



**Parkburn Quarry
Preliminary Site
Investigation**

Fulton Hogan Limited

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Preliminary Site Investigation**

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Executive Summary

Fulton Hogan Limited (FHL) operate Parkburn Quarry, immediately north of Pisa Moorings. The quarry was developed by FHL in the 1980s and has been in operation since this time. The quarry produces a range of aggregates, from sealing chip to construction and concrete aggregates. As the site is nearing the end of its operational lifespan, Fulton Hogan are seeking a plan change to rezone the site so that it can be redeveloped for a range of future land uses upon closure.

Currently, a range of activities associated with quarry operation take place on site, including asphalt production, concrete batching and block manufacture, disposal of cleanfill, and fuel storage. These activities are listed on the Ministry for the Environment's Hazardous Activities and Industries List (HAIL) and therefore any subdivision, change of use, or soil disturbance where these activities occur will be subject to the provisions of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCSC).

To assist Fulton Hogan in managing the risks associated with contaminants in soil, e3Scientific has undertaken a Preliminary Site Investigation (PSI) to identify the areas of potential contamination within the site, consider the risks to human health associated with the proposed development, consider the activity status of the future development under the NESCSC, and assess the need for further investigation.

Based on the review of site history information and a site inspection, six discrete HAIL activities were identified. HAIL activities identified during this investigation include commercial concrete manufacture, asphalt manufacture, fuel storage, persistent pesticide use associated with the orchard, bulk storage of treated timber and waste disposal to land associated with the cleanfill. These HAIL activities are predominantly located in the industrial area on the northern portion of the property. Within the quarry itself, fuel and bitumen storage were the only HAIL activities identified.

Based on the proposed plan change and eventual development of the site, there is potential for workers and residents to be exposed to contaminants associated with the existing HAIL activities.



Within the future residential area, the identified HAIL activities include relatively small-scale hydrocarbon storage associated with the bitumen spray plant, a diesel tank and waste oil storage, and a diesel generator. It is possible that these activities could leave localised areas of hydrocarbon contamination. Although topsoil will need to be imported to this part of this site, there is a relatively low risk that inhalation of volatile contaminants would remain an open exposure pathway. Any topsoil imported to the site should be certified as meeting the appropriate human health and environmental criteria.

Within the future industrially zoned area, the identified HAIL activities include concrete manufacturing and batching, asphalt production, fuel storage, persistent pesticide use, treated timber storage, and disposal of cleanfill. We consider that it is highly unlikely that contaminants in soil associated with concrete manufacture, persistent pesticide use, and treated timber storage would pose a risk to human under the proposed commercial/industrial land use.

It is possible that contaminants associated with asphalt production, fuel storage and cleanfill disposal could result in soil contamination that could pose a risk to long term outdoor workers using the site in the future without appropriate investigation, remediation and/or management during development. The greatest risks are associated with hydrocarbon storage, particularly around any underground fuel storage infrastructure (e.g. fuel supply pipelines). Risks associated with the disposal of cleanfill appear relatively low; however, given the long history of filling, it is possible that localised areas of contaminated fill material may be present.

Given the on-going use of the site for these HAIL activities, it would be appropriate to complete additional investigation upon decommissioning of any potentially contaminating land uses. These investigations may also be better able to assess risks to human health as plans for the proposed development become more detailed.



1 Introduction

1.1 Purpose

Fulton Hogan Limited (FHL) operate Parkburn Quarry, immediately north of Pisa Moorings. The quarry was developed by FHL in the 1980s and has been in operation since this time. The quarry produces a range of aggregates, from sealing chip to construction and concrete aggregates. As the site is nearing the end of its operational lifespan, Fulton Hogan are seeking a plan change to rezone the site so that it can be redeveloped for a range of future land uses upon closure.

Currently, a range of activities associated with quarry operation take place on site, including asphalt production, concrete batching and block manufacture, disposal of cleanfill, and fuel storage. These activities are listed on the Ministry for the Environment's Hazardous Activities and Industries List (HAIL) and therefore any subdivision, change of use, or soil disturbance where these activities occur will be subject to the provisions of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS).

To assist Fulton Hogan in managing the risks associated with contaminants in soil, e3Scientific has undertaken a Preliminary Site Investigation (PSI) to identify the areas of potential contamination within the site, consider the risks to human health associated with the proposed development, consider the activity status of future development under the NESCS, and assess the need for further investigation.

1.2 Proposed Development

Fulton Hogan are proposing to rezone the quarry through a private plan change. Draft concept plans provided by Fulton Hogan indicate that the site could potentially accommodate a wide range of uses, including residential (standard and high density), commercial, retail commercial, childcare / education, green space, and industrial (Figure 1).





Figure 1: Draft concept plans

The residential areas will be located towards the south of the property, where the current quarry operations are located, adjacent to the existing Pisa Moorings development. The residential areas could be located around man-made waterways and inlets, as found in the southern area of Pisa Moorings. The commercial and industrial areas will be located towards the northern boundary of the site, where these types of activities currently take place.

As the developed areas of the quarry have been stripped, topsoil for residential areas will need to be imported, either from off-site or from stockpiles of soil stripped during quarry operations.

1.3 Scope of Work

The scope of work completed during the investigation included the following:

- Review of land use history from historic aerial photographs, certificates of title, Central Otago District Plan (CODC) property files, and information available from the Otago Regional Council (ORC).
- Completion of a site inspection and review of existing physical environment.



- Development of a conceptual site model identifying potential contaminant sources, the possible routes of exposure to contaminants that may be present in soils on the site, and critical receptors.
- Consideration of risks to human health, the need for any further investigation, and the status of the development under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (the NESCS).
- Preparation of a Preliminary Site Investigation report in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No. 1: Reporting on Contaminated Sites in New Zealand (Ministry for the Environment, 2021).

e3Scientific's experience in the provision of contaminated land services is provided in Appendix A.

1.4 Limitations

The findings of this report are based on the Scope of Work outlined above. e3Scientific Limited (e3s) performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental science profession. No warranties, express or implied, are made. Subject to the Scope of Work, e3s's **assessment is limited** strictly to identifying the risk to human health based on the historical activities on the site. The confidence in the findings is limited by the Scope of Work.

The results of this assessment are based upon site inspections conducted by e3s personnel, information from interviews with people who have knowledge of site conditions and information provided in previous reports. All conclusions and recommendations regarding the properties are the professional opinions of e3s personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, e3s assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside e3s, or developments resulting from situations outside the scope of this project.

Observations and assessments of the site are relevant to the time of inspection and the scope of this assessment. Investigations were limited to the site



investigation area. e3Scientific notes that the continued operation of the site could result in contamination that may alter the status of the site under the NESCS.



2 Site Location and Description

2.1 Site Location

The area under investigation (the site) is located at 922 and 922A Luggate-Cromwell Road (SH6) (see Figures 2 and 3). The site is situated between Lake Dunstan and the state highway, approximately 8 km north of Cromwell.

The property to the immediate north of the site is owned by Downer EDI Limited, and accommodates a quarry, associated support buildings and infrastructure associated with civil construction and road maintenance. Beyond the Downer EDI quarry, the land is primarily agricultural (pastoral) with some rural residential use. The southern boundary backs onto the Pisa Moorings residential housing development. The land west of the site, opposite SH6, is used for a combination of lifestyle, grazing and viticulture. Lake Dunstan lies immediately to the east of the site. A public walkway/cycleway traverses the lakeside marginal strip along the lake edge. From the southern boundary, the site extends approximately 980 m to the north and covers an area of approximately 120 ha.

The central coordinates of the site are E: 1304358 N: 5014130 (NZTM)

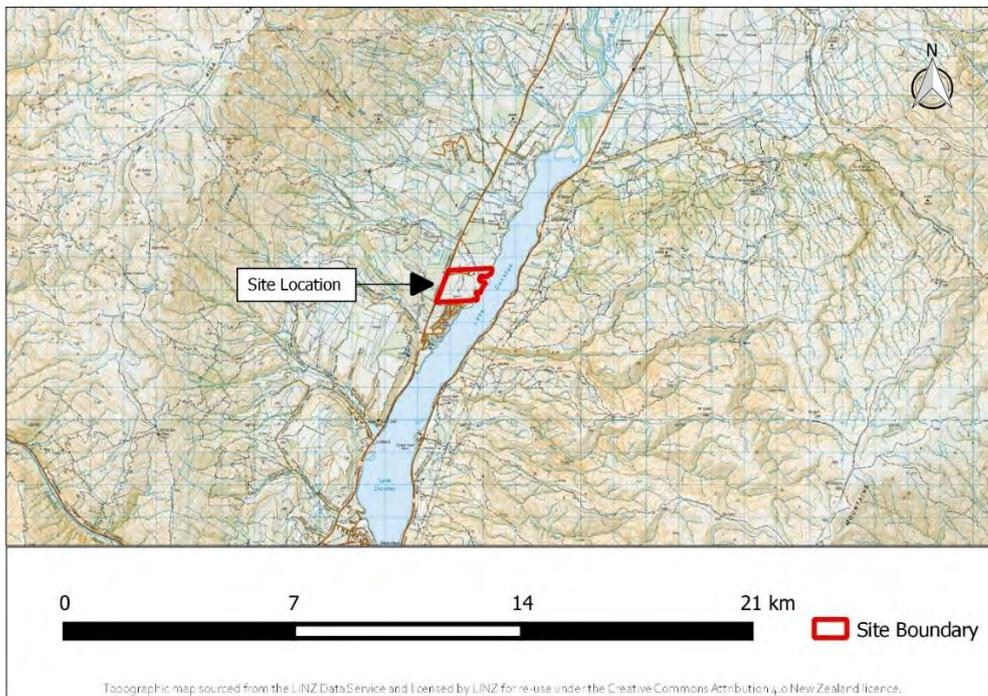


Figure 2: Site Location (topographic)



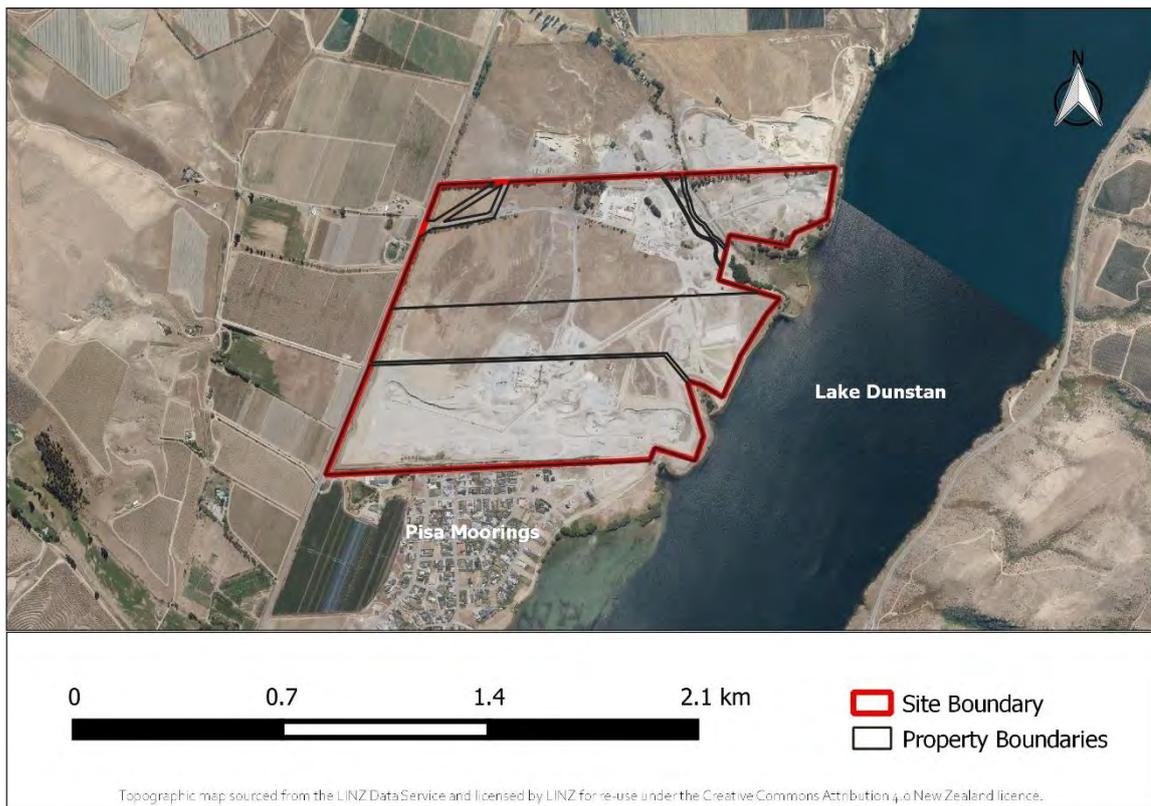


Figure 3: Site location (aerial)

The site is zoned Rural in Central Otago District Council District Plan, and eastern portion of the site is subject to Scheduled Activity notation SA25A – ‘Gravel Pit Parkburn.’

2.2 Topography

Natural ground at the site slopes gently in a southward direction with an elevation 220 m above mean sea levels in the northwest corner to 199 m above mean sea level in the southeast corner. The local topography is highly influenced by the operation of the quarry, with active faces approximately 10 m high in the southern part of the site.

2.3 Geology

Based on the 1:250,000 Geological Map of New Zealand, the site is situated primarily on Late Pleistocene River deposits consisting of unweathered to slightly weathered, loose, sandy well-rounded gravel usually on the large outwash plains. There is a small section on the central northern boundary of the site that is situated on Holocene River deposits. These consist of loose commonly angular, boulders,



gravel, sand and silt forming alluvial fans; grades into scree (upslope) and valley alluvium (GNS Science, 2021).

2.4 Hydrogeology

The site overlies the Pisa Groundwater Management Zone. This zone is not identified in the current Regional Plan: Water or any of its schedules but has been identified in the draft/recommended aquifers on the ORC Water Allocation for Consultants webpage. The Groundwater Management Zone extends through the Late Pleistocene River deposits east of SH6 and Holocene river deposits that extend up the valleys of the foothills that run west of SH6. Groundwater beneath the site flows east through the alluvial terraces towards Lake Dunstan. The aquifer is unconfined with generally highly permeable sediments that are comprised of sandy gravel or sandy cobble gravel and is likely to be hydraulically connected to Lake Dunstan.

There are four bores on site, with reported depths to water ranging from 9.9 to 12.6 metres below ground level (mbgl). e3s examined the bore logs from nearby bores to assess the likely aquifer thickness and permeability. No basement rock was found in nearby bores; however, there was clay at the base of G41/0319 and clay-bound gravels at 30 mbgl in G41/0465 at 40 mbgl, which may function as the base of the aquifer. This indicates the saturated thickness of the aquifer may be 10-15 m.

There are 36 recorded bores within a 1km radius of the site's location (Figure 4). Of these bores, the primary usages are: 14 for Irrigation, 16 for domestic use, 3 for community supply, 2 for commercial/industrial, 1 for investigation, and 1 is unknown.



Table 1: Summary of Site Location and Description

Address	922 & 922A Luggate Cromwell road, Mount Pisa, 9393
Legal Descriptions	Section 64-65 Block IV Wakefield Survey District, Part Section 62-63 Block IV, Part Section 63 Block IV Wakefield survey District and Section 1 Survey Office Plan 365897.
Location	North of Pisa Moorings residential area, West of lake Dunstan, East of SH6 and approximately 1.5 km south of Smiths Way.
NZTM Coordinates	E: 1304358 N: 5014130 (NZTM)
Owners	Fulton Hogan Limited
Site area	120 ha
Surrounding Land Uses	North: Agricultural farming, commercial/industrial. East: Lake Dunstan South: Residential housing West: Viticulture
Regulatory Authorities	Regional Authority: Otago Regional Council Local Authority: Central Otago District Council
Zoning	Rural Resource Area
Topography	Sloping from south-east to the north-west corner, but heavily influenced by quarry operations
Geology	Late Pleistocene River deposits
Hydrogeology	Pisa Groundwater Management Zone
Nearest Surface water	Lake Dunstan directly to the east, Park Burn passing through the north-east corner and small water races running through the site.
Current Land Use	Industrial and commercial
Future Land Use	Residential, industrial, and commercial



3 Site History

3.1 Historical Certificates of Title, Maps and Surveys

Online available historical maps and images of the area available from the 1800's to present day were accessed via the National Library Cartographic Collection on 23 September 2021 and MapsPast.org.nz on 19 August 2021.

A perpetual lease for what is now Sections 62 and 63 was issued to Robert Davidson in 1894. The lease was transferred to a series of private owners (some of which are illegible on the scanned copy of the deed) in 1905, 1940, and 1947. In 1983, the eastern portion of the site was acquired by the Crown for electricity generation so that it could be inundated by Lake Dunstan. In 1985, the lease was transferred to Robert and Charles Perriam, farmers, and a new certificate of title (10B/738) was issued. In December 1985, the title was transferred to Fulton Hogan Limited, and a mining license commenced on 20 July 1987. In 2008, two sections were declared to be road and vested with Central Otago District Council, and an adjoining road was stopped and amalgamated with the adjoining land to create the current title (407414).

The land that is now Sections 64 and 65 was also appears to have been leased for agricultural use until it was transferred from the Perriams to Fulton Hogan Limited in 1985.

Historic surveys and certificates of title are provided in Appendix B.

3.2 Historic Aerial Photography

Aerial images sourced from retrolens.nz, the National Library, and from Google Earth Pro and Google maps street view have been reviewed. A summary of notable observations is presented in Table 2. Selected images are included in Appendix C.

The review of aerial photographs was completed using digital copies of the images, which provide higher resolution than those provided in the appendix.



Table 2: Summary of Aerial Images and Maps

Date	Source	Site Observations
07.03.1958	Retrolens	An unsealed driveway runs from SH6, approximately 150 m south of the northern site boundary, across the site, to a house, just beyond the eastern boundary of the site. A small orchard is visible between the driveway and the Park Burn. Most of this orchard lies outside of the site boundary to the east; however, approximately 1000 m ² is within the site. The remainder site is flood irrigated pasture, with several farm tracks and water races visible. The Clutha Mata-Au is approximately 450 m east of the site.
01.03.1975	Retrolens	An irrigation pond has been created south of the orchard visible in the previous image. Four rectangular shapes/structures are visible on the site, two located together within the central parcel and two separated on the southern parcel. The balance of the site continues to be used for flood irrigated pasture. Stacks of felled trees are visible in the central northern portion of the site.
14.11.1976	Retrolens	The majority of the site is similar to the previous image. The rectangular structures visible in the previous image have been removed, with no sign of soil disturbance, suggesting these were most likely bales of hay/feed. Felled trees can still be seen in the central northern section of the site.
20.02.1978	Retrolens	There are no significant changes from the previous image.
17.02.1983	Retrolens	There are no significant changes from the previous image.
19.02.2001	Retrolens	Lake Dunstan has been filled, up to the eastern site boundary. Gravel extraction in the northern portion of the site, on both sides of the Park Burn, has commenced. Two structures associated with present day asphalt plant are visible to the west of Park Burn. There is a small pond visible in the north-east corner of the site. The southern portion of the site remains largely unchanged.
27.02.2003	Retrolens	Quarrying extends further south along the eastern site boundary. The ponds in the north-eastern corner of the site are much larger. The southern portion of the site remains largely unchanged.



Table 2 (continued)

Date	Source	Site Observations
02.2007	Google Earth (c)	A second area of quarrying along the southern boundary, connected to the main driveway by two haul roads, is visible. The ponds in the north-east corner of the site have been filled, and series of small ponds can be seen in pits on the eastern side of the site. In the centre of the northern section, two additional buildings, parking area, and material storage associated with the concrete block manufacturing plant has been established. A gate house and weighbridge has been established near the entrance to the site from SH6. South of the site, Pisa Moorings has been established, with several house and roading infrastructure in place.
10.2011	Google Earth (c)	The layout of the site remains largely the same as the previous image. The quarry to the south has been extended further east and west. The series of ponds in the central/eastern portion of the site have extended further south, and these are in various stages of being filled, with discrete loads of material visible in three of the ponds. The banks of the Park Burn have more vegetation.
12.2015	Google Earth (c)	The overall layout of the site remains unchanged, and the progression of quarrying and filling has continued through the site.
11.2019	Google Earth (c)	The overall layout of the site remains unchanged, and the progression of quarrying and filling has continued through the site. Two more locations have been setup as work yards with infrastructure in place. Both are within the north-eastern section of the site.
06.2021	Fulton Hogan	A recent drone image shows the site in its current configuration. Again, the overall layout of the site remains unchanged, and the progression of quarrying and filling has continued through the site. South of the site, Pisa Moorings is fully developed.

3.3 District Council Information

e3s was provided resource consent and building consent documentation for the site from the Central Otago District Council.

The following information was found in the property file:



- A 1988 building permit (F037756) to erect an office building at the existing weighbridge.
- A 1990 building permit (H056122) to erect a relocated bitumen storage shed. Plans provided with the application show diesel storage at the weighbridge and asphalt plant, and kerosene near the bitumen shed. The weighbridge is located approximately 120 m southeast of the asphalt plant.
- A 1995 building consent application (BC950406) and associated processing information for the installation a shed at the asphalt plant. Plans provided with the application show diesel storage at the weighbridge and asphalt plant.
- A 2004 building consent application (BC040935) and associated processing information for the installation of a prefabricated Portacom building near a new weighbridge, approximately 250 m from the site entrance. The Portacom building was used as an office and washroom and included a single chamber septic tank and wastewater disposal field.
- 2005 building consent and resource consent applications (BC050850 RC050211) and associated processing information for the construction of concrete block processing facility, capable of producing a range of concrete products including masonry, paving stones, landscaping, and other associated building products. The facility is constructed from pre-cast concrete block building and includes a single chamber septic tank and wastewater disposal field. Information in the file also indicates that a 10,000 L diesel tank is used to provide fuel for a boiler, and cement is stored in silo adjacent to the main building. Wash water is channelled into a collection area and settling ponds, after which the water is to be recycled or directed to a soak pit.
- A 2006 building consent application (BC060538) to relocate a Portacom for staff facilities at the weighbridge.
- A 2007 resource consent application (RC070216) and associated processing information for a land use consent to extract and convey sand and gravel. The purpose of the consent was to allow extraction outside of the Scheduled Area provided in the district plan, and to convey these products to the existing processing plant.



- A 2015 building consent application (BC150440) to add an extension to the side of a shed to allow for the installation of a 40,000 L vertical bitumen tank. Plans for the consent show the layout of the asphalt plant, including diesel and kerosene tanks, loading bins, and bitumen spray release.
- A 2015 building consent application (BC150689) and associated processing information for a single pitch storage shed at the concrete block processing facility.
- A 2016 building consent application (BC160880) and associated processing information for the installation of a transportable office on piles near the weighbridge.
- A 2018 building consent application (BC180636) and associated processing information for the foundations and site works for a Portacom office near the weighbridge.
- A 2019 resource consent application (RC190341) and associated processing information to construct three additional relocatable offices/amenities buildings near the weighbridge. The is consent was later amended (RC200046) to allow two further Portacom buildings to be established. There are three subsequent building consents (BC200395, BC190440, BC190726) associated with these structures.
- A 2020 resource consent application (RC210112) and associated processing information to build a commercial shed for a glass crushing plant. Power for the crushing plant is provided by a standalone generator. The fuel source for the generator is not described in the application. There is a subsequent building consent (BC210205) to install a recycled glass materials shed.
- A 2020 building consent application (BC200568) and associated processing information to install a Smart Shelter container roof.
- A 2020 building consent application (BC200771) and associated processing information for foundation and drainage works to install an ablution block. Wastewater is discharged to an existing septic tank.
- A 2021 resource consent application (RC210129) and associated processing information to install two 20,000 litre diesel fuel tanks to replace



one 30, 000 litre diesel fuel tank, located approximately 20 m WSW of the asphalt plant. The tank is noted to be scheduled to be removed mid-2021.

None of the Project Information Memoranda for the above consents identified the likely presence of any hazardous substances, and available plans did not specify the use of any asbestos containing materials (ACM). Supporting documentation from the district council is too large to append but can be provided upon request.

3.4 Regional Council Information

e3Scientific reviewed Otago Regional Council's Hazardous Activities and Industries List (HAIL) Register and consent information on 23 September 2021 and requested information on any Resource Management Act incidents or complaints related to the site.

Part of the site is currently recorded on the Otago Regional Council's HAIL database. This piece of land is registered as site number HAIL.00359.01, as verified HAIL site under the category E2: Asphalt or Bitumen Manufacture. The site is noted as a consented asphalt plant. An underground petroleum storage system (UPSS) removal report was received by the ORC from Z Energy in 2015. The investigation confirmed that residual contamination was acceptable for commercial/industrial land use. However, because of the on-going use as an asphalt plant and other areas of hazardous substance storage, this site is recorded with a contamination status of 'partially investigated.' The UPSS removal report is discussed further in section 3.5.

With regards to the balance of the site, the ORC notes that the database is continually under development and should not be regarded as a complete record of all properties in Otago. The absence of available information does not necessarily mean that the property is uncontaminated; rather no information exists on the database.

There are 25 resource consents associated with the site. Of these, thirteen are expired, five are surrendered, and six are current. Eight of the 25 consents are associated with construction of bores or groundwater takes, Seven are associated with discharges to air from an asphalt plant, six are associated with discharges of water, silt and/or sediment to land for processing aggregate, dust suppression, and truck washing, one is associated with a crossing over the Park



Burn, one is to discharge dust from the quarry operation, and one is to discharge solid fill to land for the purpose of backfilling the quarry.

The Otago Regional Council confirmed that there are four Resource Management Act incidents or complaints recorded for the site. Three of these are associated with dust. The fourth was a complaint regarding odour associated with stockpiles of broken glass.

Supporting documentation from the regional council is provided in Appendix D

3.5 Previous Investigation Reports

The only contaminated land investigation report available for the site is a 'Site Assessment for the Removal of an Underground Petroleum Storage System at the Fulton Hogan Asphalt Plant, Parkburn Quarry, 922 Luggate-Cromwell Road, Cromwell, Central Otago' prepared by Pattle Delamore Partners for Z Energy in 2015.

The report describes the results of soil benchmarking and Tier 1 risk assessment following the removal of a 10,000 L kerosene tank, 10,000 L diesel tank, and associated pipework in October 2014. The two tanks were located end to end in a single tank pit. All thirty samples collected from the tank pit, fuel pipelines and vent risers contained petroleum hydrocarbons below the relevant tier 1 soil acceptance criteria for commercial/industrial land use and for the protection of groundwater quality.

A dispenser within the bituminous emulsion manufacturing building and a 7 m section of pipeline were not removed at the time, and two new aboveground tanks replaced the removed UPSS.



4 Site Inspection

e3s staff conducted a site walkover on the 28th of September 2021. e3s staff were accompanied by Matt Goulding, Fulton Hogan's Central Quarries Operations Manager.

The site inspection was conducted in accordance with the Contaminated Land Management Guidelines No. 5: Site investigation and analysis of soils (revised 2021) (Ministry for the Environment, 2021).

Information gathered during site inspections included:

- General site condition, current use, local topography, and surrounding environmental setting.
- The condition of the buildings.
- The nature of the ground surface across the site.
- The location and condition of surface watercourses, drainage systems, and any groundwater wells.
- Visible signs of contamination or potential contamination, such as evidence of spills or leaks, surface staining, absent or stressed vegetation, and odours.
- Visible signs of areas of fill, stockpiled material, waste, ground disturbance, burnt areas, and former building foundations.
- The location of any chemical storage and transfer areas, bunding, waste storage areas, and discharges.
- The land use of neighbouring properties that have the potential to have an impact on the site or be affected by contamination from the site.
- The location of former buildings, processes or activities undertaken on the site.

The wider site layout is shown in Figure 55, and descriptions of the main parts of the site are provided in the following sections. Site photographs and observations are provided in Appendix E.



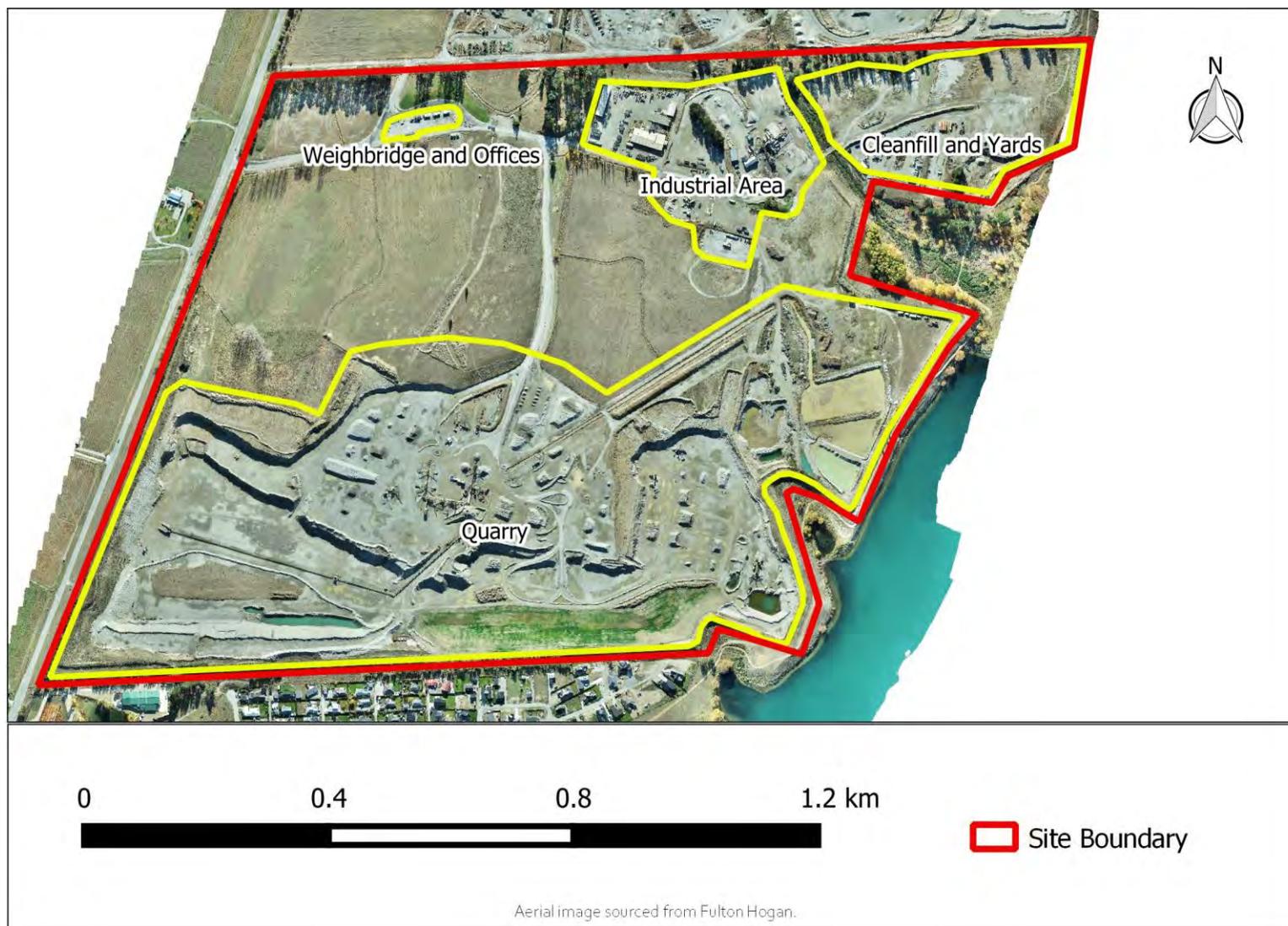


Figure 5: Site Layout



4.1 Weighbridge and offices

The weighbridge and site offices are located approximately 250 m from the SH6 entrance to the property.

There are five Portacom style buildings in addition to the weighbridge. All buildings appeared to be in good condition. The surface cover is predominantly hard stand, gravels, and landscaped areas (Figure 66).

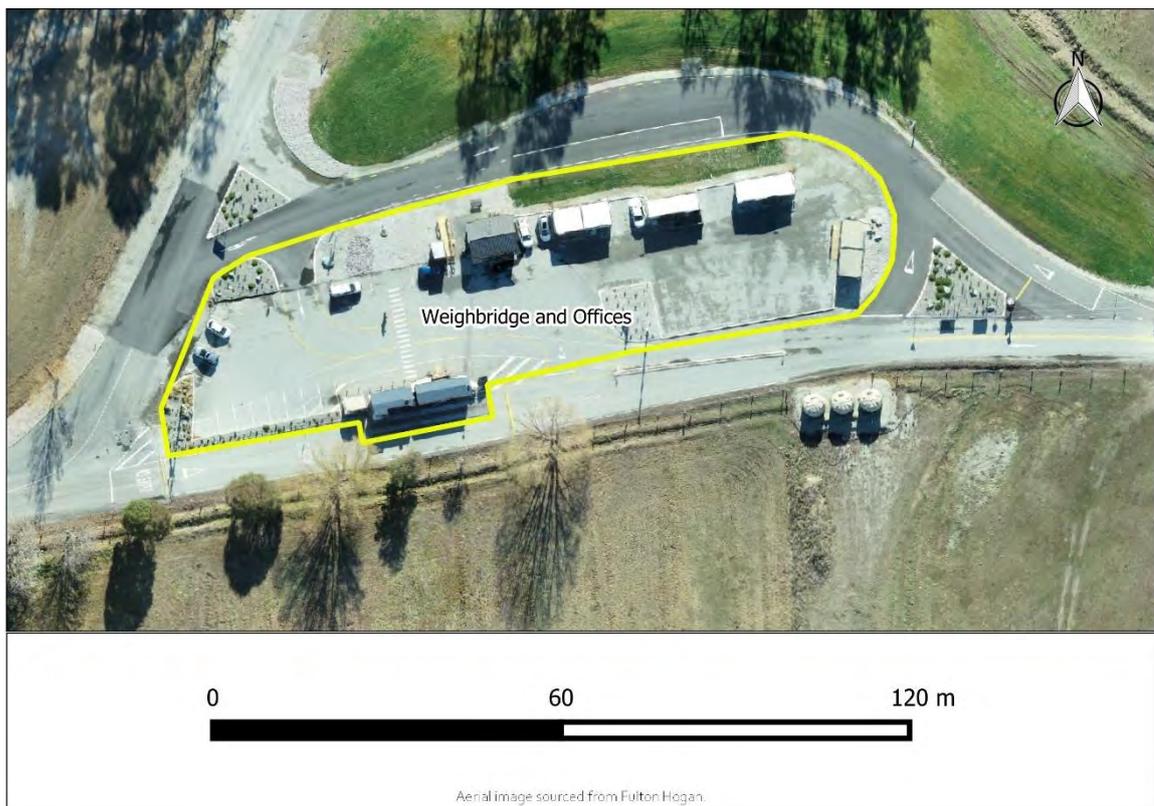


Figure 6: Weighbridge and offices

There was no evidence of any hazardous substance use or storage in this area.

4.2 Industrial Area

Approximately 200 m east of the weighbridge, approximately 7.5 ha of land is used for industrial activity, predominantly related to asphalt and concrete manufacturing.

Activities in this area include: the Firth Concrete block manufacturing facility, the Fulton Hogan asphalt plant, the Allied Concrete batching plant, a yard formerly



used for producing pre-cast concrete panels for the Frankton Marina, a truck wash, and truck parking area (Figure 77).

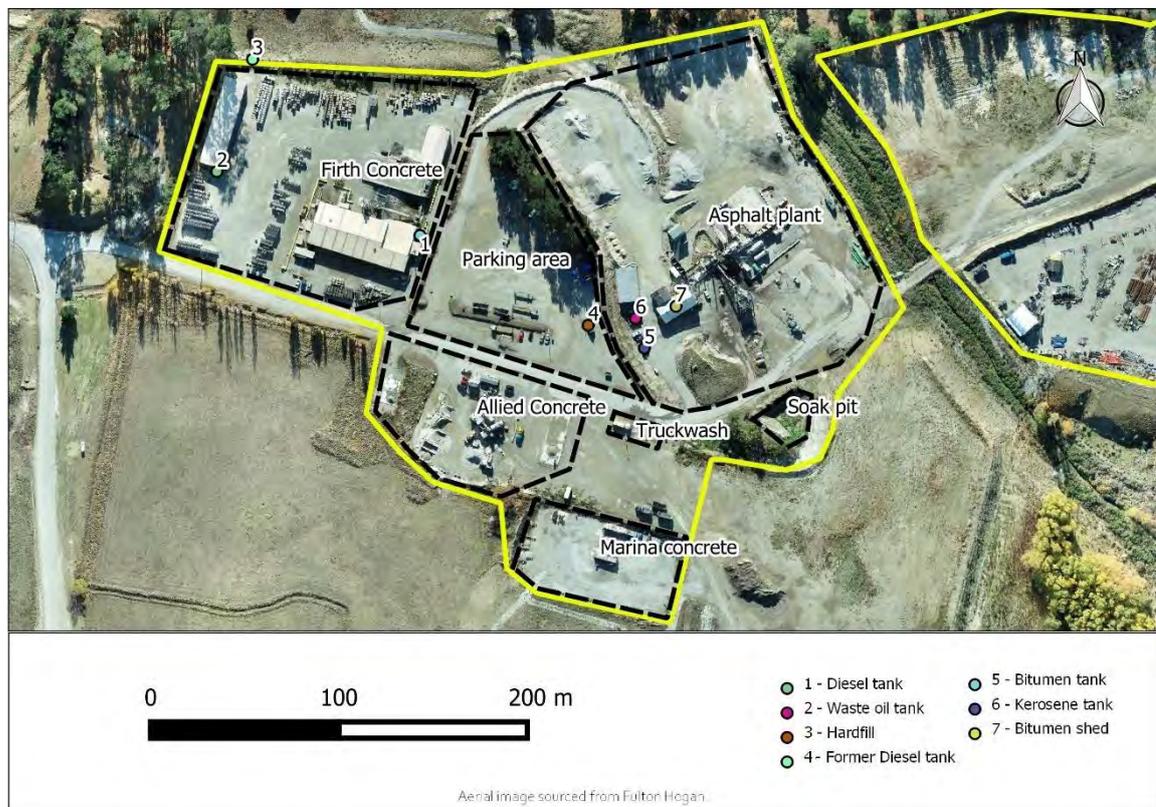


Figure 7: Industrial area activities

The Firth Concrete block manufacturing facility is located on the western end of the industrial area. The gravel yard was generally tidy and well kept. A 10,000 L diesel tank is located to the east of the manufacturing building (1). An open storage shed is located along the western boundary of this area. A small, waste oil 'igloo' was present to the south of the open shed (2). There was no staining around the waste oil tanks. Several empty drums of concrete retardant (Sika Retarder) were stored behind (west of) the open shed. Hardfill, consisting of broken concrete tiles and blocks was deposited over the landscape bund, north of the factory (3).

East of the Firth Concrete block manufacturing facility, an open yard is used as a parking area by Fulton Hogan Transport. An above ground diesel tank (4) associated with the nearby asphalt plant, was removed from the site in September 2021. Evidence of disturbed ground beneath the removed tank, including some soil on a plastic sheet, was still present. There was no evidence of staining or odour in this area. Underground fuel lines, running to the asphalt plant are reportedly still present.



The asphalt plant itself is located down an embankment to the east of the parking area. The plant is comprised of aggregate feeder bins, bitumen storage tanks, mixing drum, conveyor belt feeding, asphalt storage silos, a bag house and an operations office. The asphalt plant can produce up to 120 tonnes per hour (tph) of asphalt but will typically run at a production rate of approximately 80 tph. Bitumen and kerosene are stored in a bunded above ground tank at the base of the terrace. Bitumen is also stored in a shed near the plant. The ORC resource consent specifies that the plant can be run on used oil; however, to date only diesel fuel has been used.

The Allied Concrete batching plant is located on the opposite side of the main access road from the transport yard. The batching plant appears to be located at the repurposed weighbridge, where diesel fuel storage was noted in plans with several of the building consent applications. Immediately south of the batching plant, there is a gravel yard which was used by a company to produce concrete panels for the construction of the Frankton Marina in 2018. These areas appeared generally tidy.

A truck wash is located on the south side of the main access road. Run-off from the truck wash flows down the site of the access road into an infiltration pond. This is one of the discharge points authorised by ORC consent RM15.108.02. There was no oily sheens or hydrocarbon odour associated with the run-off water or sediment at the truck wash.

4.3 Cleanfill and Yards

On the opposite side of the Park Burn, an area of past quarrying is now used for cleanfill disposal and for outdoor yards used by JCL Asphalt Limited and several divisions of Fulton Hogan (Figure 8).



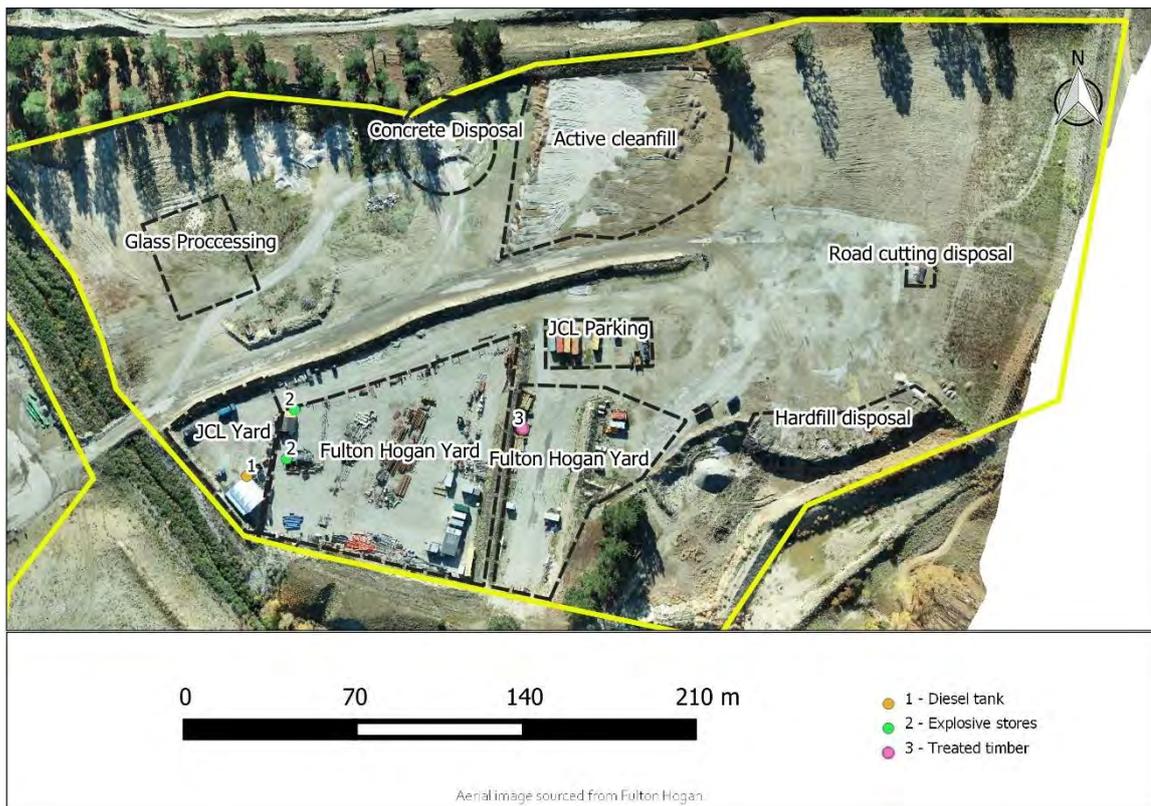


Figure 8: Cleanfill and yards area

A new shed, which will be used for crushing and storage of recycled glass, has been constructed. This building was consented under RC210112. During the site inspection, drainage work was being completed, but storage and crushing of glass had not yet commenced.

Beyond the new glass processing shed, an excavation is used for disposal of surplus concrete. Further to the east, there are two active (1-2 m high) faces used for cleanfill disposal. A concrete bay just east of the weighbridge at the entrance to the site is used for drop-off of small loads of cleanfill by Fulton Hogan and their sub-contractors. This material is then relocated to the cleanfill face. Visible material was predominantly soil, rock, and gravel, with occasional loads of cured asphalt, and some scattered broken glass across the surface of the cleanfill. A separate area is used for disposal of hardfill, including concrete, tile, bricks, and cured asphalt, as well as soil, gravel and rock. Disposal of material at the cleanfill is authorised by ORC resource consent 99664.

A Cleanfill Management Plan prepared by Fulton Hogan outlines the procedures required to achieve environmental best practice. Visual inspections of the quality of the fill material coming to the site are completed to ensure the material is consistent with resource consent requirements. If a non-complying load is



identified, the cleanfill operator is to isolate the load and advise the Quarry Manager immediately. Signage is in place at the entrance to the cleanfill, providing a clear description of acceptable materials. Material is not to be accepted from any Hazardous Activities and Industries List (HAIL) sites unless it has been suitably analysed.

A partially buried skip is used for temporary storage of waste from high pressure water cutting used during roading maintenance work. The skip is covered and sealed, with waste periodically taken to landfill when full.

To the east of the hardfill disposal area, finished areas of the cleanfill have been capped with gravel for use as open yards for other divisions of Fulton Hogan, as well as JCL Asphalt.

At the JCL Asphalt yard, there is a moveable above ground diesel tank located in the corner of the container shelter (1). Some soil staining was also visible. In this area, there were also 4 x 1,000 L IBC of concrete additive (Sika Viscacrete), with some visible product on the ground below the IBCs. The Fulton Hogan civil engineering and construction yards were predominantly used for the storage of building supplies and equipment. There were two small steel explosive storage containers (2) used by the Fulton Hogan geotechnical team. There was also a stack of CCA treated telephone poles (3) in the construction yard. Otherwise, there was no evidence of hazardous substance storage or use in these areas, and surface gravels were free of staining.

4.3.1 Cleanfill and Hardfill XRF Results

An Olympus Vanta field portable X-Ray Fluorescent Spectrophotometer (XRF) was used to collect in-situ field readings of heavy metal concentrations at 40 locations within the active faces of the cleanfill and hardfill disposal area, and across the finished cleanfill surface. For comparison, 10 readings were also taken from undisturbed ground under the pine trees, north of the cleanfill area to provide an estimate of naturally occurring background concentrations. Although not as precise as laboratory analysis, use of an XRF enables a rapid screening-level assessment of soil contaminant concentrations. A table of XRF screening results is provided in Appendix F, and raw results exported from the instrument are available upon request.



XRF instrument checks were undertaken in accordance with e3Scientific's XRF standard operating procedure. These included checking the functionality of the XRF, performing an energy calibration and checking the calibration of the XRF with a certified reference material (NIST 2711a) and a silicon dioxide blank, monitoring analysis time, and ensuring the integrity and cleanliness of the XRF sampling window throughout the sampling.

To collect readings, samples were checked for large non-representative debris, e.g. large pebbles or roots, and these were removed from the sample prior to analysis with the XRF. Soil was gently tamped down to provide a uniform surface for the instrument window. One reading was taken from each location, using two beams, with analysis times of 30 seconds and 3 seconds.

All instrument blank readings returned results of 0.0 parts per million (ppm), with the exception of one zinc reading, which measured at 7.0 ppm. This reading may have been associated with dust within the instrument. Given the range of concentrations detected on site (53 to 385 ppm), this is not considered significant.

One or more heavy metals in 14 out of the 40 samples exceeded the background concentration established using the XRF; however, for 4 of these, the exceedance was by less than 35%, within the expected precision of the XRF. Three samples exceeded the Manaaki Whenua Landcare Research (2015) predicted background concentration by more than 35%, indicating that there is a higher likelihood that contaminants in excess of the local natural background were present in these samples.

4.4 Quarry Area

The active quarry occupies approximately 60 hectares over the southern half of the site. Extraction of sand and aggregate within the eastern two-thirds of the site is allowable under the Scheduled Activity designation in the district plan. Quarrying in the western third of the site is authorised by RC070216, which was issued in 2007. The current layout of the quarry is shown in Figure 99 below.



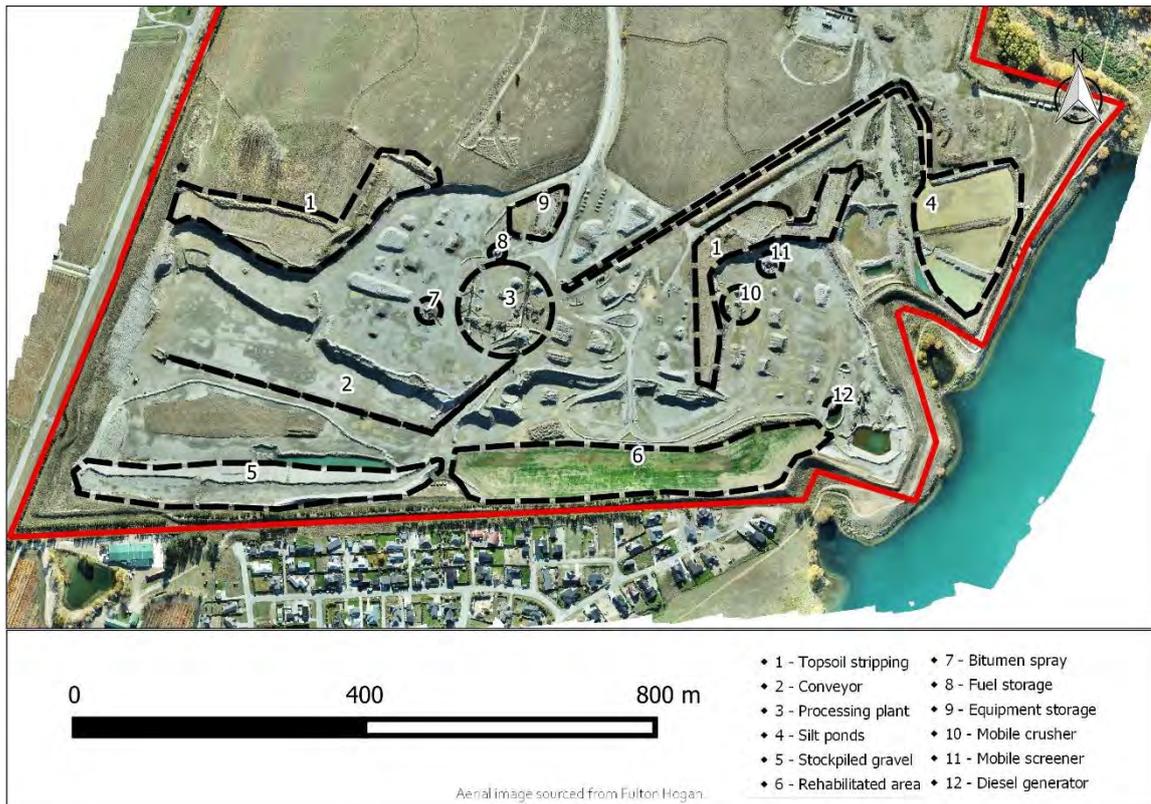


Figure 9: Quarry layout

Topsoil and overburden are stripped from the natural ground surface in advance of the active quarry faces (1). Within the consented quarry area, the extracted material is transported, using a conveyor belt system (2), to the crushing plant (3). Water is sprayed over aggregate as it passes through the plant on a screened conveyor. Debris and sediments are washed off the gravels, and wash water from the processing plant is discharged through a sludge channel to a series of silt ponds (4), which remove sediment from the water. No flocculants are used in this process. Water evaporates or infiltrates through gravels at the base of the ponds. After processing, the sorted material is stored at the site prior to dispatch.

Surplus pea gravel (4.5 to 8 mm gravels) from processing is used for reclamation within the quarry. These gravels are currently being used to form a 1V:3H batter along the southern face of the quarry (5). Topsoil stripped from the site is then placed over the pea gravels and grassed (6).

Roading chip produced at the processing plant is sprayed with a bitumen emulsion at a processing plant in the quarry (7). Bitumen is stored in a 30,000 L tank. The bitumen-coated chip is stored in separate stockpiles at the quarry.



North of the processing plant, there is a small fuel storage area, which includes a moveable double skinned diesel tank, and a bunded waste oil storage area (8). A storage area (9) near the shed is used for miscellaneous equipment and parts.

Mobile crushing (10) and screening (11) plants are used within the eastern portion of the quarry. These machines are periodically refuelled by a mobile diesel delivery service.

A small generator (12) with an in-built diesel tank is located within this part of the quarry. The diesel powers a generator used to supply power to pump for dust suppression. There was no evidence of soil staining or spills near the generator.

4.5 Balance of the site

The balance of the site is predominantly undeveloped pasture. The land is not currently grazed and there was no evidence of contaminating activities.

In the forested area to the west of the Firth Concrete plant, there was some old equipment and occasional surface litter, but not to the extent that soil contamination is likely.

The area occupied the orchard visible in the early aerial images was vacant land, and partially occupied by a bund. Topsoil from this area appeared to have been stripped in the past.



5 Summary of HAIL Activities

5.1 Identified HAIL Activities

The Ministry for the Environment's Hazardous Activities and Industries List (HAIL) is a compilation of activities and industries that have the potential to cause land contamination resulting from hazardous substance use, storage, or disposal. The HAIL is intended to identify most situations in New Zealand where use and storage of hazardous substances could cause, and in some cases have caused, land contamination.

Based on the review of site history information and a site inspection, several separate HAIL activities were identified. HAIL activities identified during this investigation include commercial concrete manufacture, asphalt manufacture, fuel storage, persistent pesticide use associated with the orchard, bulk storage of treated timber and waste disposal to land associated with the cleanfill. The identified HAIL activities are summarised in Table 3.



Table 3: Identified HAIL Activities

HAIL Activity	Dates	Comment	Likelihood
E4. Commercial concrete manufacture or commercial cement storage	2005 - present	Concrete block manufacturing facility	Certain
E2. Asphalt or bitumen manufacture or bulk storage (excluding single-use sites used by a mobile asphalt plant)	1987 - present	Asphalt plant	Certain
A17. Storage tanks or drums for fuel, chemicals or liquid waste	<1990-2004	Various fuel storage	Possible
A10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds	<1958--1985	1000 m ² of orchard	More likely than not
A18. Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or bulk storage of treated timber outside	~2020 - present	250 m ² of treated timber storage	Certain
G5. Waste disposal to land (excluding where biosolids have been used as soil conditioners)	1987 - present	Cleanfill	Likely

5.2 Non-HAIL Areas

Based on a review of site history information and observations on site, it is more likely than not those activities listed on the HAIL have *not* been undertaken on the site outside of those areas identified in section 5.1.

There is no evidence of HAIL activities having occurred through the balance of pastoral land through the site. There is no evidence of stock yards, sheep dips, woolsheds, farm landfills or other rural HAIL activities on the site in any historic aerial photographs.

It is likely that routine applications of superphosphate and DDT would have occurred during the period of low intensity productive use as farmland. These agrichemicals were commonly used to fertilise soil and control pests such as grass grub. e3Scientific has assessed Organochlorine Pesticides (such as DDT) and



cadmium (a contaminant associated with superphosphate) concentrations in soils throughout Otago and Southland. In all investigations, contaminants have only been encountered at elevated concentrations approaching NESCS soil contaminant standards in the vicinity of sheep dips, sheep footbaths, dusting yards and areas of historic agrichemical storage. It is highly unlikely the broadacre application of agrichemicals over the farm have occurred at a rate and intensity that would result in an accumulation of contaminants in concentrations that could present a risk to human health or the environment. As such, this activity is not considered a HAIL activity.

It is known that several on-site wastewater treatment and disposal systems have been used to treat domestic-type effluent from small offices and ablution blocks. These small-scale systems are considered as being of sufficient size or risk to be interpreted as HAIL sites under category HAIL category G6: *Waste recycling or waste or wastewater treatment*. Hazardous substances associated with wastewater effluent primarily come from commercial and industrial trade wastes that discharge to the sewer network. The primary risk to human health from domestic wastewater is associated with biological hazards, such as viruses and bacteria. These pathogens fall outside the scope of hazardous substance and contaminated land regulation but should be considered a matter for worker health and safety if excavation into the disposal fields were to be necessary.

Although mining industries are listed under HAIL Category E7, gravel extraction is explicitly excluded from this category, and the extraction and processing of aggregate at the Parkburn Quarry is not considered a HAIL activity.

Within the Fulton Hogan civil engineering yard, two small steel containers were used for storing explosives. Although HAIL Category C1 includes '*explosive or ordinance production, maintenance, dismantling, disposal, bulk storage or re-packaging,*' we do not consider the quantity stored to be considered of sufficient scale to be considered a HAIL activity.

Although waste recycling is listed under HAIL Category G6, we consider that the storage and crushing of glass should not be considered a HAIL activity, as it does not involve the storage, use or disposal of hazardous substances.

Prior to the development of the quarry, the only identified HAIL activity was the presence of a small (1,000 m²) orchard. Topsoil within the former orchard may have contained concentrations of organochlorine or heavy metal persistent



pesticides. Topsoil stripped from the site is typically used for reclamation and creating bunds on site, and it is possible that soil from the orchard has been reused or relocated on site. However, the volume of topsoil from this area, perhaps 200 m³, is relatively small compared to the volume of soil that has been stripped throughout life of the quarry, perhaps 150,000 m³. With incidental mixing of soils as they are stockpiled and moved around site prior to and during reclamation, we do not consider the reuse of topsoil to be a HAIL activity.

Outside the areas identified in Section 5.1, it is more likely than not that no activities or industries listed on the HAIL have occurred. The approximate spatial extents of HAIL and non-HAIL areas are shown in Figure 10.

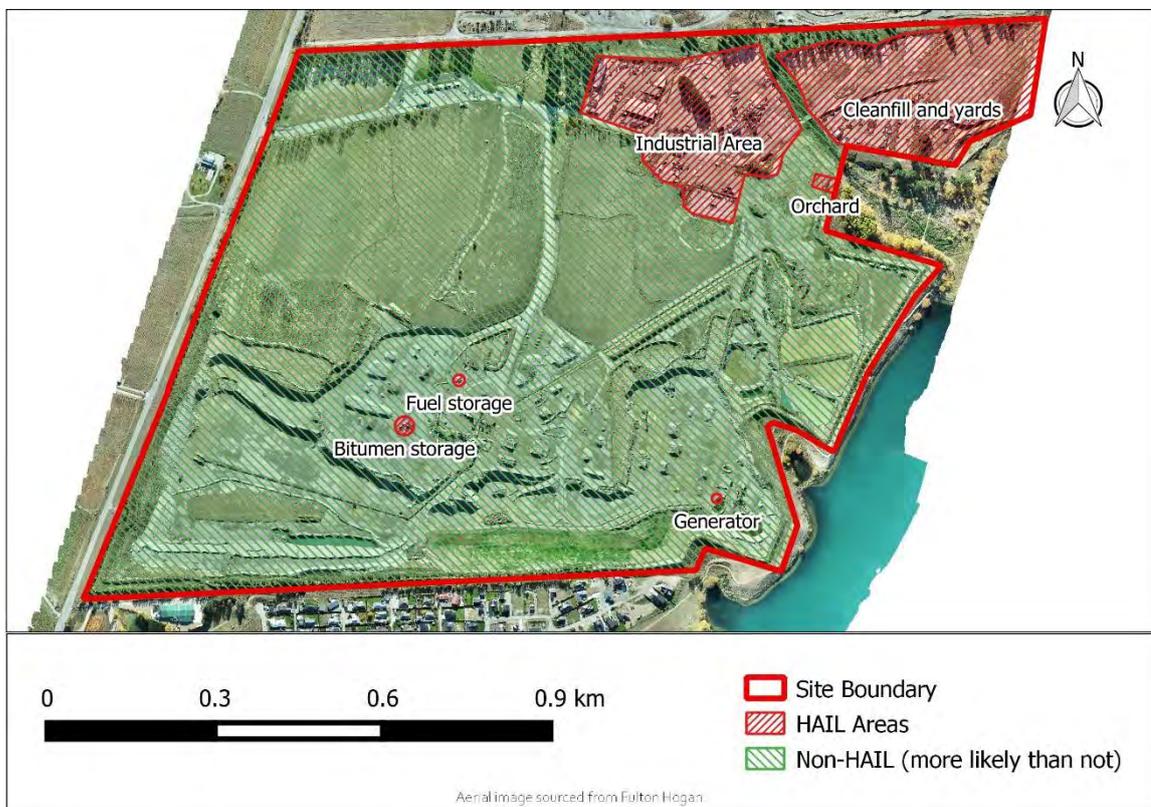


Figure 10: Approximate spatial extent of HAIL areas

5.3 Integrity Assessment

Overall, the established site history spans a period of approximately 120 years. Information obtained from the historic certificates of title and maps, historic aerial images (with a maximum interval of 18 years between 1983 and 2001), local authorities, and a site walkover has provided a reasonable understanding of the site history.



6 Preliminary Conceptual Site Model

A conceptual site model (CSM) for assessing site contamination provides an overview of the interaction between contaminants on site and potential receptors. Also referred to as the pollutant linkage model, the conceptual site model consists of three components (source-pathway-receptor), which if linked, indicate a risk may be present.

The following section sets out a preliminary conceptual site model. This preliminary conceptual site model is based on the collated information including an understanding of the possible contaminant sources, the possible routes of exposure to contaminants that may be present in soils on the site, and critical receptors.

6.1 Sources

A summary of the hazardous activities that have occurred on the site and the contaminants that may be associated with these activities is presented in Table 4 and described in the following sections. The contaminant list in Table 4 is based on site-specific observations and Appendix C of the NESCS User's Guide (Ministry for the Environment, 2012).

Table 4: HAIL activities and potential contaminants

HAIL Activity	Locations	Potential Contaminants
Concrete manufacture	Firth Concrete Block Plant Allied Concrete Batching Plant Frankton Marina Concrete Plant	Cement, calcium hydroxide, alkalis, ammonia, additives
Asphalt manufacture	Fulton Hogan Asphalt Plant	Total petroleum hydrocarbons (TPH) Polycyclic Aromatic Hydrocarbons (PAH)
Fuel storage	Diesel generator, bitumen spray, diesel and waste oil storage	Total petroleum hydrocarbons (TPH) Polycyclic Aromatic Hydrocarbons (PAH)



Persistent pesticide use	Former orchard	Heavy metals Organochlorine Pesticides
Treated timber storage	Fulton Hogan construction yard	Copper, chromium, arsenic
Waste disposal to land	Cleanfill area	Heavy metals

6.1.1 Concrete manufacture

Commercial concrete manufacture has taken place on site since 2005. Contaminants associated with concrete manufacture may affect soil pH and stormwater quality; however, risks to human health are generally not considered significant.

In addition to the contaminants listed in Table 4, small quantities of concrete retarding admixture are used within the concrete block manufacturing plant. The active ingredient in this product is tetrapotassium pyrophosphate. Tetrapotassium pyrophosphate is a common food additive, and not considered particularly toxic. The material safety data sheet (MSDS) does not list any special environmental protections required and does not identify the product as toxic to people.

A 10,000 L diesel tank and waste oil igloo are also known to be present within the concrete block manufacturing facility, and it is suspected diesel storage also occurred at the Allied Concrete batching plant in the past.

6.1.2 Asphalt manufacture

The asphalt manufacturing plant has operated on site since 1987. Asphalt manufacture involves the storage and handling of petroleum hydrocarbons including diesel, kerosene, and bitumen. Once manufactured and cured, asphalt is relatively stable, and unlikely to leach significant quantities of contaminants.



6.1.3 Fuel storage

Outside of the asphalt and concrete block plants, there are four known areas of relatively small-scale fuel storage. These include a diesel tank, waste oil storage, and generator at the quarry plant and diesel storage at the JCL asphalt yard.

6.1.4 Persistent pesticide use

Approximately 1,000 m² of orchard was present on the site from at least 1958 until 1985. During this period, organochlorine and heavy metal pesticides are likely to have been used on site. These contaminants typically bind strongly to soils and are not readily leached through the soil profile.

Topsoils from within the footprint of the former orchard were stripped as part of quarry development, and it is unlikely that pesticide residues are still present within this area. As discussed in section 5.2, topsoil stripped from the site is typically used for reclamation or creating bunds on site, and it is possible that soil from the orchard has been reused or relocated on site. However, the volume of topsoil from this area, perhaps 200 m³, is relatively small compared to the volume of soil that has been stripped throughout life of the quarry, perhaps 150,000 m³. With incidental mixing of soils as they are stockpiled and moved around site prior to and during reclamation, it is unlikely that detectable concentrations of pesticides could be found on site.

6.1.5 Treated timber storage

A relatively small area within the Fulton Hogan construction yard has been used for storage of treated timber poles. Although this activity has only occurred recently, and appears to be for relatively short duration, leaching of copper, chromium and arsenic from tanned timber can impact soils directly under the poles. Although leaching from treated timber stacks can pose a risk to human health under residential land use, results from previous investigations suggest that exceedance of commercial/industrial soil contaminant standards is unlikely (Marlborough District Council, 2016)

6.1.6 Waste disposal to land

Backfilling of the north-eastern portion of the site with cleanfill has taken place since the 1980's.



This activity was consented by the Otago Regional Council in November 2000, and the cleanfill generally appears to be well managed. ORC compliance reports in 2009 and 2020 identified minor non-compliance associated with reporting, but both inspections found the site to be tidy with no evidence of unconsented fill types or adverse environmental effects. A cleanfill management plan for the Parkburn Quarry was prepared by Fulton Hogan in 2018.

The management plan provides clear direction on consent and unconsented fill types and confirms that material from HAIL sites is not to be accepted without prior sampling.

Field readings of heavy metal concentrations with an X-Ray Fluorescent Spectrophotometer (XRF) indicates that heavy metal concentrations within most of the soil within the cleanfill surface and tipping faces are consistent natural background concentrations. A small number of readings returned results that indicate some contaminated fill material has been received.

6.2 Receptors and Pathways

Based on the proposed plan change and eventual development of the site, potential receptors will vary throughout the site. Because HAIL activities have been identified in areas proposed to be used for industrial and residential purposes, potential receptors will include:

- Construction workers involved in the development of the site.
- Outdoor workers in the industrial or commercially zoned areas.
- Adults and children living on the site in the residential and childcare areas.

Exposure pathways for contaminants to these potential receptors include:

- Incidental ingestion of contaminated soil.
- Inhalation of contaminants entrained in dust or volatile contaminants.
- Dermal absorption of contaminants.
- Consumption of produce grown in soils on site.

6.3 Preliminary Risk Assessment

A conceptual site model, based on the identified sources, pathways and receptors above is described in Table 5.



Based on the proposed plan change and eventual development of the site, there is potential for workers and residents to be exposed to contaminants associated with the existing HAIL activities.

Within the future residential area, the identified HAIL activities include relatively small-scale hydrocarbon storage associated with the bitumen spray plant, a diesel tank and waste oil storage, and a diesel generator. It is possible that these activities could leave localised areas of hydrocarbon contamination. Although topsoil will need to be imported to this part of this site, there is a relatively low risk that inhalation of volatile contaminants would remain an open exposure pathway. Any topsoil imported to the site should be certified as meeting the appropriate human health and environmental criteria.

Within the future industrially zoned area, the identified HAIL activities include concrete manufacturing and batching, asphalt production, fuel storage, persistent pesticide use, treated timber storage, and disposal of cleanfill. We consider that it is highly unlikely that contaminants in soil associated with concrete manufacture, persistent pesticide use, and treated timber storage would pose a risk to human under the proposed commercial/industrial land use.

It is possible that contaminants associated with asphalt production, fuel storage and cleanfill disposal could result in soil contamination that could pose a risk to long term outdoor workers using the site in the future without appropriate investigation, remediation and/or management during development. The greatest risks are associated with hydrocarbon storage, particularly around any underground fuel storage infrastructure (e.g. fuel supply pipelines). Risks associated with the disposal of cleanfill appear relatively low; however, given the long history of filling, it is possible that localised areas of contaminated fill material may be present.

Given the on-going use of the site for these HAIL activities, it would be appropriate to complete additional investigation upon decommissioning of any potentially contaminating land uses. These investigations may also be better able to assess risks to human health as plans for the proposed development become more detailed.



Table 5: Preliminary conceptual site model

Area	Source	Exposure Pathway	Possible Receptor	Pathway Linkage Assessment
Future Industrial Zoned Areas	Contaminants associated with asphalt manufacture, fuel storage and disposal of cleanfill	Ingestion of contaminated soil	Long term Outdoor workers and Construction workers involved in development of the site	Potentially complete – Site remains to be occupied and utilised by various commercial/industrial businesses.
		Dermal contact with contaminated soil and dust		
		Inhalation of volatile contaminants or contaminated dust		
Future residential zoned areas	Contaminants associated with hydrocarbon storage	Ingestion of contaminated soil	Residents	Incomplete – Residential development will require topsoil to be imported, either from off-site or from stockpiles of soil stripped during quarry operations. As such, direction exposure is unlikely.
		Dermal contact with contaminated soil and dust		
		Consumption of home grown produce		
		Inhalation of volatile contaminants or contaminated dust	Construction workers involved in development of the site	Potentially complete (volatile contaminants) – Inhalation of volatile contaminants may be a potentially complete pathway, even after topsoil has been imported.
		Ingestion of contaminated soil		
		Dermal contact with contaminated soil and dust		
Inhalation of volatile contaminants or contaminated dust				



7 Activity Status under the NESCS

Preliminary investigation of the site has identified areas of HAIL activity on discrete pieces of land throughout the site. As such, the NESCS will apply to subdivision, change of use, and soil disturbance associated with the development of the site if the plan change is approved.

7.1 Subdivision and Land Use Change

Regulation 8(4) of the NESCS states that subdividing land or changing the use of a piece of land is a permitted activity while the following requirements are met:

- (a) A preliminary site investigation of the land or piece of land must exist
- (b) The report on the preliminary site investigation must state that it is highly unlikely that there will be a risk to human health if the activity is done to the piece of land.
- (c) The report must be accompanied by a relevant site plan to which the report is referenced.
- (d) The consent authority must have the report and the plan.

In this case, we do not consider that the requirements of Regulation 8(3) are currently fully met. We consider the proposed zoning associated with the plan change to be generally suitable; however, given the on-going use of the site for HAIL activities, it would be appropriate to complete additional investigation upon decommissioning of any potentially contaminating land uses. These investigations may also be better able to assess risks to human health as plans for the proposed development become more detailed.

7.2 Soil Disturbance and Removal

Regulation 8(3) states that disturbing the soil of the piece of land is a permitted activity while the following requirements are met:

- a) Controls to minimise the exposure of humans to mobilised contaminants must:
 - i) be in place when the activity begins.
 - ii) be effective while the activity is done.
 - iii) be effective until the soil is reinstated to an erosion-resistant state.
- b) The soil must be reinstated to an erosion-resistant state within 1 month after the serving of the purpose for which the activity was done.



- c) The volume of the disturbance of the soil of the piece of land must be no more than 25 m³ per 500 m².
- d) Soil must not be taken away in the course of the activity, except that,—
- e) For the purpose of laboratory analysis, any amount of soil may be taken away as samples.
- f) For all other purposes combined, a maximum of 5 m³ per 500 m² of soil may be taken away per year.
- g) Soil taken away in the course of the activity must be disposed of at a facility authorised to receive soil of that kind:
- h) The duration of the activity must be no longer than 2 months:
- i) The integrity of a structure designed to contain contaminated soil or other contaminated materials must not be compromised.

Based on disturbance over the entire area of HAIL activity (160,000 m²) a maximum of 8000 m³ could be disturbed in any one year, and 1600 m³ can be removed.

Any soil disturbance or removal within the identified HAIL areas that do not meet the permitted activity criteria outlined in Regulation 8(3) would be a discretionary activity under Regulation 11 unless a Detailed Site Investigation (DSI) to quantify contaminant concentrations is completed.



8 Summary and Conclusions

Fulton Hogan Limited (FHL) operate Parkburn Quarry, immediately north of Pisa Moorings. The quarry was developed by FHL in the 1980s and has been in operation since this time. The quarry produces a range of aggregates, from sealing chip to construction and concrete aggregates. As the site is nearing the end of its operational lifespan, Fulton Hogan are seeking a plan change to rezone the site so that, upon closure, it can be redeveloped for a range of future land uses, including residential (standard and high density), commercial, retail commercial, childcare / education, green space, and industrial.

To assist Fulton Hogan in managing the risks associated with contaminants in soil, e3Scientific has undertaken a Preliminary Site Investigation (PSI) to identify the areas of potential contamination within the site, consider the risks to human health associated with the proposed development, consider the activity status of the future development under the NESCS, and assess the need for further investigation.

Based on a detailed review of site history information, HAIL activities identified during this investigation include commercial concrete manufacture, asphalt manufacture, fuel storage, persistent pesticide use associated with the orchard, bulk storage of treated timber and waste disposal to land associated with the cleanfill.

We consider that it is highly unlikely that contaminants in soil associated with concrete manufacture, persistent pesticide use, and treated timber storage would pose a risk to human under the commercial/industrial land use proposed for these areas.

It is possible that contaminants associated with asphalt production, fuel storage and cleanfill disposal could result in soil contamination that could pose a risk to long term outdoor workers using the site in the future without appropriate investigation, remediation and/or management during development. The greatest risks are associated with hydrocarbon storage, particularly around any underground fuel storage infrastructure (e.g. fuel supply pipelines). Risks associated with the disposal of cleanfill appear relatively low; however, given the



long history of filling, it is possible that localised areas of contaminated fill material may be present.

Given the on-going use of the site for these HAIL activities, it would be appropriate to complete additional investigation upon decommissioning or closure of any potentially contaminating land uses. At that stage, we consider that it would be appropriate to develop a number of feasible strategies for remediation and/or site management if necessary.



9 Report Certification

I, Simon Beardmore of e3Scientific, certify that:

1. This preliminary site investigation meets the requirements of the Resource Management (National Environmental Standard for assessing and managing contaminants in soil to protect human health) Regulations 2011 because it has been:
 - a. done by a suitably qualified and experienced practitioner, and
 - b. reported on in accordance with the current edition of Contaminated land management guidelines No 1 – Reporting on contaminated sites in New Zealand, and
 - c. certified by a suitably qualified and experienced practitioner.

2. This preliminary site investigation does **not** conclude:
 - a. it is highly unlikely that there will be a risk to human health if the subdivision and/or land use change described in Section 1.2 is done to the piece of land.

Evidence of the qualifications and experience of the suitably qualified and experienced practitioner(s) who have done this investigation and have certified this report is included in Appendix A.



Signed and dated:06/12/21.....



10 References

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Appendices

Appendix A:

e3Scientific Limited Contaminated Land Experience



Contaminated Land Services

e3Scientific Limited (e3Scientific) is a New Zealand owned and operated environmental science consultancy. Our team delivers technical, innovative science; practical solutions; and expert advice to assist our clients in the smart management of the environment.

e3Scientific provides a range contaminated land services, including:

- Due Diligence Investigations.
- Preliminary Site Investigations.
- Detailed Site Investigations.
- Soil and groundwater remedial advice and management.
- Peer review and regulator support.

Our Contaminated Land team has a sound understanding of New Zealand's regulatory environment with respect to the assessment and management of contaminated land and has been a major supplier of contaminated land services in Otago and Southland since 2012.

Simon Beardmore is the Technical Director of the Contaminated Land team at e3Scientific. Simon has over 12 years post graduate experience working as an Environmental Scientist, specialising in the investigation and management of contaminated land. Simon developed contaminated land management strategy and standard operating procedures at the Otago Regional Council and has completed and supervised the delivery of preliminary and detailed site investigations, and site remediation projects throughout Otago and Southland. Simon is responsible for technical oversight of projects and certifying contaminated land investigations as a suitably qualified and experienced practitioner. Simon is supported by Team Leader Fiona Rowley, Senior Environmental Scientists Carrie Pritchard, Jodi Halleux and Simon Bloomberg, and Environmental Scientist and Geospatial Specialist Jessie Lindsay.

The e3Scientific team has completed many Preliminary Site Investigations, Detailed Site Investigations and remedial projects across New Zealand and regularly provides peer review of site investigations for district and regional councils. Projects have involved investigations into the impact on soil quality associated with operational and historic timber treatment plants, fuel storage and distribution facilities, substations, sheep dips and yards, orchards, vineyards, agricultural activities, gasworks, service stations, and operational and closed landfills.





The following provides a summary of key contaminated land work e3Scientific is involved in or has completed:

- Hundreds of Preliminary Site Investigations and Detailed Site Investigations to support subdivision, landuse change and earthworks consent applications.
- Support Environment Southland's Selected Landuse Register including the identification of Hazardous Activities on properties across Southland and the registration of HAIL sites.
- Review of groundwater contamination associated with the former Invercargill gasworks site including the completion of a groundwater investigations and an environmental risk assessment to support a discharge consent application.
- Large scale remedial works of former timber treatment plants and sheep dips including the completion of detailed investigations to delineate the extent of contaminated soils, design of remedial action plans, project management of remedial works and completion of site validation and council close out reports.
- Investigations into an area of arsenic impacted soils in Frankton including the completion of detailed investigations to delineate the horizontal extent, consideration of the source of the arsenic, liaison with property owners and council.
- Project management of a bioavailability study of arsenic impacted soils in Gibbston Valley to support a Tier 2 risk assessment associated with a residential development.
- Oversight of the removal of multiple underground fuel storage systems for private residences, schools and oil and gas clients.

The e3Scientific team is committed to professional development, and employing new technologies in the prevention, assessment and remediation of contaminated land. e3Scientific is an active member of the Australasian Land & Groundwater Association and WasteMINZ.

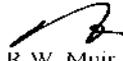


Appendix B:
Historic Certificates of Title



**RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy**




R.W. Muir
Registrar-General
of Land

Identifier 407414
Land Registration District Otago
Date Issued 07 February 2008

Prior References
GN7705203.1 OT10B/738

Estate Fee Simple
Area 50.1065 hectares more or less
Legal Description Part Section 62-63 Block IV and Part
Section 63 Block IV Wakefield Survey
District and Section 1 Survey Office Plan
365897

Registered Owners
Fulton Hogan Limited

Interests

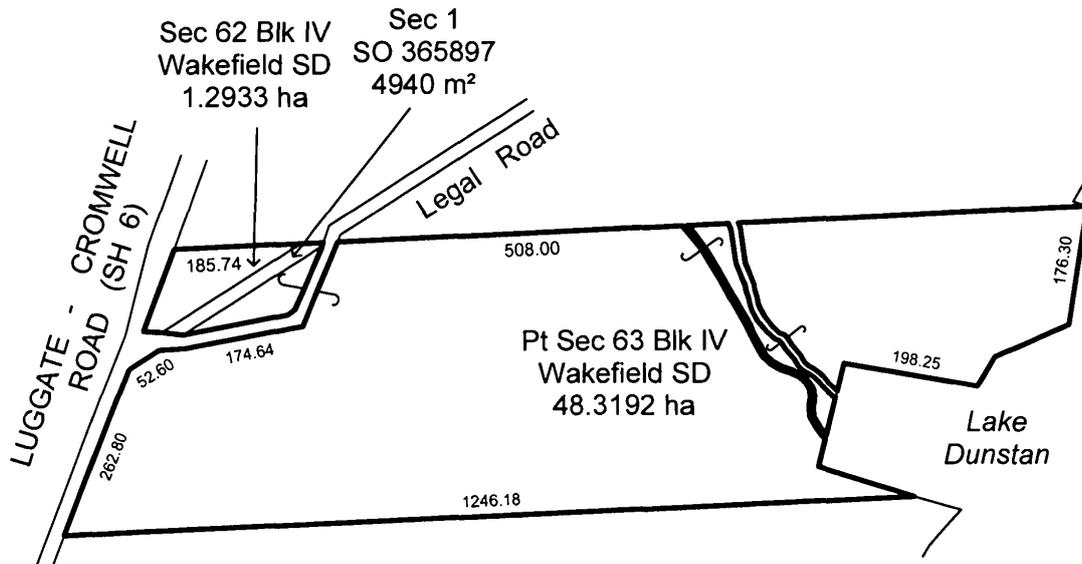
Subject to Section 8 Mining Act 1971(affects part formerly in CT OT10B/738)
Subject to Section 5 Coal Mines Act 1979(affects part formerly in CT OT10B/738)
5041663.1 Gazette Notice (2001/1044) declaring adjoining road (S.H.No. 6) to be limited access road - 11.5.2001 at 9:31 am
5057376.2 Notice pursuant to Section 91 Transit New Zealand Act 1989 - 10.7.2001 at 2:30 pm

Title Diagram ct 40741

Cpy - 01/01, Pgs - 001, 22/02/08, 09:06



DocID: 212144396



Total area: 50.1065 ha
For further dimensions see SO 365897 & SO 20808

CANCELLED

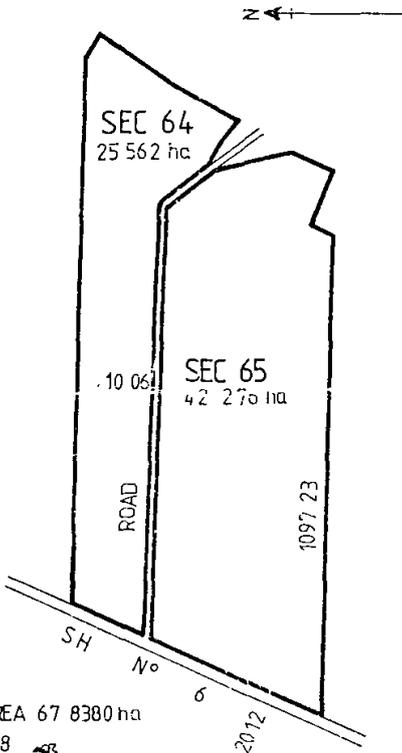


No. 10A / 748

Renewable Lease under the Land Act 1948

This Deed, made the 1st day of July 1982, between HER MAJESTY THE QUEEN (hereinafter referred to as "the Lessor"), of the one part, and CHARLES ROBERT PERPIAN of Lower Farm (hereinafter referred to as "the Lessee"), of the other part: WITNESSETH that, in consideration of the rent hereinafter reserved, and of the covenants, conditions, and agreements herein contained and implied, and on the part of the Lessee to be paid, observed, and performed, the Lessor doth hereby demise and lease unto the lessee, all that parcel of land containing by admeasurement 67.8380 hectares more or less, situated in the Land District of Otago, and being Sections 64 and 65 Block IV Wakefield Survey District

(hereinafter referred to as "the Lessee"), of the other part: WITNESSETH that, in consideration of the rent hereinafter reserved, and of the covenants, conditions, and agreements herein contained and implied, and on the part of the Lessee to be paid, observed, and performed, the Lessor doth hereby demise and lease unto the lessee, all that parcel of land containing by admeasurement 67.8380 hectares more or less, situated in the Land District of Otago, and being Sections 64 and 65 Block IV Wakefield Survey District



TOTAL AREA 67.8380 ha
SQ 20838

as the same is more particularly delineated with bold black lines on the plan hereon, together with the rights, easements, and appurtenances thereto belonging. TO HOLD the said premises intended to be hereby demised unto the Lessee for the term of 33 years, commencing on the 1st day of July 1982 together with the period between the date of this Lease and the aforesaid 1st day of July 1982, YIELDING and paying therefor for the first 11 years of the said term unto the Department of Lands and Survey at Dunedin the annual rent of \$ 792.00 calculated on a Rental Value of \$ 17600.00 payable without demand by equal half-yearly payments in advance on the 1st day of January and the 1st day of July in each and every year during the said period of 11 years, and for the next two successive periods of 11 years of the said term a rent determined in respect of each of those periods in the manner provided in section 132A of the Land Act 1948. AND also paying in respect of the improvements specified in the Schedule hereto the sum of \$ by a deposit of \$ (which has already been paid), together with interest thereon at the rate of per centum per annum and thereafter by half yearly instalments of \$ on the 30th day of June and the 31st day of December in each and every year subject to variation of the rate of interest and the amount of the half yearly instalments in the manner hereinafter provided. The first such instalment shall be payable on the 31st day of December 1982. Interest on the balance of the purchase money from the day of 19 to the day of 19 shall be payable on the said day of 19

July 19 82 together with the period between the date of this Lease and the aforesaid 1st day of July 19 82, YIELDING and paying therefor for the first 11 years of the said term unto the Department of Lands and Survey at Dunedin the annual rent of \$ 792.00 calculated on a Rental Value of \$ 17600.00 payable without demand by equal half-yearly payments in advance on the 1st day of January and the 1st day of July in each and every year during the said period of 11 years, and for the next two successive periods of 11 years of the said term a rent determined in respect of each of those periods in the manner provided in section 132A of the Land Act 1948. AND also paying in respect of the improvements specified in the Schedule hereto the sum of \$ by a deposit of \$ (which has already been paid), together with interest thereon at the rate of per centum per annum and thereafter by half yearly instalments of \$ on the 30th day of June and the 31st day of December in each and every year subject to variation of the rate of interest and the amount of the half yearly instalments in the manner hereinafter provided. The first such instalment shall be payable on the 31st day of December 1982. Interest on the balance of the purchase money from the day of 19 to the day of 19 shall be payable on the said day of 19

AND it is hereby declared and agreed (1) That these presents are intended to take effect as a renewable lease of Farm land under section 63 of the Land Act 1948 and of any enactments passed in amendment or substitution thereof and the provisions of the said Act and of the regulations made thereunder applicable to such leases shall be binding in all respects upon the parties hereto in the same manner as if such provisions had been fully set out herein.

(2) That the Land Settlement Board pursuant to its powers under section 170B of the Land Act 1948, reserves the right to review the rate of interest payable by the Lessee in the respect of the improvements specified in the Schedule hereto for the second and each ensuing period of 5 years of the term hereof, and the provisions of that section shall apply to any such review, and any necessary adjustments to the instalments payable

Assistant
 IN WITNESS whereof the Commissioner of Crown Lands for the said Land District, on behalf of the Lessor, has hereunto set his hand,
 and these presents have also been signed by the said Lessee

No. 10A/748

Assistant
 Signed by the said Commissioner, on behalf of the Lessor,
 in the presence of—

Witness: *[Signature]*
 Occupation: *Chief, Dept. Land & Survey*
 Address: *Dunedin*

[Signature]
 Assistant Commissioner of Crown Lands

Signed by the above-named Lessee in the presence of—

Witness: *[Signature]*
 Occupation: *[Signature]*
 Address: *[Signature]*

[Signature]
 Lessee

Interests at date of Issue:

X20543 Irrigation Agreement under Part X1 of the
 Public Works Act 1928 with Her Majesty the Queen
 - 9.12.1958 at 2.40 pm.

X20544 Irrigation Agreement under Part X1 of the
 Public Works Act 1928 with Her Majesty the Queen
 - 9.12.1958 at 2.41 pm.

394308 Mortgage to Bank of New Zealand - 2.11.1972
 at 11.09 am.

506156 Compensation Certificate pursuant to Section
 17 of the Public Works Amendment Act 1948 - 1.11.1978
 at 11.59 am.

[Signature]
 A.L.R.

638087/2 Transfer to Robert Stanley
 Perriam of Lowburn Farmer - 2.7.1985
 at 10.37am

[Signature]
 A.L.R.

638087/3 Mortgage to Charles Robert
 Perriam - 2.7.1985 at 10.37am

[Signature]
 A.L.R.

648690) Cancelled and new C.T. 10B/1452
 13.12.1985) issued for the within land

[Signature]
 A.L.R.

DUPLICATE DESTROYED
 11/13/1986

44572E-2,000/3/80 MK

DISTRICT LAND REGISTRAR
CANCELLED
 OTAGO
 NEW ZEALAND

10.24 23.NOV.84 626107/3
 PARTICULARS ENTERED IN REGISTER
 LAND REGISTRY OTAGO
 ASST. LAND REGISTRAR

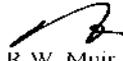




**COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952**

Historical Search Copy




R.W. Muir
Registrar-General
of Land

Identifier **OT10B/738** **Cancelled**

Land Registration District **Otago**

Date Issued 26 August 1985

Prior References

OT115/31

Estate Fee Simple
Area 50.2450 hectares more or less
Legal Description Section 62-63 Block IV Wakefield Survey
District

Original Proprietors

Fulton Hogan Limited

Interests

Subject to Section 8 Mining Act 1971

Subject to Section 5 Coal Mines Act 1979

Mining Licence embodied in register 9D/212 - 3.8.1987 at 9:08 am

5041663.1 Gazette Notice (2001/1044) declaring adjoining road (S.H.No. 6) to be limited access road - 11.5.2001 at 9:31 am

5057376.2 Notice pursuant to Section 91 Transit New Zealand Act 1989 - 10.7.2001 at 2:30 pm

5879308.1 Expiry of Mining Permit 684068 - 29.1.2004 at 9:00 am

7705203.1 Gazette Notice (2008 page 360) declaring Section 3 SO 365897(317m2) and Section 4 SO 365897 (6009m2) to be road and vested in the Central Otago District Council on 31.1.2008 and stopping the adjoining road (Section 1 SO 365897 -4940m2) and amalgamating it with the within land CT 407414 issued- 7.2.2008 at 9:00 am

CANCELLED

Reference:
Certificate No. 641455
P.R. Vol. 115 Folio 31
Transfer No.



REGISTER

No. 10B/738

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 26th day of August one thousand nine hundred and eighty five under the seal of the District Land Registrar of the Land Registration District of O T A G O being a Certificate in lieu of Grant, **WITNESSETH** that ROBERT STANLEY PERRIAM of Lowburn, Farmer

is seized of an estate in fee simple (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, which said land was originally acquired by the abovenamed

as from the 17th day of December one thousand nine hundred and eighty four under Section 124A Land Act 1948 that is to say: All that parcel of land containing 50.2450 hectares more or less being Sections 62 and 63 Block IV WAKEFIELD DISTRICT

Interests at date of issue:



Subject to the reservations and conditions imposed by Section 8 Mining Act 1971 and Section 5 Coal Mines Act 1979

X20543 Irrigation Agreement under Part XI Public Works Act 1951 1958 at 2.40pm

649433 Transfer to Fulton Hogan Limited - 23.12.1985 at 1.43pm

X20544 Irrigation Agreement under Part XI Public Works Act 1951 1958 at 2.41pm

684068 Mining Licence under the Mining Act 1971 affecting part of the within land in favour of Fulton Hogan Limited for a term of 21 years commencing on 20 July 1987 - 3.8.1987 at 9.08 am See Volume 9D Folio 212

6380873 Mortgage to Charles Robert Perriam - 2.7.1985 at 10.37am

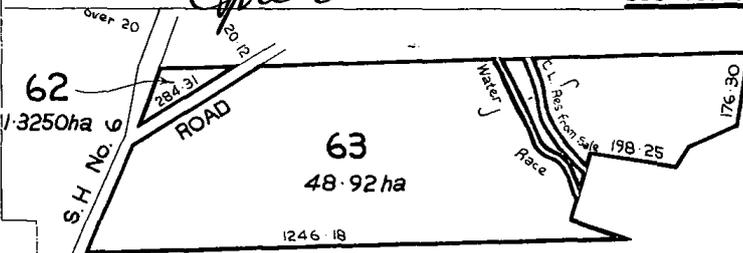
DISCHARGED
JUN 1995
ALR.

DISCHARGED
JUN 1995
ALR.

[Signature]
A.L.R.

[Signature]
A.L.R.

[Signature]
A.L.R.



Scale 1:12500 S.O. 20808
Total Area: 50.2450ha

Measurements are Metric

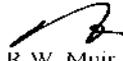
Register copy for L. & D. 69, 71, 72

10B/738



**RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy**




R.W. Muir
Registrar-General
of Land

Identifier OT10B/1452
Land Registration District Otago
Date Issued 13 December 1985

Prior References
OT10A/748

Estate Fee Simple
Area 67.8380 hectares more or less
Legal Description Section 64-65 Block IV Wakefield Survey
District

Registered Owners
Fulton Hogan Limited

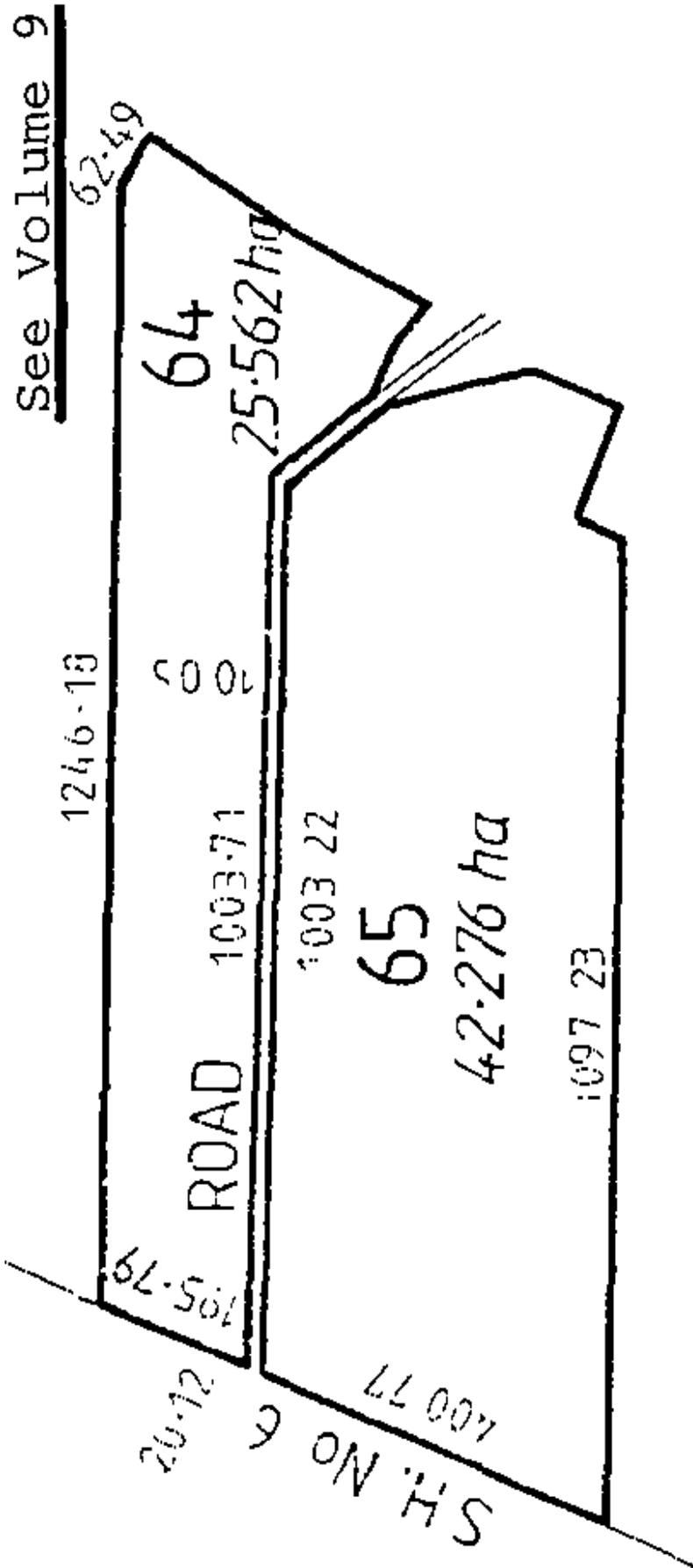
Interests

Subject to Section 8 Mining Act 1971

Subject to Section 5 Coal Mines Act 1979

5041663.1 Gazette Notice (2001/1044) declaring adjoining road (S.H.No. 6) to be limited access road - 11.5.2001 at 9:31 am

See Volume 9



Reference to the file 115/31

NEW ZEALAND
CANCELLED



(Crown Lands Form No. 51)

Register-book.

Vol. 115 fol. 31

Application No.

115/31

Image Quality due to Condition of Original

Clay LAND DISTRICT.

LEASE IN PERPETUITY UNDER PART III. OF "THE LAND ACT, 1892," AND SECTION 7 OF "THE MINING ACT AMENDMENT ACT (No. 2), 1893."

No. 829.

This Deed, made the 6th day of October, 1897, between Her Majesty the Queen (who with her heirs and successors is hereinafter termed "the Lessor"), of the one part, and Robert Davidson

of Lamburn Ferry in the Land District of Clay

Block IV Wakfield District

139 ac. 25 per.

EQUIVALENT METRIC
AREA IS 80.5957 ha
605706 31.4080 ha
49.1877 ha
611832/4 50.2450 ha

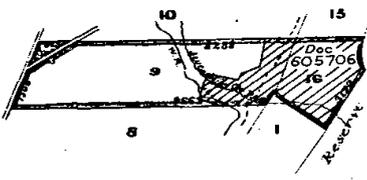
in the Colony of New Zealand (hereinafter, with his executors, administrators, and permitted assigns, referred to as and included in the term "the Lessee"), of the other part, & it is expressly that, in consideration of the rent hereinafter reserved, and of the covenants, conditions, and agreements herein contained and implied and on the part of the Lessee to be paid, observed, and performed, the Lessor doth hereby demise and lease unto the Lessee All that piece or parcel of land, containing by admeasurement One hundred and Ninety nine (199) acres roads and breach free (25) perches, a little more or less, situated in the Land District of Clay aforesaid, and being Section 5 numbered 9 and 10, Block IV Survey District of Wakfield, as the same is more particularly delineated and described in the plan drawn hereon, and therein

coloured red in outline; together with the rights, easements, and appurtenances to the same belonging: To hold the said several premises intended to be hereby demised unto the Lessee for the term of nine hundred and ninety nine years, commencing from the 1st day of January next seven and a half plying and paying therefor unto the Receiver of Land Revenue for the said District of Clay the annual rent of Three pounds ten shillings and eight pence

(£ 3 : 10 : 8), payable half-yearly in advance on the 1st day of January and 1st day of July in each and every year during the said term, free from all deductions whatsoever the Lessee being a

And it is hereby declared and agreed that these presents are intended to take effect as a lease in perpetuity under Part III. of "The Land Act, 1892"; and the provisions of that statute applicable to such leases, so far as the same apply to the term, estate, or interest hereby granted or created, and to the relations between the Lessor and Lessee from time to time, shall, subject to the provisions of section 7 of "The Mining Act Amendment Act (No. 2), 1893," be binding in all respects upon the parties hereto in the same manner as if such provisions had been fully set out herein: And it is hereby further declared that if any dispute or disagreement shall arise between the parties hereto touching the construction of these presents, or in anywise relating hereto, such dispute or disagreement shall be referred to arbitration in the manner set forth in section 79 of the said Act; and neither of the said parties shall take or cause to be taken any steps or proceedings to set aside or call in question any award or decision which may have been given upon any such reference as final:

In Witness whereof the Commissioner of Crown Lands for the Land District of Clay on behalf of the Lessor, hath hereunto set his hand, and these presents have been also executed by the said Lessee,



Scale: 30 chains to an inch.

Signed by the said Commissioner, on behalf of the said Lessor, in the presence of—
James de la G. Jones
Well
Signed by the above-named Robert Davidson as Lessee, in the presence of—
William Ferguson
Lamburn Ferry
Robert Davidson

Robert Davidson
Robert Davidson

"Land Act, 1892," Part III.

Transfer No. 40562 Robert Perriam to
Dunlop Macpherson of Lowburn Parkhouse
entered 2nd September 1905 at 11.00

605706 Gazette Notice declaring parts of
Sections 9 (1.95 ha, 2.42 ha, 4800 m²)
and 16 (205580 ha) shown hatched black on
the diagram hereon are acquired for the
generation of electricity and shall vest
in the Crown from and after the 27th day
of October 1983 - 21.11.1983 at 10.56 am

Transmission No. 12288 to Susan Hill etc. as holders of Wanaia
Road, Lowburn. Vidua entered 27th Feb. 1940 at 10.00

Mortgage No. 54614 Susan Hill Macpherson to
The Treasury Ltd
DISCHARGED
Produced 11.11.1983

[Signature]
A.L.R.

Transmission No. 2692 to Ernest Jolly & Ernest
Merchant as Executor entered 20th June 1940
at 11.30.00

The within land is now known as Sections
62 (1.3250 ha) and 63 (48.92 ha) Block IV
Wakefield S.D. - 20.3.1984 at 11.51 am
See Re-appellation 611832/4

Transfer No. 152214 Ernest Jolly to William Henry Perriam
and Charles Robert Perriam both of Auckland
Produced 11.11.1983

[Signature]
A.L.R.

Mortgage No. 107136 William Henry Perriam and Charles
Robert Perriam to the Bank of New Zealand
Produced 11.11.1983

626107/1 Certificate of alteration with
effect from 27.10.1984 reducing the
rental value to \$118.94 and annual rent
to \$1.76 - 23.11.1984 at 10.24 am.

Transfer No. 155697 William Henry Perriam
Charles Robert Perriam to the Bank of New Zealand
Produced 11.11.1983

[Signature]
A.L.R.

1928 Imposition Agreement under Part 21 of the Public Works Act
1928 between Her Majesty the Queen and Charles Robert
Perriam entered 9th December 1958 at 2.40.00

638087/2 Transfer to Robert Stanley
Perriam of Lowburn Farmer - 2.7.1985
at 10.37am

[Signature]
A.L.R.

1928 Imposition Agreement under Part 21 of the Public Works Act
1928 between Her Majesty the Queen and Charles
Robert Perriam entered 9th December 1958 at 2.40.00

638087/3 Mortgage to Charles Robert
Perriam - 2.7.1985 at 10.37am

[Signature]
A.L.R.

394308 Mortgage to Bank of New Zealand -
DISCHARGED
2.11.1972 - 9.11.1985

641455) Cancelled and new C.T.
26.8.1985) 103/738 issued.

[Signature]
A.L.R.

[Signature]
A.L.R.

THIS REPRODUCTION (ON A REDUCED SCALE)
CERTIFIED TO BE A TRUE COPY OF THE
ORIGINAL REGISTER FOR THE PURPOSES OF
SECTION 215A LAND TRANSFER ACT 1952.
[Signature] A.L.R.

DISTRICT LAND
REGISTRAR
CANCELLED
OTAGO
NEW ZEALAND

503342 Certificate of Charge under
Section 280(1) Public Works Act
1928 - 13.9.1978 at 4.42 pm

[Signature]
A.L.R.

506156 Compensation Certificate pursuant to
section 17 of the Public Works Amendment Act
1948 - 1.11.1978 at 11.59 am

[Signature]
A.L.R.

DUPLICATE DESTROYED
9/19/1985

No. 829.

DATED 6th October 1897.

Her Majesty the Queen

Robert Davidson

Dist. Land District.

LEASE

Of Section 9 & 16, Block 11.

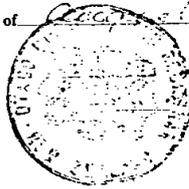
Wakfield Survey District.

Under "The Land Act, 1892."

Nine hundred and ninety-nine years from

1st January 1898.

Entered at 10 o'clock on the 21st day of October 1897.



District Land Registrar.

SECTIONS 141 TO 147 OF "THE LAND ACT, 1892."

Compulsory Residence.

141. Residence on any land, not being land purchased for cash, selected under this Part of this Act shall be compulsory, and shall commence in bush-lands or on swamp-lands within four years, and in open or partly open land within one year, from the date of selection; and thereafter such residence shall be continuous—

- (1) On lands occupied with right of purchase, for six years on bush-lands or on swamp-lands, and for seven years on open or partly open land;
(2) On lease-in-perpetuity lands, for a term of ten years.

But these conditions of residence shall not apply to any person who has acquired an interest in any lease or license under an intestacy or by virtue of a will.

142. The Board may dispense with residence if the lessee or licensee reside and continue to reside on lands contiguous to the lands held under lease or license. Lands shall be deemed to be contiguous to each other if only separated by a road or stream, or by such interval of space as the Board may determine in each case.

The Board may also dispense with residence for four years after the commencement of the term where residence is otherwise compulsory in cases where the lessee or licensee are youths or unmarried women living within the land district, and residing with their parents or near relatives.

In case of the death of either or both parents of a child or children, residence may be dispensed with until such child or one of such children respectively attain the age of seventeen years.

143. Personal residence may also be dispensed with by the Board in the cases hereinafter mentioned:—

- (1) Whenever any two persons, being licensees with right of purchase or leases in perpetuity, have lawfully intermarried at some period not sooner than twelve months after the issue of the last of such licenses or leases, such persons may reside on such one of the selections of land made by them as they may think fit.
(2) Whenever any two persons, one of whom has become a selector of land with right of purchase or a lessee in perpetuity, and the other is an owner or occupier of freehold land, have lawfully intermarried at some period not sooner than twelve months from the issue of the license or lease held by such selector, such selector may reside on such freehold.
(3) Residence on such selection or on such freehold, as may be the case, shall be deemed a compliance with the conditions of section one hundred and forty-one in respect of residence by such several persons.
(4) The Board, however, shall have a discretionary power to dispense with personal residence on sufficient and consistent grounds being shown, and non-residence

Improvements.

144. Every selector of lands under this Part of this Act, whether for occupation with right of purchase or for lease in perpetuity, shall put on the land comprised in his license or lease, as the case may be, substantial improvements—

- (a.) Within one year from the date of his license or lease, to a value equal to ten per centum of the price of the land;
(6.) Within two years from the date of his license or lease, to a value equal to another ten per centum of the price of the land;
(c.) And thereafter, but within six years from the date of his license or lease, to a value equal to another ten per centum of the price of the land;

And in addition thereto shall, within six years from the date of his license or lease, put substantial improvements of a permanent character on first-class land to the value of one pound for every acre of such land, and on second-class land to an amount equal to the net price of every acre of such land: Provided that in no case shall the additional improvements required on second-class land be more than ten shillings per acre.

And every selector shall be bound at any time when so required by the Board to make and sign a statutory declaration as to his fulfilment of the conditions of occupation and improvement of the land in his occupation up to the time of making the said declaration.

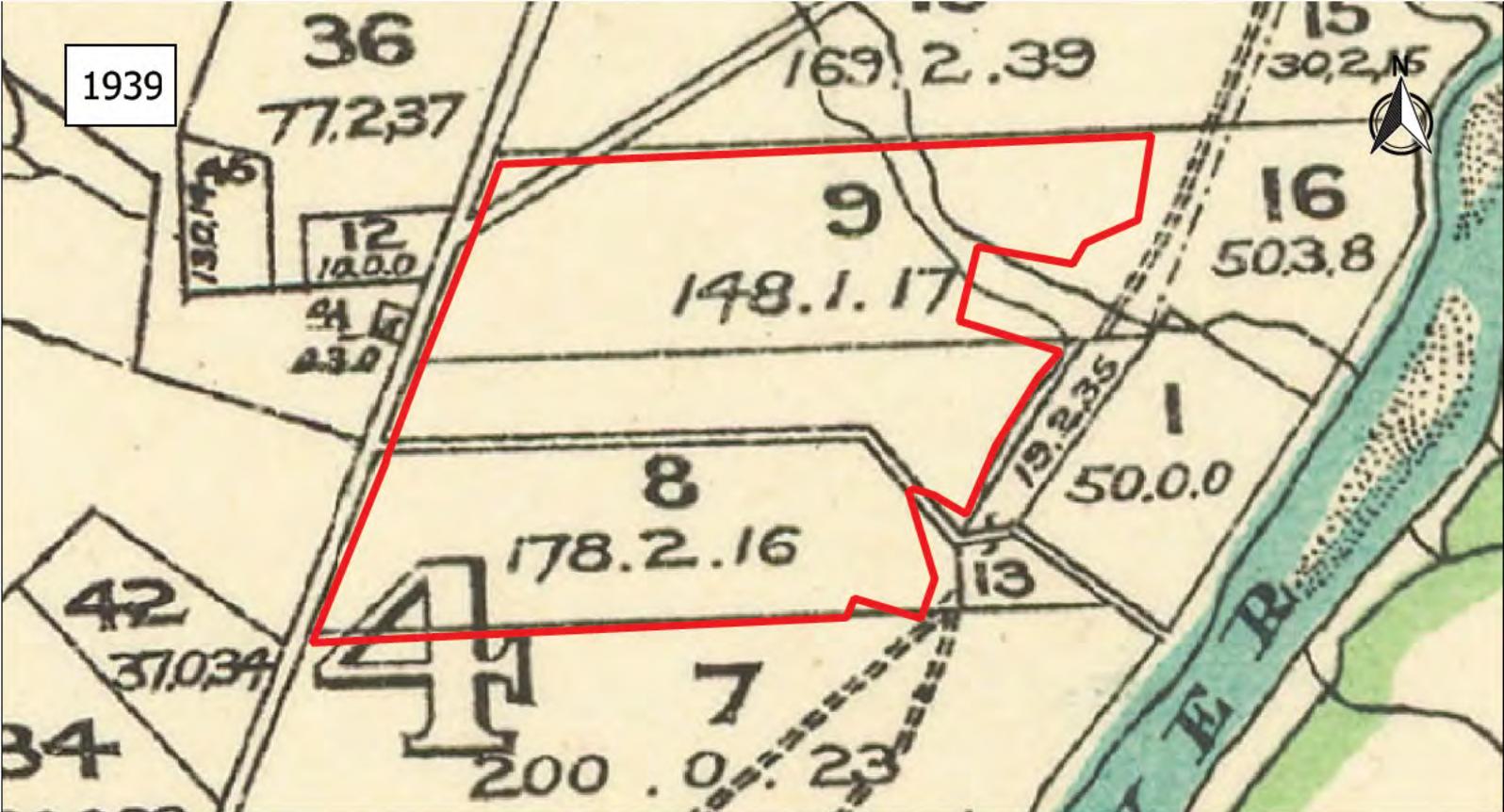
145. Any holder of bush-lands or swamp-lands on deferred payments under section one hundred and fourteen of "The Land Act, 1887," or in any special settlement under regulations made before the twenty-seventh day of February, one thousand eight hundred and ninety-one, under Part V. of such Act, and any holder of a perpetual lease of any land under section one hundred and forty-eight of such Act, shall be deemed to have complied with the requirements of section twenty-one of "The Land Act Amendment Act, 1887," if within six years from the date of his license or lease he has brought or shall bring into cultivation twice the amount of land required by the herein first above-mentioned sections or regulations respectively, and in addition thereto has put or shall put substantial improvements of a permanent character on the land in his occupation to the value of one pound for every acre of such land.

146. In the case of suburban lands the Board in its discretion may dispense with conditions as to improvements of special monetary value, where such substantial improvements have been effected as in the opinion of the Board are reasonable in the circumstances.

147. The Board, on compliance with the provisions of section eighty-three, or on their being satisfied by a statutory declaration that the transferee is unable or not so able as to make the improvements on the land required by this Act, may sanction a transfer, either by way of mortgage or otherwise, of land other than such land, or of any interest in such land, held under this Part of this Act, at any time after the first selection thereof, to any person not disqualified who shall make the declaration under the particular system under which the land is held, as given in the Schedules to this Act.

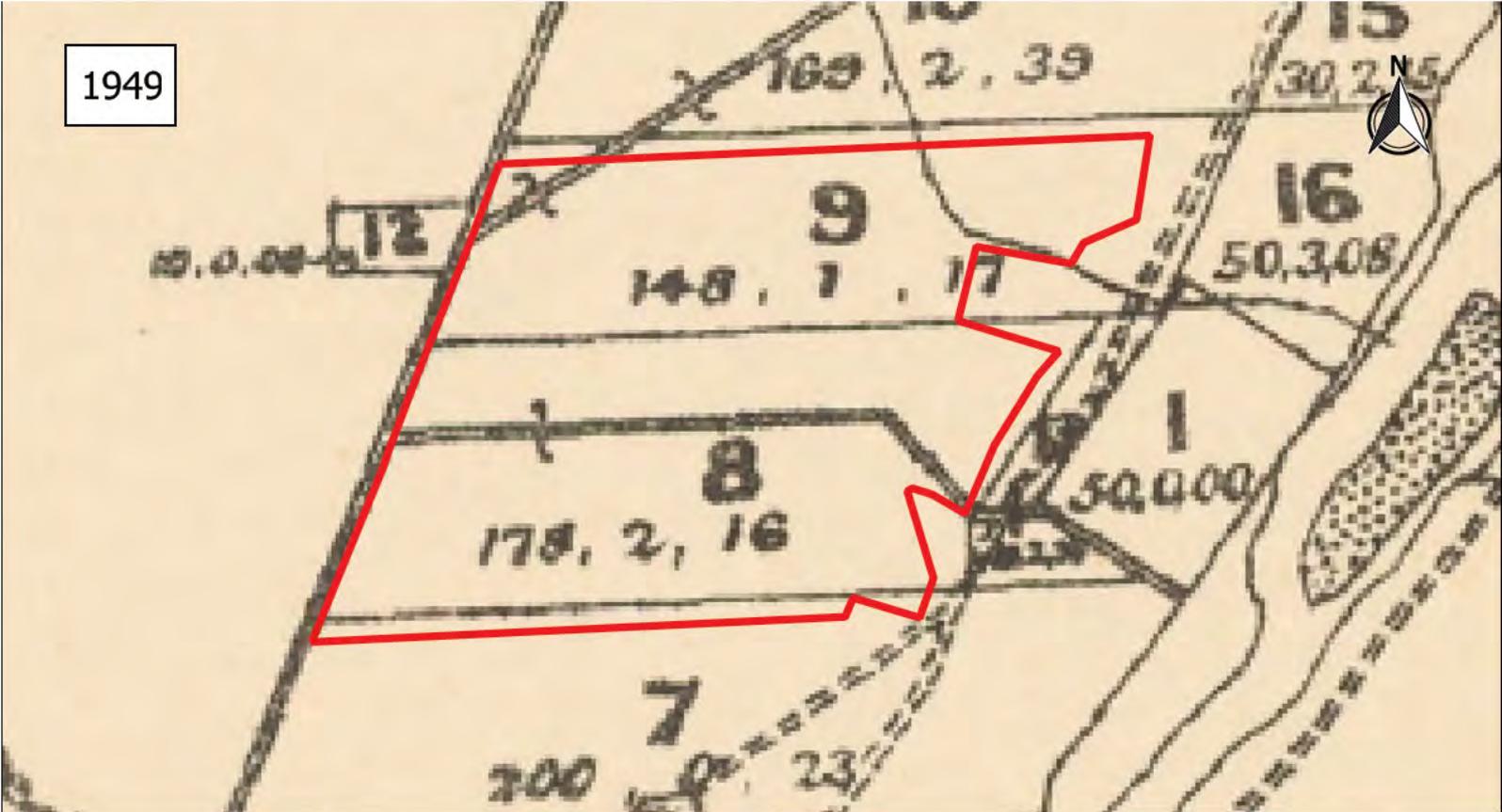


1939



 Site Boundary

1949

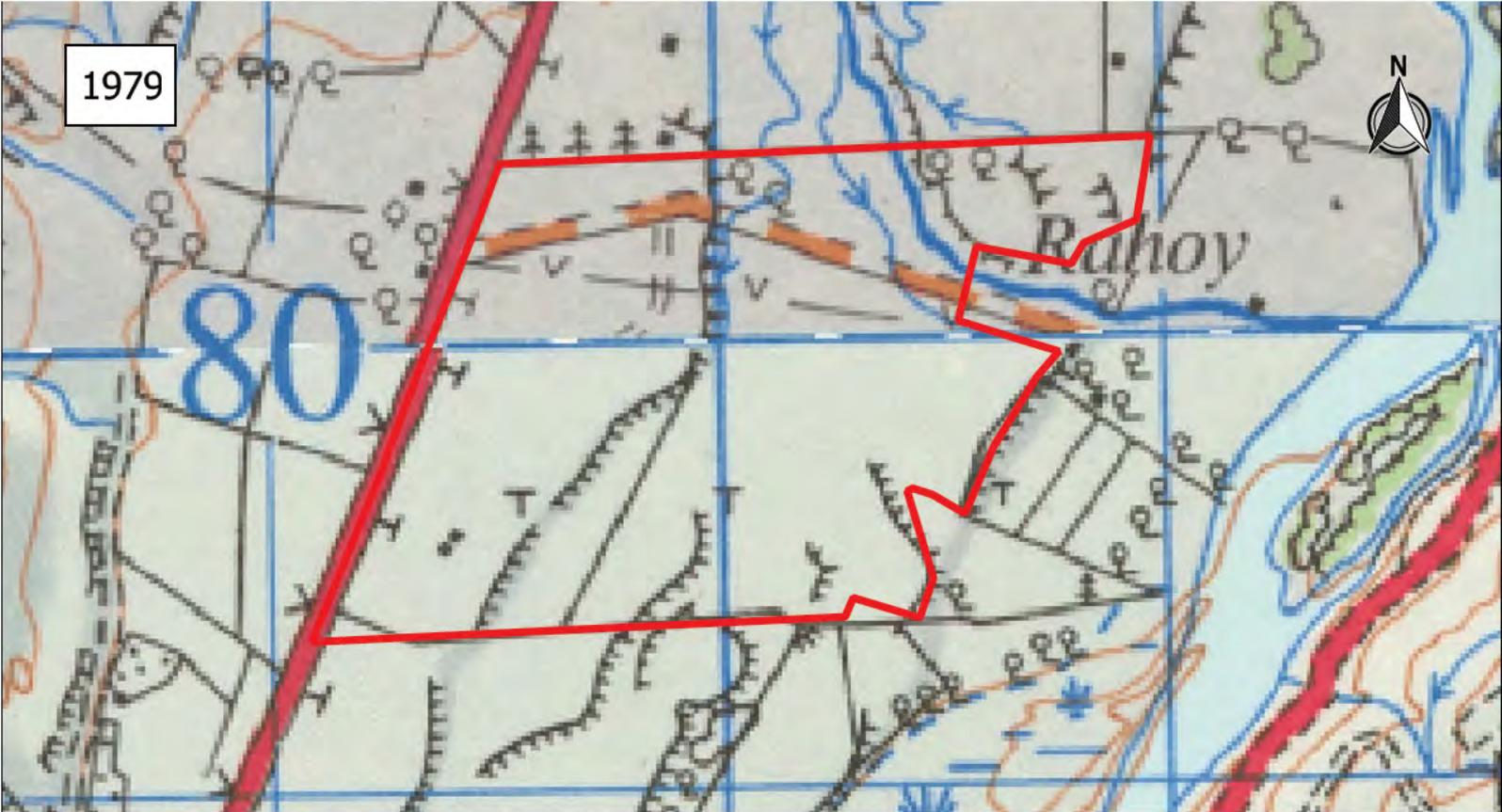


0 500 1000 1500 m



 Site Boundary

1979

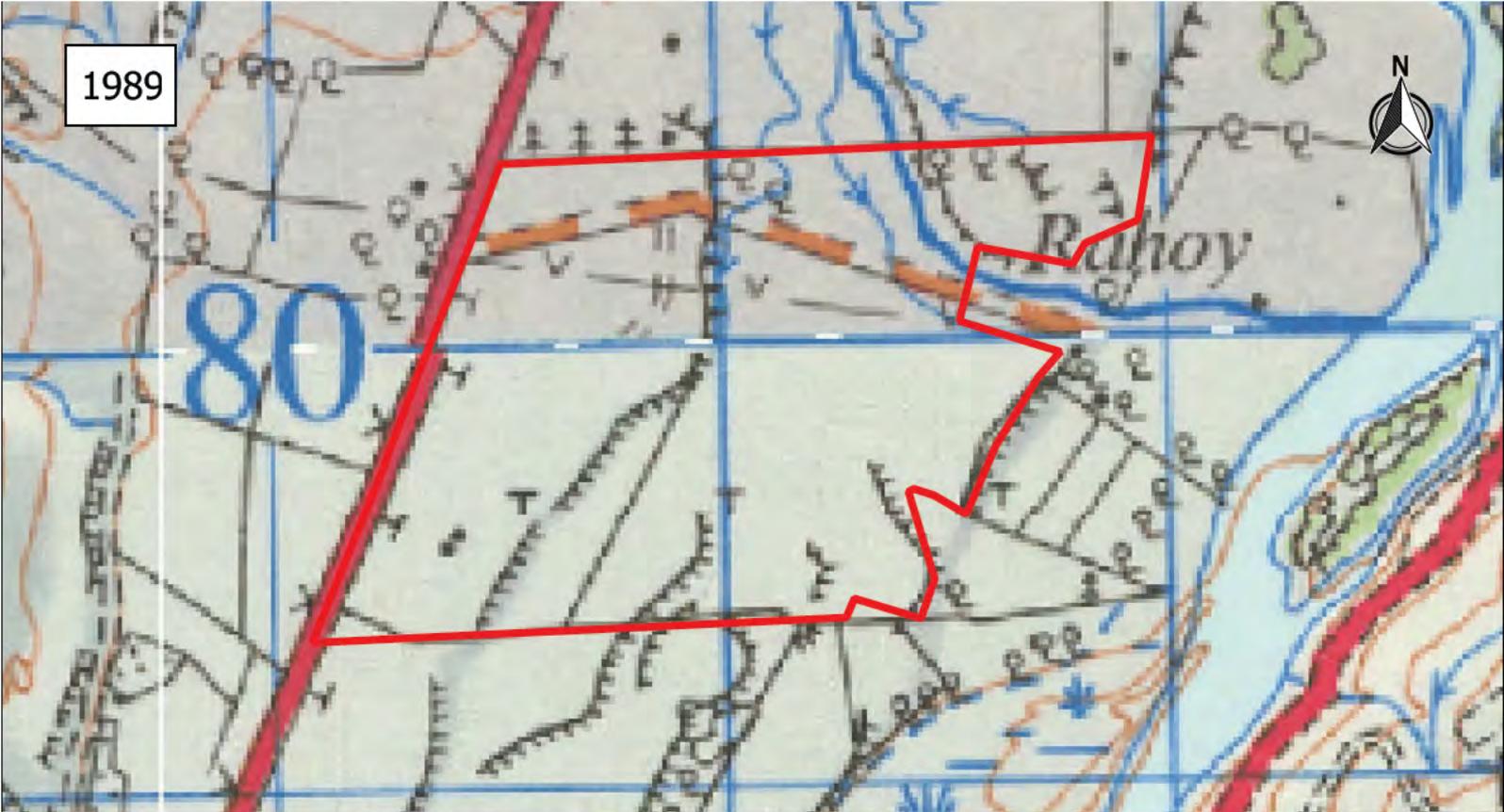


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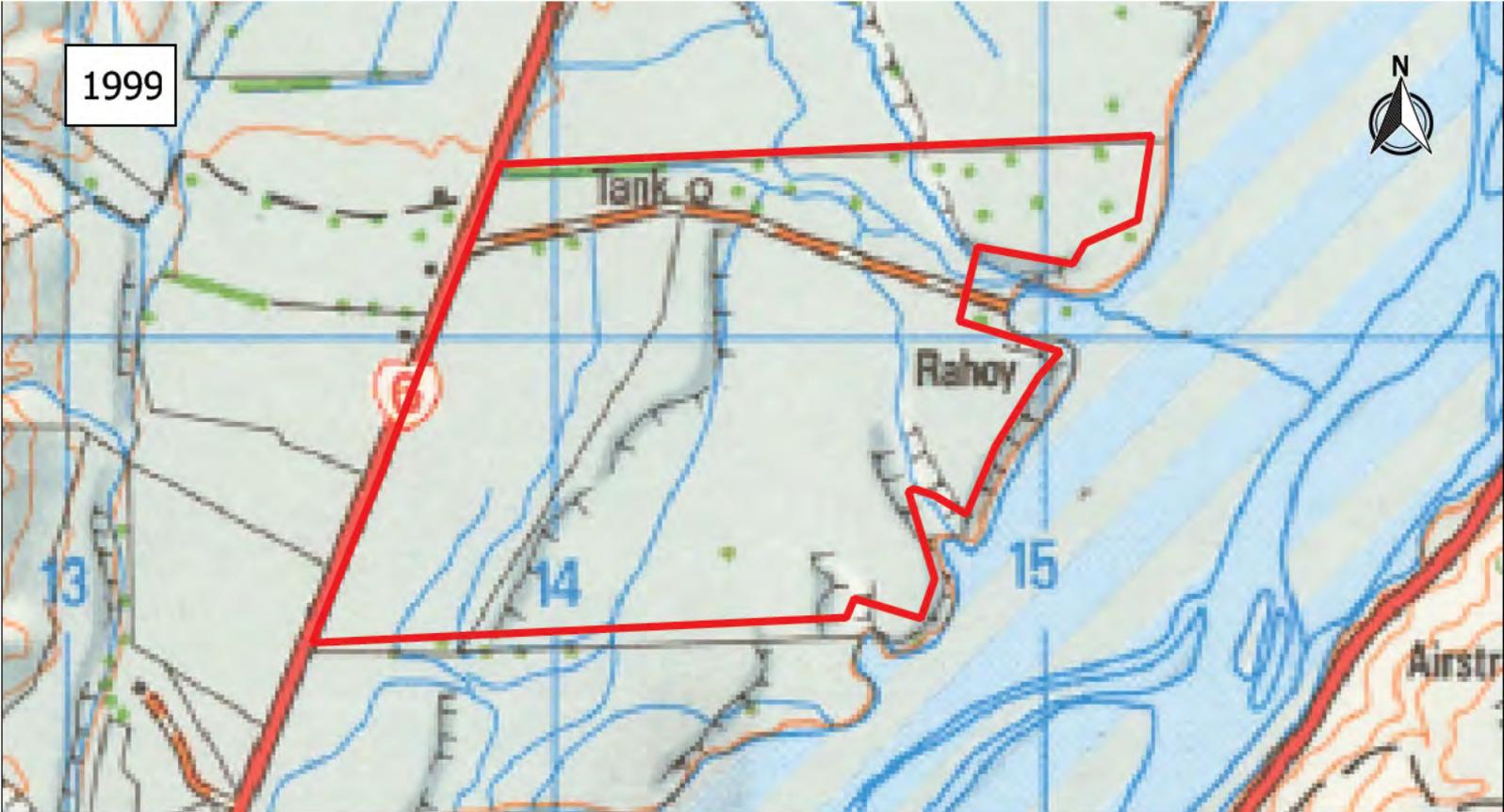
 Site Boundary

1989

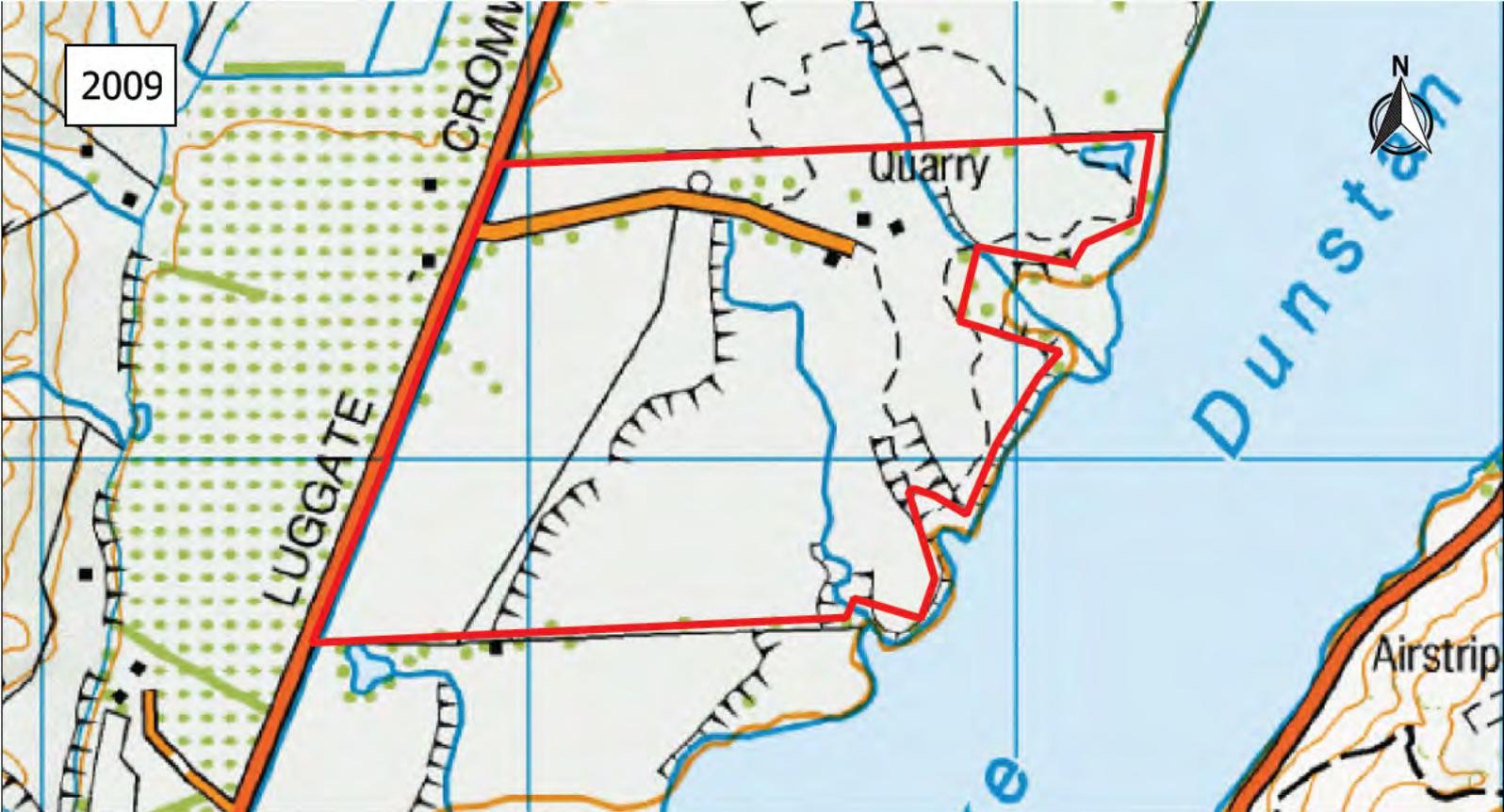


 Site Boundary

1999



 Site Boundary



0 500 1000 1500 m



 Site Boundary

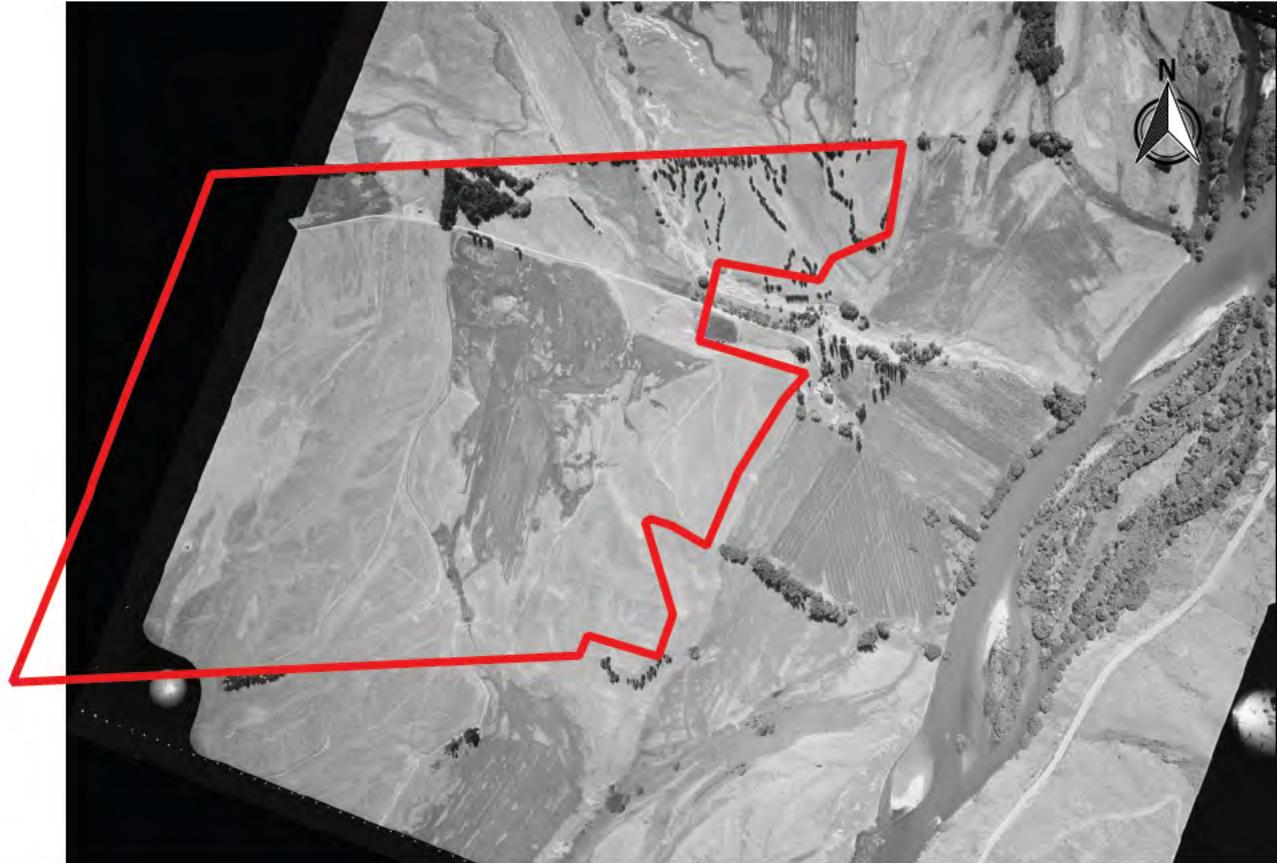
Appendix C:
Historic Aerials

1958



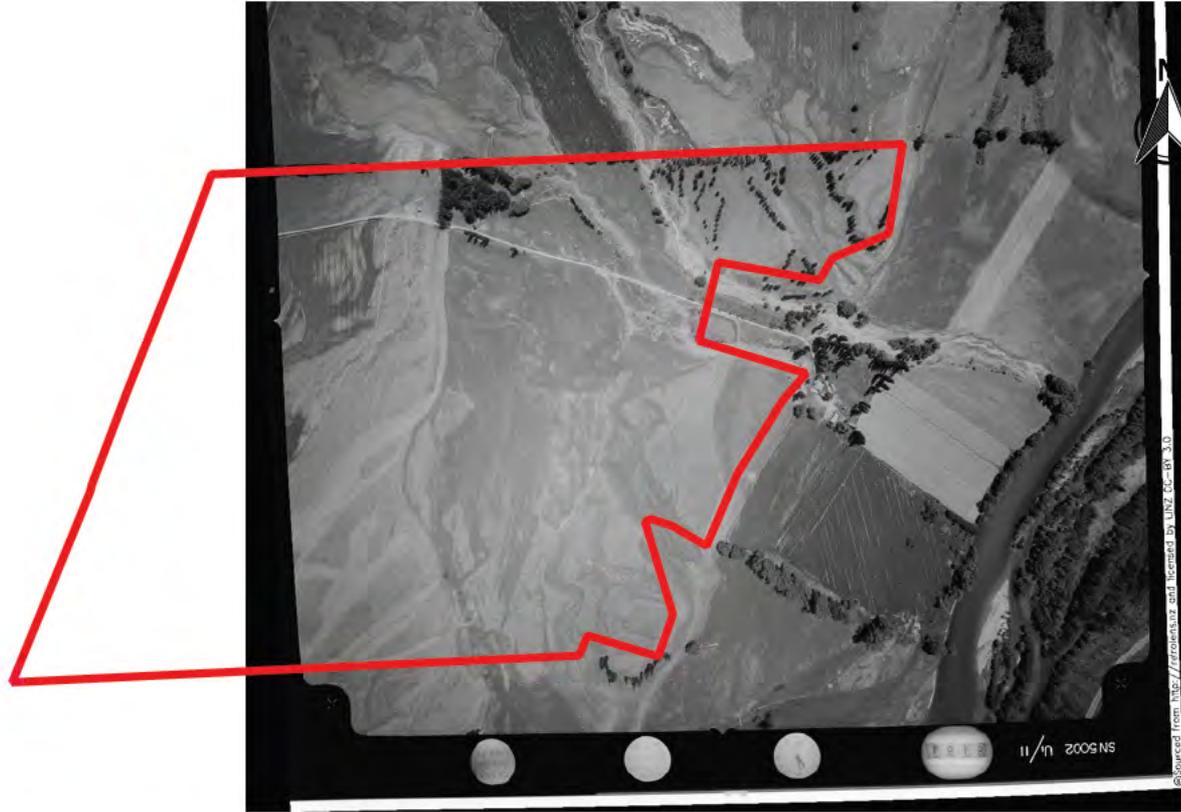
 Site Boundary

1975



 Site Boundary

1976



 Site Boundary

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1978



 Site Boundary

1983



 Site Boundary

2001



 Site Boundary

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2003



 Site Boundary

Aerial image sourced from Google Earth Pro, Maxar technologies.

2007

Untitled Map

Write a description for your map.



 Site Boundary

Aerial image sourced from Google Earth Pro, Maxar technologies.

2011



 Site Boundary

Aerial image sourced from Google Earth Pro, Maxar technologies.

2015



 Site Boundary

Aerial image sourced from Google Earth Pro, Maxar technologies.

2019



Google Earth



 Site Boundary

Aerial image sourced from Google Earth Pro, Maxar technologies.

2021



 Site Boundary

Aerial image sourced from Fulton Hogan

Appendix D:

Otago Regional Council Supporting Information

From: [Contaminated Land](#)
To: s 9(2)(a)
Subject: RE: Parkburn Quarry
Date: Friday, 10 September 2021 3:04:07 PM
Attachments: Out of Scope

Hi Simon,

No problem, find attached the cleanfill's Annual Works Programme.

There are five incidents on file for Parkburn Quarry, these being:

- **IN17.0186** (01/04/2017) – Complaint about dust at Pisa Moorings as it was windy from the North. ORC contacted Fulton Hogan and informed them of the complaint and that they need to check their water system.
- **IN16.0790** (22/07/2016) – Complaint the quarry was stockpiling broken glass and glass bottles in the yard and there was a strong smell associated with it. Complainant was concerned it might cause something to leach into the lake.
- **IN16.0406** (07/04/2016) – Complaint about clouds of dust coming from the quarry on a windy day (wind coming from the north). The complainant informed ORC they couldn't see over the bund but felt that dust mitigation should always be employed when the weather conditions are windy.
- **IN15.1172** (30/11/2015) – Complaint about dust coming from the quarry and hours that the crushing plant should be working. The complainant informed ORC that the crushing plant has been operating all day up to 10:30pm and starting up again at 4:30am. Complainant was wanting to know whether there was a constraint on the crushing plant working hours.
- **IN08.0001** (12/07/2008) – Burn off by Works Infrastructure.

Let me know if you need any further information.

Have a great weekend.

Thanks,
Shannen



Shannen Barns
ENVIRONMENTAL OFFICER

s 9(2)(a)

www.orc.govt.nz

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From: Simon Beardmore s 9(2)(a)

Sent: Thursday, 9 September 2021 4:07 p.m.

To: Contaminated Land <contaminated.land@orc.govt.nz>

Subject: RE: Parkburn Quarry

Awesome – thanks so much. Two hopefully quick additional queries:

Can you provide a copy of the cleanfill's annual work programme (A1418462)/

Can you check if there have been any RMA incidents recorded for the site?

Thanks again,

Simon Beardmore

From: Contaminated Land <contaminated.land@orc.govt.nz>

Sent: Thursday, 9 September 2021 11:01 AM

To: Simon Beardmore s 9(2)(a)

Subject: RE: Parkburn Quarry

Hi Simon,

Lastly, find attached the photos from the 2020 audit reports for 99664, 2004.600, RM15.108.01-.02 and RM18.376.01.V1.

As mentioned, if you require any specific PM information please get in touch.

Kind regards,

Shannen



Shannen Barns

ENVIRONMENTAL OFFICER

P 0800 474 082 | M s 9(2)(a)

s 9(2)(a)

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From: Simon Beardmore s 9(2)(a)
Sent: Wednesday, 1 September 2021 10:11 a.m.
To: Contaminated Land <contaminated.land@orc.govt.nz>
Cc: Liam Salemink Waldrens s 9(2)(a)
Subject: Parkburn Quarry

Good morning,

Hope you are doing well on this fine Level 3 morning.

We are preparing a preliminary site investigation for Fulton Hogan's Parkburn Quarry.

Would you be able to provide copies of information relating to HAIL.00359.01, including tank pull report and any correspondence

And consents information (application, recommending report, any performance monitoring results, and ORC audit reports) for:

- 99664
- 2004.600
- RM18.376.01.V1
- RM15.108.01-.02
- RM17.359.01 and .03

Thanks very much,



Simon Beardmore

Technical Director - Contaminated Land

s 9(2)(a)

w. e3scientific.co.nz



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Well Number	Status	Type	Take Consent	Depth	Diameter	Depth To Water	Drill Date
G41/0465	Completed	Borehole		30.92	0.15	20.07	11/04/2016
G41/0459	Completed	Borehole		30.17	0.4	9.86	18/11/2015
G41/0453	Completed	Borehole		22.8	0.15	12.6	12/08/2015
G41/0489	Completed	Borehole		28.67	0.15	20.29	2/11/2017
G41/0298				20	0.15	0	1/07/2003
G41/0293				10	0.125	0	5/01/2003
G41/0284	Completed	Borehole	RM13.445.01	31.33	0.15	15.45	3/08/2001
G41/0275	Completed	Borehole		34.59	0.15	12.95	24/06/2002
G41/0267	Completed	Borehole	RM15.093.01	25.06	0.15	14.5	13/09/2002
G41/0303	Completed	Borehole	RM17.138.01	25	0.3	0	10/01/2003
G41/0302	Completed	Borehole	RM17.138.01	25	0.03	0	10/01/2003
G41/0301	Completed	Borehole	RM15.108.01.V1	30	0.3	0	9/01/2003
G41/0356	Completed	Borehole		23.34	0.15	13	13/12/2007
G41/0350	Completed	Borehole		29.92	0.15	13.23	26/09/2007
G41/0344	Completed	Borehole	RM11.237.01	27.63	0.3	12.97	16/09/2005
G41/0386	Completed	Borehole	RM16.002.01	27.88	0.125	20.92	22/12/2010
G41/0378	Completed	Borehole	2009.478	19	0.2	3.76	3/02/2010
G41/0159				25	0.1	0	1/04/1997
G41/0201				35	0.15	0	27/08/1999
G41/0199	Completed	Borehole	RM14.064.01	27.95	0.15	16.42	25/11/1999
G41/0172	Completed	Borehole	RM17.254.01	28.66	0.15	15.42	12/07/1998
G41/0171			RM17.155.01	12	0.1	0	
G41/0227	Completed	Borehole		25	0.31	0	2/03/2001
G41/0226	Completed	Borehole		12.15	0.125	4.38	26/01/2001
G41/0215	Completed	Borehole	2000.549	28.44	0.15	15.47	5/05/2000
G41/0205			RM19.253.01	52	0.15	0	27/08/1999
G41/0204	Completed	Borehole	2002.326.V1	25.44	0.15	13.44	12/08/1999
G41/0244	Completed	Borehole		31	0.15	18.82	5/10/2001
G41/0240	Completed	Borehole	2001.A47.V1	29.92	0.15	21	6/08/2001
G41/0237	Completed	Borehole	2001.82	31.33	0.15	15.45	3/08/2001
G41/0102	Completed	Borehole		27.8	0.15	13.25	17/01/1996
G41/0004	Abandoned	Borehole		205	0	0	1/10/1978
G41/0132				30	0.1	0	10/07/1996
G41/0126	Completed	Borehole		11.16	0.15	3.65	12/09/1995
G41/0125				10	0.8	0	
G41/0115	Completed	Borehole		23.485	0.2	12.6	6/01/1994
G41/0113	Completed	Borehole	2010.042.V1	24.9	0.2	16.74	10/08/1992

s 9(2)(a)

Location	Driller	Drawdown	Pump Rate	Pump Duration	Use1	Use2	Screen From	Screen To	Bore Consent Number
Luggate-Cromwell Road	McNeill	24.04	1512	150	Irrigation		27.92	30.92	RM16.015.01
Cromwell	McNeill	22.99	0	0	Commercial	Industrial	24.17	30.17	RM15.310.01
Cromwell	McNeill	0.35	717.12	120	Irrigation		21.3	22.8	RM15.167.01
Adjacent to Luggate Cromwell Road approximately 1,380 metres West of Lake Dunstan	SouthDrill	0.21	0	138.24	Domestic		27.67	28.67	RM17.150
Pisa North development adjacent to Lake Dunstan.		0	0	0	Community Supply		0	0	2003.571
Adjacent to Lake Dunstan at Pisa Moorings, Lowburn		0	71.7	0	Domestic		80.2	81.3	2003.255
Parkburn Rd, Lowburn-Luggate Rd	McNeill	3	1166.4	0	Irrigation		28.58	31.33	2002.524
Clarks Rd - Lowburn	McNeill	3.74	432	0	Irrigation		31.65	34.59	2002.339
Pisa Moorings	McNeill	2.35	1814	0	Domestic	Irrigation	22.36	25.06	2002.243
approximately 475 metres east of State Highway 6,		0	2592	0	Domestic		81.68	82.5	2003.757
approximately 475 metres east of State Highway 6,		0	2592	0	Domestic		29.75	30.45	2003.755
Adjacent State Highway 6, Mount Pisa		0	3456	0	Unknown		0	0	2003.718
State Highway 6 Cromwell	McMillan	0.07	183	90	Domestic	Irrigation	21.84	23.34	2007.504
Smiths Way	McNeill	0.04	115.2	120	Domestic		0	0	2007.397
Lowburn Cromwell	McNeill	0.71	2764	240	Irrigation		0	0	2005.395
Cromwell Luggate Highway	McNeill	0.26	108	60	Domestic	Stockwater	26.88	27.88	RM10.418
Revival Lane and Ferry Lane, Cromwell	SouthDrill	6.05	1382.4	240	Domestic		16	19	2009.478
	McNeill	0	95	0	Domestic	Stockwater	0	0	97218
SITE B - S SIDE PARK BURN ADJ (W SIDE) SH6	McNeill	0	0	0	Irrigation	Domestic	0	0	99331
Pisa Range Estate, Lowburn-Wanaka Rd	McNeill	2.05	1296	0	Domestic	Irrigation	26.66	27.95	99033
Chard Farm, Lowburn-Wanaka Rd	McNeill	1.67	1123.2	0	Domestic	Irrigation	26.57	28.66	97663
	McNeill	0	285.1	0	Irrigation		0	0	97607
behind #925 SH6		0	777.6	0	Irrigation		42.6	43.6	2001.162
Adjacent to Lake Dunstan - Cromwell	McNeill	0.02	112.32	0	Domestic		11.05	12.15	2001.064
SH6	McNeill	4.74	1987.2	0	Irrigation		25.28	28.44	2000.094
W OF SH 6 ADJ TO ROAD	McNeill	0	1728	0	Irrigation		0	0	99422
Clarks Road adjacent to SH6, Cromwell-Wanaka Rd - Lowburn	McNeill	3.16	777.6	0	Community Supply	Irrigation	23.8	25.44	99383
East of State Highway, north of Parkburn Creek. Wanaka Rd	McNeill	6.8	1900	0	Irrigation		27.9	31	2001.821
North of Park Burn Creek, Cromwell - Wanaka Highway	McNeill	3.2	950.4	0	Domestic	Irrigation	28.32	29.92	2001.67
SH6 Wanaka Rd	McNeill	3	1166.4	0	Irrigation		28.23	31.33	2001.525
Wanaka Rd - Lowburn	McNeill	0	182.4	0	Domestic		24.68	27.8	94552
		0	0	0	Investigation		0	0	
	McNeill	0	121	0	Domestic		0	0	96358
Wanaka Rd - Wanaka	McNeill	2.3	1373.8	0	Community Supply		9.02	11.04	95705
	McNeill	0	51.8	0	Irrigation		0	0	
Wanaka Rd - Cromwell	McNeill	1.2	976.3	0	Irrigation		20.6	23.45	93517
#940 SH6	McNeill	0	2160	0	Commercial		0	0	

s 9(2)(a)

Easting	Northing	Consent Number	Consent Type	Consent Status	Postal Address	Consent Expiry Date	Purpose
1304551	5014468	3978	Discharge to Air Permit	Expired	PO Box 277, Alexandra 9340	31/03/1993	To discharge to air from the operation of a mobile asphalt plant with main base at Parkburn, Cromwell
1304751	5014568	95546	General/Structure Land Use Consent	Expired	PO Box 277, Alexandra 9340	1/08/1996	To construct a crossing over the Parkburn Creek for the purpose of facilitating access to an industrial activity
1304551	5014468	4187	Discharge to Air Permit	Expired	PO Box 277, Alexandra 9340	1/04/1998	To discharge to air from the operation of a hot-mix asphalt plant at Parkburn, Cromwell
1304551	5014468	HD/1158/90	Discharge to Air Permit	Expired	PO Box 277, Alexandra 9340	1/04/1998	To discharge to air from the operation of a hot-mix asphalt plant at Parkburn, Cromwell (current consent no as at 15 September 1995 - No. 4187)
1304851	5014268	3353	Groundwater Take Permit	Expired	PO Box 277, Alexandra 9340	1/06/1998	To take 145,000 litres per hour from a bore for gravel washing at Parkburn, Cromwell
1304851	5014268	3353B	Discharge to Land Permit	Expired	PO Box 277, Alexandra 9340	1/06/1998	to discharge 145,000 litres per hour onto land
1304351	5013967	2003.718	Bore Construction Consent	Expired	PO Box 277, Alexandra 9340	4/09/2005	To construct a bore for the processing of roading aggregate for an unlimited term.
1304551	5014568	96273	Discharge to Air Permit	Expired	1 Parry Street, Dunedin 9016	31/10/2006	To discharge to air contaminants produced when manufacturing up to 40 tonnes per hour of asphalt, including the products of diesel oil at the Bitumix Parkburn Quarry, Cromwell
1304551	5014267	98117	Discharge to Air Permit	Expired	PO Box 277, Alexandra 9340	30/04/2013	To discharge contaminants to air for the purpose of operating an asphalt plant. Location of activity: Parkburn quarry, SH 6, Cromwell
1304851	5014268	98127	Groundwater Take Permit	Expired	PO Box 277, Alexandra 9340	1/06/2018	To take 31,680,000 litres per month at a maximum rate of 144,000 litres per hour from a bore for the purpose of gravel washing, asphalt plant, mobile concrete plant, truck washing, domestic and irrigation - Parkburn Quarry.
1304551	5014267	98130	Discharge to Land Permit	Expired	PO Box 277, Alexandra 9340	1/06/2018	To discharge 23,760,000 litres per wash water per month at a maximum rate of 108,000 litres per hour, to land from settling ponds for the purpose of gravel, sand and crushed aggregate washing at Parkburn Quarry
1304551	5014267	98129	Groundwater Take Permit	Expired	PO Box 277, Alexandra 9340	1/06/2018	To take 23,760,000 litres of water per month at a maximum rate of 108,000 litres per hour, from open pits for the purpose of gravel, sand and crushed aggregate washing at Parkburn quarry
1304951	5014368	98128	Discharge to Land Permit	Expired	PO Box 277, Alexandra 9340	1/06/2018	To discharge up to 31,680,000 litres of quarry wash water per month at a maximum rate of 144,000 litres per hour, to land from settling ponds. See 98127 for groundwater take.
1305051	5014468	99664	Discharge to Land Permit	Current	PO Box 277, Alexandra 9340	6/11/2026	To discharge solid fill to land within an operating gravel quarry beside Lake Dunstan at the location where the Parkburn flows into the Lake for the purpose of backfill at a quarry site.
1304351	5013967	2003.719.V1	Groundwater Take Permit	Surrendered	Private Bag 1962, Fairfield, Dunedin 9054	10/09/2028	To take and use groundwater for the purpose of processing roading aggregate.
1304551	5014267	2004.6	Discharge to Air Permit	Current	PO Box 277, Alexandra 9340	31/03/2041	To discharge dust to air for the purpose of quarrying, crushing and screening aggregate.
1304756	5014503	RM18.376.01.V1	Discharge to Air Permit	Current	PO Box 277, Alexandra 9340	6/03/2044	To discharge contaminants to air for the purpose of operating an asphalt plant
1304756	5014503	RM12.385.01	Discharge to Air Permit	Surrendered	PO Box 277, Alexandra 9340	21/11/2047	To discharge contaminants to air for the purpose of operating an asphalt plant.
1304857	5014082	RM15.108.02.V1	Discharge to Land Permit	Current	PO Box 277, Alexandra 9340	1/11/2050	To discharge silt, sediment and water to land for the purpose of aggregate washing, processing aggregate, asphalt and concrete, truck washing and dust suppression.
1304286	5013958	RM15.108.01.V1	Groundwater Take Permit	Current	PO Box 277, Alexandra 9340	1/11/2050	To take and use groundwater for the purpose of processing aggregate, asphalt and concrete, truck washing, domestic use, irrigation and dust suppression.
1304784	5014492	RM17.359.01	Discharge to Land Permit	Surrendered	Private Bag 1962, Fairfield, Dunedin 9054	12/01/2053	To discharge water to land for the purpose of processing aggregate, asphalt and concrete, truck washing and dust suppression
1304855	5014046	RM17.359.03	Discharge to Land Permit	Surrendered	Private Bag 1962, Fairfield, Dunedin 9054	12/01/2053	To discharge water to land for the purpose of processing aggregate and dust suppression.
1304175	5013704	RM17.359.04	Groundwater Take Permit	Surrendered	Private Bag 1962, Fairfield, Dunedin 9054	12/01/2053	To take and use groundwater for the purpose of processing aggregate, irrigation and dust suppression
1304340	5013960	RM15.310.01	Bore Construction Consent	Current	PO Box 277, Alexandra 9340		To construct a bore for the purpose of accessing groundwater

Appendix E:
Site Photographs



Figure 1: Working face of quarry.



Figure 2: Stockpiled pea gravel for reclamation.



Figure 3: Reclaimed area at southern end of quarry.



Figure 4: Diesel generator with in-built fuel tank in quarry.



Figure 5: Mobile crusher within Schedule Activity portion of quarry.



Figure 6: Bitumen spray plant within quarry.



Figure 7: Fuel and waste oil storage within quarry.



Figure 8: Silt ponds for treatment and disposal of quarry plant wash water.



Figure 9: Asphalt plant



Figure 10: Bitumen storage at the asphalt plant.



Figure 11: Former diesel tank location.



Figure 12: Firth concrete block plant, with concrete silo (white) and diesel tank (yellow) in background.



Figure 13: Allied concrete batching plant.

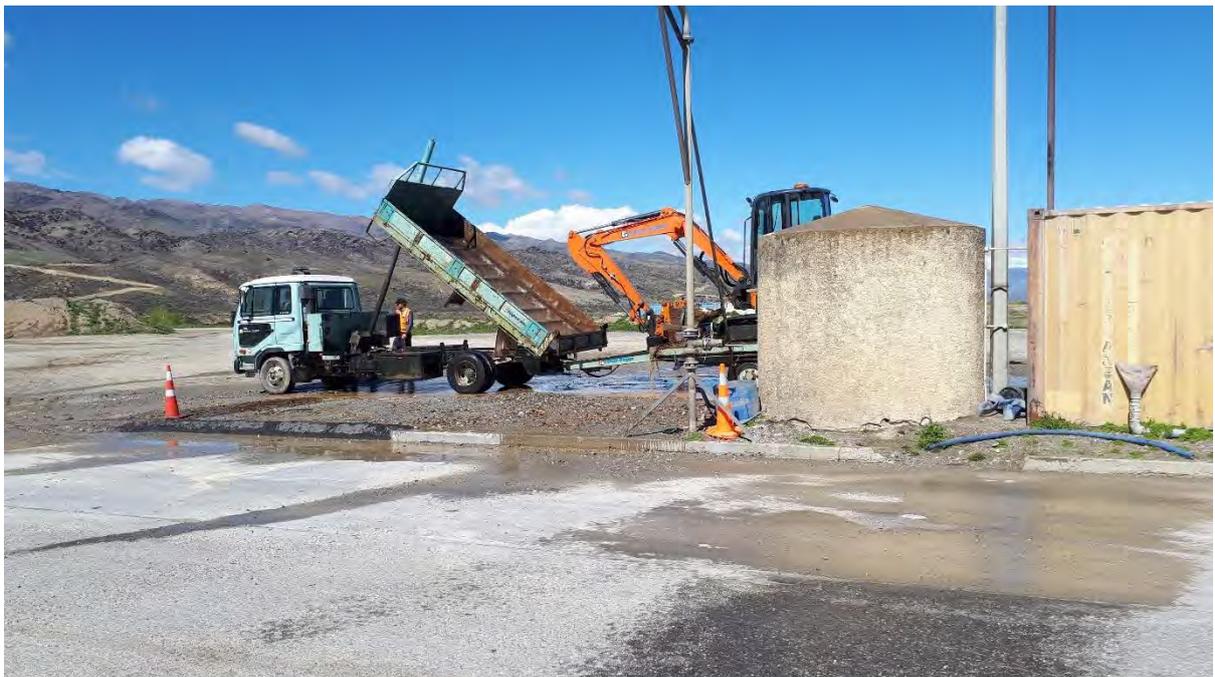


Figure 14: Truck wash.



Figure 17: Road cutting waste storage.



Figure 18: Hardfill face.



Figure 19: New glass processing building.



Figure 20: JCL Asphalt yard, with diesel tank (white) at entrance to container shelter.

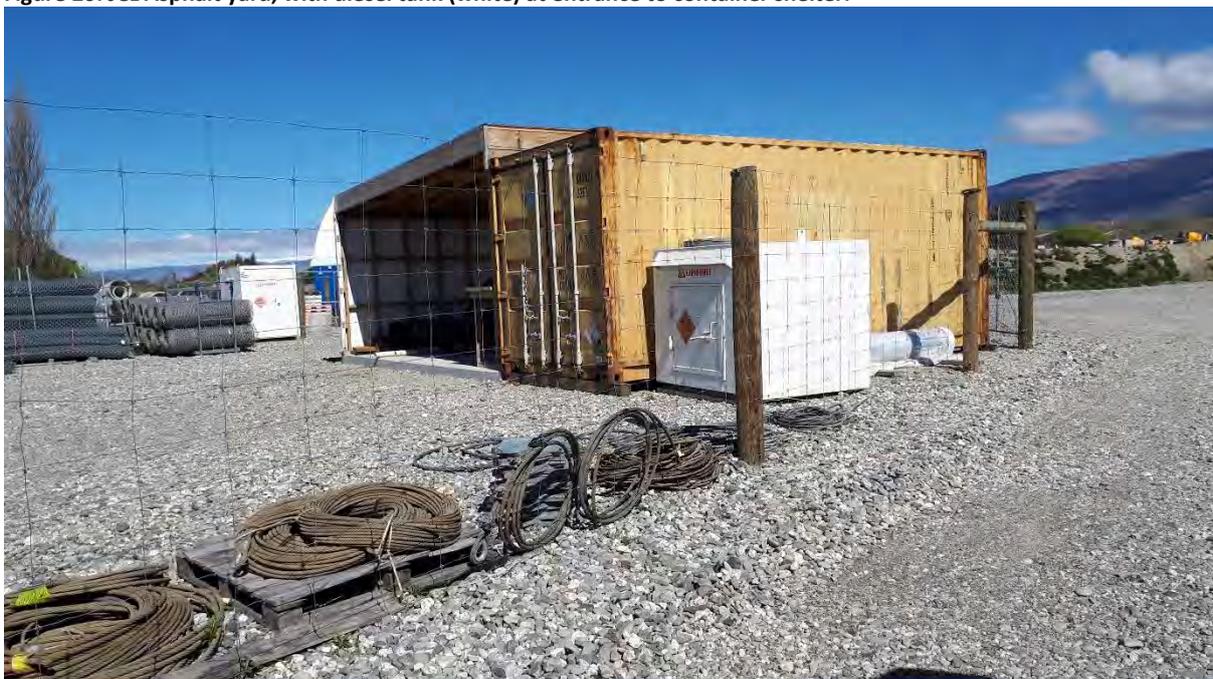


Figure 21: Two explosive storage containers (white) at Fulton Hogan yard.

Appendix F:
XRF Screening Results

Table 1: XRF background readings (ppm)

Sample ID	Depth (m)	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc
background 1	0.0-0.05	14	<LOD	<LOD	31	26	31	99
background 2	0.0-0.05	8	<LOD	<LOD	17	19	15	58
background 3	0.0-0.05	10	<LOD	<LOD	11	16	19	70
background 4	0.0-0.05	6	<LOD	<LOD	17	20	11	65
background 5	0.0-0.05	8	<LOD	<LOD	16	20	17	56
background 6	0.0-0.05	9	<LOD	<LOD	19	26	16	76
background 7	0.0-0.05	7	<LOD	<LOD	12	20	18	53
background 8	0.0-0.05	9	<LOD	<LOD	17	19	14	63
background 9	0.0-0.05	11	<LOD	<LOD	18	18	22	67
background 10	0.0-0.05	7	<LOD	75	19	19	16	70
Local Background Minimum		6	<LOD	<LOD	11	16	11	53
Local Background Maximum		15	<LOD	75	31	26	38	99
Predicted Background Concentration ¹		12	0.34	80	43	44	45	182

¹ 95 %ile predicted background concentration for Gravel (Manaaki Whenua Landcare Research, 2015)
 < Denotes concentration is below laboratory detection limits

Table 2: XRF Screening results (ppm)

Sample ID	Depth (m)	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc
cleanfill 01	0.0-0.05	13	<LOD	48	22	19	27	95
cleanfill 02	0.0-0.05	10	<LOD	<LOD	12	13	<LOD	62
cleanfill 03	0.0-0.05	9	<LOD	44	<LOD	19	18	62
cleanfill 04	0.0-0.05	7	<LOD	<LOD	11	12	<LOD	38
cleanfill 05	0.0-0.05	14	<LOD	83	21	15	19	62
cleanfill 06	0.0-0.05	11	<LOD	95	26	59	26	78
cleanfill 07	0.0-0.05	9	<LOD	55	22	58	14	63
cleanfill 08	0.0-0.05	10	<LOD	<LOD	8	12	<LOD	74
cleanfill 09	0.0-0.05	9	<LOD	52	12	10	15	41
cleanfill 10	0.0-0.05	16	<LOD	<LOD	25	21	26	54
cleanfill 11	0.0-0.05	10	<LOD	76	21	42	22	70
cleanfill 12	0.0-0.05	7	<LOD	75	<LOD	27	17	32
cleanfill 13	0.0-0.05	11	<LOD	124	22	38	19	55
cleanfill 14	0.0-0.05	5	<LOD	<LOD	<LOD	5	<LOD	64
cleanfill 15	0.0-0.05	7	<LOD	90	16	43	13	58
cleanfill 16	0.0-0.05	7	<LOD	70	14	43	23	52
cleanfill 17	0.0-0.05	13	<LOD	<LOD	22	19	16	50
cleanfill 18	0.0-0.05	9	<LOD	<LOD	14	18	<LOD	55
cleanfill 19	0.0-0.05	6	<LOD	98	14	8	17	51
cleanfill 20	0.0-0.05	18	<LOD	48	19	367	13	385
cleanfill 21	0.0-0.05	10	<LOD	43	13	11	<LOD	38
cleanfill 22	0.0-0.05	18	<LOD	<LOD	23	19	16	63
cleanfill 23	0.0-0.05	8	<LOD	40	14	12	12	49
cleanfill 24	0.0-0.05	8	<LOD	<LOD	17	21	14	45
cleanfill 25	0.0-0.05	10	<LOD	<LOD	13	14	14	60
cleanfill 26	0.0-0.05	11	<LOD	<LOD	11	16	11	59
cleanfill 27	0.0-0.05	10	<LOD	<LOD	16	21	12	36
cleanfill 28	0.0-0.05	12	<LOD	<LOD	16	22	14	40
cleanfill 29	0.0-0.05	11	<LOD	54	7	12	14	58
cleanfill 30	0.0-0.05	12	<LOD	<LOD	19	19	11	50
hardfill 31	0.0-0.05	9	<LOD	<LOD	14	22	14	61
hardfill 32	0.0-0.05	11	<LOD	<LOD	27	21	17	96
hardfill 33	0.0-0.05	11	<LOD	72	19	23	16	59
hardfill 34	0.0-0.05	10	<LOD	48	18	95	11	188
hardfill 35	0.0-0.05	16	<LOD	65	30	23	26	93
hardfill 36	0.0-0.05	14	<LOD	<LOD	20	22	18	57
hardfill 37	0.0-0.05	11	<LOD	<LOD	16	13	15	57
hardfill 38	0.0-0.05	10	<LOD	47	8	14	<LOD	45
hardfill 39	0.0-0.05	9	<LOD	<LOD	10	18	14	68
hardfill 40	0.0-0.05	7	<LOD	69	11	15	<LOD	51
Local Background Minimum ¹		6	<LOD	<LOD	11	16	11	53
Local Background Maximum ¹		15	<LOD	75	31	26	38	99
Predicted Background Concentration ⁵		12	0.34	80	43	44	45	182

¹ Based on 10 XRF readings from an undisturbed part of the site
² 95 %ile predicted background concentration for Gravel (Manaaki Whenua Landcare Research, 2015)
 < Denotes concentration is below laboratory detection limits
 Orange shading denotes exceedance of local background maximum