury Road to the east and Kivers Road to the west (here in referred to as 'the site'). The wider property forming the farm also includes two blocks of land on the southern side of Grange Road. These are referred to as the 'South Blocks' and are shown on Figure 1. The South Block areas are outside of the scope of this PSI as they are not intended to be quarried in the future. However, in some instances the data sources reviewed have included these blocks as they fall under the wider property.

A site location map and existing site layout is presented as Figure 1 in Appendix A.

### 2.1 Site Identification

The details of the site are provided in Table 1 below.

Table 1: Site Details	
<b>Address</b>	139 Grange Road, Burnham
<b>Legal Description</b>	CB82/294, CB137/244, CB31/285
<b>Site Owner</b>	Burnham Farm Limited
<b>Grid Reference</b>	NZTM BX23: 4262 7278
<b>Area</b>	Approximately 380 hectares
<b>Zoning</b>	Rural Zone – Outer Plains
<b>Current Land Use</b>	Operational Irrigated Heifer Grazing Farm
<b>Surrounding Land Use</b>	North: Open paddocks South: Grange Road followed by open paddocks, lifestyle block homes and Burnham Military Camp East: Aylesbury Road followed by open paddocks West: Open paddocks



## 2.2 Site Description

At the time of the PDP site inspection on 30 January 2020, the site consisted of an operational irrigated heifer grazing farm. The South Blocks were not included as part of this site inspection.

The majority of the site comprised of grassed paddocks, with the site divided into three main sections of north, south-west and south-east, based on three circular irrigation pivot systems. The sections of the site not included in the three main pivot irrigation systems have smaller separate irrigation systems. A yard area is located in the centre of the site comprising of a barn, mechanical workshop, refuelling tanks, portacabin, several silos, a stock yard and a waste pit. Other farming materials such as fence posts, a covered silage stockpile, rows of baling and fertiliser are also stored in this area.

Photographs of the site are presented in Appendix B.

## 2.3 Environmental Setting

The geological map for the area (Forsyth et al., 2008 1:250,000) reports that the surrounding area is underlain by 'grey river alluvium beneath plains or low-level terraces (Q1a)''.

The nearest surface water to the site consists of multiple field drains located in the paddocks surrounding the site. The Selwyn River is located 5.5km to the south of the site.

The Environment Canterbury (ECan) Land and Water Regional Plan (LWRP) shows that the site is located outside of the Christchurch Groundwater Protection Zone.

The ECan online GIS database was searched for groundwater bores / wells located within a 2 km radius of the site boundary. There are eleven groundwater bores recorded within the site's boundaries, all of which are used for irrigation or stock water supply. One-hundred and forty-three groundwater bores were recorded within a 2 km radius of the site, all of which are recorded as being 'active (exist, present)', including nineteen for water level observation, thirty-six for irrigation, fifty-eight for domestic supply and / or stockwater supply, three for commercial/industrial and two for geotechnical investigations.

Groundwater bores in the area indicate that groundwater would be expected to be encountered at a depth of approximately 10–20 m below ground level (bgl). Groundwater is expected to flow in a predominately south-easterly direction beneath the site.

A plot and table summarising the active bores within a 200 m radius of the site are presented in Appendix C.

### 3.0 Desktop Review of Site History

A desktop assessment was undertaken to provide an overview of any potential contaminants of concern that may be present at the site as a result of any documented past and present activities. The following information was sourced in order to establish the history of the site:

- ∴ Historical aerial photographs;
- ∴ Environment Canterbury (ECan) and Selwyn District Council (SDC) information; and
- ∴ Site inspection.

#### 3.1 Historical Aerial Photographs

Historical aerial photographs for the site have been reviewed. The reviewed aerial photographs are presented in Appendix D.

Table 2: Historical Aerial Photographs	
1942	The site consists of paddocks, with a farmhouse in the south-east corner of the site. Forestry trees can be seen in sections of the paddocks and forestry access roads can be seen crosscutting the site. The farmhouse consists of two buildings surrounded by trees, with surrounding lawns and several outbuildings.
1962	The site is covered in mature forestry trees, with forestry access roads clearly visible and the farmhouse still visible in the south-east corner of the site with lawn surrounding the farmhouse.
1974	The property remains unchanged apart from the harvesting of some trees in the south-eastern corner of the site
1982	The farmhouse and associated outbuildings have been demolished. The hedges and lawns surrounding the demolished farmhouse are still present. The balance of the site appears to have been harvested with diagonal lines suggesting rows of slash (forestry debris during harvesting).
1994	The site has been replanted with forestry. A circular area of trees is visible in the location of the former farmhouse.
2004	The trees have been harvested across the site, with loading out areas and tracks visible. Pounded water is present in numerous areas across the site, particularly within loading out areas and the access tracks. Large ponded areas are noted centrally on the site and on the western boundary. It is unknown if these may have been pits.

Table 2: Historical Aerial Photographs	
<b>2015-16</b>	The property has developed into its current layout, with the positions of the three main pivots across the site clearly visible. The current yard is also visible in the southern central section of the site. The current waste pit can be seen next to the two silos located in the centre of the site. 100’s of used tyres can be seen in the yard area (used for covering the silage stockpiles) with volume estimated to be less than 20 m <sup>3</sup> .
<b>2022</b>	The property remains in its current layout. No significant changes are identified.
<p><i>Notes:</i></p> <ol style="list-style-type: none"> <li><i>1. Historical aerial photographs sourced from Canterbury Map Partners, administered by ECan.</i></li> <li><i>2. It should be noted that some aerial images are at a large scale and therefore of relatively low quality.</i></li> </ol>	

### 3.2 Environment Canterbury Information

#### 3.2.1 Listed Land Use Register (LLUR)

The ECan LLUR is used to hold information about sites that have used, stored or disposed of hazardous substances, based on activities detailed on the HAIL (MfE, 2011). It should be noted that the LLUR is not complete and new sites are regularly being added as ECan receives information and conduct their own investigations.

As of July 2023, the site remains unlisted on the LLUR. However, the neighbouring properties 168 Aylesbury Road, 177 Grange Road and Burnham Military Camp (Res 1176) located immediately east, south and southeast of the site respectively, are listed under two distinct HAIL Codes:

- ∴ A10 – Persistent pesticide bulk storage or use - Applies to the two residential / lifestyle block properties at 168 Aylesbury Road and 177 Grange Road. This primarily relates to greenhouse / tunnel houses associated with gardening and horticultural activities.
- ∴ G3 – Landfill Sites – RES 1176, Burnham (Burnham Military Camp) applies to a larger parcel associated with Military operations and development. Evidence of landfilling at this site was noted from 1994 to present.

These sites identified outside of the property are not expected to have resulted in any contamination of soils on the subject site and are located down hydraulic gradient of the site so are not expected to cause contamination via groundwater migration.

A copy of the LLUR documentation is presented in Appendix E.

### 3.2.2 Resource Consents

The ECan online GIS database was searched for resource consents located within a 2 km radius of the site. There are eighty-one resource consents recorded as 'issued-active', with ten recorded as being issued within the site. Consents CRC220897, CRC220897, CRC222635, CRC220897, CRC22089, and CRC222635 are six consent applications currently on-hold for water permitting. Consents CRC222536, CRC222536, CRC222536, CRC221642 are four ground water permits that are active under an S124 continuance and relates to groundwater take for irrigation purposes onsite.

There is considered to be no consented activity that would result in ground contamination that could impact site soils within 2 km of the site.

A table and plot of resource consents within a 2 km radius of the site are presented in Appendix F.

### 3.3 Selwyn District Council Information

The property files for the site were requested from Selwyn District Council and reviewed for this PSI. The files contained various building consents and applications, none of which related to environmental or potentially contaminating activities and therefore were of no relevance to this investigation and have not been listed here. There have been no changes on site since 2020 so no additional information from SDC was sought.

### 3.4 Anecdotal Information

The following information was provided during a telephone discussion on 27 January 2020 with the original site owner Mr Leo Donkers (Camden Group).

- ∴ The property was formerly used for logging until 2005 when the farm was converted from forestry to an irrigated cropping/cattle fattening farm;
- ∴ The site was purchased by the Camden Group in 2010 and converted to an irrigated heifer grazing farm;
- ∴ Several waste pits are located on site, including a former infilled pit on the western boundary and a current pit adjacent to the current yard in the centre of the site. There was no information regarding the composition of the former infilled pit, but the current waste pit was reportedly used for the disposal of general farming waste materials; and
- ∴ The former logging yard in the northern centre of the site formerly had an above ground diesel storage tank of unknown volume for the fuelling of the vehicles used for the forestry operations.

A plan showing the location of the former forestry yard and a plan showing the two pits (infilled and current), as provided by Mr Donkers, has been presented in Appendix G.

As part of updating this PSI in July 2023, the client (Dan McGregor) confirmed that there have been no new potentially contaminating activities at the site since the site inspection in 2020. The site has continued to operate as a working farm.

### 3.5 Site Inspection

A site inspection was undertaken by PDP on 30 January 2020. The main findings from the site inspection are summarised below. Key features are shown in Figure 1 presented in Appendix A and photographs of the site are presented in Appendix B.

- ∴ One main barn of corrugated iron construction is located in the central portion of the site associated with the current farming operations. The southern end of the barn is currently used for the storage of general farming materials/consumables and vehicles including tractors. This portion of the barn is unsealed and some minor hydrocarbon staining was observed on the ground surface. This was considered typical for normal farming operations where equipment is stored. The northern end of the barn is used as a vehicle workshop and has a concrete surface. A hazardous storage cupboard with signage (2WE – Agrichemicals) was evident in the workshop;
- ∴ Two shipping containers are located approximately 50 m north of the barn, with one container marked as containing anhydrous ammonia (fertilizer);
- ∴ In the centre of the site, approximately 200 m north of the barn are two above ground fuel storage tanks. One is an old disused diesel fuel tank and the other the current tank used to fuel the farm vehicles on site. There was no obvious significant staining on the surface surrounding these tanks;
- ∴ A waste pit was visible approximately 35 m east of the fuel storage tanks. The pit was approximately 4-5 m deep and was being used for the disposal of waste farming materials. Visible waste included organic material (vegetation and deceased farm animals), metal (wire etc), concrete, plastics including tarpaulins, and wood (including some treated wood such as fence posts);
- ∴ There were a number of used tyres (100's) placed on the top of the silage stockpile. Other used tyres were stored in the area; and
- ∴ The area of the former infilled pit on the western boundary (as reported by Mr Donkers) showed as a slight depression on the ground surface with relatively sparse grass growth during the site walkover.

## 4.0 Summary of Site History and Potential Sources of Contamination

The available historical information shows the site has been used predominantly for forestry purposes, converting to an irrigated cropping/cattle fattening farm in 2005 and becoming an irrigated heifer grazing farm in 2010 until present. There was no evidence to suggest that any herbicides/pesticides have been used historically at the site.

Key land use activities that may have resulted in contaminating soils/groundwater include:

- ∴ An above ground diesel tank was reportedly present in the yard of the former forestry yard (location estimated based on anecdotal evidence provided). This was likely a small above ground tank. The likelihood of there being any significant contamination in the ground associated with this fuel storage is low.
- ∴ Two above ground fuel storage tanks for refuelling farm vehicles are currently present on site;
- ∴ Storage of bulk fertilisers and other materials such as fence posts and used tyres which are used in the general operational aspects of the farm; and
- ∴ Waste pits/infill pits have been identified at the site. The current farming waste pit was observed during the site inspection and contained organics, metal, concrete, plastics and wood waste. The full composition and extent of the material in the pit is unknown. It is understood that future pits will be used in the general area. The composition of the material within the former infilled pit is unknown. Other pits may also exist across the site associated with general farming practices.

Based on this information, the potential contamination sources from past and present land use activities do exist but are confined to certain areas of the property only (refer Figure 3). The contamination sources were considered to be typical for a large forestry/farming operation.

The identified potential contamination sources/HAIL activities include:-

- ∴ '*Landfill sites*' (HAIL Reference G3) relating to potential for uncontrolled fill within identified past infilled pits and the current waste pit.
- ∴ '*Waste disposal to land*' (HAIL Category G5) associated with storage of general farming materials (treated timber posts) including 100's of used tyres.
- ∴ '*Bulk storage of fertilizer*' (HAIL Category A6) associated with storage of fertilisers onsite.

- ∴ 'Storage tanks or drums for fuel' (HAIL Category A17) associated with former fuel tank in forestry operations yard and two above ground fuel storage tanks located near to the current yard.

HAIL locations on the site are presented in Appendix A, Figure 2.

## 5.0 Preliminary Soil Sampling Exercise

No sampling of soils around the current operational yard area or known pit locations was considered necessary as these HAIL areas will continue to be used so will need to be individually investigated/remediated as the quarry progressively develops and expands into these areas. However, in order to provide a general indication of the contamination status of the broad-acre surface soils across the site (i.e. general soils outside of the identified HAIL areas), a preliminary soil sampling investigation was undertaken. This was to inform developers on whether controls in a Site Management Plan would need to be considered during the handling and management of potentially contaminated surface soils during the quarry development.

It should be noted the soil sampling does not constitute a full detailed site investigation (DSI) for the entire site. Additional targeted sampling would be required as the quarry is developed in identified/discovered HAIL areas.

### 5.1 Soil Sampling Strategy and Analysis

An appropriate soil sampling strategy was derived to meet the objectives described above. A total of 15 soil samples (SS1 to SS15) were collected in a general grid pattern across the site in order to provide broad acre coverage.

A plan showing the soil sampling locations is presented on Figure 1, Appendix A.

The soil profiles across the site displayed silty topsoil to a depth of 0.2 m – 0.3 m bgl, underlain by sandy gravel.

No obvious stains, odours or possible contamination sources were observed during the collection of the soil samples from across the site.

Representative soil samples were collected from the surface soils. On each occasion, a clean pair of nitrile gloves was used for sample collection to prevent cross contamination between samples and to protect the PDP site worker during sample collection. All samples were placed directly into glass jars with food grade plastic sealed lids supplied by Analytica Laboratories Limited (Analytica). Following collection, these samples were placed immediately into a chilly-bin containing frozen ice packs. The chilly-bin was sent with chain of custody documentation to Analytica in Hamilton for analysis. The samples were received the following day after shipment.

Samples were analysed for heavy metals and organochlorine pesticides (OCPs). These compounds are considered to provide a general indication as to the presence of any likely contamination associated with the general horticultural/agricultural land use activities across the site.

## 5.2 Selected Guideline Criteria

In the absence of any applicable land use standards/guidelines for the future use of the site, comparison of the laboratory results to the ECan background soil concentrations for selected trace elements in the major Canterbury soil groups has been undertaken (ECan, 2007). In particular, the total recoverable metals analytical results have been compared with ECan Level Two background soil concentrations for the 'Yellow Brown Stony' soil group in which the land is located.

Whilst OCP compounds are anthropogenic it is important to note that due to their historical ubiquitous application in agriculture, parklands and turf management they can be considered to also be present at low but detectable 'background' concentrations (MfE, 1998). While there are no official ECan background soil concentrations, ECan has recently recognised that some OCPs are ubiquitous in the environment and has adopted an interim 'background' level (0.431 mg/kg) for  $\sum\text{DDT}^2$  (OCP compounds). This value was taken from the report prepared by MfE entitled '*Ambient Concentrations of Selected Organochlorines in Soils*' and dated December 1998.

## 5.3 Soil Sampling Results and Comparison to Guideline Criteria

The selected guideline criteria for heavy metals and OCPs are presented in Table A, Appendix H. A copy of the laboratory report and chain of custody documentation are presented in Appendix I.

### Heavy Metals

All fifteen samples collected and analysed from locations SS1 to SS15 recorded heavy metal concentrations below the ECan (2007) background levels for the local soil type.

### OCPs

No detectable OCP compound concentrations were reported in any of the fifteen samples, therefore all samples were below the MfE (1998) background level.

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<sup>2</sup> For this assessment, the results for DDT, DDD and DDE are summed together ( $\sum\text{DDT}$ ) and compared to background soil concentrations and the soil contaminant standard for DDT.



## 6.0 Consideration of the NESCS

### 6.1 Provisions of the NESCS

The NESCS seeks to control activities on contaminated land so as to protect human health. The regulations apply to land which is described as having, has had or is more likely than not to have had an activity or industry described in the HAIL undertaken on it (i.e. the 'piece of land').

As discussed in Section 4.0, there have been land use activities carried out within discrete areas of the site that have the potential to have caused land contamination (i.e. HAIL areas) and these will need to be considered during future site development works. Soil sampling across the remainder of the site (i.e. outside of the identified HAIL areas) showed concentrations of key indicator contaminants at background levels for the area.

As the site is currently being used as 'production land', under regulation 5(8) the NESCS has only limited applicability, and applies for the following activities only:

- ∴ 5(8)(a) Removal or replacement of a fuel storage system;
- ∴ 5(8)(b) Soil disturbance of the piece of land which is being used for residential purposes (note that there is currently no residential use at the site currently);
- ∴ 5(8)(c) Subdivide the land in a way that causes the piece of land to stop being productive land; and
- ∴ 5(8)(d) Change of the use of the land in a way that causes the piece of land to stop being production land.

Therefore, on the basis of the above, the NESCS is not applicable for the current soil disturbance activities and general operation for 'production land'. However, the proposed change in land use as a quarry is not defined as 'production land' under the Section 2 of Resource Management Act (RMA; 1991) and therefore the NESCS regulations will need to be taken into consideration for the proposed quarry development.

For the proposed quarry development, the NESCS will potentially apply to the following activities:

- ∴ Disturbance of soils in the identified HAIL areas under regulation 5(4); and
- ∴ Changing the use of a land under regulation 5(6).

**Soil disturbance** is a permitted activity under regulation 8(3) provided that controls are put in place to minimise contact with soil during the disturbance, that the soil be reinstated to an erosion-resistant state within one month of completion of the works and that disposal of removed soil is to a facility authorised to receive such waste. The NESCS also sets limits on the volume of

soil disturbance (no more than 25 m<sup>3</sup> per 500 m<sup>2</sup> is disturbed), soil removal (no more than 5 m<sup>3</sup> per 500 m<sup>2</sup> is removed from the site per year) and duration of works (no longer than two months). Based on the nature of quarrying activities, these conditions will unlikely be able to be met so under regulation 8(5) the activity of soil disturbance in those areas where HAIL activities have been identified will require resource consent. No soil sampling has been undertaken in the identified HAIL areas as they will continue to be used for this activity in the short to medium term. As such, the consent application will need to proceed down the **discretionary activity** process.

**Change in land use** is a permitted activity under regulation 8(4) if it can be demonstrated through the review of the site history that it is highly unlikely that there will be a risk to human health if the activity is done to the 'piece of land'. Given the proposed activity will involve the disturbance of confirmed HAIL areas including farming landfill pits, there is the potential for exposure to uncharacterised waste material/contaminants and therefore a potential risk to human health exists. A resource consent would therefore be required to be obtained for the change in land use. Given the absence of a detailed site investigation of the identified HAIL areas, the consent application will need to proceed down the **discretionary activity** process.

The recommended approach to manage the identified contamination sources is to undertake targeted detailed site investigations of each HAIL area as the quarry development progresses (i.e. immediately prior to disturbance of these identified areas). This will ensure that any contamination sources associated with the ongoing use of the site as production land is captured in the assessments. The results of the testing will determine the appropriate course of action that is required and what remedial works, if any, are required. This would be outlined in a Site Management Plan prepared for the quarry development works.

There has been no assessment of any other consenting requirements associated with the operation of a quarry at the site.

## 7.0 Summary and Conclusions

PDP has reviewed and updated the available site history information for the portion of land within the property defined as 139 Grange Road, Burnham to reflect current site conditions as of July 2023. The objective of the investigation was to identify any potential sources of contamination from past and/or present land use activities at the site, determine an indication of the contamination status of the near surface soil through a limited soil sampling investigation and to assess the applicability of the NESCS for the future progressive development of the site as a quarry. This has been carried out to support the consenting process.

The site appears to have been used as a forestry plantation from at least the 1940's until circa 2005. In 2005 the farm was converted to an irrigated cropping/cattle fattening farm and more recently since 2010 the property has

been operated as an irrigated heifer grazing farm. The following HAIL activities have been identified across the site:

- ∴ *'Landfill sites'* (HAIL Reference G3) relating to potential for uncontrolled fill within identified past infilled pits (based on anecdotal information provided) and the current operational farming waste pit(s).
- ∴ *'Waste disposal to land'* (HAIL Category G5) associated with storage of general farming materials (treated timber posts) including 100's of used tyres.
- ∴ *'Bulk storage of fertilizer'* (HAIL Category A6) associated with bulk storage of fertilisers onsite.
- ∴ *'Storage tanks or drums for fuel'* (HAIL Category A17) associated with former fuel tank in forestry operations yard and two above ground fuel storage tanks located near to the current yard.

No sampling of soils around the current operational yard area or known pit locations was completed as these areas will continue to be used for the ongoing operation of the farm and the progressive development of the quarry. However, broad-acre sampling of surface soils outside of the HAIL areas was undertaken to provide an initial indication to the presence of any contaminants in the near surface soils. The sampling results showed the likely key indicator contaminants (i.e. heavy metals and OCPs) at background levels for the area.

On the basis of the site history information and preliminary soil sampling results, a number of potentially contaminating activities have been identified at the site, however these are in discrete areas only and should not be interpreted across the wider site. These contamination sources were considered to be typical for a large forestry/farming operation.

As the site is currently being used as 'production land', the NESCS is not applicable for the current soil disturbance activities and general operation for the current use of the site. However, the proposed change in land use as a quarry is not defined as 'production land' and therefore the NESCS regulations (soil disturbance and change in land use) will need to be taken into consideration for the proposed quarry development. Given these HAIL areas will continue to be used for the short to medium term, a detailed site investigation has not been undertaken so the consent application will need to proceed down the **discretionary activity** process.

The recommended approach to manage the identified contamination source areas during the proposed future quarrying operations is through the development and implementation of a Site Management Plan. This would include the requirement to further investigate the HAIL areas identified in this PSI prior to any quarrying activities taking place in the sections of the quarry identified. It is recommended that this is included as a condition of the land use consent issued for the operation of the quarrying activities.

## 8.0 References

Forsyth, Barrell and Jongens., 2008; 1:250,000. Geology of the Christchurch Area. Institute of Geological and Nuclear Sciences 1:25,000 Geological Map 16. Lower Hutt, New Zealand.

Environment Canterbury, 2007. *Background concentrations of selected trace elements in Canterbury soils. Addendum 1: Additional samples and Timaru specific background levels.* Environment Canterbury Report R07/1/2.

Ministry for the Environment, 2011. *Hazardous Activities and Industries List.* Ministry for the Environment, Wellington.

Ministry for the Environment, 2011a. *Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand.* Ministry for the Environment, Wellington.

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

*Resource Management (National Environment Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.*

## 9.0 Report Limitations

This report has been prepared on the basis of information provided by Burnham 2020 Ltd and others (not directly contracted by PDP for the work). PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared based on: visual observations of the site vicinity and analysis of fifteen soil samples. Soil samples were analysed by an analytical laboratory for a suite of heavy metals and OCPs. The site conditions as described in this report have been interpreted from, and are subject to, this information and its limitations and accordingly PDP does not represent that its interpretation accurately represents the full site conditions.

This report is based on the observation and sampling at fifteen locations at the site. The environmental conditions have been interpolated between the sampling locations, and accordingly the interpolated conditions cannot be guaranteed to be accurate.

The laboratory test results provide an approximation of the concentration of the tested parameters and are subject to the inherent limitations of the laboratory techniques used for the tests.

PDP has sampled and tested only for those chemicals that are described in this report. The presence or absence of other chemicals at the site is not considered in this report.

The information contained within this report applies to sampling soil undertaken on the date stated in this report, or if none is stated, the date of this report. With time, the site conditions and environmental standards could change so that the reported assessment and conclusions are no longer valid. Accordingly, the report should not be used to refer to site conditions and environmental standards applying at a later date without first confirming the validity of the report's information at that time.

This report has been prepared by PDP on the specific instructions of Burnham 2020 Ltd for the limited purposes described in the report. PDP accepts no liability if the document is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

*© 2023 Pattle Delamore Partners Limited*

## Appendix A: Figures

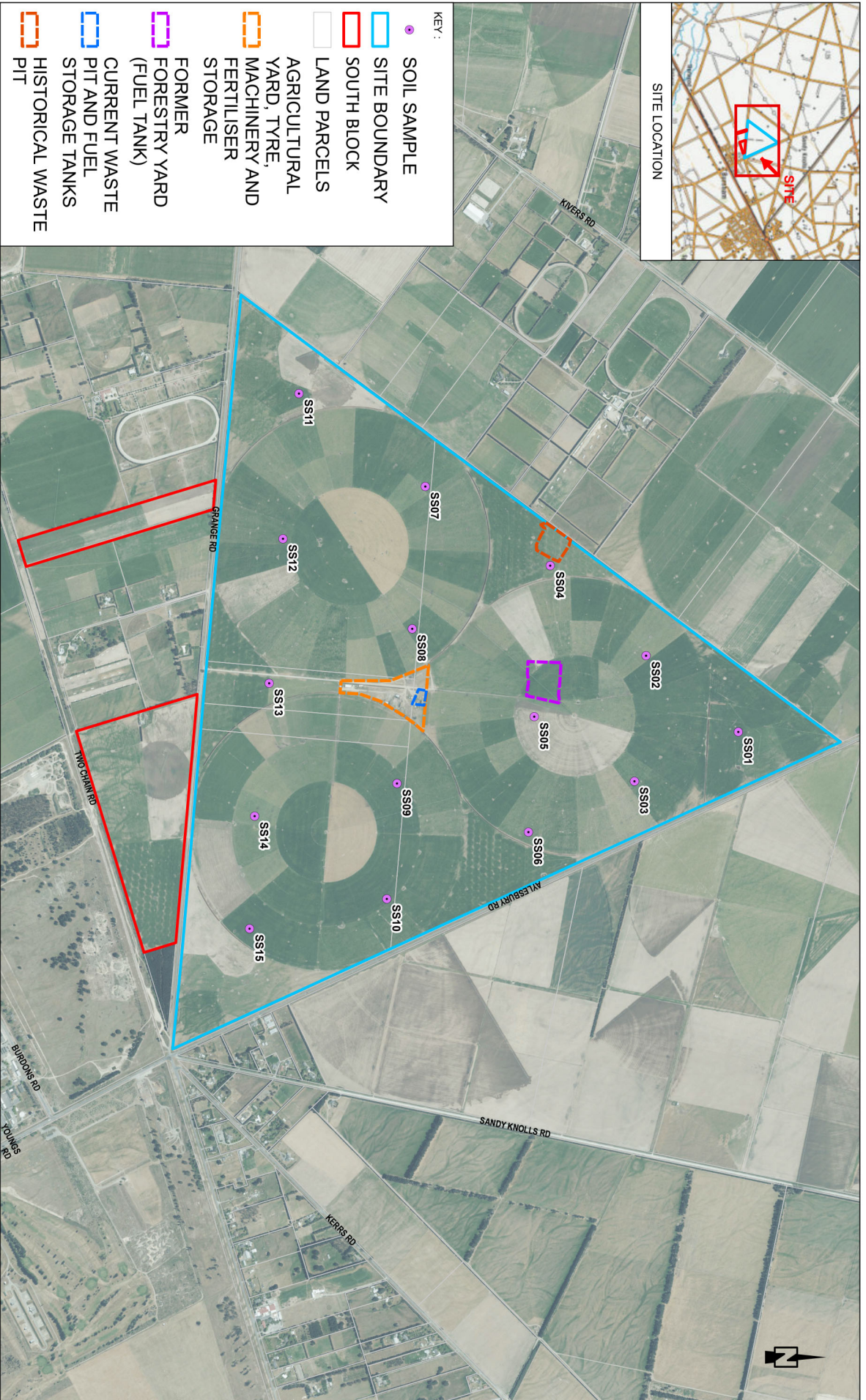


FIGURE 1: SITE LOCATION, SITE BOUNDARY AND SOIL SAMPLE LOCATIONS



FIGURE 2: HAIL LOCATIONS



## Appendix B: Site Photographs



**Photograph 1: (View north from the yard looking towards the silos)**



**Photograph 2: (View south towards the entrance of the site and the yard (historical fuel tank in left field of view))**



**Photograph 3: (Fuel storage tanks, historical (red tank) and current (white))**



**Photograph 4: (View of the northern side of the barn and mechanics workshop)**



**Photograph 5: (Inside of barn showing storage of various materials and some hydrocarbon staining on sandy gravel surface)**



**Photograph 6: (Current waste pit looking north-east, showing soil profile on northern edge of pit and waste material including wood, organics and tyres)**

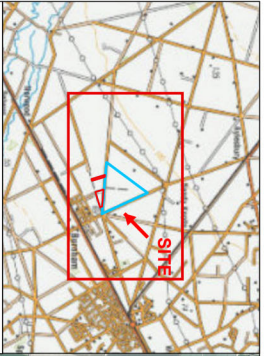


**Photograph 7: (Close up of waste material, including dead stock)**

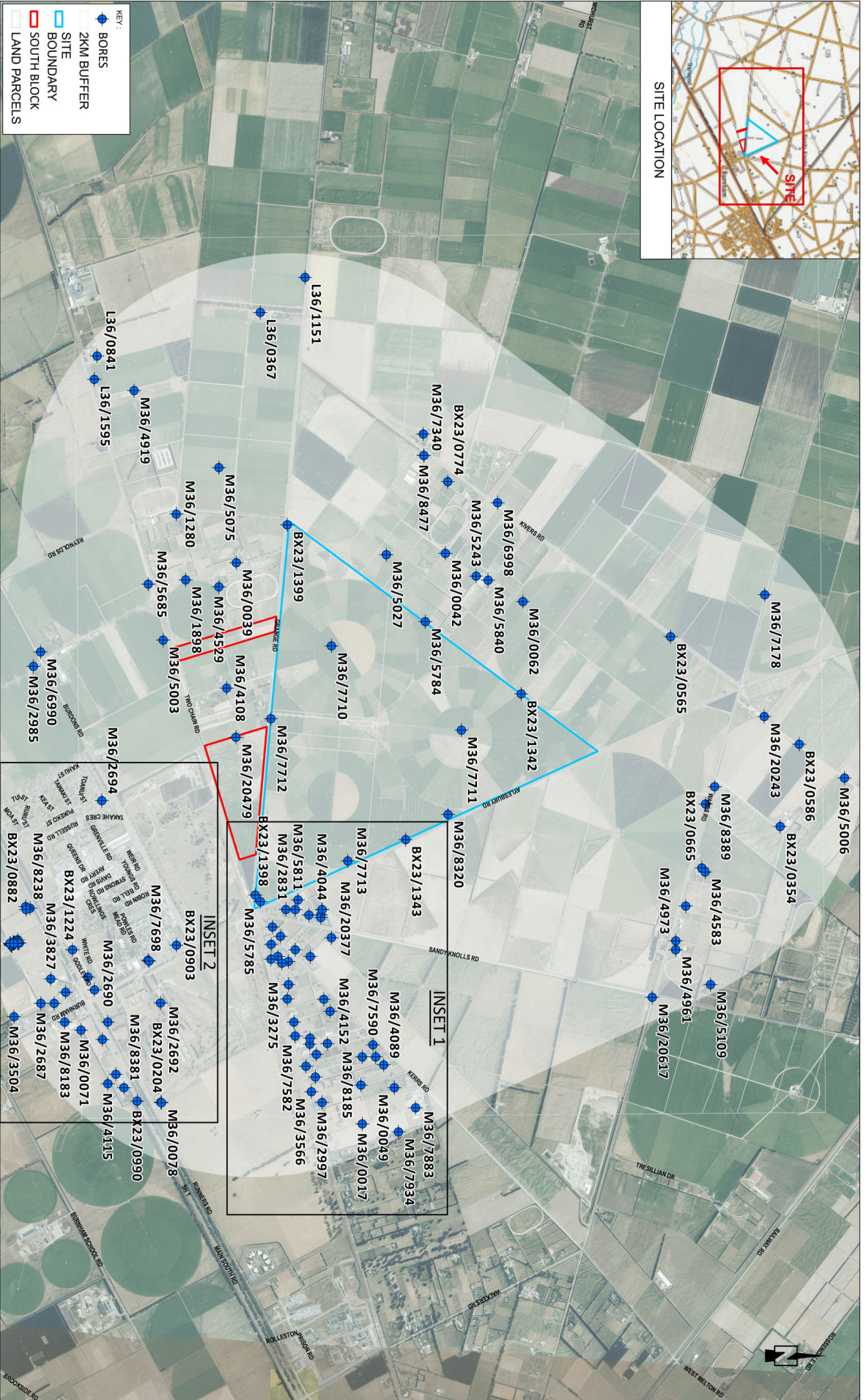


**Photograph 8: (Disturbed ground/depression shown on western boundary of site where former waste pit is located)**

## **Appendix C: Environment Canterbury Bore Information**



SITE LOCATION



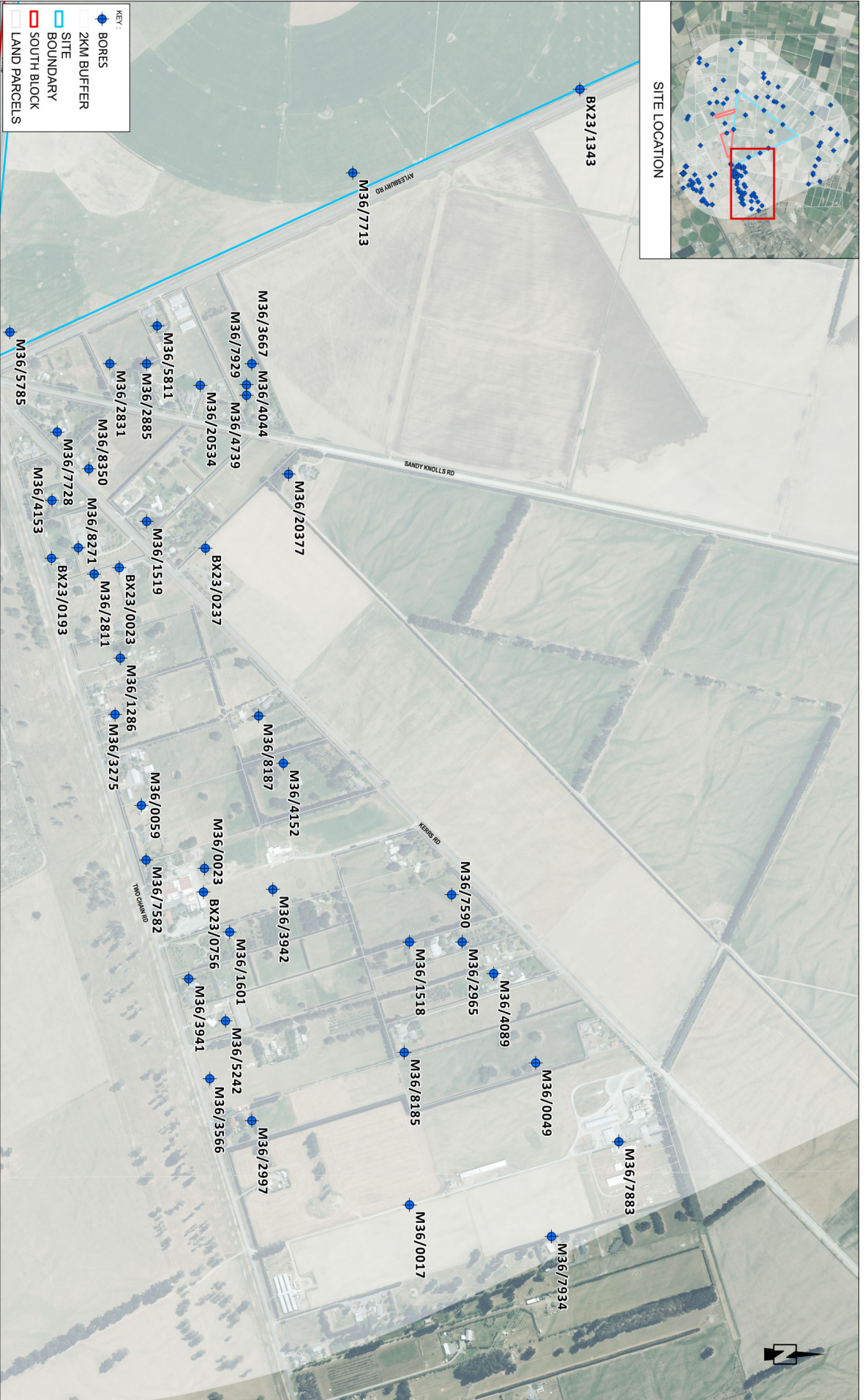
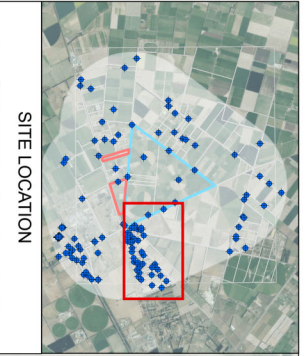
KEY:

- ◆ BORES
- 2KM BUFFER
- SITE
- SOUTH BLOCK
- LAND PARCELS

SOURCE:  
 1. AERIAL IMAGERY / FLOW (2015-2018) SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION-INTERNATIONAL LICENSE  
 2. BORE DATA SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION-INTERNATIONAL LICENSE  
 3. LAND DATA SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION-INTERNATIONAL LICENSE  
 4. ROAD DATA SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION-INTERNATIONAL LICENSE  
 5. ROAD DATA SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION-INTERNATIONAL LICENSE  
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 10. ROAD DATA SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION-INTERNATIONAL LICENSE

BORES WITHIN 2 KM OF SITE BOUNDARY



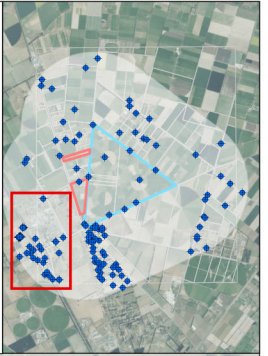


INSET 1: BORES WITHIN 2 KM OF SITE BOUNDARY

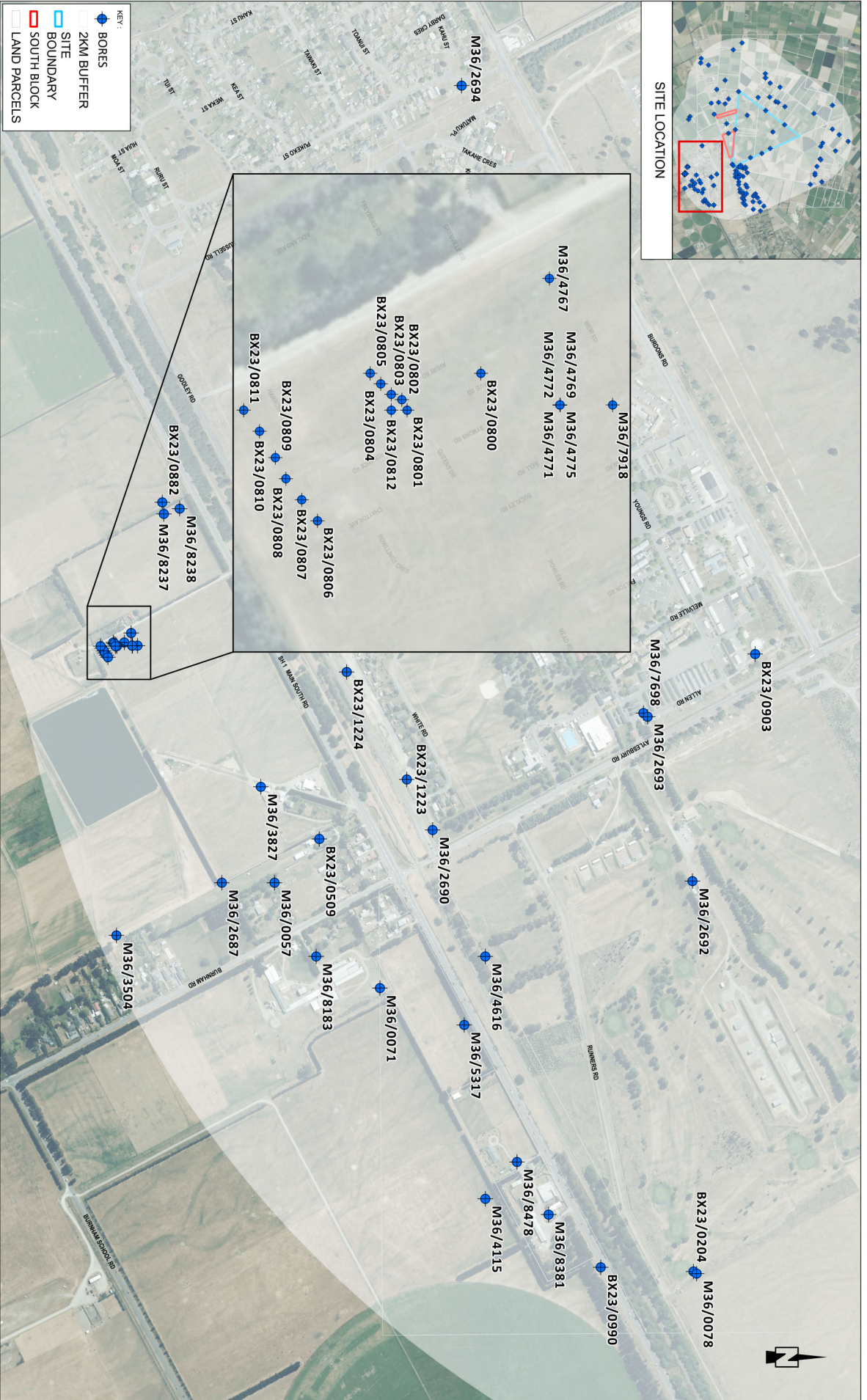


SOURCE:  
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 2. BORE DATA AND BOUNDARY DATA SOURCED FROM THE LINZ DATA SERVICE. THIS DATA IS PROVIDED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.  
 3. LAND PARCEL DATA SOURCED FROM THE LINZ DATA SERVICE AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.  
 4. SOUTH BLOCK DATA SOURCED FROM THE LINZ DATA SERVICE AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.  
 5. BURNHAM 2020 LTD - BURNHAM QUARRY

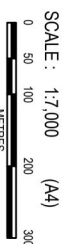




SITE LOCATION



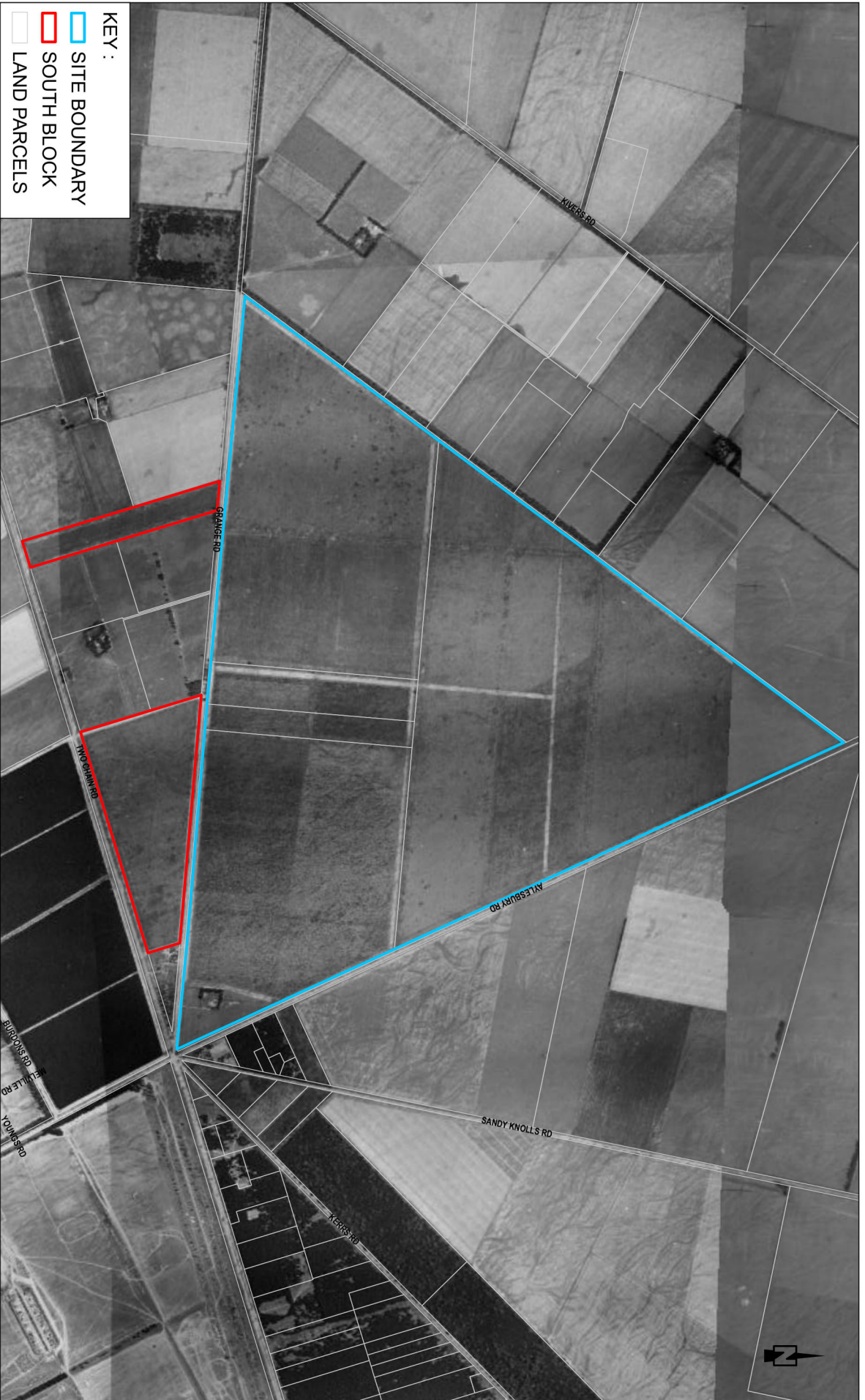
INSET 2: BORES WITHIN 2 KM OF SITE BOUNDARY



**SOURCE:**  
 1. AERIAL IMAGERY (FROM 2015-2018) SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY CIA FOR REUSE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.  
 2. LAND PARCEL BOUNDARIES AND SOUTH BLOCK BOUNDARIES SOURCED FROM THE LINZ DATA SERVICE (https://data.linz.govt.nz/) AND LICENSED FOR REUSE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.  
 3. BORE LOCATION DATA PROVIDED BY ENVIRONMENT CANTONBURY AND USED WITH PERMISSION.



## Appendix D: Historical Aerial Photographs



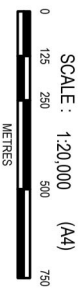
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■ SITE BOUNDARY

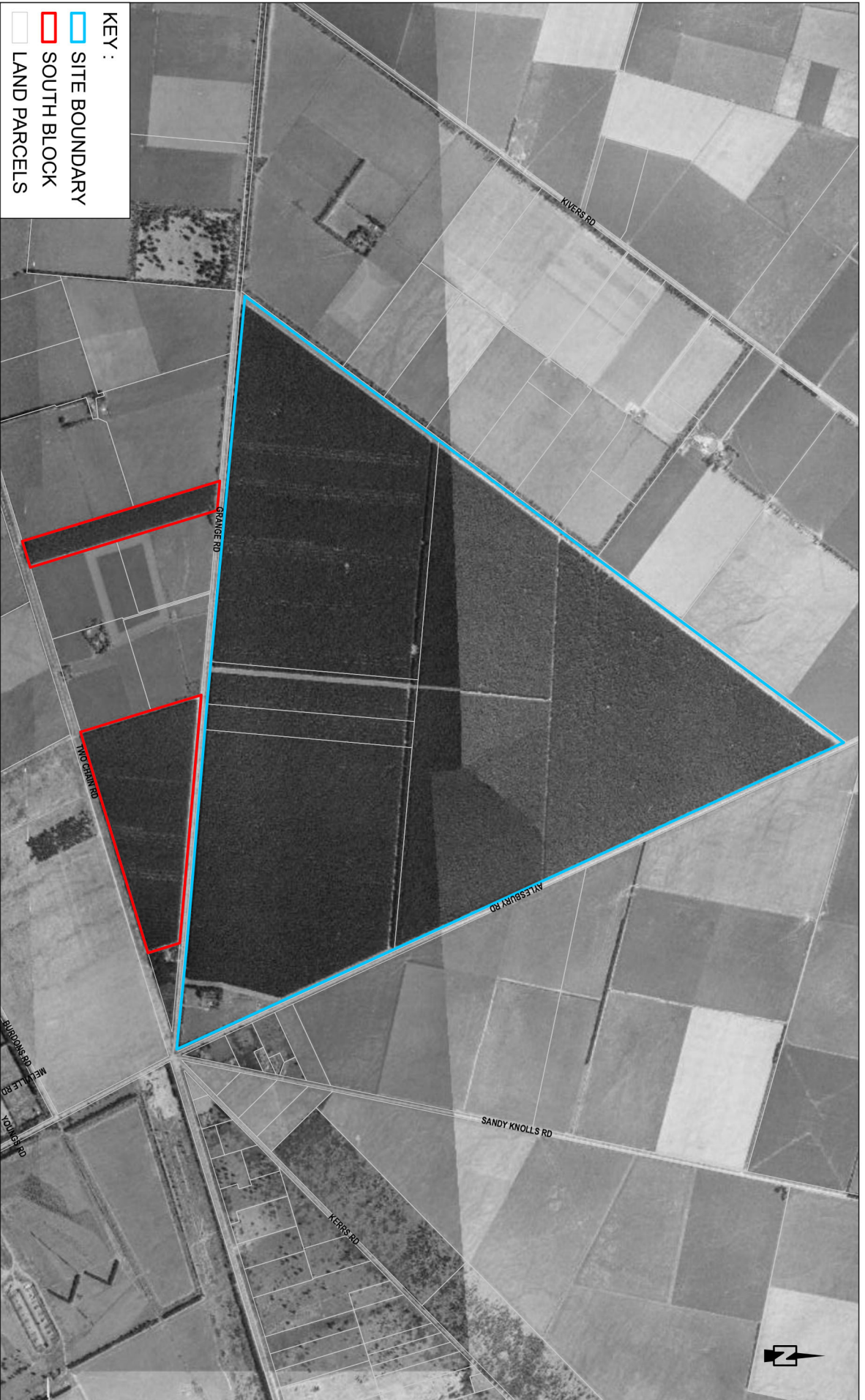
■ SOUTH BLOCK

□ LAND PARCELS

AERIAL PHOTOGRAPH: 1942



SOURCE:  
AERIAL IMAGERY SOURCED FROM CARTAGRIFF MAPS AND LICENSED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.  
LAND PARCELS DATA SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.



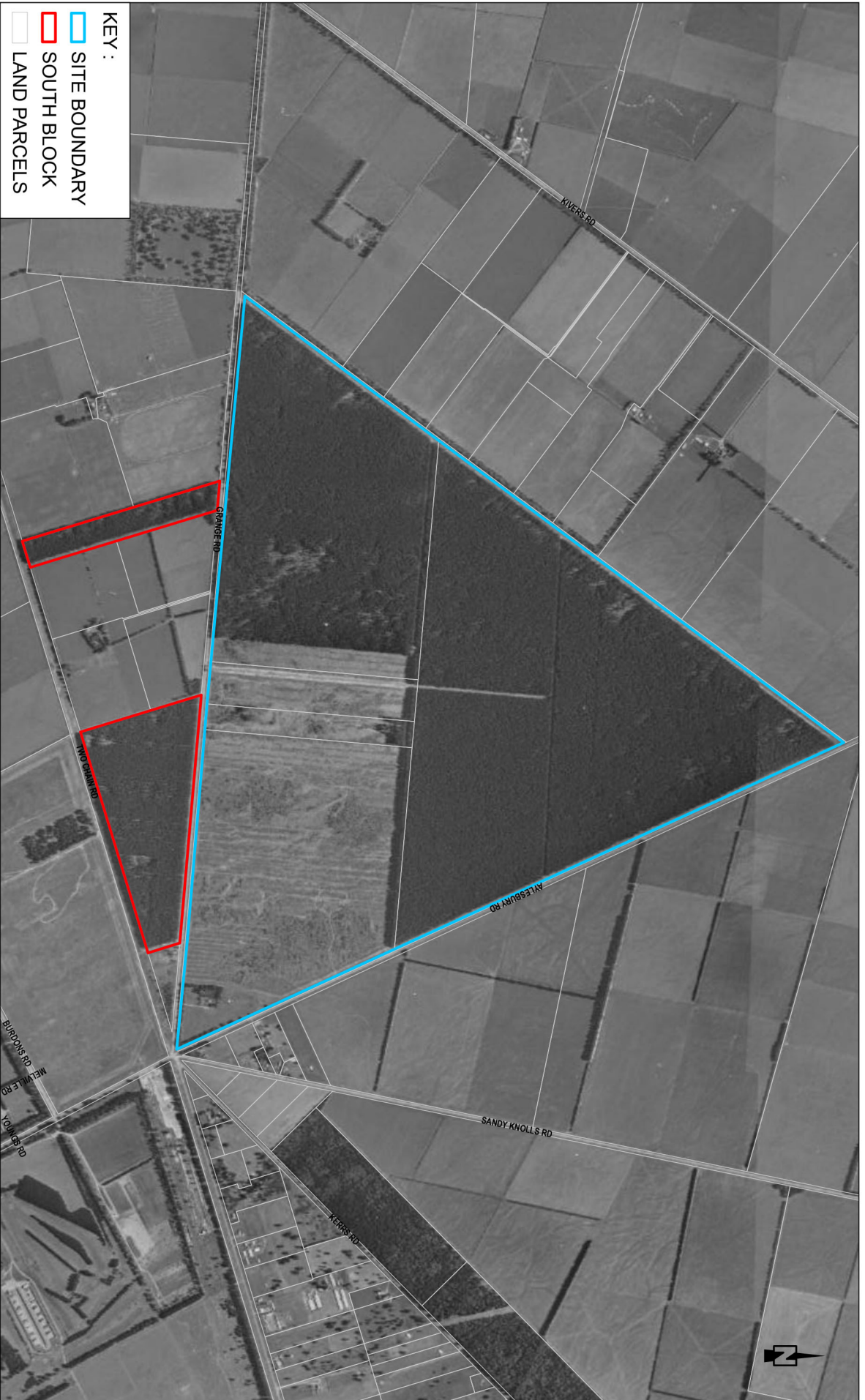
**KEY :**

- SITE BOUNDARY
- SOUTH BLOCK
- LAND PARCELS

SOURCE:  
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BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS  
ATTRIBUTION 4.0 INTERNATIONAL LICENSE  
LAND DATA SERVICE https://data.linz.govt.nz/ and SRTM DATA SOURCED FROM  
THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE  
UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL  
LICENSE.

**AERIAL PHOTOGRAPH: 1962**





**KEY :**

- SITE BOUNDARY
- SOUTH BLOCK
- LAND PARCELS

SOURCE:  
AERIAL IMAGERY SOURCED FROM CARTERRARY MAPS AND LICENSED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.  
LAND DATA SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.

AERIAL PHOTOGRAPH: 1974





**KEY :**

- SITE BOUNDARY
- SOUTH BLOCK
- LAND PARCELS

SOURCE:  
AERIAL IMAGERY SOURCED FROM CARTERRARY MAPS AND LICENSED  
BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS  
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LAND DATA SERVICE: https://data.land.govt.nz/ AND METS SOURCED FROM  
THE LINZ DATA SERVICE: https://data.land.govt.nz/ AND LICENSED FOR RE-USE  
UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL  
LICENSE.

AERIAL PHOTOGRAPH: 1982





KEY :  
SITE BOUNDARY  
SOUTH BLOCK  
LAND PARCELS

AERIAL PHOTOGRAPH: 1994

SOURCE:  
AERIAL IMAGERY SOURCED FROM CARTERRARY MAPS AND LICENSED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.  
LAND BOUNDARIES AND SITE SOURCED FROM THE LINZ DATA SERVICE <https://data.linz.govt.nz/> AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.

CH4098100.mxd 23/07/2023 ISSUE 1

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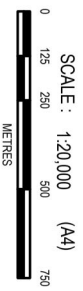


KEY :

- SITE BOUNDARY
- SOUTH BLOCK
- LAND PARCELS

SOURCE:  
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LAND DATA SERVICE: https://data.land.govt.nz/ AND INST SOURCED FROM THE LINZ DATA SERVICE https://data.land.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.

AERIAL PHOTOGRAPH: 2000



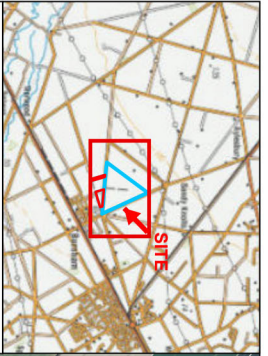


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SOUTH BLOCK  
LAND PARCELS

AERIAL PHOTOGRAPH: 2015-16

SOURCE:  
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LAND PARCELS DATA SOURCED FROM THE LINZ DATA SERVICE. THE LINZ DATA SERVICE IS PROVIDED UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.

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SITE LOCATION



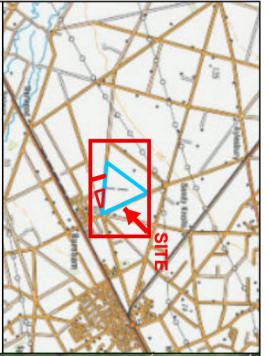
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- LAND PARCELS
- SOUTH BLOCK

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2 COASTAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE  
LINZ DATA SERVICE. THIS DATA SERVICE IS USED FOR REFERENCE UNDER  
3 BORE INFORMATION PROVIDED BY ENVIRONMENT CANTEBURY AND USED  
WITH PERMISSION.

AERIAL PHOTOGRAPH: 2020





SOURCE:  
1. AERIAL IMAGERY SOURCED FROM LINZ  
2. COASTAL/TOPOGRAPHICAL INFORMATION AND INSERT SOURCED FROM THE  
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3. BORE INFORMATION PROVIDED BY ENVIRONMENT CANTEBURY AND USED  
WITH PERMISSION.

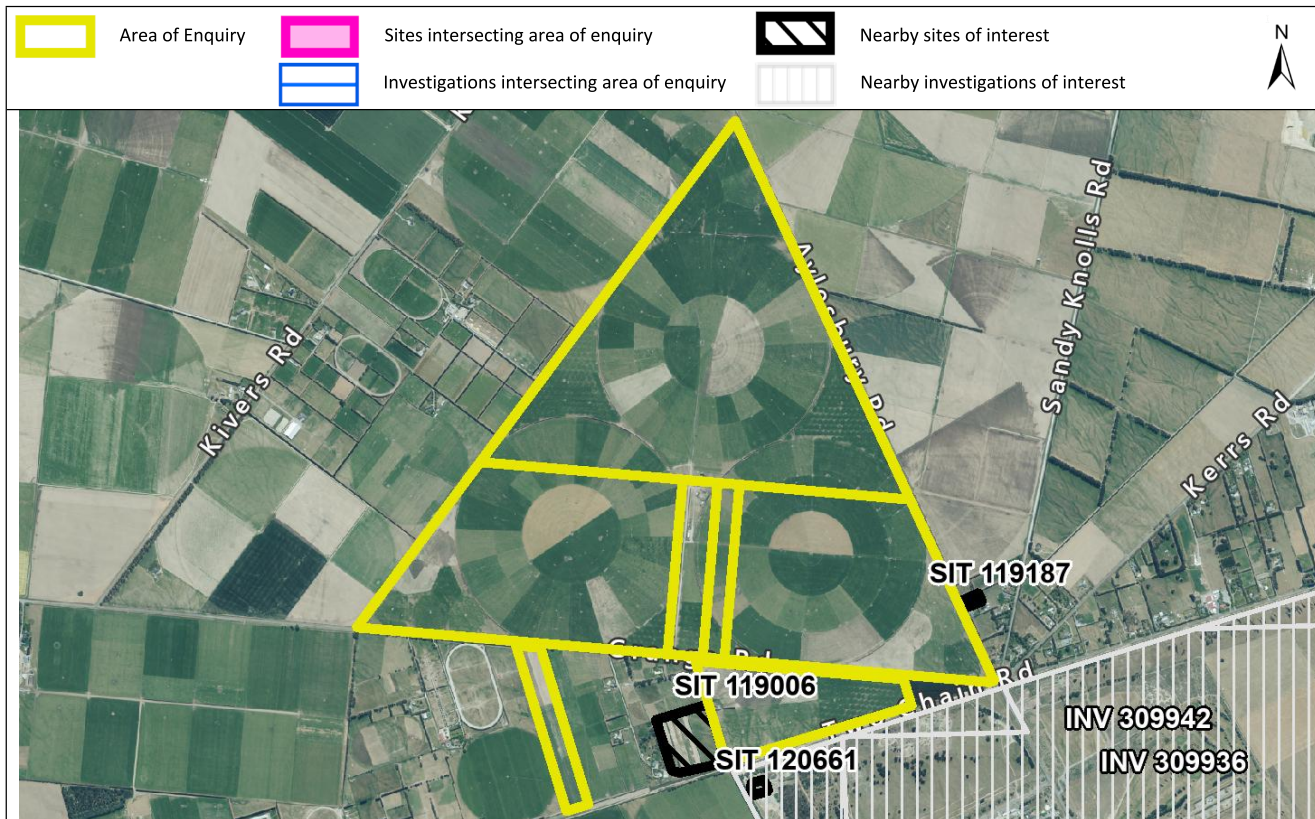
AERIAL PHOTOGRAPH: 2022

**Appendix E: Environment Canterbury  
Listed Land Use Register**

# Property Statement from the Listed Land Use Register

Visit [ecan.govt.nz/HAIL](http://ecan.govt.nz/HAIL) for more information or contact Customer Services at [ecan.govt.nz/contact/](http://ecan.govt.nz/contact/) and quote ENQ349144

**Date generated:** 13 July 2023  
**Land parcels:** RS 27777  
 RS 27724  
 RS 19387  
 RS 25412  
 RS 27725  
 RS 27776  
 RS 27862



The information presented in this map is specific to the area within a 200m radius of property you have selected. Information on properties outside the search radius may not be shown on this map, even if the property is visible.

## Sites at a glance

 Sites within enquiry area

Site number	Name	Location	HAIL activity(s)	Category
-------------	------	----------	------------------	----------

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

 Nearby sites

Site number	Name	Location	HAIL activity(s)	Category
119006	177 Grange Rd	177 Grange Rd	A10 - Persistent pesticide bulk storage or use;	Not Investigated
119187	168 Aylesbury Rd	168 Aylesbury Rd	A10 - Persistent pesticide bulk storage or use;	Not Investigated
120661	RES 1176, Burnham	RES 1176, Burnham	G3 - Landfill sites;	Not Investigated

Please note that the above table represents a summary of sites and HAILs intersecting the area of enquiry within a 200m buffer.

## More detail about the sites

### Site 119006: 177 Grange Rd (Within 200m of enquiry area.)

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

Location: 177 Grange Rd  
Legal description(s): Lot 3 DP 55816

HAIL activity(s):	Period from	Period to	HAIL activity
	1994	2005	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

#### Notes:

- 5 Nov 2014** This record was created as part of the Selwyn District Council 2015 HAIL identification project.
- 5 Nov 2014** Vineyard
- 5 Nov 2014** Area defined from 1994 to 2005 aerial photographs. Horticultural activities (persistent pesticides) were noted in aerial photographs reviewed.
- 5 Nov 2014** Area defined from 1994 to 2005 aerial photographs. Horticultural activities (persistent pesticides) were noted in aerial photographs reviewed.



#### Investigations:

There are no investigations associated with this site.

### Site 119187: 168 Aylesbury Rd (Within 200m of enquiry area.)

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

Location: 168 Aylesbury Rd  
Legal description(s): Lot 3 DP 21748

HAIL activity(s):	Period from	Period to	HAIL activity
	2000	Present	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

#### Notes:

- 5 Nov 2014** This record was created as part of the Selwyn District Council 2015 HAIL identification project.
- 5 Nov 2014** Greenhouse and tunnel house
- 5 Nov 2014** Area defined from 2000 to present aerial photographs. Horticultural activities (persistent pesticides) were noted in aerial photographs reviewed.



#### Investigations:

There are no investigations associated with this site.

### Site 120661: RES 1176, Burnham (Within 200m of enquiry area.)

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

Location: RES 1176, Burnham  
Legal description(s): RES 1176

HAIL activity(s):

Period from	Period to	HAIL activity
1994	Present	Landfill sites

**Notes:**

7 Jan 2016

This record was created as part of the Selwyn District Council 2015 HAIL identification project.

7 Jan 2016

Area defined from 1994 to present aerial photographs. A landfill site was noted in aerial photographs reviewed.



**Investigations:**

**INV 309942**

**PFAS Preliminary Site Investigation: Burnham Military Camp**

Pattle Delamore Partners Ltd - Preliminary Site Investigation

1 May 2019

**Summary of investigation(s):**

Environment Canterbury has received a Preliminary Site Investigation report that includes all or part of the property you have selected.

A Preliminary Site Investigation seeks to identify potential sources of contamination resulting from current and historical land uses.

The preliminary site investigation may not have found any potential sources of contamination on the property you have enquired about. Where potential sources of contamination have been identified, a site identification number (e.g. SIT 1234) and land uses from the Hazardous Activities and Industries List (HAIL) will be shown on your statement.

This investigation has not been summarised.



**Nearby investigations of interest**

**INV 309936**

**NZDF HAIL Investigation Report**

ENGEO - Preliminary Site Investigation

1 Mar 2018

**Summary of investigation(s):**

Environment Canterbury has received a Preliminary Site Investigation report that includes all or part of the property you have selected.

A Preliminary Site Investigation seeks to identify potential sources of contamination resulting from current and historical land uses.

The preliminary site investigation may not have found any potential sources of contamination on the property you have enquired about. Where potential sources of contamination have been identified, a site identification number (e.g. SIT 1234) and land uses from the Hazardous Activities and Industries List (HAIL) will be shown on your statement.

This investigation has not been summarised.

## Disclaimer

The enclosed information is derived from Environment Canterbury's Listed Land Use Register and is made available to you under the Local Government Official Information and Meetings Act 1987.

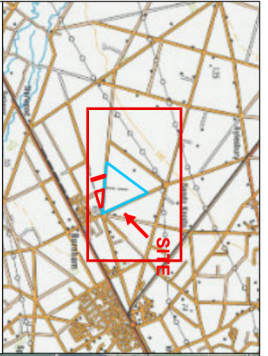
The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness 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.

Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

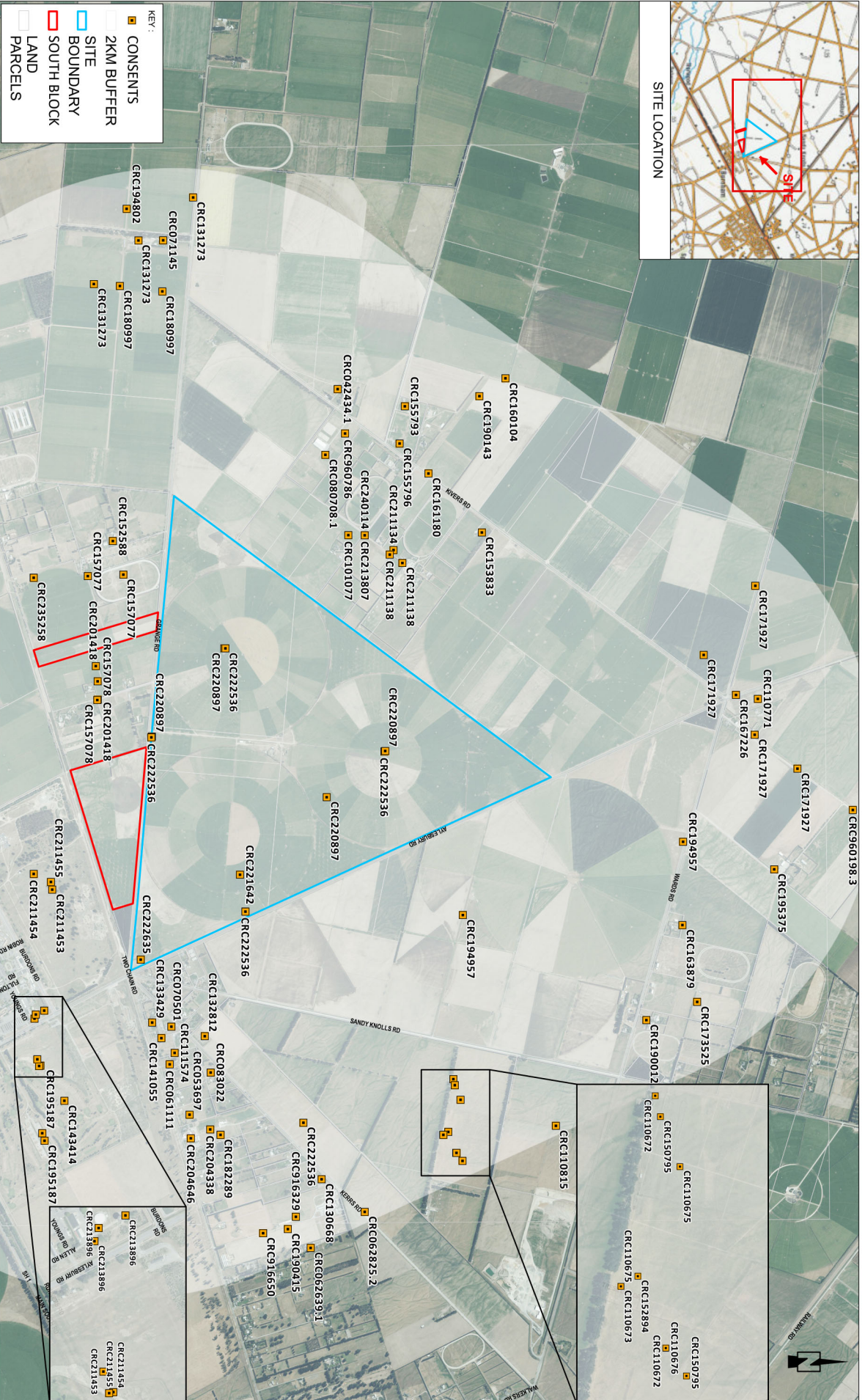




**Appendix F: Environment Canterbury  
Resource Consent Information**



SITE LOCATION



KEY:

- CONSENTS
- 2KM BUFFER
- SITE
- SOUTH BLOCK
- LAND
- PARCELS

RESOURCE CONSENTS WITHIN 2 KM OF SITE BOUNDARY



SOURCE:  
 1. AERIAL IMAGERY (10/11/2015-2019) SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY CIA. FOR REUSE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.  
 2. AERIAL IMAGERY (2019-2023) SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY CIA. FOR REUSE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.  
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 10. AERIAL IMAGERY (2019-2023) SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY CIA. FOR REUSE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENSE.



## Appendix G: Anecdotal Information



# Burnham Farm 384 ha

Existing rubbish hole.  
Used for Organic, plant and  
lead stock. Burnt periodically

Old rubbish hole that  
has filled in



KIVERS ROAD

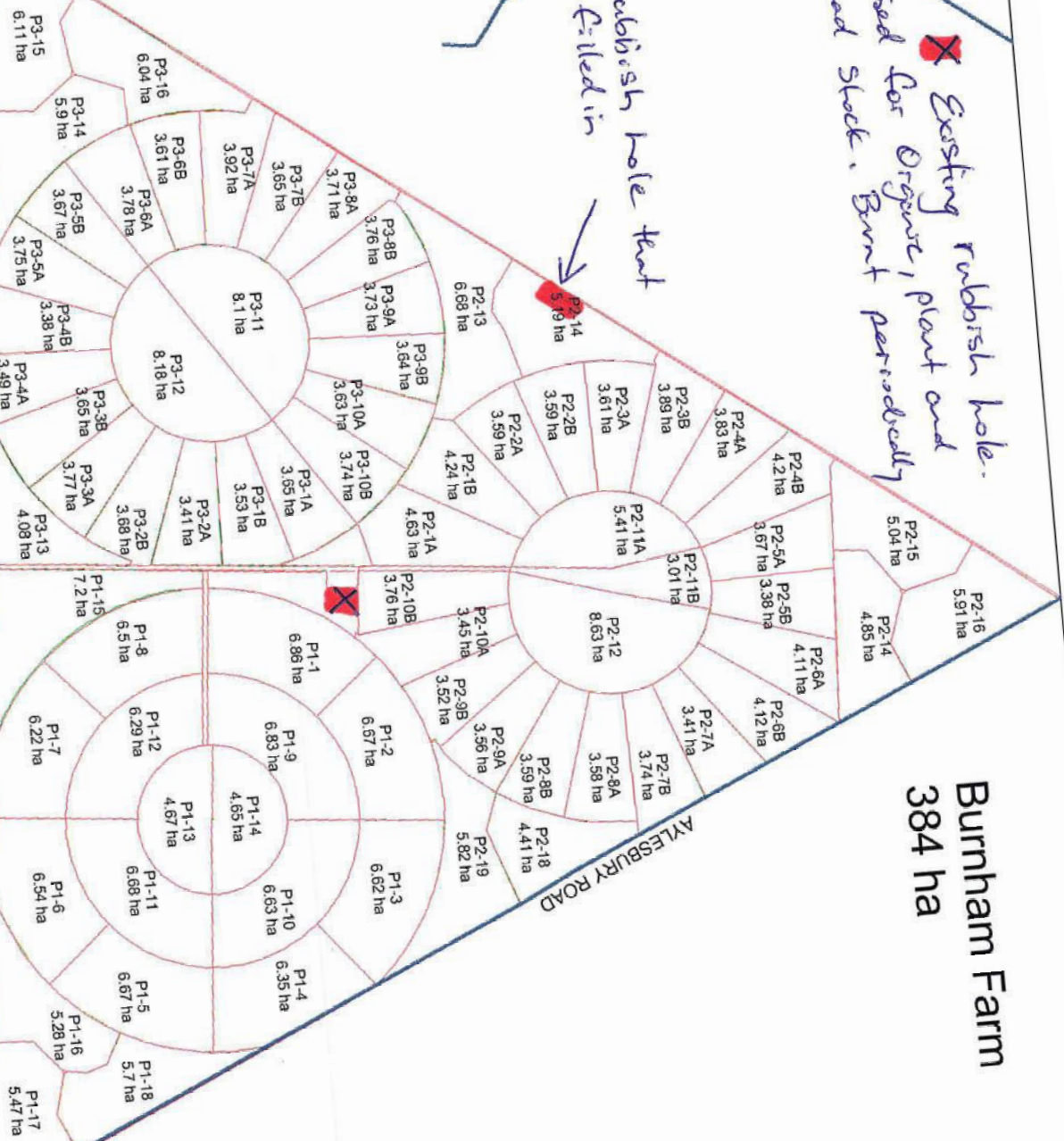
GRANGE ROAD

AYLESBURY ROAD

SANDY KNOLLS ROAD

KERRS ROAD

TWO CHAIN ROAD



Smiths



Laneways

Pivot 3  
88.71

160  
14.65

171  
10.93

151  
14.6

172  
15.75

152  
16.6

180  
9.84

190  
7.54

141  
11.66

140  
9.34

200  
5.35

142  
7.07

P102  
6.67

P103  
6.62

P101  
6.86

P1M1  
6.83

P1C1  
4.65

P1M2  
6.63

P1O4  
6.4

P1C1  
4.67

P1M3  
6.68

P1O5  
6.67

220  
16.51

P1O8  
6.5

P1M4  
6.29

210  
4.14

130  
7.38

P1O7  
6.25

P1O6  
6.56

120  
11.31

100  
5.42

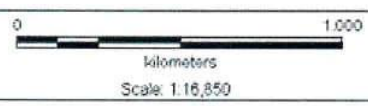
4  
3.56

1  
8.71

2  
8.39

3  
9.56

3  
3.56



## Appendix H: Results Tables





## Certificate of Analysis

Pattle Delamore Partners Ltd  
at Level 2, Grant Thornton House  
Christchurch 8011  
Attention: Kay Higginbotham  
Phone: 0275353133  
Email: edward.cromwell@pdp.co.nz

Lab Reference: 20-03730  
Submitted by: Kay Higginbotham  
Date Received: 31/01/2020  
Date Completed: 4/02/2020  
Order Number:  
Reference: C04096700

Sampling Site:

### Report Comments

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

#### Heavy Metals in Soil

Client Sample ID			SS01	SS02	SS03	SS04	SS05
Date Sampled							
Analyte	Unit	Reporting Limit	20-03730-1	20-03730-2	20-03730-3	20-03730-4	20-03730-5
Arsenic	mg/kg dry wt	0.125	2.7	2.8	2.7	3.2	3.3
Cadmium	mg/kg dry wt	0.005	0.11	0.12	0.067	0.082	0.066
Chromium	mg/kg dry wt	0.125	11	13.0	12	12	13.2
Copper	mg/kg dry wt	0.075	4.8	4.2	3.4	4.1	4.3
Lead	mg/kg dry wt	0.25	11.8	12.5	11.7	11.6	12.7
Nickel	mg/kg dry wt	0.05	6.50	6.31	6.13	7.13	7.50
Zinc	mg/kg dry wt	0.05	44.3	42.7	38.3	41.7	49.9

#### Heavy Metals in Soil

Client Sample ID			SS06	SS07	SS08	SS09	SS10
Date Sampled							
Analyte	Unit	Reporting Limit	20-03730-6	20-03730-7	20-03730-8	20-03730-9	20-03730-10
Arsenic	mg/kg dry wt	0.125	2.8	3.0	3.2	3.4	2.9
Cadmium	mg/kg dry wt	0.005	0.065	0.090	0.044	0.095	0.065
Chromium	mg/kg dry wt	0.125	12	13.7	13.4	13.1	12
Copper	mg/kg dry wt	0.075	4.6	5.1	4.6	4.5	5.2
Lead	mg/kg dry wt	0.25	11.8	12.7	12.6	12.4	11.5
Nickel	mg/kg dry wt	0.05	6.59	7.33	7.75	7.37	6.93
Zinc	mg/kg dry wt	0.05	44.8	40.3	45.3	48.8	49.5

## Heavy Metals in Soil

Client Sample ID			SS11	SS12	SS13	SS14	SS15
Date Sampled							
Analyte	Unit	Reporting Limit	20-03730-11	20-03730-12	20-03730-13	20-03730-14	20-03730-15
Arsenic	mg/kg dry wt	0.125	3.1	3.0	3.4	2.8	2.8
Cadmium	mg/kg dry wt	0.005	0.064	0.065	0.046	0.076	0.046
Chromium	mg/kg dry wt	0.125	13.3	12.6	13.5	12.6	12
Copper	mg/kg dry wt	0.075	4.1	3.2	4.8	3.3	3.1
Lead	mg/kg dry wt	0.25	12.8	12.8	15.4	12.6	11.6
Nickel	mg/kg dry wt	0.05	7.52	7.66	8.45	7.22	6.57
Zinc	mg/kg dry wt	0.05	49.7	47.6	50.3	44.1	40.7

## Organochlorine Pesticides - Soil

Client Sample ID			SS01	SS02	SS03	SS04	SS05
Date Sampled							
Analyte	Unit	Reporting Limit	20-03730-1	20-03730-2	20-03730-3	20-03730-4	20-03730-5
2,4'-DDD	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDE	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDT	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDD	mg/kg dry wt	0.003	<0.003	<0.003	<0.003	<0.003	<0.003
4,4'-DDE	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDT	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total DDT	mg/kg dry wt	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
alpha-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Aldrin	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
beta-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Chlordane	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Nonachlor	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
delta-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dieldrin	mg/kg dry wt	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan I	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Endosulfan II	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Endrin	mg/kg dry wt	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
gamma-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor epoxide	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Hexachlorobenzene	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Methoxychlor	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
trans-nonachlor	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
trans-Chlordane	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chlordane (sum)	mg/kg dry wt	0.02	<0.020	<0.020	<0.020	<0.020	<0.020
TCMX (Surrogate)	%	1	93.4	87.7	94.1	89.0	90.4

**Organochlorine Pesticides - Soil**

Client Sample ID			SS06	SS07	SS08	SS09	SS10
Date Sampled							
Analyte	Unit	Reporting Limit	20-03730-6	20-03730-7	20-03730-8	20-03730-9	20-03730-10
2,4'-DDD	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDE	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDT	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDD	mg/kg dry wt	0.003	<0.003	<0.003	<0.003	<0.003	<0.003
4,4'-DDE	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDT	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total DDT	mg/kg dry wt	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
alpha-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Aldrin	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
beta-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Chlordane	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Nonachlor	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
delta-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dieldrin	mg/kg dry wt	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan I	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Endosulfan II	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Endrin	mg/kg dry wt	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
gamma-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor epoxide	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Hexachlorobenzene	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Methoxychlor	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
trans-nonachlor	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
trans-Chlordane	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chlordane (sum)	mg/kg dry wt	0.02	<0.020	<0.020	<0.020	<0.020	<0.020
TCMX (Surrogate)	%	1	93.0	89.4	87.3	89.9	89.2

**Organochlorine Pesticides - Soil**

Client Sample ID			SS11	SS12	SS13	SS14	SS15
Date Sampled							
Analyte	Unit	Reporting Limit	20-03730-11	20-03730-12	20-03730-13	20-03730-14	20-03730-15
2,4'-DDD	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDE	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDT	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDD	mg/kg dry wt	0.003	<0.003	<0.003	<0.003	<0.003	<0.003
4,4'-DDE	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDT	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total DDT	mg/kg dry wt	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
alpha-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Aldrin	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
beta-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Chlordane	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Nonachlor	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
delta-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dieldrin	mg/kg dry wt	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan I	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Endosulfan II	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01

**Organochlorine Pesticides - Soil**

Client Sample ID			SS11	SS12	SS13	SS14	SS15
Date Sampled							
Endosulfan sulfate	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Endrin	mg/kg dry wt	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
gamma-BHC	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor epoxide	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Hexachlorobenzene	mg/kg dry wt	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Methoxychlor	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
trans-nonachlor	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
trans-Chlordane	mg/kg dry wt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chlordane (sum)	mg/kg dry wt	0.02	<0.020	<0.020	<0.020	<0.020	<0.020
TCMX (Surrogate)	%	1	90.4	87.8	89.1	85.1	92.0

**Method Summary**

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

**OCP in Soil**              Samples are extracted with hexane, pre-concentrated then analysed by GC-MSMS. (Chlordane (sum) is calculated from the main actives in technical Chlordane: Chlordane, Nonachlor and Heptachlor). (In accordance with in-house procedure).

**Total DDT**                Sum of DDT, DDD and DDE (4,4' and 2,4 isomers)



Emily Hanna, B.Sc.  
Trace Elements Team Leader



Kimmy Ignacio, B.Sc.  
Technician



## Sample Receipt Report

Pattle Delamore Partners Ltd  
 at Level 2, Grant Thornton House  
 Christchurch 8011  
 Attention: Kay Higginbotham  
 Phone: 0275353133  
 Email: edward.cromwell@pdp.co.nz

Lab Reference: 20-03730  
 Submitted by: Kay Higginbotham  
 Date Registered: 31/01/2020  
 Date Due: 5/02/2020  
 Order Number:  
 Reference: C04096700

Sampling Site:

**Note:** The published due date is that of tests done internally, subcontracted tests are subject to the sub-contractor's turnaround times and may be reported on or following the due date indicated.

### Summary of Samples

Laboratory ID	Client Sample Reference	Date Sampled	Depth	Sample Type	Condition On Arrival
20-03730-1	SS01			Soil	Acceptable
20-03730-2	SS02			Soil	Acceptable
20-03730-3	SS03			Soil	Acceptable
20-03730-4	SS04			Soil	Acceptable
20-03730-5	SS05			Soil	Acceptable
20-03730-6	SS06			Soil	Acceptable
20-03730-7	SS07			Soil	Acceptable
20-03730-8	SS08			Soil	Acceptable
20-03730-9	SS09			Soil	Acceptable
20-03730-10	SS10			Soil	Acceptable
20-03730-11	SS11			Soil	Acceptable
20-03730-12	SS12			Soil	Acceptable
20-03730-13	SS13			Soil	Acceptable
20-03730-14	SS14			Soil	Acceptable
20-03730-15	SS15			Soil	Acceptable

Summary of Testing		7 Heavy Metals in Soil	OCP in Soil	Dry Sieve
20-03730-1	SS01	✓	✓	✓
20-03730-2	SS02	✓	✓	✓
20-03730-3	SS03	✓	✓	✓
20-03730-4	SS04	✓	✓	✓
20-03730-5	SS05	✓	✓	✓
20-03730-6	SS06	✓	✓	✓

## Summary of Testing

		7 Heavy Metals in Soil	OCP in Soil	Dry Sieve
20-03730-7	SS07	✓	✓	✓
20-03730-8	SS08	✓	✓	✓
20-03730-9	SS09	✓	✓	✓
20-03730-10	SS10	✓	✓	✓
20-03730-11	SS11	✓	✓	✓
20-03730-12	SS12	✓	✓	✓
20-03730-13	SS13	✓	✓	✓
20-03730-14	SS14	✓	✓	✓
20-03730-15	SS15	✓	✓	✓

## Heavy Metals in Soil Testing Breakdown

		Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc
20-03730-1	SS01	✓	✓	✓	✓	✓	✓	✓
20-03730-2	SS02	✓	✓	✓	✓	✓	✓	✓
20-03730-3	SS03	✓	✓	✓	✓	✓	✓	✓
20-03730-4	SS04	✓	✓	✓	✓	✓	✓	✓
20-03730-5	SS05	✓	✓	✓	✓	✓	✓	✓
20-03730-6	SS06	✓	✓	✓	✓	✓	✓	✓
20-03730-7	SS07	✓	✓	✓	✓	✓	✓	✓
20-03730-8	SS08	✓	✓	✓	✓	✓	✓	✓
20-03730-9	SS09	✓	✓	✓	✓	✓	✓	✓
20-03730-10	SS10	✓	✓	✓	✓	✓	✓	✓
20-03730-11	SS11	✓	✓	✓	✓	✓	✓	✓
20-03730-12	SS12	✓	✓	✓	✓	✓	✓	✓
20-03730-13	SS13	✓	✓	✓	✓	✓	✓	✓
20-03730-14	SS14	✓	✓	✓	✓	✓	✓	✓
20-03730-15	SS15	✓	✓	✓	✓	✓	✓	✓

If you have any queries please email us at [enviro.reception@analytica.co.nz](mailto:enviro.reception@analytica.co.nz) or telephone 07 444 5574.

**Note: Soil** samples will be held onsite for 3 months. Samples will be disposed on the 20th of the 3rd month following the month of receipt (ie: Samples received in January will be disposed on the 20th of April), Please contact our environmental sample reception at [enviro.reception@analytica.co.nz](mailto:enviro.reception@analytica.co.nz) or 07 444 5574 if you wish to extend the samples holding period.

**Note: Water** samples will be held onsite for 1 month. Samples will be disposed of routinely according to receipt dates.

## **Appendix I: Laboratory Reports and Chain of Custody Information**

Table A : Soil Sample Results - Heavy Metals and pesticides - Burnham Quarry

Sample Name	S501	S502	S503	S504	S505	S506	S507	S508	
Sample Depth (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Environment Canterbury Background Concentrations <sup>1</sup>
Laboratory Reference	20-03730-1	20-03730-2	20-03730-3	20-03730-4	20-03730-5	20-03730-6	20-03730-7	20-03730-8	
Date	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	Regional - Yellow Brown Stony
<b>Heavy Metals</b>									
Arsenic	2.7	2.8	2.7	3.2	3.3	2.8	3.0	3.2	6.35
Calcium	0.11	0.12	0.067	0.082	0.066	0.065	0.090	0.044	0.14
Chromium	11	13.0	12	12	13.2	12	13.7	13.4	19.89
Copper	4.8	4.2	3.4	4.1	4.3	4.6	5.1	4.6	11.66
Lead	11.8	11.7	11.6	11.6	12.7	11.8	12.7	11.8	19.75
Nickel	6.50	6.31	6.13	7.13	7.50	6.59	7.33	7.75	13.91
Zinc	44.3	42.7	38.3	41.7	49.9	44.8	40.3	45.3	69.58
<b>Organochlorine Pesticides (OCP)</b>									
DDT <sup>2,3</sup>	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	0.431 <sup>1</sup>
Dieldrin <sup>4,5</sup>	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	-
Sample Name	S509	S510	S511	S512	S513	S514	S515		Environment Canterbury Background Concentrations <sup>1</sup>
Sample Depth (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Laboratory Reference	Z0403730-9	Z0403730-10	Z0403730-11	Z0403730-12	Z0403730-13	Z0403730-14	Z0403730-15		
Date	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020		Regional - Yellow Brown Stony
<b>Heavy Metals</b>									
Arsenic	3.4	2.9	3.1	3.0	3.4	2.8	2.8	2.8	6.35
Calcium	0.095	0.065	0.064	0.065	0.046	0.076	0.096	0.044	0.14
Chromium	13.1	12	13.3	12.6	13.5	12.6	13	12	19.89
Copper	4.5	5.2	4.1	3.2	4.8	3.3	3.1	4.6	11.66
Lead	12.4	11.5	12.8	12.8	15.4	12.6	11.6	11.8	19.75
Nickel	7.37	6.93	7.52	7.66	8.45	7.22	6.57	7.75	13.91
Zinc	48.8	49.5	49.7	47.6	50.3	44.1	40.7	45.3	69.58
<b>Organochlorine Pesticides (OCP)</b>									
DDT <sup>2,3</sup>	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	0.431 <sup>1</sup>
Dieldrin <sup>4,5</sup>	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	-

Notes:

1. Background concentrations of selected trace elements in Canterbury soils - Addendum 1, (Ecan 2007). Report no. RD7/1/21. Based on 'Regional - Yellow Brown Stony' soil type - background concentration value based on maximum plus half inter-quartile range (excluding outliers, which are indicated in brackets).
2. Results for DDT, DDD and DDE summed and compared to soil contaminant standard for DDT
3. Background soils concentration for DDT - Ministry for the Environment, December 1998. Ambient Concentrations of Selected Organochlorines in Soils. Ministry for the Environment, Wellington.
4. Results for Aldrin and Dieldrin summed and compared to soil contaminants standard for Dieldrin.
5. Where one or more of the compounds was below the detection limit, a value of half the detection limit was used in the sum. Where all compounds in the sum are non-detects, the overall detection limit is the sum of the detection limits.

All results in mg/kg.