

PRELIMINARY SITE INVESTIGATION (PSI)

CNR NORTH CHATTTON WAIKAKA RD AND WAIKAKA RD, WAIKAKA



Reference Number: REP-1773/PSI/AUG2022

PREPARED FOR: WAIKAKA GOLD MINES LTD

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Statement

This site investigation has been prepared in accordance with the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011. It has been managed by a suitably qualified and experienced practitioner (SQEP); and reported on in accordance with the current edition of the Ministry for the Environment's *Contaminated Land Management Guidelines No. 1 – Reporting on Contaminated Sites in New Zealand*.

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Thank you for the opportunity to carry out this investigation. Should you have any queries regarding this report please do not hesitate to contact us on 09 475 0222.

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EXECUTIVE SUMMARY

Waikaka Gold Mines Ltd (WGML) has commissioned Geosciences Ltd to prepare a Preliminary Site Investigation (PSI) report to investigate land on the corner of Waikaka Road and North Chatton Waikaka Road for the presence of contaminants. The primary purpose of this is to provide an assessment of actual and potential soil contamination risks in light of WGL commencing an alluvial gold mining operation on site.

This report summarises Geosciences Ltd.'s investigation and has been prepared following the Ministry for the Environment's Guidelines for investigations involving potentially contaminated land (referred to herein as the MfE CLMG, Guidelines). The PSI consisted of a desktop study to gather information about the site and its history with respect to potentially contaminating land usages, a site inspection and limited soil and sediment sampling. This information was used to develop an initial conceptual site model (CSM), which identifies potential sources of contamination, pathways for release, and potential effects.

The desktop study identified that the site has been previously mined in the early 20th century after which it was returned to rural pastoral land used primarily for beef. L&M mining also conducted a brief mining project in 2001 to the south of the existing mine pond. An assembly and storage area for plant and equipment used during L&M mining was also identified on site.

A closed landfill exists on the banks of Shepherds Creek and will not be disturbed during the proposed mining operation, however as it is located near a proposed stream diversion it was taken into consideration.

Based on the CSM, a judgemental sampling regime was employed to target two potential sources of contamination which included the close landfill and the assembly and storage area. A composite sampling regime was employed to target the rural pasture where no distinct source locations could be identified. GSL subsequently collected 10 soil samples from across the site, and two sediment sample from the base of the landfill, with the samples analysed for the contaminants of concern identified by the CSM.

Soil and sediment sampling from the site revealed concentrations of contaminants that complies with the NES criteria for the protection of human health and with the Land Care Research/ANZECC criteria for the protection of the environment.

From the investigations described above it is concluded that the site does not meet Environment Southland's definition of land that is contaminated and that it does not pose a risk to future land users and to the environment and is therefore suitable for the proposed WGML development.

1 INTRODUCTION

Geosciences Ltd (GSL) has prepared the following report for Waikaka Gold Mines Ltd (WGML) in accordance with discussions held at a meeting between GSL and WGML on 6 July 2022.

This report has been prepared in accordance with the Ministry for the Environment (MfE) Contaminated Land Management Guidelines (CLMG): No. 1 - "*Guidelines for Reporting on Contaminated Sites in New Zealand*", and No. 5 - "*Site Investigation and Analysis of Soils*" (References 1 and 2).

2 PROPERTY DETAILS

Property details are provided in Table 1 below.

TABLE 1: PROPERTY DETAILS

Location	Corner North Chatton -Waikaka Rd and Waikaka Rd, Waikaka
Legal Description	1 Lot 3 DP 5492 2 Lot 3 DP 13018 3 Lot 2 DP 7758 4 Lot 2 DP 5492 5 Part Lot 3 DP 7758 6 Lot 5 DP 13018 7 Lot 2 DP 346166 8 Lot 2 DP 13018 9 Part Section 49 Block XIV 10 Part Lot 1 DP 7758 11 Lot 3 DP 13135 12 Part Lot 5 DP 7758 13 Lot 6 DP 7758 14 Lot 1 DP 10945 15 Section 124 Block XIV 16 Lot 4 DP 13018 17 Lot 9 DP 13018 18 Lot 4 DP 7758
Size	Approximately 100 Ha
Zoning	Rural

The properties at the above addresses, hereafter referred to as 'the site' in this report, are located approximately 3km south-west of Waikaka and 22 km north of Gore. The site comprises mainly grazing pasture and is surrounded by similar farmland. The Waikaka Stream flows through the site in a north-west to south-easterly direction (Figure 1).

2.1 ENVIRONMENTAL CONTEXT

The site is rural pasture used predominantly for cattle grazing. The site's topography is dominated by flat to rolling pasture, with moderately steep banks along the Waikaka Stream.

2.1.1 GEOLOGY

The published geology of the site is described as underlain by old dredge tailings derived from flood plain alluvium unconformably overlying clays, silt, sands and conglomerates of the late Miocene-Pliocene pebble hill gravels and the late Oligocene-Miocene Gore Lignite measures (Turnbull, 2003).

2.2 TOPOGRAPHY AND DRAINAGE

The Site is located on farmland on the generally flat (dipping $<1^\circ$ toward the southeast) valley floor of the northwest to southeast trending Waikaka Stream valley, with low-lying hills located to the east and west. The ground surface is modified by historic gold dredging, with poor drainage resulting in the construction of a network of open drains to improve farm pasture. The valley floor declines from 120 m Reduced Level (RL) to 113 m RL from north to south.

The Waikaka Stream crosses through the centre of the site, with the Shepherds Creek tributary connecting to the Waikaka Stream from the low-lying hills to the north. The proposed site extents are bounded to the west and north by Waikaka Road. The southern extent of the site is bounded by an approximately 1 km wide terminal pond produced in the early 2000s by the L&M mining operation. A bathymetric survey undertaken of the L&M pond by Ross Dungey Consulting Ltd in December 2021 recorded depths ranging from 1.1 and 8.29 m across the pond floor, with a mean depth of 5.58 m. A 100 m wide and 8 m high pile of dredge tailings is located along the southern edge of the L&M terminal pond.

3 PROPOSED DEVELOPMENT

Waikaka Gold Mines Ltd (WGML) proposes to develop an alluvial gold mining operation (proposed mine) within Exploration Permit 56372 at Chatton North, Southland. The development is subject to grant of a mining permit, resource consents for mining, and completion of final feasibility studies before a decision to mine will be finalised.

The mine will be developed as an open pit mining operation in a sequence of east-west traverses commencing from the starter pit in the southwest corner of the mine area and advancing northwards. Approximately 2.4km length of the Waikaka River crosses the mine path and is proposed to be permanently diverted.

Figure 2 shows the proposed extent of the mining operation.

The purpose of this PSI is to identify any potentially contaminating activities (and associated soil quality) that occurred within the proposed mining area and the potential impact that such activities might have had on the ability of the site to be mined.

4 STANDARDS AND REGULATIONS

Because of the change in land use outlined above, it will be necessary to address the requirements of the following standards, rules, and regulations applicable for the site.

4.1 NATIONAL ENVIRONMENTAL STANDARD (NES)

The *National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health* (NES) (MfE, 2012) ensures that land affected by contaminants in soil is appropriately identified and assessed. When soil disturbance and/or land development activities take place, it should be, if necessary, remediated or the contaminants contained to make the land safe for human use.

Under the NES, land is considered to be actually or potentially contaminated if an activity or industry on the MfE Hazardous Activities and Industries List (HAIL) has been, is, or is more likely than not to have been, undertaken on the land. Consequently, a change in land use, subdivision, or development requires a preliminary site investigation (PSI) of the land to determine if there is a risk to human health because of any current or former activities that are occurring, or may have occurred, on the land under investigation.

4.2 SOUTHLAND WATER AND LAND PLAN (SWLP)

Section 30(1)(f) of the RMA provides the Environment Southland (ES) with a statutory duty to investigate land for the purposes of identifying and monitoring contaminated land and for the control of discharges of contaminants into or onto land or water and discharges of water into water.

Environment Southland's proposed Southland Water and Land Plan (SWLP) was made partially operative following a council meeting in January 2021. The proposed SWLP introduces new methods to manage activities that we know adversely affect the quality of Southland's freshwater. Relevant objectives, policies and rules of the proposed Plan, as well as those in the existing plans, must be considered in all resource consent applications lodged with Environment Southland.

Rule 46 and 46a of the proposed SWLP deals specifically with contaminated land and maintains that a site investigation to determine the presence of hazardous substances is a permitted activity when carried out in accordance with the Ministry for the Environment's Contaminated Land Management Guidelines No.1 and 5. As there are no outstanding appeals on these rules they can be considered operative under Section 87 of the Resource Management Act 1991. For all purposes of this investigation, the relevant provisions of the proposed SWLP relating to soil contamination have legal jurisdiction and those provisions have been considered where they may have an impact on the proposed development.

4.3 GORE DISTRICT PLAN

The Gore District Plan Chapter 4.1 refers to other RMA activities applying to resource consents including the provisions of the NES for Assessing and Managing Contaminants in Soil to Protect Human Health which apply where a HAIL activity has been undertaken on the land subject to specified activities and subdivision. In certain circumstances resource consent will be required from the Gore District Council.

Chapter 4.1 also refers to the provisions of regional plans prepared by Environment Southland. This includes the discharge of contaminants to land, water or air and notes that in certain circumstances resource consent will be required from Environment Southland.

5 PSI OBJECTIVES AND SCOPE OF WORKS

5.1 PSI OBJECTIVES

The objectives of this investigation were to assess:

- if the land is covered by the NES as a result of any current or former HAIL activities;
- the extent of any current or former HAIL activities on site;
- whether any current or former HAIL activities present potential constraints with regards to the proposed landuse; and
- the need, if any, for further detailed investigations.

5.2 SCOPE OF WORKS

To achieve the objectives of the PSI, GSL has undertaken the following:

- a review of historic aerial photographs of the site;
- a review of property files held by Council;
- conversation with a landowner;
- a visual site inspection of the site and surrounding area;
- selected soil and sediment sampling for analytical analysis; and
- the preparation of this report in accordance with the Ministry for the Environment (MfE) Contaminated Land Management Guidelines (CLMG): No. 1 - "*Guidelines for Reporting on Contaminated Sites in New Zealand*", detailing the findings of this investigation and the need, if any, for further work.

6 SITE HISTORY

A desktop study of publicly available files and photographs was undertaken to determine the history of the site with respect to any current or historic potentially contaminating land uses.

6.1 ANECDOTAL EVIDENCE

A discussion was held with John Gardyne at the time of the site walkover. Mr Gardyne has owned and farmed the majority of the site since 1987. The site was sowed with fodder crops in 1987 and grazing started in 1996 after meeting the Ministry for Primary Industries (MPI) soil quality criteria. Before grazing can commence MPI required a suite of soil testing to be carried out, including levels of OCPs and DDT. Mr Gardyne also confirmed that no topsoil has been imported to the site during his ownership.

According to Mr Gardyne the landfill marked on Figure 2 was closed in 1981. The exact footprint and depth of the landfill is unknown as there are no official records. However, during the site visit Mr Gardyne outlined the extent of the landfill to the best of his knowledge. The specific contents of the landfill are also unknown, but to Mr Gardyne's knowledge the waste is likely to be a combination of domestic waste, scrap metal and cleanfill.

6.2 HISTORIC AERIAL PHOTOGRAPHS

The Historic aerial photographs referred to below are available for the site on the Retrolens website (Reference 4). The findings of the historic aerial photograph review are summarised below, while copies of the aerial photographs have been attached in Appendix A.

TABLE 2: HISTORICAL AERIAL PHOTOGRAPH REVIEW

1946	This aerial shows the site as mainly pasture. The Waikaka stream and Shepards Creek are clearly visible. A few tree lines are visible with what appears to be a smaller section of land surrounded by a square of trees two thirds of the way down Waikaka Road. Surrounding land is mainly rural pastureland.
1961, 1963, 1969, 1970	All these images are similar in that the site is mainly pasture with bush and trees visible along the riparian zone. Surrounding land use is predominantly pasture.
1980, 1987	The small scale of these images does not provide a lot of detail however the site and surrounding landuse is unchanged and still rural pasture. The farm track running parallel to North Chatton Waikaka Road is clearly visible.
2014, 2022	This aerial shows the site as similar to the present. The paddocks and farm tracks are clearly visible as is the L&M pond along the southern extent of the site. To the north of the pond is an area with a circular track where plant and vehicles were stored. Land immediately surrounding the site is rural.

6.2.1 SUMMARY OF AERIAL PHOTOGRAPHS

A review of the historic aerial images indicates that the site has been under rural landuse since at least 1946. Surrounding landuse is also rural with the occasional farmhouse and associated buildings.

No direct visual evidence of any HAIL activities or industries was noted in the historic aerial photographs.

6.3 CONTAMINATION REGISTERS

A search of both the Environment Southland (ES) and Gore District Council's (GDC) contamination registers found no HAIL activities listed on the site. However, a GDC topographical map displayed the location of a landfill on the eastern bank of Shepherds Creek. The proposed mine area does not extend to the location of the landfill, however mining will involve the diversion of the Waikaka Stream to within 20m of the base of the landfill.

6.4 PROPERTY FILE

GSL were provided with a copy of the property files from Gore District Council for review of historic activities for 999 and 1282 Waikaka Road.

6.4.1 999 WAIKAKA ROAD

A total of six building consents were included in the property file which mainly applied to the house located on Turnbull Road which is included in this parcel. These were for building extensions, recladding of the existing house and installation of a diesel heating system.

A Resource Consent to apply waste treatment solids to land in 2010 was also recorded and included 16 large farm holdings in the vicinity of Waikaka road in the one consent.

6.4.2 1282 WAIKAKA ROAD

Two building consents related to the erection of a farm shed and silo.

No pertinent information relating to ground contamination was found in any of the two property files received from GDC. The property files can be provided electronically on request.

6.5 HISTORIC MINING ACTIVITIES

The younger valley fill alluvial deposits in the Waikaka valley were extensively dredged between 1902 and 1927.

The McGeorge brothers produced 58,000 oz of gold between 1902 and 1926 in the immediate mine area. No.1 and No.2 dredges worked the younger alluvial deposits to a depth of 4 - 6 metres in the north and south of the area while the No.3 dredge was designed to work to a depth of approximately 15m over the upper part of the older Waikaka Quartz Gravels (WQC) sub-cropping below the shallow Holocene alluvial gravels.

In 2001 L&M Mining commenced mining the WQG at the southern end of the proposed mine area, immediately north of where the McGeorge No.3 dredge worked but ceased mining after 15 months. Overburden was moved by round-pit and cross-pit conveyor systems feed by bucket wheel excavators. The gold-bearing wash was mined below water and fed to a floating gold recovery plant at the advancing mine face.

7 SITE INSPECTION & INFRASTRUCTURE

GSL personnel undertook a site inspection on 18 July 2022. At the time of the inspection the site was in similar configuration to that observed in the most recent aerial images, that is, rural land in various stages of vegetation. Some paddocks were covered in winter feed crops such as kale and beets with stock strip feeding. Other paddocks were either grassed or bare after winter feeding.

Historically dredged areas have been converted to pasture and there is little physical evidence of historical operations except for a few small dredge ponds in the northern end of the proposed mine area. The majority of the site is covered with large pebbles and gravels remnant from previous mining.

The Waikaka Stream crosses through the centre of the site, with the Shepherds Creek tributary connecting to the Waikaka Stream from the low-lying hills to the north. These waterways are clearly marked with vegetated banks of trees and tall grasses. The proposed site extents are bounded to the west and north by Waikaka Road and North Chatton Waikaka Road.

The southern extent of the site is bounded by an approximately 1 km wide terminal pond produced in the early 2000s by the L&M mining operation with a mean depth of 5.58 m. A 100 m wide and 8 m high pile of dredge tailings is located along the southern edge of the L&M terminal pond. The pond is approximately 1000m long and has an area of 10 hectares. The stockpile is located immediately to the south of the pond and is 10m high, 1000m long and about 300 m wide. It is estimated to contain approximately one million cubic metres of mined overburden.

A number of farm tracks and races cross the property.

There is a bare unsealed area north of the pond with mainly abandoned machinery such as excavator tracks and cabins. There was also a small empty shipping container and silage bales. A small area of ash on the edge of the pad was noted where recent burning had occurred, this appeared to consist of mainly organic matter such as wood. No visual or olfactory evidence of hydrocarbon egress from the area or surrounding soils was noted.

Further south from this is the pond, stockpile and historic gold room, as appears in the aerial photographs. These areas have not changed since the last aerial photograph and will not be disturbed as part of the proposed WDL project.

Site photographs taken during the site inspection are included as Appendix B.

8 CONCEPTUAL MODEL FOR POTENTIAL CONTAMINATION

A Conceptual Site Model (CSM) is a means of summarising the identified sources of contamination at the site, along with the potential migration pathways for contaminants, and the receptors (people or environmental) that could be exposed to the contamination. In order for a risk from contamination to exist, a complete linkage must be identified between a source and a receptor.

Based on the findings of the desktop study and site inspection, GSL has developed the following conceptual site model for potential soil contamination on the site.

8.1 POTENTIAL SOURCES OF CONTAMINATION

The following HAIL activities were identified to have occurred on the site under investigation:

- Potential HAIL Item E7 - *Mining industries (excluding gravel extraction) including exposure of faces or release of groundwater containing hazardous contaminants, or the storage of hazardous wastes including waste dumps or dam tailings*
- Confirmed HAIL Item G.3 – *Landfill Sites*

The potential impact from these activities with respect to the proposed mining and associated earth disturbing activities are discussed below.

8.1.1 POTENTIAL HAIL ITEM E7 - MINING INDUSTRIES

Early 1990s

It is noted that Item E7 above is regarded as 'potential' as no evidence of hazardous chemicals were used during previous mining of the site. Mining was conducted on the site in the early 1900's and involved the removal of gravels to a depth of 4-6 m via dredges. There are generally no chemicals involved in alluvial gold mining processes. However, it is known that mercury binds with gold and can advance the separation process and as such has been used mainly in artisanal and small-scale mining. GSL could not locate any records indicating the mining processes that were applied or the infrastructure that existed during the early mining activities at the site under investigation.

Early 2000s

The L&M mining activities were conducted in 2001 and to the south of the site under investigation and therefore not relevant to this PSI as this land will not be disturbed. The northern extent of L&M Mining is the existing pond north of the tailings stockpile.

There is limited information as to what activities occurred in the Assembly and Storage area located to the north of the pond during the period of L&M mining. The site walkover revealed mainly discarded plant and machinery in the area and no obvious visual or olfactory sources of contamination.

GSL do not regard this location as being of a scale commensurate with Class F *Vehicle refuelling, service and repair* of the HAIL as no bulk storage of fuels or chemicals was identified, and maintenance activities were likely minor and infrequent. If activities related to plant maintenance resulted in discharge of contaminants to soil, they are likely to be constrained to small, localised hotspots and may be encompassed by HAIL Item I if found to pose a risk to human or environmental health.

8.1.2 CONFIRMED HAIL ITEM G.3 – LANDFILL SITES

Although a closed landfill has been identified to the east of the proposed mine, it is not intended to be disturbed during mining operations. However, as the proposed stream diversion will be within 20m of the landfill, consideration of potential contamination was included in this PSI.

8.1.3 AGRICULTURAL

Although agriculture is not an item on the HAIL, the historical use of persistent pesticides are included in Item A.10 while the historic use of fertilisers that included Super Phosphate is known to have elevated the concentrations of Cadmium in soil.

The approximate areas subject to actual and potential HAIL activities are illustrated on Figure 2.

8.2 EXPECTED CONTAMINANTS OF CONCERN AND THEIR SPATIAL DISTRIBUTION

The expected spatial distributions of each of the potentially contaminating HAIL activities identified above, and their associated primary contaminants of concern, are discussed in turn in the following sections.

8.2.1 LANDFILL

There is the potential for a number of contaminants to be present in the landfill, however, the general contaminants indicative of historic closed landfills are heavy metals, polycyclic aromatic hydrocarbons (PAHs) and organic chlorine pesticides (OCPs). These contaminants may be present in any leachate or runoff from the landfill and would likely be limited to the close proximity of the landfill and the subsurface below the body of fill.

As the landfill will not be disturbed, human exposure pathways are not considered but ongoing leaching from the site may have ecological impacts.

8.2.2 MINING

The method of historical mining on site was essentially the extraction of gravels by bucket dredge, screening of the gravels and recovery of gold from the fine fraction on tables. The gravels and fines were returned to the mine void and eventually returned to pasture. Although historically mercury was used to recover gold from gold concentrate, there is no evidence that mercury was used on the gold dredges themselves.

8.2.3 ASSEMBLY AND STORAGE AREA

The burning of organic waste such as green waste and timber (treated and/or untreated construction timber etc.) can result in the accidental release of potential contaminants to a degree that poses a risk to human or environmental health.

There is the potential for small amounts of hydrocarbons to leak or accidentally spilled during plant and vehicle maintenance. Therefore, the primary contaminants of concern associated with this area and historical activities are heavy metals and petroleum products (TPHs). It is expected that any contamination in this area would be constrained to small, localised hotspots.

9 PRELIMINARY SOIL SAMPLING AND ANALYSIS

As there is no historical evidence of any contaminants being used on site during previous mining operations and limited information on the nature of the landfill, soil and sediment sampling was conducted to eliminate any potential concerns.

Preliminary sampling involves collecting samples to give insight into contamination at a site, without a high degree of statistical reliability. It generally refers to targeted sampling, using prior knowledge of the site to select the contaminants to be analysed and to focus on known, suspected or point source areas of contamination. Preliminary sampling, if undertaken, is completed as part of a PSI or before designing a detailed site investigation.

As there was limited information regarding the use of contaminants in any of the identified HAIL activities at the site, preliminary sampling was undertaken based on former uses of the site. The intrusive investigation focused on the potential presence of relevant contaminants of concern (COC), including heavy metals, organochlorine pesticides (OCPs), polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPH).

Targeted intrusive soil sampling was conducted at the site based on the findings of the desktop study. This was in two areas recognised as having the potential for contamination: the base of the known landfill area and the assembly and storage area of the former mining activities.

Two discrete sediment samples were collected from the Shepherd's Creek in close proximity of the closed landfill to determine whether contaminants from the landfill have leached into the creek. Two discrete surface soil samples were also collected from the Assembly and Storage area. One was collected beneath an abandoned excavator track and the other from an area where surficial evidence of a recent burn was noticed.

As the contaminant distribution and concentration across the pasture is expected to be relatively homogenous across the areas of application, two composite soil samples (each comprising of four samples) were collected from across the general pasture area.

Soil samples were collected from the top 75mm of soil by hand spade as the pastures were wet and pugged at the time of sampling and not suitable for the use of a shallow hand auger.

Samples were placed directly into sterile glass jars or resealable plastic zipper bags with the date, location, sample identification number, sample depth, and initials of the sampler noted on the container. Soil sampling equipment was decontaminated in between samples using a soft soap solution in accordance with GSL internal quality control procedures. The sampling protocol followed was in accordance with the CLMG No. 5 Site Investigation and Analysis of Soils.

The soil sampling strategy followed is described in Table 3 below while the soil sample locations are shown in Figure 3.

TABLE 3: SOIL SAMPLING STRATEGY

Soil/Sediment Sample	Location	Anticipated Risk	Indicated Laboratory Analysis
SS1 SS2 SS3 SS4 Composited	Composite of paddocks in Northern half of site	Low	Heavy Metals
SS5 SS6 SS7 SS8 Composited	Composite of paddocks in Northern half of site	Low	Heavy Metals
Sed 1	Foot of landfill on Shepherds Creek	Moderate	Heavy Metals, PAH ¹ , OCP ²
Sed 2	Foot of landfill on Shepherds Creek	Moderate	Heavy Metals, PAH, OCP
SS9	Beneath excavator track	Low	Heavy Metals, TPH ³
SS10	Burn area	Low	Heavy Metals, TPH

Notes:

1. PAH = Polycyclic Aromatic Hydrocarbon
2. OCP = Organochlorine Pesticides
3. TPH = Total Petroleum Hydrocarbons

10 LABORATORY ANALYSIS

Sample containers were placed in a chilly bin with ice packs and a chain of custody document (COC) indicating the analysis to be performed and were dispatched to Eurofins Environment Testing in Penrose, Auckland for the analysis of the contaminants of concern as indicated in Table 3 above. Eurofins Environment Testing are accredited by International Accreditation New Zealand (IANZ) for the analyses undertaken.

10.1 QUALITY ASSURANCE AND QUALITY CONTROL

GSL field staff are appropriately qualified, suitably trained and experienced in undertaking contaminated land assessments. Personnel are cognisant of the requirements for sample handling and storage, and equipment decontamination procedures alongside completion of field assessments, notes and record keeping and documentation. During this assessment, appropriate sample handling and storage protocols were followed to ensure sample integrity was maintained during sampling and transport while laboratory analysis has been undertaken at an IANZ accredited laboratory. Consequently, it is considered that appropriate QA/QC has been met for this investigation.

10.2 ACCEPTANCE CRITERIA AND RELATIVE GUIDELINES

The *User's Guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health* details Soil Contaminant Standards (SCSs) for seven inorganic substances and five organic compounds (or groups of compounds). The contaminants analysed at this site for which SCSs are available are arsenic, cadmium, copper, lead, mercury, dieldrin, BaP and DDT.

There will be no consumption of produce grown on the land during mining and the activity is considered to be industrial with varying degrees of exposure. Therefore, the NES human health SCS criteria for '*commercial industrial outdoor worker-unpaved*' has been applied to the proposed change in landuse.

For contaminants of concern that are not listed as priority contaminants, the NESCS references the Ministry for the Environment's Contaminated Land Management Guidelines No. 2: *Hierarchy and Application in New Zealand of Environmental Guideline Values* to provide guidance.

Sediment samples collected from the foot of the landfill have been compared to the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Reference 7).

The results are also compared to the *Land Care Research Background Soil Concentrations of Selected Trace Elements and Organic Contaminants in New Zealand* (Reference 6) for gravel substratum.

10.3 ANALYTICAL RESULTS

The analytical results are summarised in Tables 4 and 5 below and the laboratory transcripts provided in Appendix C.

There were no OCPs or TPHs detected in the soil samples analysed, as a result these compounds were omitted from the tables below.

TABLE 4: SOIL - ANALYTICAL RESULTS¹

	Arsenic	Cadmium	Copper	Mercury	Lead
Comp 1	5.1	0.12	17	0.08	8.5
Comp 2	4	0.13	14	0.07	8.2
SS9	4.2	0.1	18	0.09	8.5
SS10	5.1	0.11	19	0.09	10
NES ²	70	1 330	>10 000	4 200	3 300
Land Care Eco-SGV ³	20	3.1	80	NV	530
Background ⁴	2.88	0.66	10	NV	12.2

Notes:

1. All metal concentrations measured in mg/kg;
2. National Environmental Standards (NES) for Assessing and Managing Contaminants in Soil to Protect Human Health –Commercial Industrial outdoor worker-unpaved.
3. LandCare Soil guideline values for the protection of ecological receptors (Eco-SGVs) (Reference 6)
4. LandCare Predicted Background Concentrations for Southland – Gravel (Reference 6)
5. NV = No Value

TABLE 5: SEDIMENT - ANALYTICAL RESULTS¹

	Arsenic	Cadmium	Copper	Mercury	Lead	Benzo(a)Pyrene	Total PAH
Sed 1	4.5	0.23	15	0.05	14	<0.03	0.55
Sed 2	4.3	0.06	11	0.05	7.5	0.04	0.56
ANZECC ²	20	1.5	65	0.15	50	NV	10

Notes:

1. All concentrations measured in mg/kg, pH measured in pH units.
2. Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines (Reference 7).
3. BaP Equiv. = equivalent BaP concentration calculated as the sum of each of the detected concentrations of nine carcinogenic PAHs multiplied by their respective potency equivalency factors
4. NV = No Value

10.4 DISCUSSION OF RESULTS

There were no OCPs detected in the two sediment samples (Sed1 and Sed2) or TPHs detected in the two soil samples (SS9 and SS10) analysed.

10.4.1 HEAVY METALS

The concentrations of heavy metals (including Mercury) in the four soil samples analysed revealed concentrations of contaminants that are compliant with both the NES criteria for Commercial Industrial outdoor worker-unpaved and the NES SCS for rural land use. Given the proposed mining activities, only the NES criteria for Commercial Industrial outdoor worker-unpaved are referenced in Table 4.

The concentrations of heavy metals (including Mercury) in the four soil samples and the two sediment samples are compliant with the Land Care Ecological Soil Guideline Values (Eco-SGVs).

10.4.2 POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

There were no PAHs detected in sediment sample Sed1 while sediment sample Sed2 revealed a concentration of Benzo(a)pyrene that is at the laboratory's detection limit. However, this concentration is well below the NES criteria for the proposed land use as well as for rural land use. The total PAH concentrations in both sediment samples are also well within the ANZECC(2000) criteria for the protection of the environment.

10.4.3 TOTAL PETROLEUM HYDROCARBONS AND ORGANOCHLORINE PESTICIDES

There were no TPHs detected in the two soil samples analysed from the mining storage area and no OCPs detected in the two sediment samples analysed.

11 CONCLUSIONS

Based on the findings of the above investigation, it is concluded that:

- Although the site is the location of a historical HAIL activity in the form of a closed landfill, the landfill area will not be disturbed during the proposed mining activities.
- There is no evidence that the closed landfill has adversely impacted the nearby Shepherds Creek.
- The major component of the mining operations that occurred onsite included the extraction of gravels by dredging operations. It is noted that gravel extraction is excluded from Item E.7 of the HAIL.
- The separation of gold dust from gravels deposits are mainly achieved by physical process like screening and gravitational methods and does not involve chemical processes.
- The desk top study and site walkover did not reveal any noticeable signs of contamination;
- Soil and sediment sampling from the site revealed concentrations of contaminants that complies with the NES criteria for the protection of human health and with the Land Care Research/ANZECC criteria for the protection of the environment.

From the investigations described above it is concluded that the site does not meet Environment Southland's definition of land that is contaminated and that it does not pose a risk to future land users and to the environment and is therefore suitable for the proposed WKGL development.

12 REFERENCES

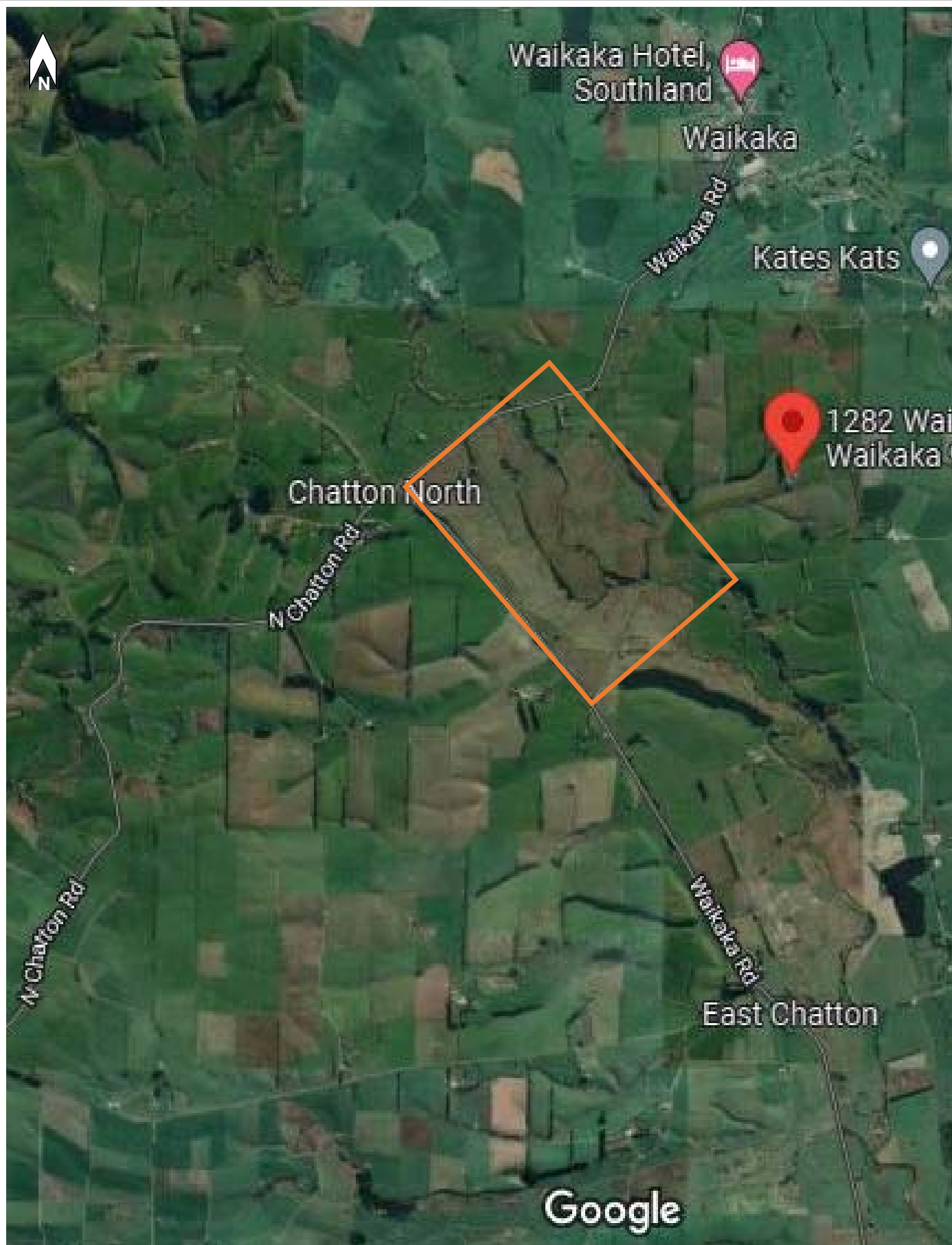
1. Ministry for the Environment (2003) — *Contaminated Land Management Guidelines No.1: Reporting on contaminated Sites in New Zealand*. Ministry for the Environment, Wellington, New Zealand.
2. Ministry for the Environment (2003) — *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils*. Ministry for the Environment, Wellington, New Zealand.
3. Ministry for the Environment (2012) - *Users Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*. Ministry for the Environment, Wellington, New Zealand.
4. Retrolens Historical Image Resource - www.retolens.co.nz
5. Ministry for the Environment (2011) – *Methodology for Deriving Standards for contaminants in Soil to Protect Human Health*. Ministry for the Environment, Wellington, New Zealand.
6. Jo-Anne Cavanagh (2016) – *Users Guide: Background Soil Concentrations and Soil Guideline Values for the Protection of Ecological Receptors (Eco-SGVs) – Consultation Draft*. Land Care Research. Report No LC2595.
7. ANZECC & ARMCANZ. (2000) – *Australian and New Zealand guidelines for fresh and marine water quality. October 2000. National Water Quality Management Strategy Paper No 4*. Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Canberra, Australia.
8. Turnbull I M and Allibone A H (2003) – *Geology of the Murihiku Area*. Institute of Geological & Nuclear Sciences Limited. Wellington. ISBN 0-478-098000-6.

13 LIMITATIONS

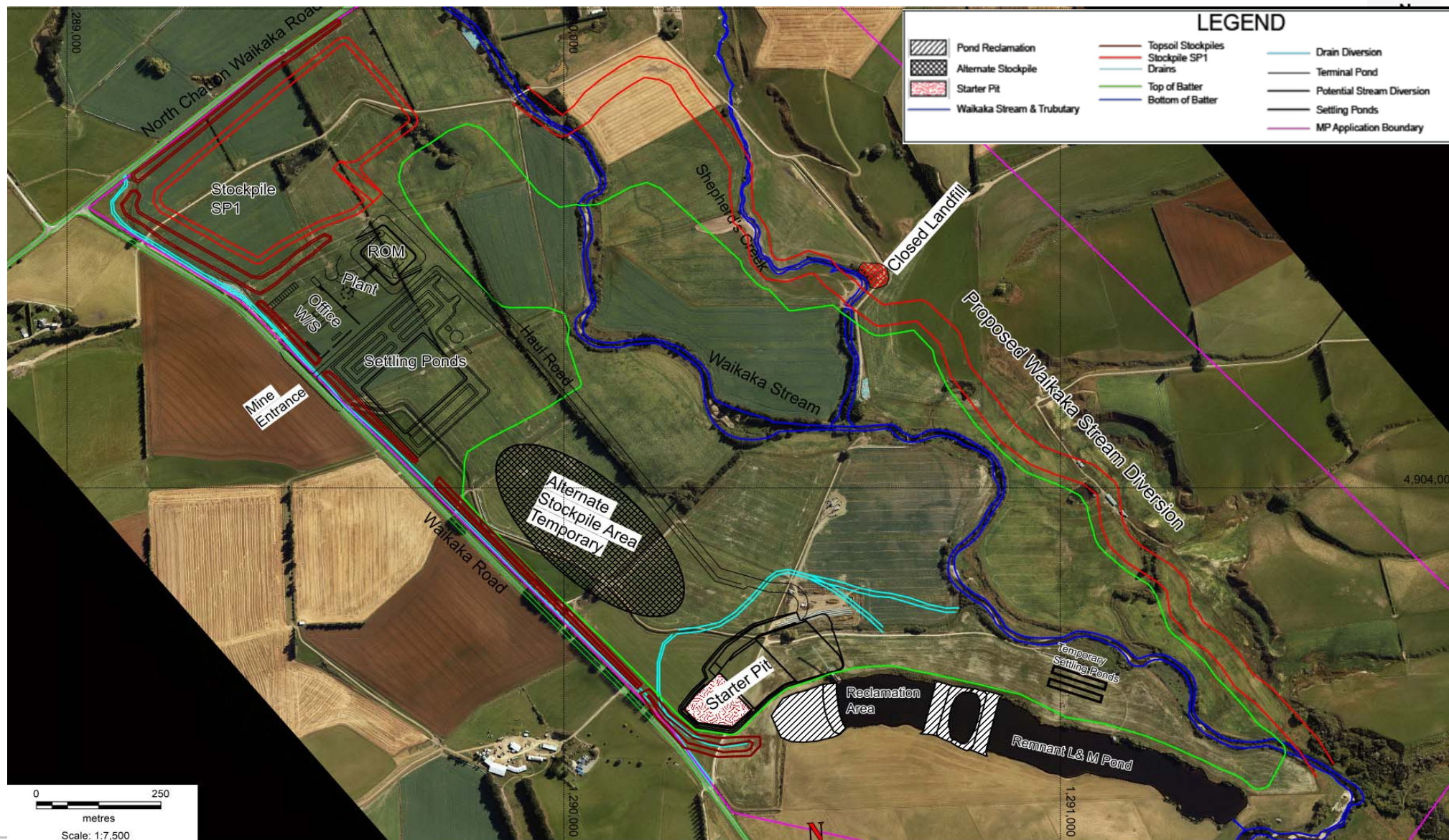
The conclusions and all information in this Report are given strictly in accordance with and subject to the following limitations and recommendations:

1. The assessment undertaken to form this conclusion is limited to the scope of work agreed between GSL and the client, or the client's agent as outlined in this Report. This report has been prepared for the sole benefit of the client and neither the whole nor any part of this report may be used or relied upon by any other party.
2. The investigations carried out for the purposes of the report have been undertaken, and the report has been prepared, in accordance with normal prudent practice and by reference to applicable environmental regulatory authority and industry standards, guidelines and assessment criteria in existence at the date of this report.
3. This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by GSL for use of any part of this report in any other context.
4. This Report was prepared on the dates and times as referenced in the report and is based on the conditions encountered on the site and information reviewed during the time of preparation. GSL accepts no responsibility for any changes in site conditions or in the information reviewed that have occurred after this period of time.
5. Where this report indicates that information has been provided to GSL by third parties, GSL has made no independent verification of this information except as expressly stated in the report. GSL assumes no liability for any inaccuracies in or omissions to that information.
6. Given the limited Scope of Works, GSL has only assessed the potential for contamination resulting from past and current known uses of the site.
7. Environmental studies identify actual sub-surface conditions only at those points where samples are taken and when they are taken. Actual conditions between sampling locations may differ from those inferred. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from that predicted. Nothing can be done to prevent the unanticipated and GSL does not guarantee that contamination does not exist at the site.
8. Except as otherwise specifically stated in this report, GSL makes no warranty or representation as to the presence or otherwise of asbestos and/or asbestos containing materials ("ACM") on the site. If fill has been imported on to the site at any time, or if any buildings constructed prior to 1970 have been demolished on the site or materials from such buildings disposed of on the site, the site may contain asbestos or ACM.
9. Except as specifically stated in this report, no investigations have been undertaken into any off-site conditions, or whether any adjoining sites may have been impacted by contamination or other conditions originating from this site. The conclusion set out above is based solely on the information and findings contained in this report.
10. Except as specifically stated above, GSL makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.
11. The investigation and remediation of contaminated sites is a field in which legislation and interpretation of legislation is changing rapidly. Our interpretation of the investigation findings should not be taken to be that of any other party. When approval from a statutory authority is required for a project, that approval should be directly sought by the client.
12. Use, development or re-development of the site for any purpose may require planning and other approvals and, in some cases, environmental regulatory authority and accredited site auditor approvals. GSL offers no opinion as to whether the current or proposed use has any or all approvals required, is operating in accordance with any approvals, the likelihood of obtaining any approvals, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environmental works.
13. GSL makes no determination or recommendation regarding a decision to provide or not to provide financing with respect to the site. The on-going use of the site and/or planned use of the site for any different purpose may require the owner/user to manage and/or remediate site conditions, such as contamination and other conditions, including but not limited to conditions referred to in this report.
14. Except as required by law, no third party may use or rely on, this report unless otherwise agreed by GSL in writing. Where such agreement is provided, GSL will provide a letter of reliance to the agreed third party in the form required by GSL.
15. To the extent permitted by law, GSL expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this Report. GSL does not admit that any action, liability, or claim may exist or be available to any third party.
16. Except as specifically stated in this section, GSL does not authorise the use of this report by any third party.

FIGURES



Title:	Figure 1 Site Location	Reference: Job-1773
Project name:	Waikaka Gold Mines Limited	Date: 18/08/22
geosciences ENVIRONMENTAL ltd	Level 1, 47 Clyde Road, Browns Bay, 0630, Tel: (09) 475 0222	Drawn: TM
		Approved: JF



geosciences Ltd
ENVIRONMENTAL

Title:

Figure 2— Proposed Mine Development Area

Reference: J1773

Date: 18/08/2022

Level 1, 47 Clyde Road, Browns Bay, 0630
Tel: (09) 475 0222

Project name:

Waikaka Gold Mines Limited

Drawn: TM

Approved: JF



Aerial photograph courtesy of Google Maps

Title:	Figure 3 — Soil Sample Locations	Reference: Job-1773
Project name:	Waikaka Gold Mines Limited	Date: 18/08/22
geosciences Ltd ENVIRONMENTAL	Level 1, 47 Clyde Road, Browns Bay, 0630, Tel: (09) 475 0222	Drawn: TM
		Approved: JF

APPENDIX A HISTORICAL AERIAL PHOTOGRAPHS



Aerial photograph courtesy of Retrolens

Title:	APPENDIX A HISTORICAL AERIAL PHOTOGRAPHS	Reference: Job-1773
Project name:	Waikaka Gold Limited	Date: 18/08/22
geosciences ENVIRONMENTAL ltd	Level 1, 47 Clyde Road, Browns Bay, 0630, Tel: (09) 475 0222	Drawn: JF
		Approved: CW



Aerial photograph courtesy of Retrolens

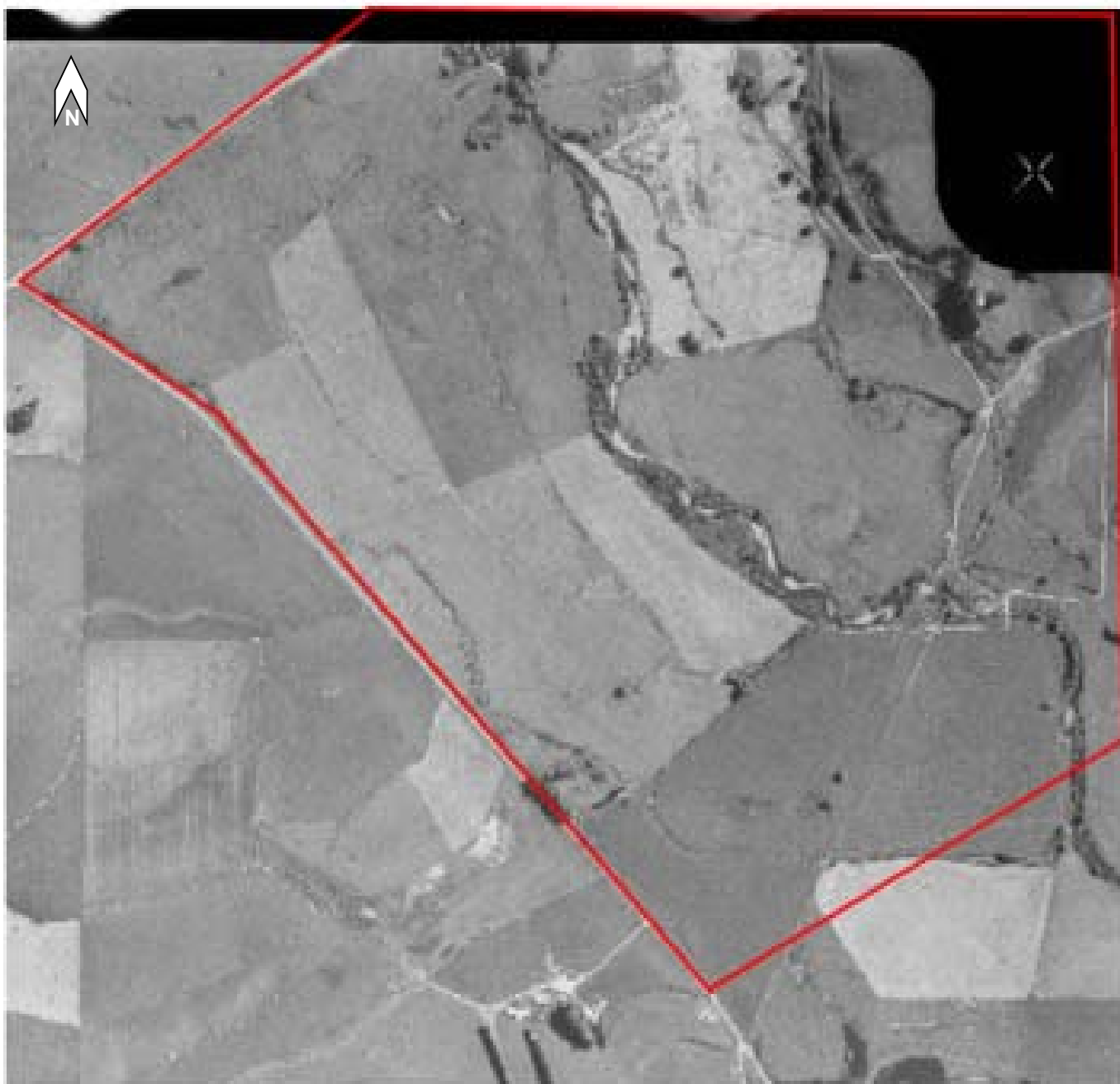
Title:	APPENDIX A - HISTORICAL AERIAL PHOTOGRAPHS	Reference: Job-1773
Project name:	Waikaka Gold Mines Limited	Date: 18/08/22
geosciences Ltd ENVIRONMENTAL	Level 1, 47 Clyde Road, Browns Bay, 0630, Tel: (09) 475 0222	Drawn: TM
		Approved: JF



1963

Aerial photograph courtesy of Retrolens

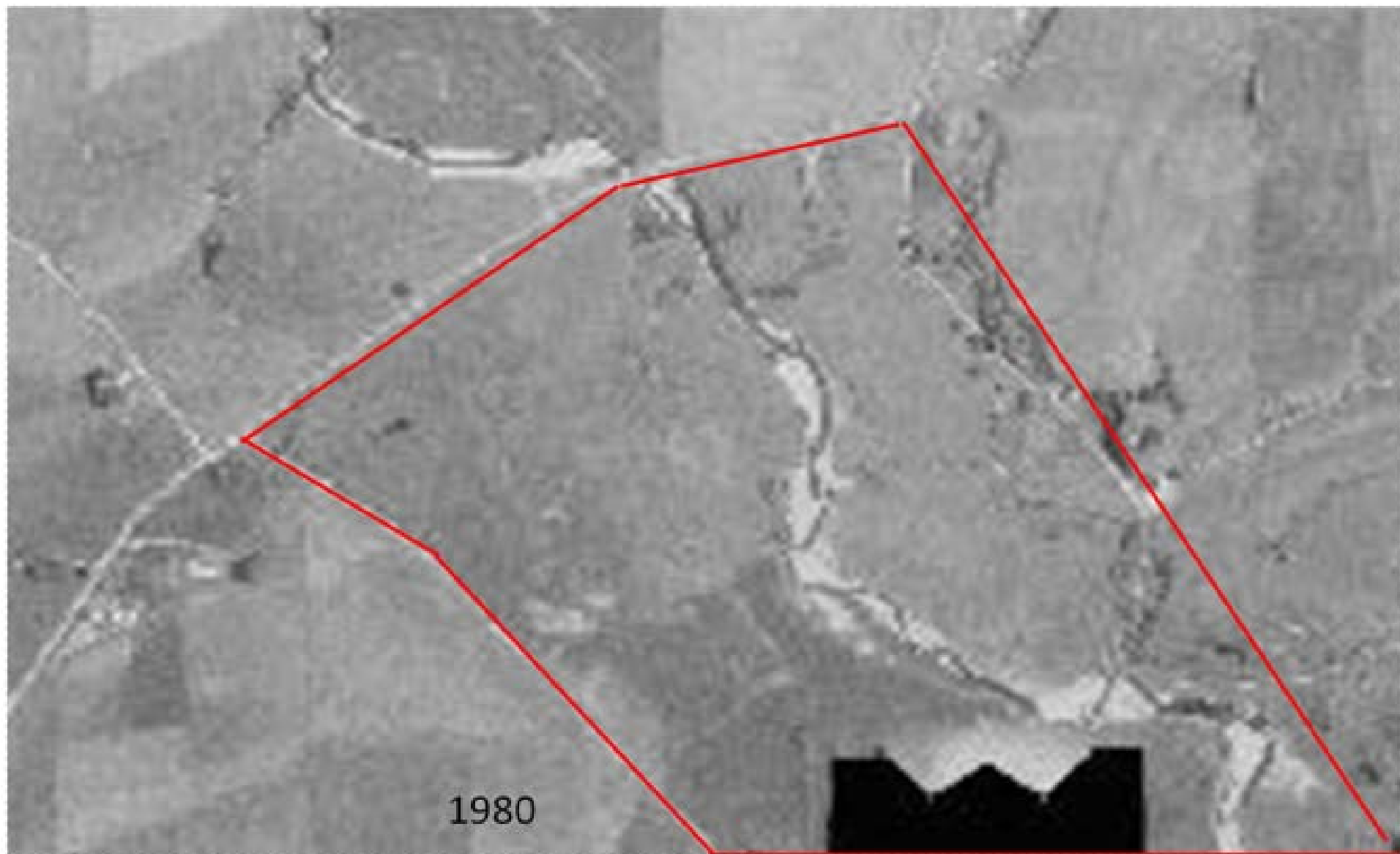
Title:	APPENDIX A - HISTORICAL AERIAL PHOTOGRAPHS	Reference: Job-1773
Project name:	Waikaka Gold Mines Limited	Date: 18/08/22
	Level 1, 47 Clyde Road, Browns Bay, 0630, Tel: (09) 475 0222	Drawn: TM
		Approved: JF



1970

Aerial photograph courtesy of [PetaLorel](#)

Title:	APPENDIX A - HISTORICAL AERIAL PHOTOGRAPHS	Reference: Job-1773
Project name:	Waikaka Gold Mines Limited	Date: 18/08/22
geosciences Ltd ENVIRONMENTAL	Level 1, 47 Clyde Road, Browns Bay, 0630, Tel: (09) 475 0222	Drawn: TM
		Approved: JF





Aerial photograph courtesy of Retrolens

Title:	APPENDIX A - HISTORICAL AERIAL PHOTOGRAPHS	Reference: Job-1773
Project name:	Waikaka Gold Mines Limited	Date: 18/08/22
geosciences ENVIRONMENTAL ltd	Level 1, 47 Clyde Road, Browns Bay, 0630, Tel: (09) 475 0222	Drawn: TM
		Approved: JF



2014

Aerial photograph courtesy of Retrolens

Title:	APPENDIX A - HISTORICAL AERIAL PHOTOGRAPHS	Reference: Job-1773
Project name:	Waikaka Gold Mines Limited	Date: 18/08/22
geosciences Ltd ENVIRONMENTAL	Level 1, 47 Clyde Road, Browns Bay, 0630, Tel: (09) 475 0222	Drawn: TM
		Approved: JF

APPENDIX B

SITE PHOTOGRAPHS



PLATE 1: FOOT OF CLOSED LANDFILL



PLATE 2: STORAGE AND ASSEMBLY AREA



PLATE 3: LOOKING WEST FROM WAIKAKA ROAD



PLATE 4: Paddock in South East of Site



PLATE 5: VIEW SOUTH TOWARDS THE DREDGE PONDS



PLATE 6: VIEW OF NORTHERN PADDOCKS



PLATE 7 VIEW WEST TOWARDS WAIKAKA STREAM

APPENDIX C LABORATORY TRANSCRIPTS

Geosciences Ltd
First Floor, 47 Clyde Road
Browns Bay
Auckland NZ 0630



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

Attention: Johan Faurie

Report 907817-S
Project name [WAIKAIA GOLD LTD](#)
Project ID [1773](#)
Received Date Jul 22, 2022

Client Sample ID			COMPOSITE1	COMPOSITE2	SS9	SS10
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			K22-JI0044342	K22-JI0044343	K22-JI0044344	K22-JI0044345
Date Sampled			Jul 18, 2022	Jul 18, 2022	Jul 18, 2022	Jul 18, 2022
Test/Reference	LOR	Unit				
Heavy Metals						
Cadmium	0.01	mg/kg	0.12	0.13	0.10	0.11
Copper	0.1	mg/kg	17	14	18	19
Mercury	0.01	mg/kg	0.08	0.07	0.09	0.09
Metals M8 (NZ MfE)						
Arsenic	0.1	mg/kg	5.1	4.0	4.2	5.1
Lead	0.1	mg/kg	8.5	8.2	8.5	10
% Moisture	1	%	24	23	23	15
Total Petroleum Hydrocarbons (NZ MfE 1999)						
TPH-SG C7-C9	5	mg/kg	-	-	< 5	< 5
TPH-SG C10-C14	10	mg/kg	-	-	< 10	< 10
TPH-SG C15-C36	20	mg/kg	-	-	< 20	< 20
TPH-SG C7-C36 (Total)	35	mg/kg	-	-	< 35	< 35

Client Sample ID			SED1	SED2
Sample Matrix			Soil	Soil
Eurofins Sample No.			K22-JI0044346	K22-JI0044347
Date Sampled			Jul 18, 2022	Jul 18, 2022
Test/Reference	LOR	Unit		
Heavy Metals				
Cadmium	0.01	mg/kg	0.23	0.06
Copper	0.1	mg/kg	15	11
Mercury	0.01	mg/kg	0.05	0.05
Metals M8 (NZ MfE)				
Arsenic	0.1	mg/kg	4.5	4.3
Lead	0.1	mg/kg	14	7.5
% Moisture	1	%	43	43
Organochlorine Pesticides (NZ MfE)				
2,4'-DDD	0.01	mg/kg	< 0.01	< 0.01
2,4'-DDE	0.01	mg/kg	< 0.01	< 0.01
2,4'-DDT	0.01	mg/kg	< 0.01	< 0.01
4,4'-DDD	0.01	mg/kg	< 0.01	< 0.01

Client Sample ID			SED1	SED2
Sample Matrix			Soil	Soil
Eurofins Sample No.			K22-JI0044346	K22-JI0044347
Date Sampled			Jul 18, 2022	Jul 18, 2022
Test/Reference	LOR	Unit		
Organochlorine Pesticides (NZ MfE)				
4,4'-DDE	0.01	mg/kg	< 0.01	< 0.01
4,4'-DDT	0.01	mg/kg	< 0.01	< 0.01
DDT + DDE + DDD (Total)*	0.01	mg/kg	< 0.01	< 0.01
a-HCH	0.01	mg/kg	< 0.01	< 0.01
Aldrin	0.01	mg/kg	< 0.01	< 0.01
b-HCH	0.01	mg/kg	< 0.01	< 0.01
Chlordanes - Total	0.01	mg/kg	< 0.01	< 0.01
cis-Chlordane	0.01	mg/kg	< 0.01	< 0.01
d-HCH	0.01	mg/kg	< 0.01	< 0.01
Dieldrin	0.01	mg/kg	< 0.01	< 0.01
Endosulfan I	0.01	mg/kg	< 0.01	< 0.01
Endosulfan II	0.01	mg/kg	< 0.01	< 0.01
Endosulfan sulphate	0.01	mg/kg	< 0.01	< 0.01
Endrin	0.01	mg/kg	< 0.01	< 0.01
Endrin aldehyde	0.01	mg/kg	< 0.01	< 0.01
Endrin ketone	0.01	mg/kg	< 0.01	< 0.01
g-HCH (Lindane)	0.01	mg/kg	< 0.01	< 0.01
Heptachlor	0.01	mg/kg	< 0.01	< 0.01
Heptachlor epoxide	0.01	mg/kg	< 0.01	< 0.01
Hexachlorobenzene	0.01	mg/kg	< 0.01	< 0.01
Methoxychlor	0.01	mg/kg	< 0.01	< 0.01
Toxaphene	0.5	mg/kg	< 0.5	< 0.5
trans-Chlordane	0.01	mg/kg	< 0.01	< 0.01
Dibutylchloredate (surr.)	1	%	115	114
Tetrachloro-m-xylene (surr.)	1	%	118	118
Polycyclic Aromatic Hydrocarbons (NZ MfE)				
Acenaphthene	0.03	mg/kg	< 0.03	< 0.03
Acenaphthylene	0.03	mg/kg	< 0.03	< 0.03
Anthracene	0.03	mg/kg	< 0.03	< 0.03
Benz(a)anthracene	0.03	mg/kg	< 0.03	< 0.03
Benzo(a)pyrene	0.03	mg/kg	< 0.03	0.04
Benzo(a)pyrene TEQ (lower bound)*	0.03	mg/kg	< 0.03	0.04
Benzo(a)pyrene TEQ (medium bound)*	0.03	mg/kg	0.04	0.06
Benzo(a)pyrene TEQ (upper bound)*	0.03	mg/kg	0.08	0.09
Benzo(b&j)fluoranthene ^{N07}	0.03	mg/kg	< 0.03	< 0.03
Benzo(g,h,i)perylene	0.03	mg/kg	< 0.03	< 0.03
Benzo(k)fluoranthene	0.03	mg/kg	< 0.03	< 0.03
Chrysene	0.03	mg/kg	< 0.03	< 0.03
Dibenz(a,h)anthracene	0.03	mg/kg	< 0.03	< 0.03
Fluoranthene	0.03	mg/kg	< 0.03	< 0.03
Fluorene	0.03	mg/kg	< 0.03	< 0.03
Indeno(1,2,3-cd)pyrene	0.03	mg/kg	< 0.03	< 0.03
Naphthalene	0.1	mg/kg	< 0.1	< 0.1
Phenanthrene	0.03	mg/kg	< 0.03	< 0.03
Pyrene	0.03	mg/kg	< 0.03	< 0.03
p-Terphenyl-d14 (surr.)	1	%	112	101
2-Fluorobiphenyl (surr.)	1	%	104	104

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Heavy Metals	Auckland	Jul 22, 2022	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Metals M8 (NZ MfE)	Auckland	Jul 22, 2022	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Petroleum Hydrocarbons (NZ MfE 1999)	Auckland	Jul 22, 2022	14 Days
- Method: LTM-ORG-2010 TRH and BTEX in Soil and Water by GC FID and PT GCMS			
Organochlorine Pesticides (NZ MfE)	Auckland	Jul 22, 2022	14 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water by GCMSMS			
Polycyclic Aromatic Hydrocarbons (NZ MfE)	Auckland	Jul 22, 2022	14 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water by GC MSMS			
% Moisture	Auckland	Jul 22, 2022	14 Days
- Method: LTM-GEN-7080 Moisture Content in Soil by Gravimetry			

Company Name: Geosciences Ltd
Address: First Floor, 47 Clyde Road
Browns Bay
Auckland NZ 0630
Project Name: WAIKAIA GOLD LTD
Project ID: 1773

Order No.:
Report #: 907817
Phone: 0011 64 9 4760 454
Fax:

Received: Jul 22, 2022 8:01 AM
Due: Jul 29, 2022
Priority: 5 Day
Contact Name: Johan Faurie

Eurofins Analytical Services Manager : Karishma Patel

Sample Detail						Arsenic	Cadmium	Copper	HOLD	Lead	Mercury	Moisture Set	Total Petroleum Hydrocarbons (NZ MIE 1999)	Organochlorine Pesticides (NZ MIE)	Polycyclic Aromatic Hydrocarbons (NZ MIE)
Auckland Laboratory - IANZ# 1327						X	X	X	X	X	X	X	X	X	X
Christchurch Laboratory - IANZ# 1290															
External Laboratory															
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID										
1	COMPOSITE1	Jul 18, 2022		Soil	K22-JI0044342	X	X	X		X	X	X			
2	COMPOSITE2	Jul 18, 2022		Soil	K22-JI0044343	X	X	X		X	X	X			
3	SS9	Jul 18, 2022		Soil	K22-JI0044344	X	X	X		X	X	X	X		
4	SS10	Jul 18, 2022		Soil	K22-JI0044345	X	X	X		X	X	X	X		
5	SED1	Jul 18, 2022		Soil	K22-JI0044346	X	X	X		X	X	X		X	X
6	SED2	Jul 18, 2022		Soil	K22-JI0044347	X	X	X		X	X	X		X	X
7	SS1	Jul 18, 2022		Soil	K22-JI0044348				X						
8	SS2	Jul 18, 2022		Soil	K22-JI0044349				X						
9	SS3	Jul 18, 2022		Soil	K22-JI0044350				X						
10	SS4	Jul 18, 2022		Soil	K22-JI0044351				X						
11	SS5	Jul 18, 2022		Soil	K22-JI0044352				X						
12	SS6	Jul 18, 2022		Soil	K22-JI0044353				X						

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IANZ# 1290

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NATA# 1261 Site# 1254

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Grovedale
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Tel: +61 3 8564 5000
NATA# 1261 Site# 1254

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Girraween
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NATA# 1261 Site# 18217

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Mayfield East NSW 2304
PO Box 60 Wickham 2293
Tel: +61 2 4968 8448
NATA# 1261 Site# 25079

Perth
46-48 Banksia Road
Welshpool
WA 6106
Tel: +61 8 6253 4444
NATA# 2377 Site# 2370

Company Name: Geosciences Ltd
Address: First Floor, 47 Clyde Road
Browns Bay
Auckland NZ 0630
Project Name: WAIKAIA GOLD LTD
Project ID: 1773

Order No.:
Report #: 907817
Phone: 0011 64 9 4760 454
Fax:

Received: Jul 22, 2022 8:01 AM
Due: Jul 29, 2022
Priority: 5 Day
Contact Name: Johan Faurie

Eurofins Analytical Services Manager : Karishma Patel

Sample Detail						Arsenic	Cadmium	Copper	HOLD	Lead	Mercury	Moisture Set	Total Petroleum Hydrocarbons (NZ MfE 1999)	Organochlorine Pesticides (NZ MfE)	Polycyclic Aromatic Hydrocarbons (NZ MfE)
Auckland Laboratory - IANZ# 1327						X	X	X	X	X	X	X	X	X	X
Christchurch Laboratory - IANZ# 1290															
External Laboratory															
13	SS7	Jul 18, 2022		Soil	K22-JI0044354				X						
14	SS8	Jul 18, 2022		Soil	K22-JI0044355				X						
Test Counts						6	6	6	8	6	6	6	2	2	2

Internal Quality Control Review and Glossary

General

- Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
- All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
- All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
- Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
- Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
- SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- Samples were analysed on an 'as received' basis.
- Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
- This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	µg/L: micrograms per litre
ppm: parts per million	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

- Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
- Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
- pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
- Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
- For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
- Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised by:

Karishma Patel	Analytical Services Manager
Michael Ritchie	Senior Analyst-Metal



Michael Ritchie

Head of Semi Volatiles (Key Technical Personnel)

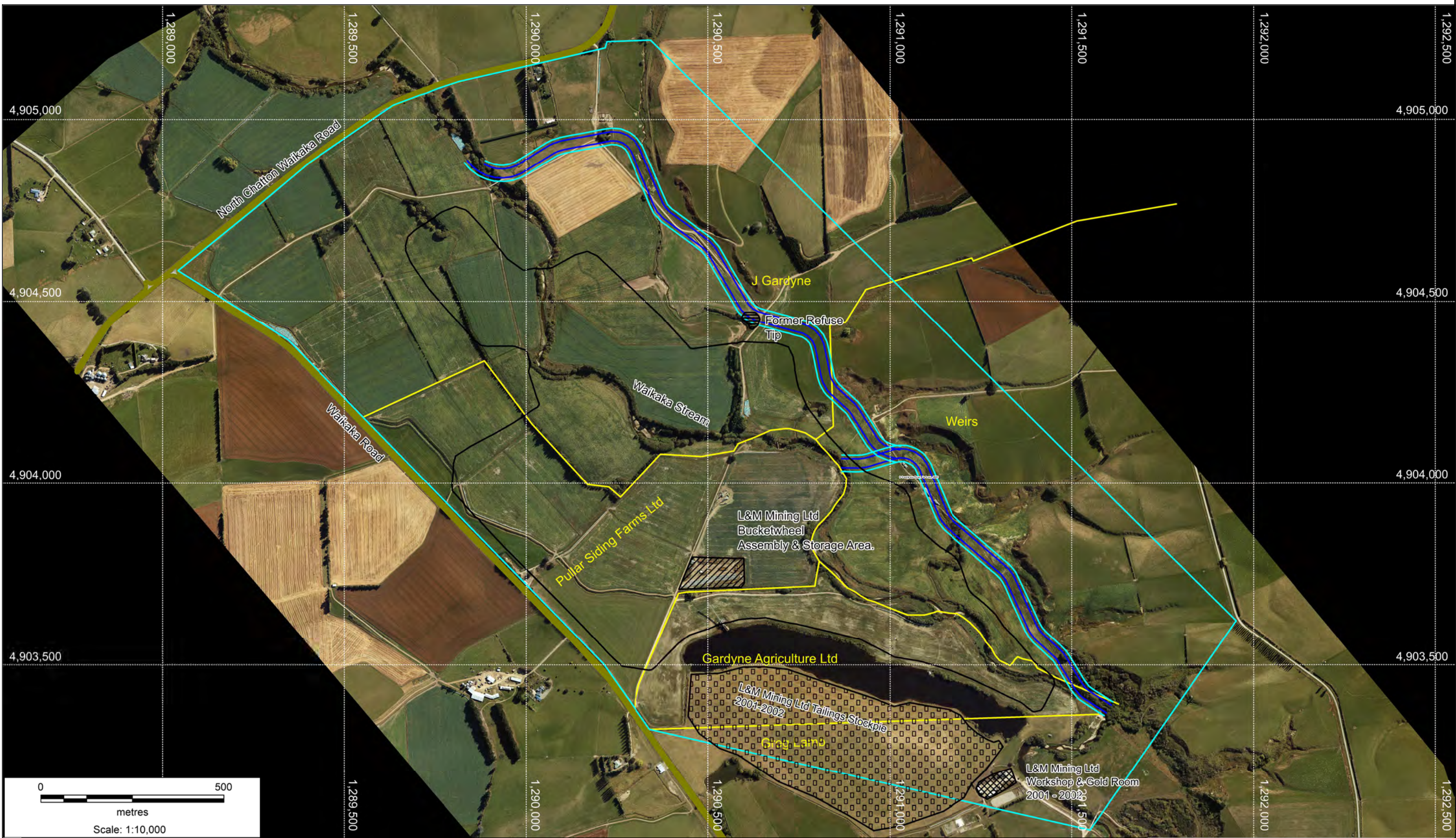
Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates IANZ accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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LEGEND

- | | | | |
|---|---------------------------------------|---|--------------------------|
|  | L&M Mining Bucketwheel Storage |  | WGML Pit Area |
|  | L&M Mining Former Workstop & Goldroom |  | MP Application Area |
|  | L&M Mining 2002 Tailings Heap |  | Proposed River Diversion |
|  | Former Waikaka Refuse Tip |  | Property Boundaries |
| | |  | Roads |



WGML WAIKAKA
GOLD MINES LTD

WAIKAKA EP 56372

Potential Contaminated Sites

Reference Files :	Compiled :	Date :	
	WNB	May 2022	
	Drawn :	Scale :	Projection: NZTM 2000
	WNB	1 : 10 000	
Drawing Path :			Drawing Name
			WK0436: