

# Preliminary Site Investigation and Detailed Site Investigation

## Proposed Huntly Managed Fill – Fill Area 3

Prepared For: Paua Planning Limited

Date: 31 August 2021

Attention: Kate Madsen  
Paua Planning Limited

EHS Support Job No.: J000103

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### Executive Summary

- Information reviewed as part of this investigation indicates that coal mine tailings and overburden material from the neighbouring former mine operation had been deposited in the northern half of the Fill Area 3 (FA3) of the proposed Huntly Managed Fill.
- The site has more likely than not has been subjected to an activity on the Ministry for the Environment's (MfE) Hazardous Activities and Industry List (HAIL) - category E7 – storage of hazardous waste dumps or dam tailings and constitutes a 'piece of land' under Regulation 5(7) of the NES-CS. As such, the proposed site re-development work will trigger the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES-CS).
- The investigation is based on proposed future commercial/industrial use. EHS Support New Zealand Ltd (EHS Support) has compared the soil investigation results to the applicable commercial/industrial land use NES-CS Soil Contaminant Standards (SCSs).
- Soil sample analysis from the EHS Support investigation reported inorganic elements at levels above the published background concentrations but well below the SCS for commercial/industrial end use. Accordingly, a controlled activity consent is required under Regulation 9 of the NES-CS for the proposed soil disturbance activity.
- It is recommended that a contaminated site management plan (CSMP) is prepared to ensure that potential human health and environmental risks associated with residual contamination are mitigated during the proposed development works. The CSMP will document soil management, reuse and disposal requirements and outline contingency measures if unexpected sources of contamination are encountered during earthworks.

## 1. Introduction and Background

EHS Support New Zealand Ltd (EHS Support) was engaged by Paua Planning Limited (Paua Planning) on behalf of Gleeson Quarries Limited to undertake a Preliminary Site Investigation and Detailed Site Investigation (PSI / DSI) for Fill Area 3 (FA3, 'the site') of the proposed Huntly Managed Fill at 310 River View Road, Huntly. The site is currently part of the Huntly Quarry operation.

Waikato Regional Council (WRC) has reportedly raised concerns regarding the potential present of coal mine tailings and overburden material beneath FA3 which could potentially contaminate the shallow groundwater in the vicinity of the site. Paua Planning has also requested EHS Support to verify if any of the material excavated from beneath FA3 would meet the proposed waste acceptance criteria for the proposed Huntly manage fill.

The work was completed in accordance with our proposal dated 1 April 2021 and this report presents the findings of the testing and discusses the results of the investigation. The purpose of the PSI / DSI were to determine:

- The site history, whether historic use is likely to have resulted in ground contamination and verify whether activities detailed on the Hazardous Activities and Industries List (HAIL), issued by the Ministry for the Environment (MfE) in Users' Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (MfE, 2012), apply to the site.
- Whether the concentrations of contaminants of concern in soils at the site are likely to exceed background concentrations or NES soil contaminant standards.
- Whether resource consents may be required to address ground contamination issues as part of the proposed re-development work with respect to the NES-CS (NES-CS, 2011) and the Waikato Regional Council Contaminated Land rules.
- Whether contamination at the site requires remedial work, poses material handling issues and/or off-site disposal/landfill constraints as part of the re-development programme.

The contaminated site assessment work performed follows the general reporting and investigation methodology presented in the MfE Contaminated Land Management Guidelines No. 1. Reporting on Contaminated Sites in New Zealand (Guideline 1) (MfE, 2021) and MfE Contaminated Land Management Guidelines No. 5. Site Investigation and Analysis of Soils (Guideline 5) (MfE, 2021), including suggested revisions. This PSI / DSI was completed under the direction of a suitably qualified and experienced practitioner (SQEP)<sup>1</sup> – as defined by the requirements of the NES-CS (NES-CS, 2011).

This report is subject to the limitations presented in **Appendix A**.

## 2. Site Description

The FA3 area is adjacent to the existing operating Huntly Quarry at 310 Riverview Road, approximately 4.5 km to the south of the Huntly township on the western side of the Waikato River – see Figure 1. Access will be through the quarry entrance and along existing quarry roads

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<sup>1</sup> Report reviewed by Andrew Rumsby, Suitably Qualified & Experienced Practitioner - Site Contamination Specialist with over 20 years' experience in contaminated land investigations.

before linking to a new/upgraded road that will lead to FA3. The site description is presented in **Table 1**.

**Table 1: Site Description**

Address	Legal Description	Area (m <sup>2</sup> )	Site Coordinates
310 Riverview Road, Huntly	Lot 1 DP 25272, Part Lot 9 DP 1278	~42,000	-37.585600, 175.145567

Source: Waikato District Council Maps Online (Google Earth, 2021).

The current surrounding property use is presented in **Table 2**.

**Table 2: Current Surrounding Property Use**

Direction	Observation
North	Pastoral farmland to the immediate north. The former O'Reilly's opencast coal mine is located approximately 350 m from the site.
South	To the south of the site is the Huntly Quarry.
East	Forested area to the immediate east.
West	Pastoral farmland

Source: Waikato District Council Maps Online (Google Earth, 2021).

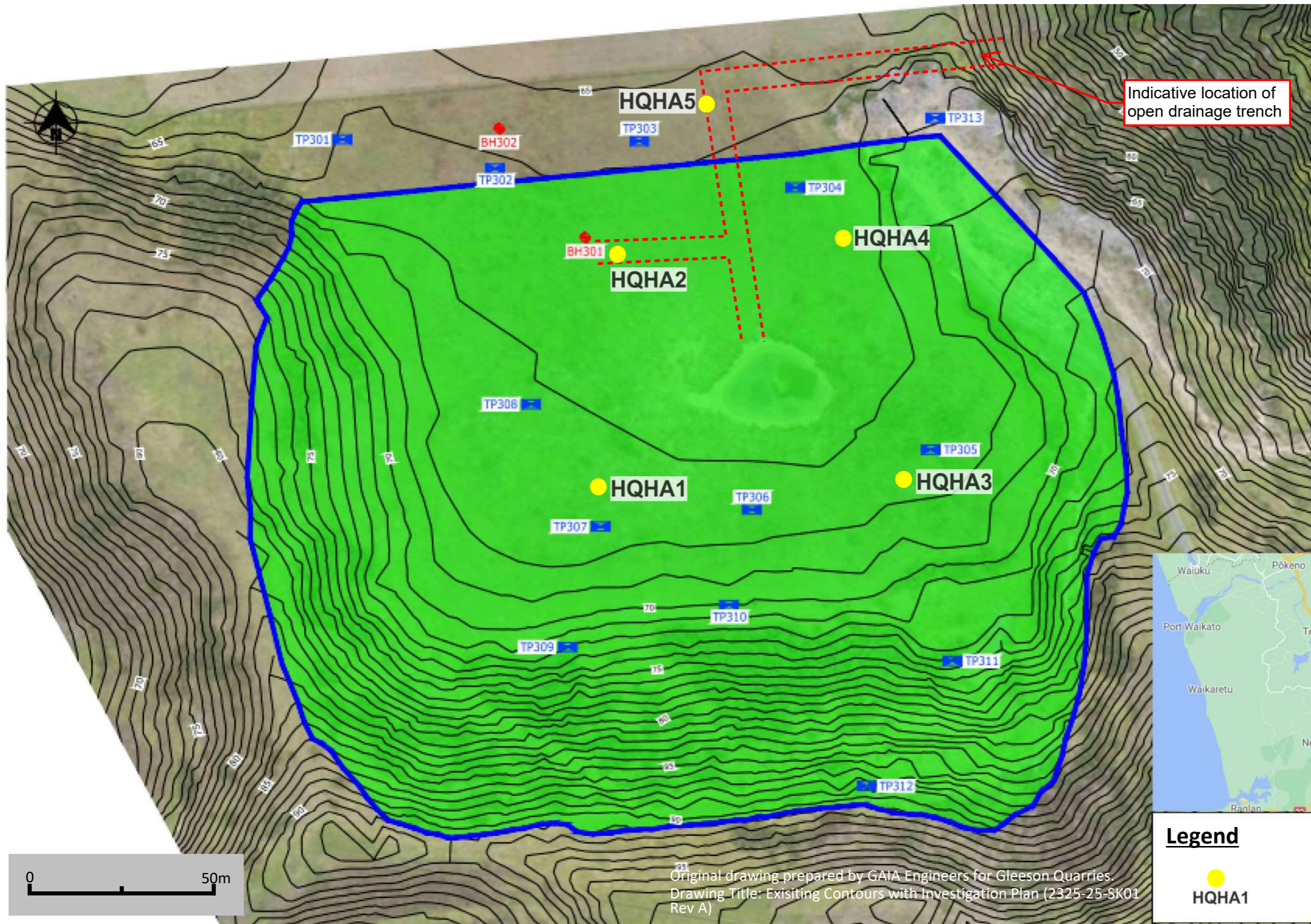
The WRC online contour maps (Google Earth, 2021) shows the topography of the site is mostly flat with gentle ridges to the west and east and northerly orientated back slopes.

EHS Support performed a site inspection on 7 April 2021. A summary of observed conditions is presented in **Table 3**.

**Table 3: Site Condition**

Site Condition	Observation
Surface water	Small pond/wetland area (approximately 700 m <sup>2</sup> ) located near the centre of the site
Local sensitive environments	No sensitive environments nearby.
Visible signs of plant stress	Not observed on-site.
Visible signs of potential contamination sources	Coal fragments noted in soil within the onsite open drainage trench

A photographic log of the site is presented as **Appendix B**.



Indicative location of open drainage trench



**Legend**

● HQHA1      Sample locations (EHS SUPPORT)

Original drawing prepared by GATA Engineers for Gleeson Quarries.  
 Drawing Title: Existing Contours with Investigation Plan (2325-25-SK01 Rev A)



**Project** Fill Area 3 - Huntly Managed Fill  
**Title** Sample Location Plan

Client

Figure 1	
Drawn: JH	Checked: AR
Date: April 2021	For Information Only

## 2.1 Geology

Published geological maps (1:250,000) indicate the site is underlain by Waikato Coal Measures of Lower the Te Kuiti Group (GNS Science, 2021). These deposits are described as carbonaceous mudstone with muddy quartzose sandstone, carbonaceous shale, coal seams and rare conglomerates, siderite concretion. The coal seams comprise of subbituminous coal of non-marine original with coal measures seams are generally 30 m thick or less but have been observed up to 85 m thick within the Huntly coalfield (Keer, 1978)(GNS Science, 1994).

In 2019, test pits excavated as part of the geotechnical investigations carried out by GAIA Engineers Ltd at the site encountered topsoil to approximately 0.3 m below ground level (bgl), followed by very stiff, dark grey clayey SILT with inclusions of Waikato coal measures mudstone boulders and coal (Gaia Engineers Limited, 2021). Groundwater was encountered in 2 of the 13 test pits, at 2 and 4.8 m bgl respectively. In March 2021, two machine boreholes were drilled at the site to a maximum of 26 m bgl. Both boreholes encountered FILL comprising clayey silt with some sand and minor gravel to approximately 21 m bgl, which was underlain by Waikato coal measures that was described as highly weathered siltstone with minor coal inclusions. Groundwater level was not measured within the boreholes (Gaia Engineers Limited, 2021).

## 2.2 History of Huntly Coldfield

The Huntly Coalfield has been worked from 1845 until 2015 (closure of Huntly East Mine) (GNS Science, 1994), (Global Energy Monitor, 2021). There are five major coal mines within the Huntly Coalfield including Huntly West (Closed 1992), Huntly East (closed 2015), Weavers Pit (closed 1993), Kimihia Opencast (1944-1977), and O'Reillys Opencast (closed 2018) (GNS Science, 1994) (New Zealand Petroleum & Minerals, 2021). The two nearest mines to the site where Weavers Pit and O'Reillys Open cast Mine. Weaver's pit open cast mine was opened in 1958 and operated until 1993 producing approximately 4.7 million tonnes of coal. Information on the total volume of coal extracted from O'Reilly open cast mine is not available, however between 2013 to 2018 approximately 99,000 tonnes of coal was extracted from the pit according to information from New Zealand Petroleum and Minerals (2021).

## 2.3 Hydrogeology

The groundwater level of the main aquifer at the Huntly Quarry pit is approximately 19 m RL and 12 m RL near the Waikato River (Pattle Delamore Partners Ltd, January 2020). The elevation of the site is approximately 50 to 60 m RL therefore groundwater will not be intercepted by the FA3 area. The regional groundwater flow is expected to be in an easterly direction towards the Waikato River.

The WRC online groundwater map (Waikato Regional Council, 2021) shows that there is one groundwater well (well ID: 72\_10634) located approximately 900 m to the south-east of the site. This 71.5 m deep well is located within the Huntly Quarry operation and was constructed for dewatering purposes (resource consent: AUTH141218.01.01). There is another bore (well ID: 69\_941) located between the main entrance to the quarry pit and the Waikato River, which is believed to be abandoned during a previous PDP investigation (Pattle Delamore Partners Ltd, January 2020). As there are no known users around the site, groundwater is not considered as a sensitive receptor as part of this investigation.

### 2.3. Hydrology

The nearest surface water (Unnamed tributary of the Waikato River) is located within 100 m north of the site. The Waikato River located some 850 m to the east of the site. The ecological impact assessment report (Boffa Miskell, 2019) indicates that the site is part of the Waikato River catchment and there are no permanent streams within the FA3 area, with only ephemeral/intermittent streams observed.

## 3. Re-Development Proposal

Works to prepare FA3 for filling will be required before active filling can commence. The preparatory works will involve the installation of the required runoff and sediment control measures followed by the geotechnical establishment works.

The required erosion and sediment control measures will include runoff diversion channels and bunds and the construction of a sediment retention pond along with a supplementary chemical treatment system. A super silt fence will be installed at the bottom end of the work area for sediment control while the pond for the fill site is constructed.

The placement of the fill material will be a combination of trucks arriving and tipping at FA3. Trucks will either be arriving and dumping directly into the open fill area or within a designated area from where the fill material will first be managed and then be moved by machinery to the relevant area of the fill. Placed fill will be compacted by track rolling, the movement of site machinery/trucks etc. or perhaps by compactor. Bare surfaces will be stabilised against erosion (topsoiled and grassed) on an ongoing basis as filling is completed in particular areas. Straw/hay mulch, fabric or similar will be applied for temporary stabilisation as required.

Cleanfill only will be placed in the top 2 m of the final contours of the site.

The estimated soil disturbance volume for the proposed development is at least 7,500 m<sup>3</sup> and the duration of the earthworks programme is likely to take longer than 90 days.

The proposed activity does not change the land to a more sensitive land use as the land is currently zoned for commercial/industrial activity (Quarrying) and proposed future activity (Managed Fill) will use similar earthmoving machinery and unit operations (load, haul and dump). Therefore, outdoor commercial/industrial exposure scenario would be applicable for both situations.

## 4. Historical Site Use

EHS Support has reviewed historic aerial photographs dating back to 1941 held on the Local Government Geospatial Alliance Retrolens website (Local Government Geospatial Alliance, 2021) and Goolge Earth (Google Earth, 2021). A summary of historic aerial photography is presented in **Table 4**, and the historical aerial photographs are shown in **Appendix C**.

**Table 4: Summary of Historical Aerial Photographs**

Year	Site	Surrounding Land Use
1941	The site and the immediate surrounding areas appear	The Waikato River and Riverview Road are located approximately 850 m to the east of the site.

Year	Site	Surrounding Land Use
	to be vacant and covered by vegetation.	Pastoral farmlands are visible some 500 m to the north and west of the site. The Huntly Quarry operation appears to have started but in a rather small scale.
1957	No significant changes apparent at the site. However, unpaved access tracks off Riverview Road have been established to provide access to the site.	Large scale earthworks believe to be in association with the O'Reilly's opencast coal mine are being undertaken at a property some 600 m to the north of the site. Additionally, more properties to the west of the site have been converted to pastoral farmland.
1966	No significant changes apparent at the site. An unpaved access track is connecting the site and the quarry pit to the north.	A small-scale quarry pit is located approximately 100 m to the north-east of the site. Three additional mine pits are visible to the further north. The Huntly Quarry operation has expanded significantly comparing to the 1941 image.
1973	No significant changes apparent at the site but more unpaved access tracks have been established to the north of the site.	The quarry pit to the north-east has doubled in size and a new open pit is visible to the north-west of the site. The Huntly Quarry has been further expanded towards the west.
1979	Vegetation near the centre of the site has been cleared and a small pond is present.	The adjacent quarry pit has been further expanded, however, the mine pit to the north-west of the site had been backfilled.
1995	No significant changes apparent at the site.	The quarry pit to the north-east has been partially backfilled and some of the surrounding areas have been re-vegetated.
2002	No significant changes apparent at the site.	Filling of the adjacent quarry pit continues.
2010	No significant changes apparent at the site.	A new quarry pit has been established to the north of the site. The former quarry area to the north-east had been filled and the area is covered by grass.
2018	No significant changes apparent at the site.	The new quarry pit visible in the 2010 image had been backfilled.

Information provided by Waikato District Council (WDC, email dated 24 August 2021) states that WRC had identified that a coal tailings dump is located at the site. Additional information is provided in **Appendix D**.

Based on the information reviewed, coal mine tailings and overburden material from the neighbouring former mine operation had been deposited in the northern half of the site. **The site has therefore more likely than not has been used for HAIL category E7 – storage of hazardous waste dumps or dam tailings and constitutes a 'piece of land' under Regulation 5(7) of the NES-CS.**

## 5. Sampling and Analysis Plan

### 5.1 Contaminants of Concern

To identify the potential contaminants of concern EHS Support review trace element data on Waikato Coalfield (Huntly township, Kopako 1 &2, Rotowaro and Huntly East). Trace element data indicated that arsenic, boron, cobalt, nickel, and zinc may exceed Waikato Background levels (Moore, 2005) (Waikato Regional Council, 2019). Thallium has also been noted to be elevated in some NZ coals and has been included as a Contaminant of Concern.

Copper, and lead have been added to the analytical suite to gain an understanding regarding the background concentrations of these elements for consenting purposes. Aluminium is not considered a contaminant of concern for human health, and it has only been analysed for water quality discharge purposes. The analytical results for aluminium will not be evaluated as part of this DSI.

### 5.2 Conceptual Site Model (CSM)

Based on the findings of the PSI and the proposed development, the potentially complete source-path-receptor contaminant linkages (refer **Appendix E**) at the site include the potential presence of selected heavy elements in soil and exposure of future excavation/maintenance workers via dermal contact, ingestion, or inhalation of impacted soil. Additionally, some heavy elements could potentially leach into groundwater and thereby discharge into the surface water body to the north of the site. The proposed sub-surface drainage scheme and subsequent treatment of the water (See Glesson Managed Fill Limited (2021) draft Fill Management Plan) by the proposed stormwater treatment system may reduced the contaminant flux by this pathway

Contaminants could potentially be transported into the Waikato River from sediment runoff during earthworks activities. However, this pathway can be effectively managed by applying sediment and erosion control measures during groundwork activities.

### 5.3 Media to be Sampled

The CSM (See **Section 5.2 and Figure 5.1**) identifies contact with soil is the primary pathway for exposure.

### 5.4 Applicable Human Health Guidelines

As this site will be used for commercial/industrial purposes the commercial/industrial -outdoor worker is the most appropriate exposure to adopt for this exposure pathway. NES-CS SCS exist for arsenic, boron, copper, and lead. Therefore NES-CS SCS commercial/industrial outdoor worker for these elements will be adopted for this risk assessment. For cobalt, nickel, thallium and zinc no NZ based guideline exists for these parameters.

Contaminated land management guidelines No. 2 states if no New Zealand based risk value exists then oversea risk-based guidelines can be used. US EPA Regional Screening levels commercial/industrial worker specifies risk-based guidelines for the protection of human health for cobalt, nickel, thallium, and zinc (US EPA, 2021) and they have been used for this assessment.



## 5.5 Sampling Methodology

Based on the findings of the PSI and the initial conceptual site model, the main objective of the soil sampling was to assess the presence or otherwise of selected heavy elements (associated with the deposited mine tailings- see **Section 5.2**) in sub-soil across the site. A systematic sampling method was used to target the northern portion of the site where the mine tailings was reportedly deposited.

EHS Support attended the site on 7 April 2021 and undertook the following:

- Three boreholes (HQHA1, HQHA3 and HQHA4) were advanced to 3 m below ground level (bgl) using a 50mm hand auger. The sampling equipment was washed with a solution of Decon-90® detergent and water between sample locations. Sample locations are shown on Figure 1.
- At each borehole location, a representative sample was collected from the recovered core from 1m, 2m and 3 m bgl using a new pair of nitrile gloves. Each sample was placed directly into a laboratory supplied glass jar.
- At sample location HQHA2 and HQHA5, samples were collected from the side walls of an open drainage trench which is approximately 3 m deep and 3 m wide. Samples were collected from 1m, 2m and 3 m bgl depth interval using a decontaminated shovel and gloved hands.
- Samples were taken in general accordance with Guideline 5 (MfE, 2021).
- The soils encountered during the excavation of investigation holes were logged (see **Appendix F**).

Soil samples (including two replicate pairs) were submitted to Analytica Laboratories Limited under chain of custody conditions for analysis of selected heavy elements (aluminium, arsenic, boron, , cadmium, cobalt, chromium, copper, lead, mercury, nickel, thallium, and zinc).

Selected samples collected from geotechnical investigation boreholes BH301 and BH302 were analysed for inorganic elements by Hill Laboratories.

## 5.6 Quality Assurance/Quality Control

As part of a quality assurance/quality programme for this investigation the following steps were undertaken:

- Trained and experience field staff were used to collect all samples.
- Sample jars were labelled with unique identifiers.
- Chain of custody and sample jars label were independently checked before shipping to the laboratory.
- Samples were collected according to EHS standard operating procedures, which are based upon recognised New Zealand (MfE CLMG#5 (2021) and international guidelines and standard methods (AS 4482.1 (Australian Standards, 2005) and ASTM E1727-20 (ASTM, 2020)).
- Rinsate blanks were not collected as part of the quality control system as the cross-contamination is unlikely to impact on validity of the sampling and assessment process (see AS 4482.1-2005). Decontamination of field equipment together with visual inspection that sampling equipment is free of visible soil is sufficient enough to prevent any cross-

contamination that could affect EHS Support interpretation of the results (result in change of the results more than 10 mg/kg).

- Soils were logged in accordance with New Zealand Geotechnical Society guidelines (New Zealand Geotechnical Society, 2005).
- Soil sampling equipment was decontaminated using Decon 90 and tap water. A new pair of gloves were used to collect each sample to prevent cross-contamination during sampling.
- All samples were analysed using IANZ accredited laboratories.
- Samples were collected in laboratory supplied sample containers and shipped to the laboratory within the specified laboratory holding times.

## 6. Sampling Results

The following field observations were recorded as part of the soil investigation performed by EHS Support:

- In general, soil comprised silty CLAY / clayey SILT to approximately 3 m bgl at sample location HQHA1 through HQHA5. Coal fragments/pieces were noted in soil recovered from location HQHA2 through HQHA5.
- Shallow groundwater was encountered at approximately 2.6 m bgl.
- Anthropogenic material such as potential asbestos containing material was not noted.

The laboratory reports are provided in **Appendix G**. Analytical results are summarised in Table 1 (in **Appendix H**). Results have been compared with the following assessment criteria:

- Background concentrations for selected elements in soil of the Waikato region.
- Soil contaminant standards (SCS) for commercial/industrial outdoor worker (unpaved) (NES-CS, 2011)
- Proposed waste acceptance criteria for the Huntly Managed fill (PDP Ltd, 2020).
- Waste acceptance criteria for Class B landfill (MfE, 2004).
- Australian & New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018)

In summary, the current investigation results show that:

- Concentrations of selected heavy elements (arsenic, boron, , cadmium, cobalt, chromium, copper, lead, mercury, nickel, thallium, and zinc) detected in some of the analysed samples were above the published background concentrations.
- The reported heavy element concentrations in the analysed samples were below the SCS for commercial/industrial outdoor worker (unpaved).
- All the reported heavy element concentrations were below the proposed waste acceptance criteria for the Huntly Managed fill except for boron in samples collected from location HQHA2. However, the calculated 95% upper confidence level of the mean for boron is 29.43 mg/kg which is within the proposed waste acceptance criterion of 45 mg/kg.
- Concentrations of leachable aluminium in sample HA1-3.0, BH301-1.5m, BH301-10.0m and BH302-1.0m were above the waste acceptance criteria for Class B landfill.
- Additionally, some of the leachable heavy elements were detected above the ANZG guideline levels for 80% ecosystem protection.

## 6.1 Quality Assurance/Quality Control

Both Analytica and Hill Laboratories are accredited by International Accreditation New Zealand (IANZ) and they use strict analytical protocols to control quality. QA/QC are within acceptable range (see **Table 6-1**).

**TABLE 6-1 QA/QC EVALUATION**

QA/QC Parameters	Comments
Precession	Acceptable 30-50% RSD <sup>2</sup> : See Appendix I and commentary below.
Accuracy	Acceptable: Used IANZ accredited lab. See Note 1.
Representativeness	Acceptable: Samples collected using SOP, trained staff, decom, sample collected with inert materials, correct sample containers and within hold times.
Completeness	Acceptable: All samples collected in accordance with SAP. All field documentation recorded.
Comparability	Acceptable: EHS Support SOP based upon standard methods (AS4482), (ASTM E1727-20) (CLMG#5) and IANZ accredited lab.
Sensitivity	Acceptable: Analytical detection limits more than five times lower than background levels

**Table Notes:**

New Zealand laboratories do not provide QA/QC report confirming performance with respect to Certified Reference Materials, but EHS Support is aware that this performance is evaluated by the laboratories before report is issued.

Two field duplicates were collected during the sampling programme to assess the field sampling techniques and soil homogeneity. The two duplicate samples were analysed for aluminium, cobalt, and thallium. The analytical results of the original and duplicate samples and calculated relative percentage difference (RPD) are presented in Appendix I. The calculated RPDs ranged between 4% (cobalt) and 65% (thallium), with the mean RPD for all six analytes being 19%, a satisfactory result (MfE (2011) notes that RPDs between 30 and 50% are typical data quality objectives for soil duplicate samples). The high calculated RPD for thallium between the original and duplicate sample is likely to reflect the low concentrations reported and use of the mean to calculate the RPD. The high RPD exhibited for thallium do not change the conclusion that thallium is present at background concentration

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<sup>2</sup> Accordance with criteria specified in AS 4482.1-2005

## 7. Risk Assessments

### 7.1 CSM Review

EHS Support has reviewed the CSM in **Section 5.2** and based upon the report findings in the CSM is still valid for the proposed activity.

Primary exposure pathway is likely via accidental soil ingestion only because:

1. Dermal uptake of these contaminants is highly unlikely according to the Methodology (Ministry for the Environment, 2011).
2. Inhalation of particulates is not regarded as a significant exposure pathway for these contaminants according to the Methodology (Ministry for the Environment, 2011).
3. On-site health & safety (such as good hygiene practices) and dust measures control measures are likely to reduce exposure to workers.
4. Workers will predominated be located within earth moving equipment and will have little, if any, direct exposure to the soils.

### 7.2 Risk to Potential Receptors

The overall risk to potential receptors is very low for the following reasons:

1. Workers will predominated be located within earth moving equipment and will have little, if any, direct exposure to the soils.
2. On-site health & safety (such as good hygiene practices) and dust measures control measures are likely to reduce exposure to workers.
3. The concentration of contaminants in soils may be above background, they are significantly lower than commercial/industrial outdoor worker NES-CS SCS.

Based upon the above reasons EHS Support considers it highly unlikely to pose a risk to human health.

## 8. Investigation Findings and Recommendations

Soil sampling and analysis indicates that selected heavy elements in soil up to 10 m bgl do not exceed the applicable standard for a commercial/industrial outdoor workers (unpaved) land use. Additionally, future site workers will be mostly within earthmoving equipment – little potential for direct contact with impact soils. In this regard the proposed soil disturbance works and/or the operation of a managed fill facility at the site are highly unlikely to pose a risk to human health or the environment.

The current investigation results show that the sub-soils from beneath the site are likely to meet the proposed waste acceptance criteria for the proposed Huntly Managed Fill. However, additional soil testing (for As, B, Cu, Pb, Ni, Tl and Zn) and SPLP testing for boron may need to be undertaken at a rate of one sample per 500 m<sup>3</sup> (as per the proposed consent requirement (AUTH141283.03.01)). As the number of test required will depend on where and how much material is to be excavated. Some of the results within this report can be used to verify compliance with the consent requirements if the samples have been collected in the material being excavated. Gleeson Managed Fill Limited will then need to calculate if additional sampling will be required to meet the consent conditions.

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The elevated concentrations of boron and zinc and SPLP testing (which may over predictive the final concentration of inorganic elements in the groundwater discharged from the sub-soil drains) indicates that there is the potential for the groundwater to have elevated concentrations of certain inorganic elements (particularly boron and zinc). Therefore, EHS Support recommends that the discharge from these drains is not directly discharged into the small stream to the north and east of FA3. Instead, it is recommended that the water from the sub-soil drains is collected and diverted for storage and testing into a treatment pond (or tank). Once the water has been tested to determine the actual water quality then a decision can be made to either discharge the water into the stormwater retention pond for treatment or removed for off-site treatment and disposal.

It is also recommended that a contaminated site management plan (CSMP) is prepared to ensure that potential human health and environmental risks associated with residual contamination are mitigated during the proposed development works. The CSMP will document soil management, reuse and disposal requirements and outline contingency measures if unexpected sources of contamination are encountered during earthworks.

## 9. Regulatory Compliance

Based on review of historical aerial photographs and WDC records, it is concluded that the site has been subjected to an activity on the HAIL (category E7 – storage of hazardous waste dumps or dam tailings, refer Section 4). Therefore, since it is more likely than not that a HAIL activity has occurred on the site and soil disturbance is likely to be longer than 2 months then the NES applies to the piece of land under Regulation 5 (4) and 5(7). The activity is not a permitted activity under Regulation 8 of the NES-CS.

However, results of the current investigation show that concentrations of contaminants in soil samples from the site exceeded the published background concentrations but were well below the SCS for commercial/industrial end use. Accordingly, regulation 5(9) does not apply to the site.

The site is not being subdivided or changing to a more sensitive land use. Therefore regulation 9 (3) and (4) do not apply to the site.

Therefore, a controlled activity consent is required under Regulation 9 (1) and 9(2) of the NES-CS for soil disturbance activity (it is unlikely that the proposed earthworks will meet the permitted activity criteria as per Regulation 8(3)). Operating a managed fill facility at the site is not considered a 'change of use' as the site is currently part of a quarry operation (i.e. commercial/industrial).

Regulation 9(5) of NES-CS also applies to the site.

It is considered that the proposed development can comply with the permitted activity rule 5.3.4.6 of the Waikato Regional Plans (WRC, 2020), providing a CSMP is prepared for the proposed development.

## 10. Conclusion

The findings of the current investigation show that coal mine tailings and overburden material from the neighbouring former mine operation had been deposited in the northern half of the FA3 area (HAIL category E7 – storage of hazardous waste dumps or dam tailings). However, results of the DSI

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show that concentrations of contaminants in soil samples were above the published background concentrations but were well below the SCS for commercial/industrial end use. Accordingly, a controlled activity consent is required under Regulation 9 of the NES-CS for the proposed soil disturbance activity. It is recommended that a CSMP is prepared for the proposed development.

## 11 SQEP Certification of Report

I *Andrew Rumsby of EHS Support New Zealand Ltd* certify that:

1. this detailed 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 (the NESCS) because it has been:
  - a. done by a suitably qualified and experienced practitioner, and
  - b. done in accordance with the current edition of *Contaminated land management guidelines No 5 – Site investigation and analysis of soils*, and
  - c. reported on in accordance with the current edition of *Contaminated land management guidelines No 1 – Reporting on contaminated sites in New Zealand*, and
  - d. the report is certified by a suitably qualified and experienced practitioner.
2. This detailed site investigation concludes that:
  - a. For activities under Regulation 9 of the NES-CS does not exceed the applicable standard in Regulation 7 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations

Evidence of the qualifications and experience of the suitably qualified and experienced practitioner(s) who have done this investigation and certified this report can be provided upon request.

Signed and dated: .....*Andrew Rumsby*..... 31/08/21

Prepared for: Paua Planning Limited  
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Date: 31 August 2021

## References

- ASTM. (2020). *ASTM E1727-20 Standard Practice for Field Collection of Soil for Subsequent Lead Determination*. American Society for Testing of Materials.
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Prepared for: Paua Planning Limited  
Project: Preliminary Site Investigation and Detailed Site Investigation, Fill Area 3 – Proposed Huntly Managed Fill  
Date: 31 August 2021

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## Appendix A – Statement of Limitations

EHS Support New Zealand Limited (“EHS Support”) has prepared this document in accordance with the usual care and thoroughness of the consulting profession for the use of Paua Planning Limited and only those third parties who have been authorised in writing by EHS Support to rely on this document. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this document. It is prepared in accordance with the scope of work and our proposal dated 1 April 2021.

The methodology adopted and sources of information used by EHS Support are outlined in this document. EHS Support has made no independent verification of this information beyond the agreed scope of works and EHS Support assumes no responsibility for any inaccuracies or omissions. No indications were found during the preparation of this document that information contained in this document as provided to EHS Support was false.

This document was prepared on the issue date and is based on the information available at the time of preparation. EHS Support disclaims responsibility for any changes that may have occurred after this time.



This document should be read in full. No responsibility is accepted for use of any part of this document in any other context or for any other purpose or by third parties. This document does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this document, EHS Support must be notified of any such findings and be provided with an opportunity to review the recommendations of this document.



Whilst to the best of our knowledge information contained in this document is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time. Therefore, this document and the information contained herein should only be regarded as valid at the time of writing, unless otherwise explicitly stated in this document.



## Appendix B - Photographic Log

Client Name: Paua Planning Limited		Site Location: 310 River View Road, Huntly	Date: 7 April 2021
<b>Photo No.</b>	<b>1.</b>		
Direction Photo Taken: West			
Description: One of the open drainage trenches noted near the centre of the site.			
<b>Photo No.</b>	<b>2.</b>		
Direction Photo Taken: North			
Description: Open drainage trench running towards the northern site boundary.			



<b>Photo No.</b>	<b>3.</b>		
Direction Photo Taken: NA			
Description Coal fragments note in excavated material placed next to open drainage trench.			
<b>Photo No.</b>	<b>4.</b>		
Direction NA			
Description: Coal fragments embedded in soil obtained from the side wall of open drainage trench.			



<b>Photo No.</b>	<b>5.</b>	
Direction Photo Taken: NA		
Description Soil encountered at borehole HQHA1.		

## Appendix C – Historical Aerial Photographs



Project Fill Area 3 - Proposed Huntly Managed Fill  
 Title Historical Aerial Photograph - 1941

Client



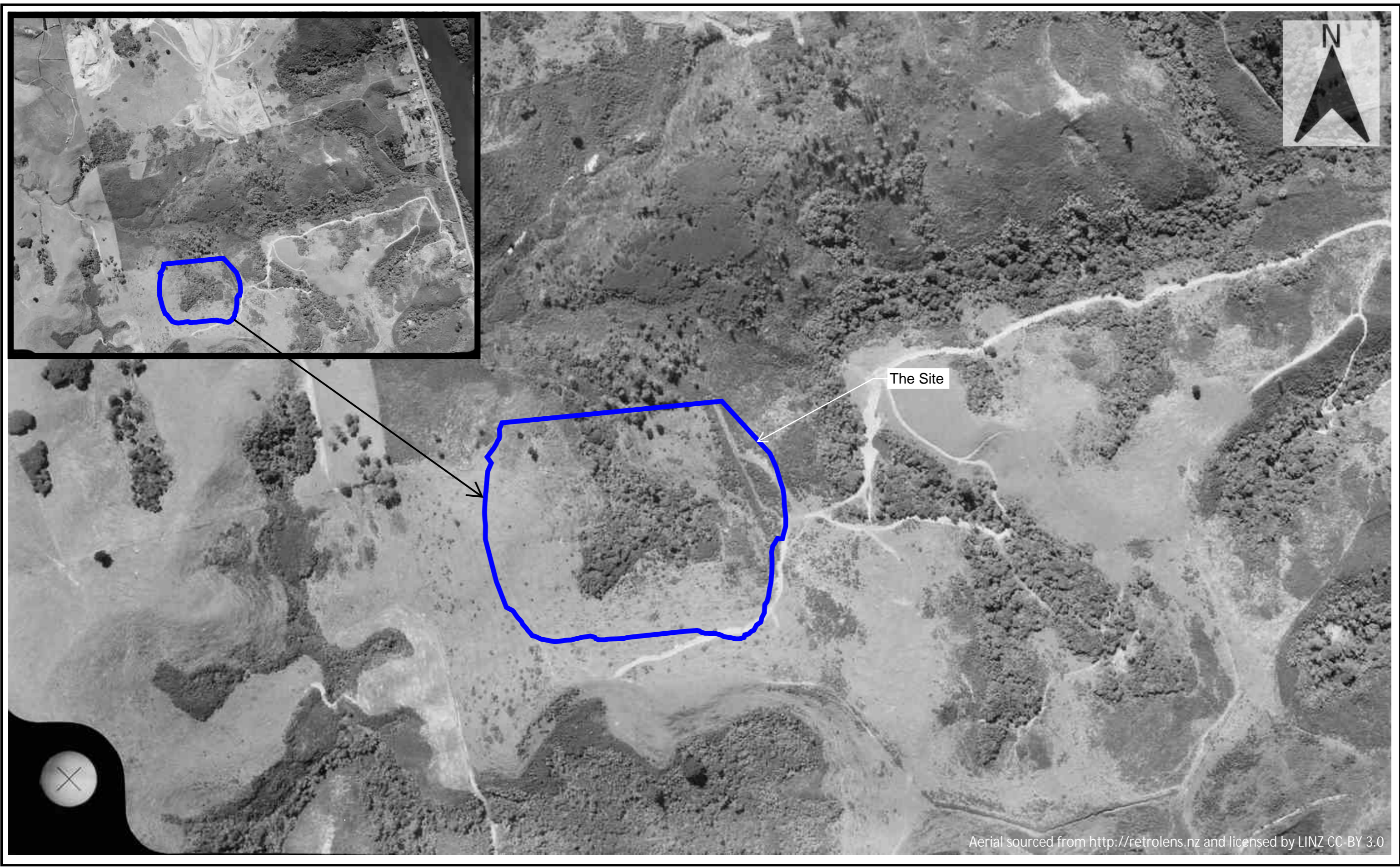
## Attachment C

Drawn: JH

Checked: AR

Date: Aug 2021

For Information Only



Project Fill Area 3 - Proposed Huntly Managed Fill  
 Title Historical Aerial Photograph - 1957



<h2>Attachment C</h2>	
Drawn: JH	Checked: AR
Date: Aug 2021	For Information Only





Project Fill Area 3 - Proposed Huntly Managed Fill  
Title Historical Aerial Photograph - 1966

Client



## Attachment C

Drawn: JH

Checked: AR

Date: Aug 2021

For Information Only



Aerial sourced from <http://retrolens.nz> and licensed by LINZ CC-BY 3.0



Project Fill Area 3 - Proposed Huntly Managed Fill  
Title Historical Aerial Photograph - 1973



<h2>Attachment C</h2>	
Drawn: JH	Checked: AR
Date: Aug 2021	For Information Only



Aerial sourced from <http://retrolens.nz> and licensed by LINZ CC-BY 3.0



Project Fill Area 3 - Proposed Huntly Managed Fill  
Title Historical Aerial Photograph - 1979



Attachment C	
Drawn: JH	Checked: AR
Date: Aug 2021	For Information Only



Aerial sourced from <http://retrolens.nz> and licensed by LINZ CC-BY 3.0



Project Fill Area 3 - Proposed Huntly Managed Fill

Title Historical Aerial Photograph - 1995

Client



## Attachment C

Drawn: JH

Checked: AR

Date: Aug 2021

For Information Only



Aerial sourced from Google Earth



Project Fill Area 3 - Proposed Huntly Managed Fill  
Title Historical Aerial Photograph - 2002

Client



## Attachment C

Drawn: JH

Checked: AR

Date: Aug 2021

For Information Only



Project Fill Area 3 - Proposed Huntly Managed Fill  
Title Historical Aerial Photograph - 2010

Client



## Attachment C

Drawn: JH

Checked: AR

Date: Aug 2021

For Information Only



Aerial sourced from Google Earth



Project Fill Area 3 - Proposed Huntly Managed Fill  
Title Historical Aerial Photograph - 2018

Client



## Attachment C

Drawn: JH

Checked: AR

Date: Aug 2021

For Information Only

## Appendix D – Council information



## Jimmy Huang

---

**From:** Alan Parkes <Alan.Parkes@waidc.govt.nz>  
**Sent:** Tuesday, 24 August 2021 12:16 PM  
**To:** Jimmy Huang  
**Cc:** Andrew Rumsby  
**Subject:** HAIL Report Application 232 Riverview Road

Hi Jimmy

I've just had our support team email me your request for a HAIL report for the Gleeson Quarries site. Firstly I'd like to apologise for your initial request somehow disappearing in the system. While I could complete a report for you I'm not sure that it's really necessary as it won't tell you anything that's not already known and there seems little point in paying for a report to do this. We can provide information free of charge where it is documented. The HAIL report really is to provide for review of historic property information where sites are not already recorded in the register or have not been reviewed previously.

I see you are requesting information specifically relating to Fill Area 3 of the managed fill resource consent application that EHS-Support has been involved with. Our records unfortunately are held at the property level and are not held spatially to enable specific locations on the property to be identified. In this case I can advise that the site is recorded on the land use register in respect of A17 Fuel storage associated with the quarrying operation on the property. I'll try to give a summary of my understanding of the status of the site below in relation to the managed fill application.

For the managed fill consent application an assessment was initially made identifying that Fill area 3 was unaffected by the HAIL A17 and that no piece of land was identified in the location. However through the consenting process for the managed fill the Regional Council has advised that a coal tailings dump is located in Fill area 3, considered to be associated with HAIL E7. I understand that some sampling of this has been undertaken by your firm.

The revised AEE for the managed fill received in May retained the original assessment of the NESCS (ie no piece of land). Since HAIL E7 has since been identified as likely to be associated with the area an updated assessment and implications for any consenting requirements under the NESCS need to be addressed.

I hope this satisfies your requirements. As noted a HAIL report would simply provide exactly the same detail and there seems little point in paying for it. If so I will cancel the application and arrange for our support team to refund the fee paid. However I can complete the HAIL report if preferred. Please let me know.

Kind regards

### Alan Parkes

Contaminated Land Specialist

### Waikato District Council

*Te Kaunihera aa Takiwaa o Waikato*

■ **Waea puukoro:** 027 275 2486 ■ **Nama waea:** 0800 492 452

**Pouaka Poutaapeta:** Private Bag 544, Ngaruawahia 3742

**Waahi Mahi:** 15 Galileo Street, Ngaruawahia

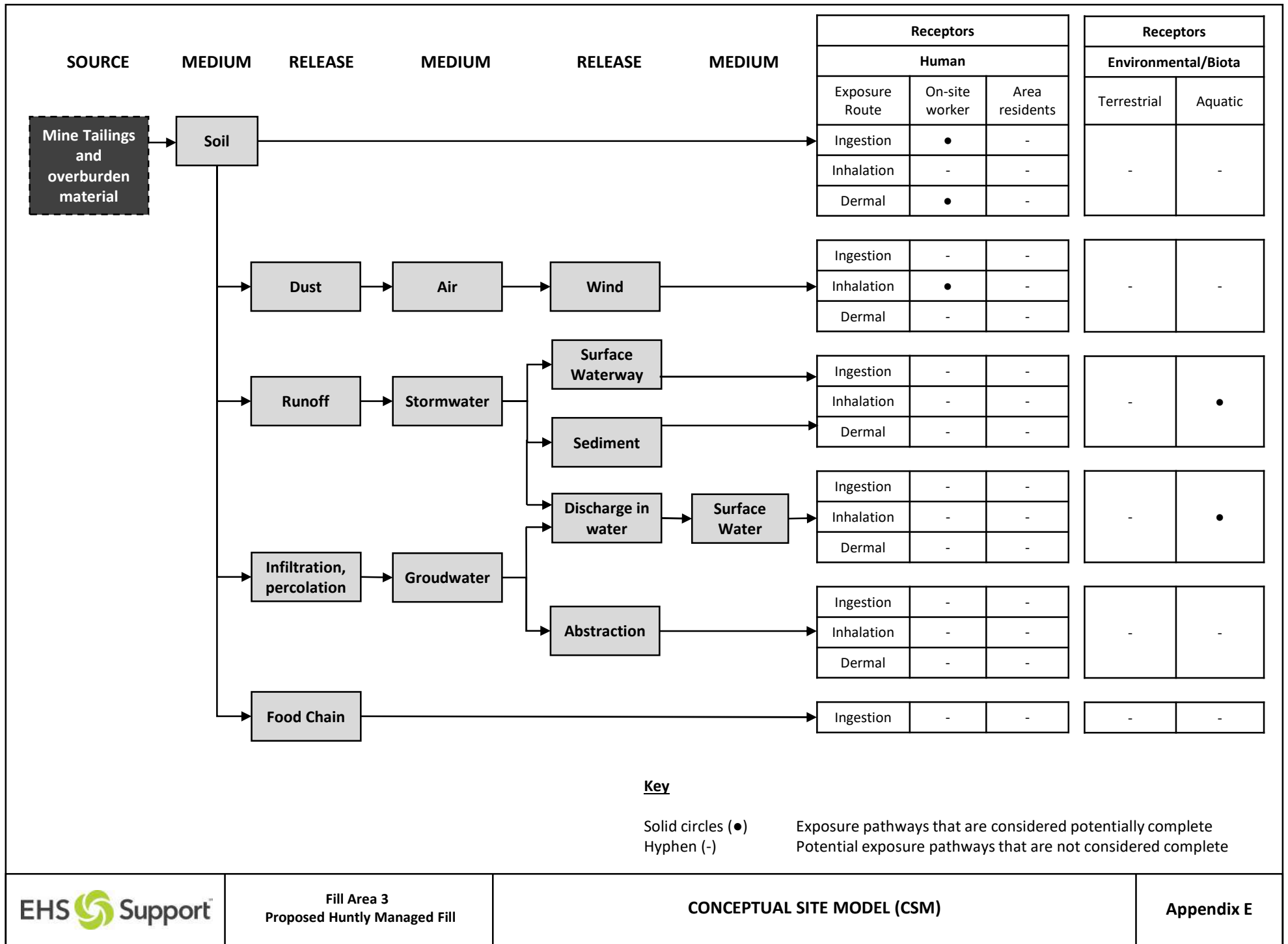


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## Appendix E – Conceptual Site Model



## Appendix F – Borehole Logs

**Comments:**

**Logged by:** JH

**Checked by:** AR

Soil Samples	Depth (m)	Soil Description	Well Construction
HA1 0-0.1	0-0.1	TOPSOIL, SILT with some rootlets, brown, moist, soft	
	0.1-0.2	CLAY with some silt, light brown with orange mottling, dry, firm	
	0.2-0.5	CLAY with some silt, brown, dry, firm	
HA1-1.0	1.0	SILT with some clay, dark grey, stiff water seeping in from 0.8 m bgl	
HA1-2.0	2.0	become wet and soft from 2.7 m	
HA1-3.0	3.0	End of hole 3 m bgl.	



**Project Number:**  
**Project:** Huntly Quarry - Disposal  
 Site Fill # 3

**Excavation Date:** 7 April 2021  
**Excavation method:** NA  
**Total depth:** 3 m bgl

**Hand Auger Hole ID:** HQHA2

**Comments:** samples collected from open trench dug for geotechnical investigation

**Logged by:** JH  
**Checked by:** AR

Soil Samples	Depth (m)	Soil Description	Well Construction
HA2 0-0.1	0.0	FILL, silty CLAY with rock pieces up to 15 cm diameter and coal fragments, brown, stiff	
	0.5		
HA2-1.0	1.0		
	1.5		
HA2-2.0	2.0		
	2.5		
		Wet from 2.8 m	
HA2-3.0 / DUPA	3.0	End of hole 3 m bgl.	
	3.5		
	4.0		
	4.5		

**Comments:**

**Logged by:** JH

**Checked by:** AR

Soil Samples	Depth (m)	Soil Description	Well Construction
HA3 0-0.1	0.5	TOPSOIL, SILT with some rootlets, dark brown, dry, soft CLAY with some silt, brown mottled orange brown, dry, firm	
HA3-1.0	1	SILT with some clay, dark grey, dry, firm/stiff	
HA3-2.0	2		
HA3-3.0	3	SILT with some clay and some small coal fragments, wet, soft	
	3	End of hole 3 m bgl.	



**Comments:**

**Logged by:** JH

**Checked by:** AR

Soil Samples	Depth (m)	Soil Description	Well Construction
HA4 0-0.1	0.5	FILL, clay with some silt and coal fragments/pieces, orange brown, dry, firm	
HA4-1.0	1	SILT with some clay, grey, dry, very stiff	
HA4-2.0	2	Clayey SILT, grey, moist, stiff	
HA4-3.0	3	wet from 2.6 m, soft with minor coal pieces  End of hole 3 m bgl.	

Comments: samples collected from open trench dug for geotechnical investigation

Logged by: JH  
Checked by: AR

Soil Samples	Depth (m)	Soil Description	Well Construction
HA5 0-0.1	0.5	FILL, silty CLAY with rock pieces up to 15 cm diameter and coal fragments, brown, stiff	
HA5-1.0	1		
HA5-2.0	1.5		
HA5-3.0/ DUPB	2	Wet from 2.8 m	
	2.5	End of hole 3 m bgl.	
	3		
	3.5		
	4		
	4.5		



# BOREHOLE LOG

HOLE NO.:  
**BH301**

CLIENT: Gleeson Quarries Ltd.  
PROJECT: Huntly Quarry Fill Sites

JOB NO.:  
**2325**

SITE LOCATION: Huntly Quarry Fill Site - 300 Riverview Road, Huntly Fill Site 3

START DATE: 01/03/2021

CO-ORDINATES: 721635mN, 433634mE

GROUND RL: 66.28 m

END DATE: 03/03/2021

SURVEY CIRCUIT: MTE DEN2000

DATUM: NZVD1946

WEATHER: Fine

PAGE: 1 OF 3

GEOLOGY	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	DEPTH (m) RL (m)	SAMPLE TYPE	TCR (%)	GRAPHIC	WEATHERING	STRENGTH	SPT DATA	VANE SHEAR STRENGTH (kPa)	NOTES, DEFECTS, SAMPLES & LABORATORY TEST RESULTS	METHOD	WATER LEVEL	PIEZOMETER INSTALLATION
Fill	Clayey SILT, with minor organic staining; light brown-orange. Stiff; low plasticity.	66		73	[Symbol]								
	Clayey SILT, with minor fibrous organic clasts, with trace gravel; brown, grey and black mottles. Firm; low plasticity; gravel, coarse, slightly weathered, Mudstone. Core Loss: 1.95 to 2.4m	65		22	[Symbol]			2, 2 / 2, 2, 1, 1 N=6					
	Clayey SILT, with minor fibrous organic clasts, with trace gravel; brown, grey and black mottles. Firm; low plasticity; gravel, coarse, slightly weathered, Mudstone. Core Loss: 3.45 to 3.9m	64		100	[Symbol]			2, 1 / 1, 1, 1, 0 N=3					
	Clayey SILT, with minor fibrous organic clasts, with trace gravel; brown, grey and black mottles. Firm; low plasticity; gravel, coarse, slightly weathered, Mudstone. Core Loss: 4.95 to 5.6m	63		100	[Symbol]			4, 6 / 3, 2, 2, 2 N=9					
	Clayey SILT, with minor fibrous organic clasts, with trace gravel; brown, grey and black mottles. Firm; low plasticity; gravel, coarse, slightly weathered, Mudstone.	62		100	[Symbol]			1, 1 / 1, 1, 2, 2 N=6					
	Clayey SILT, with minor fibrous organic clasts, with trace gravel; brown, grey and black mottles. Firm; low plasticity; gravel, coarse, slightly weathered, Mudstone. Core Loss: 7.95 to 8.6m	61		100	[Symbol]			1, 1 / 2, 2, 1, 2 N=7					
	Clayey SILT, with minor fibrous organic clasts, with trace gravel; brown, grey and black mottles. Firm; low plasticity; gravel, coarse, slightly weathered, Mudstone.	60		100	[Symbol]			0, 0 / 0, 0, 1, 1 N=2					
	Silty CLAY; brown and blue-grey, oxidises to light brown. Soft to firm; high plasticity. Core Loss: 9.45 to 9.9m	59		100	[Symbol]								
		58		0	[Symbol]								
		57		0	[Symbol]								

Rotary cored  
Water Level Not Measured

**REMARKS**  
 LOGGED BY: MK  
 CHECKED BY: JB  
 APPROVED BY: KCC  
 STATUS: FINAL  
 CONTRACTOR: Drill Force  
 RIG: Tractor  
 DRILLER: Conan

REF	DATE / TIME	LEVEL	REMARK
LOGGED IN ACCORDANCE WITH NEW ZEALAND GEOTECHNICAL SOCIETY GUIDELINES (2005)			

**Gaia Engineers Ltd**  
 5 Carmont Place,  
 Mt Wellington  
 Auckland 1060,  
 New Zealand  
 P O Box 51 295,  
 Pakuranga  
 Auckland 2140,  
 New Zealand  
 info@gaia-engineers.co.nz



# BOREHOLE LOG

HOLE NO.:  
**BH301**

CLIENT: Gleeson Quarries Ltd.  
PROJECT: Huntly Quarry Fill Sites

JOB NO.:  
**2325**

SITE LOCATION: Huntly Quarry Fill Site - 300 Riverview Road, Huntly Fill Site 3

START DATE: 01/03/2021

CO-ORDINATES: 721635mN, 433634mE

GROUND RL: 66.28 m

END DATE: 03/03/2021

SURVEY CIRCUIT: MTE DEN2000

DATUM: NZVD1946

WEATHER: Fine

PAGE: 2 OF 3

GEOLOGY	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	DEPTH (m) RL (m)	SAMPLE TYPE	TCR (%)	GRAPHIC	WEATHERING	STRENGTH	SPT DATA	VANE SHEAR STRENGTH (kPa)	NOTES, DEFECTS, SAMPLES & LABORATORY TEST RESULTS	METHOD	WATER LEVEL	PIEZOMETER INSTALLATION
	Silty CLAY; brown and blue-grey, oxidises to light brown. Soft to firm; high plasticity.	96											
	Clayey SILT, with some fibrous organics (decomposed wood fragments); light grey and light brown. Stiff, low plasticity. Core Loss: 10.95 to 11.2m	11		100				0, 1 / 1, 1, 1, 1 N=4					
	Clayey SILT, with trace fibrous organics; light grey and light brown. Stiff, low plasticity.	55		100									
	Clayey SILT, with trace organic inclusions and staining and sand; dark brown, light blue-grey and light brown. Low plasticity; sand, pumiceous.	12		100				0, 0 / 0, 1, 2, 2 N=5					
		54		100									
		13		100									
		53		100				0, 0 / 0, 0, 1, 1 N=2					
		14		100									
		52		100									
	Clayey sandy SILT, with trace organic staining; dark brown. Stiff, low plasticity. 14.9m - 15.1m: Some organic disseminated fibers	15		100				0, 1 / 2, 1, 1, 1 N=5					
		51		100									
		16		100									
		50		100				1, 0 / 1, 1, 1, 2 N=5					
	Core Loss: 16.95 to 17.4m	17		0									
	Clayey sandy SILT, with trace organic staining; dark brown. Stiff, low plasticity.	49		100									
	Clayey SILT, with some gravel; brownish. Low plasticity; gravel, Sandstone.	18		100				2, 3 / 2, 4, 4, 5 N=15					
	Silty CLAY; brown-orange and dark brown mottles. Stiff, low plasticity.	48		100									
	GRAVEL Gravel, medium, subangular. TOPSOIL; dark brown.	19		100									
	Core Loss: 19.5 to 19.95m	47		0				2, 5 / 5, 5, 4, 3 N=17					

**REMARKS**  
 LOGGED BY: MK  
 CHECKED BY: JB  
 APPROVED BY: KCC  
 STATUS: FINAL  
 CONTRACTOR: Drill Force  
 RIG: Tractor  
 DRILLER: Conan

REF	DATE / TIME	LEVEL	REMARK

**Gaia Engineers Ltd**  
 5 Carmont Place,  
 Mt Wellington  
 Auckland 1060,  
 New Zealand  
 P O Box 51 295,  
 Pakuranga  
 Auckland 2140,  
 New Zealand  
 info@gaia-engineers.co.nz



# BOREHOLE LOG

HOLE NO.:  
**BH301**

CLIENT: Gleeson Quarries Ltd.  
PROJECT: Huntly Quarry Fill Sites

JOB NO.:  
**2325**

SITE LOCATION: Huntly Quarry Fill Site - 300 Riverview Road, Huntly Fill Site 3

START DATE: 01/03/2021

CO-ORDINATES: 721635mN, 433634mE

GROUND RL: 66.28 m

END DATE: 03/03/2021

SURVEY CIRCUIT: MTE DEN2000

DATUM: NZVD1946

WEATHER: Fine

PAGE: 3 OF 3

GEOLOGY	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	DEPTH (m) RL (m)	SAMPLE TYPE	TCR (%)	GRAPHIC	WEATHERING	STRENGTH	SPT DATA	VANE SHEAR STRENGTH (kPa)	NOTES, DEFECTS, SAMPLES & LABORATORY TEST RESULTS	METHOD	WATER LEVEL	PIEZOMETER INSTALLATION
Newcastle Group	Core Loss: 19.95 to 20.9m	46											
	GRAVEL: greyish. Gravel, medium to coarse, subround. Completely weathered; greyish brown; SILTSTONE; extremely weak; sandy SILT with MnO staining on defects, non plastic.	21 45		100		EW		5, 5 / 6, 4, 4, 11 N=25			Rotary cored	Water Level Not Measured	
	Moderately weathered; orange and light brown; fine fabric, thinly laminated; SILTSTONE; very weak.	22 44		100		EW		2, 4 / 10, 17, 11, 10 N=48					
	Slightly weathered; grey; SILTSTONE; moderately strong.	23 43		100		HW							
	EOH: 24.00m	24 42		100		MV		2, 8 / 50 for 60mm N=50 for 60mm					

**REMARKS**  
 LOGGED BY: MK  
 CHECKED BY: JB  
 APPROVED BY: KCC  
 STATUS: FINAL  
 CONTRACTOR: Drill Force  
 RIG: Tractor  
 DRILLER: Conan

REF	DATE / TIME	LEVEL	REMARK
LOGGED IN ACCORDANCE WITH NEW ZEALAND GEOTECHNICAL SOCIETY GUIDELINES (2005)			

**Gaia Engineers Ltd**  
 5 Carmont Place,  
 Mt Wellington  
 Auckland 1060,  
 New Zealand  
 P O Box 51 295,  
 Pakuranga  
 Auckland 2140,  
 New Zealand  
 info@gaia-engineers.co.nz



0.00-6.00m



6.00-10.50m



10.50-14.40m



14.40-18.00m



18.00-24.00m





# BOREHOLE LOG

HOLE NO.:  
**BH302**

CLIENT: Gleeson Quarries Ltd.  
PROJECT: Huntly Quarry Fill Sites

JOB NO.:  
**2325**

SITE LOCATION: Huntly Quarry Fill Site - 300 Riverview Road, Huntly Fill Site 3

START DATE: 24/02/2021

CO-ORDINATES: 721666mN, 433609mE

GROUND RL: 65.64 m

END DATE: 26/02/2021

SURVEY CIRCUIT: MTE DEN2000

DATUM: NZVD1946

WEATHER: Fine

PAGE: 1 OF 3

GEOLOGY	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	DEPTH (m) RL (m)	SAMPLE TYPE	TCR (%)	GRAPHIC	WEATHERING	STRENGTH	SPT DATA	VANE SHEAR STRENGTH (kPa)	NOTES, DEFECTS, SAMPLES & LABORATORY TEST RESULTS	METHOD	WATER LEVEL	PIEZOMETER INSTALLATION
	TOPSOIL. Silty CLAY; light grey and brown. High plasticity.	65		53									
	Silty CLAY, with some organic inclusions; dark brown, grey and black mottles. Stiff; low plasticity.	1											
	CLAY & SILT, with trace organic staining and sand; grey, blue-grey and dark brown mottles. Stiff; low plasticity; sand, fine, pumiceous.	2		33				1, 2 / 1, 1, 0, 1 N=3					▼
	2.4m - 2.4m: with some organic staining, dark grey and dark brow mottles	3		87									
	Core Loss: 3.45 to 4.4m	4		90				0, 0 / 0, 1, 1, 1 N=3					
	Silty CLAY; light grey and light brown-orange mottles . Firm; high plasticity.	5		100				1, 0 / 1, 0, 1, 1 N=3					▼
Fill	5.3m - 5.3m: becoming dark brown-orange and dark brown, some fibrous organic inclusions	6		100				2, 2 / 1, 1, 2, 1 N=5					
	Sandy SILT; dark brown with occasional orange mottles. Stiff; low plasticity.	7		100									
	Clayey SILT, with trace organic inclusions; dark brown with occasional orange mottles. Firm; high plasticity.	8		100				0, 0 / 1, 0, 0, 1 N=2					
	Clayey SILT, with some organic staining; dark brown and grey mottles. Stiff; low plasticity.	9		57				1, 1 / 1, 1, 2, 1 N=5					
		56		48									

Rotary cored

**REMARKS**  
 LOGGED BY: MK  
 CHECKED BY: JB  
 APPROVED BY: KCC  
 STATUS: FINAL  
 CONTRACTOR: Drill Force  
 RIG: Tractor  
 DRILLER: Conan

REF	DATE / TIME	LEVEL	REMARK
1	25/02/2021	2.00	Start of Day
1	26/02/2021	4.90	Start of Day

LOGGED IN ACCORDANCE WITH NEW ZEALAND GEOTECHNICAL SOCIETY GUIDELINES (2005)

**Gaia Engineers Ltd**  
 5 Carmont Place,  
 Mt Wellington  
 Auckland 1060,  
 New Zealand  
 P O Box 51 295,  
 Pakuranga  
 Auckland 2140,  
 New Zealand  
 info@gaia-engineers.co.nz



# BOREHOLE LOG

HOLE NO.:  
**BH302**

CLIENT: Gleeson Quarries Ltd.  
PROJECT: Huntly Quarry Fill Sites

JOB NO.:  
**2325**

SITE LOCATION: Huntly Quarry Fill Site - 300 Riverview Road, Huntly Fill Site 3

START DATE: 24/02/2021

CO-ORDINATES: 721666mN, 433609mE

GROUND RL: 65.64 m

END DATE: 26/02/2021

SURVEY CIRCUIT: MTE DEN2000

DATUM: NZVD1946

WEATHER: Fine

PAGE: 2 OF 3

GEOLOGY	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	DEPTH (m) RL (m)	SAMPLE TYPE	TCR (%)	GRAPHIC	WEATHERING	STRENGTH	SPT DATA	VANE SHEAR STRENGTH (kPa)	NOTES, DEFECTS, SAMPLES & LABORATORY TEST RESULTS	METHOD	WATER LEVEL	PIEZOMETER INSTALLATION
Fill	[CONT] Clayey SILT, with some organic staining; dark brown and grey mottles. 10.2m - 10.2m: with trace mudstone inclusions. Stiff; low plasticity.	55	100	100				0, 1 / 0, 0, 1, 1 N=2					
	Silty CLAY, with trace organic staining and sand; dark grey brown. Stiff to very stiff; high plasticity; sand, fine. 11.4m - 11.4m: trace sandy silt inclusions	54	100	100				0, 0 / 0, 2, 1, 1 N=4					
	12.9m - 12.9m: becoming light grey mottles	53	100	100				0, 0 / 1, 2, 1, 2 N=6					
	15.5m - 15.5m: becoming dark grey-brown, no inclusions	50	100	100				0, 0 / 2, 1, 2, 2 N=7					
	17.0m - 17.0m: becoming light grey and orange mottles, trace sandy silt inclusions	49	100	100				1, 2 / 3, 2, 3, 4 N=12					
	17.4m - 17.6m: CLAY; light blue-grey and orange mottles. Firm; high plasticity.	48	100	100				4, 5 / 3, 2, 5, 5 N=15					
	Silty GRAVEL. Stiff; gravel, medium to coarse, rounded to subangular, moderately weathered, Mudstone.	47	100	100				3, 5 / 5, 6, 7, 7 N=25					
		46	100	100									

Rotary cored

**REMARKS**  
 LOGGED BY: MK  
 CHECKED BY: JB  
 APPROVED BY: KCC  
 STATUS: FINAL  
 CONTRACTOR: Drill Force  
 RIG: Tractor  
 DRILLER: Conan

REF	DATE / TIME	LEVEL	REMARK
1	25/02/2021	2.00	Start of Day
1	26/02/2021	4.90	Start of Day

LOGGED IN ACCORDANCE WITH NEW ZEALAND GEOTECHNICAL SOCIETY GUIDELINES (2005)

**Gaia Engineers Ltd**  
 5 Carmont Place,  
 Mt Wellington  
 Auckland 1060,  
 New Zealand  
 P O Box 51 295,  
 Pakuranga  
 Auckland 2140,  
 New Zealand  
 info@gaia-engineers.co.nz



# BOREHOLE LOG

HOLE NO.:  
**BH302**

CLIENT: Gleeson Quarries Ltd.  
PROJECT: Huntly Quarry Fill Sites

JOB NO.:  
**2325**

SITE LOCATION: Huntly Quarry Fill Site - 300 Riverview Road, Huntly Fill Site 3

START DATE: 24/02/2021

CO-ORDINATES: 721666mN, 433609mE

GROUND RL: 65.64 m

END DATE: 26/02/2021

SURVEY CIRCUIT: MTE DEN2000

DATUM: NZVD1946

WEATHER: Fine

PAGE: 3 OF 3

GEOLOGY	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	DEPTH (m) RL (m)	SAMPLE TYPE	TCR (%)	GRAPHIC	WEATHERING	STRENGTH	SPT DATA	VANE SHEAR STRENGTH (kPa)	NOTES, DEFECTS, SAMPLES & LABORATORY TEST RESULTS	METHOD	WATER LEVEL	PIEZOMETER INSTALLATION
Fill	CLAY & SILT, with trace gravel; dark brown, brown and orange mottles. Very stiff; low plasticity; gravel, coarse, Mudstone.	45											
	Silty CLAY; dark grey and dark brown mottles. Very stiff; low plasticity.	21	100					3, 4 / 5, 6, 7, 9 N=27					
	Slightly weathered; dark brown; fine fabric, laminated; SILTSTONE; weak.	44	100										
	Clayey SILT, with some gravel; dark grey and dark brown mottles. Hard; low plasticity; gravel, coarse, subround, slightly weathered, Mudstone.	22	100										
	Highly weathered; dark brown; fine fabric, laminated; SILTSTONE; extremely weak. Clayey SILT, with minor coal inclusions. Hard; non-plastic.	23	100					2, 4 / 4, 7, 8, 7 N=26					
Waikato Coal Measures		43											
		24				HW	EW	2, 3 / 5, 7, 7, 6 N=25					
	25.3m - 25.4m: Slightly weathered; dark grey-brown; laminated; CLAYSTONE; very weak.	40				MW	VW	5, 10 / 10, 6, 10, 12 N=38					
	EOH: 25.95m	26											
		39											
		27											
		38											
		28											
		37											
		29											
		36											

Rotary cored

**REMARKS**  
 LOGGED BY: MK  
 CHECKED BY: JB  
 APPROVED BY: KCC  
 STATUS: FINAL  
 CONTRACTOR: Drill Force  
 RIG: Tractor  
 DRILLER: Conan

REF	DATE / TIME	LEVEL	REMARK
1	25/02/2021	2.00	Start of Day
1	26/02/2021	4.90	Start of Day

LOGGED IN ACCORDANCE WITH NEW ZEALAND GEOTECHNICAL SOCIETY GUIDELINES (2005)

**Gaia Engineers Ltd**  
 5 Carmont Place,  
 Mt Wellington  
 Auckland 1060,  
 New Zealand  
 P O Box 51 295,  
 Pakuranga  
 Auckland 2140,  
 New Zealand  
 info@gaia-engineers.co.nz



0.00-3.45m



3.45-7.50m



7.50-12.00m



12.00-13.95m



13.95-16.50m



16.50-19.00m



19.00-21.90m



21.45-25.95m



21.90-24.45m



## Appendix G – Laboratory Reports



## Certificate of Analysis

EHS Support New Zealand Ltd  
 PO Box 15887  
 Auckland 0604

Attention: Andrew Rumsby  
 Phone: 0211020533  
 Email: andrew.rumsby@ehs-support.com

Sampling Site: Huntly Q

Lab Reference: 21-15906  
 Submitted by: JH  
 Date Received:  
 Testing Initiated: 10/04/2021  
 Date Completed: 14/04/2021  
 Order Number: Huntly Q  
 Reference: Huntly Q

### Report Comments

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

### Heavy Metals in Soil

Client Sample ID			HA1 0-0.1	HA1 1.0	HA1 2.0	HA1 3.0	HA2 0-0.1
Date Sampled			07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Analyte	Unit	Reporting Limit	21-15906-1	21-15906-2	21-15906-3	21-15906-4	21-15906-5
Arsenic	mg/kg dry wt	0.125	14.5	3.7	3.0	3.6	2.2
Beryllium	mg/kg dry wt	0.013	0.48	0.57	0.49	0.56	1.1
Boron	mg/kg dry wt	1.25	11	21	24	20	48
Cadmium	mg/kg dry wt	0.005	0.031	0.074	0.063	0.065	0.045
Chromium	mg/kg dry wt	0.125	9.4	8.8	8.5	8.6	9.6
Copper	mg/kg dry wt	0.075	16.8	21.2	19.7	19.6	15.5
Lead	mg/kg dry wt	0.25	24.7	17.2	16.9	15.5	13.3
Mercury	mg/kg dry wt	0.025	0.11	0.19	0.19	0.21	0.13
Nickel	mg/kg dry wt	0.05	4.2	12.3	7.91	8.14	6.20
Zinc	mg/kg dry wt	0.05	33.5	77.8	77.0	86.8	34.8

### Heavy Metals in Soil

Client Sample ID			HA2 1.0	HA2 2.0	HA2 3.0	HA3 0-0.1	HA3 1.0
Date Sampled			07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Analyte	Unit	Reporting Limit	21-15906-6	21-15906-7	21-15906-8	21-15906-9	21-15906-10
Arsenic	mg/kg dry wt	0.125	2.7	3.8	3.0	11	5.2
Beryllium	mg/kg dry wt	0.013	0.57	0.60	0.59	0.50	0.84
Boron	mg/kg dry wt	1.25	68	37	45	12	16
Cadmium	mg/kg dry wt	0.005	0.068	0.064	0.082	0.031	0.13
Chromium	mg/kg dry wt	0.125	7.9	7.7	8.7	9.7	8.5
Copper	mg/kg dry wt	0.075	19.4	20.0	20.4	17.1	26.5

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked \*, which are not accredited. This test report shall not be reproduced except in full, without the written permission of Analytica Laboratories.

## Heavy Metals in Soil

Client Sample ID			HA2 1.0	HA2 2.0	HA2 3.0	HA3 0-0.1	HA3 1.0
Date Sampled			07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Lead	mg/kg dry wt	0.25	15.4	16.2	23.4	22.3	18.9
Mercury	mg/kg dry wt	0.025	0.16	0.19	0.19	0.095	0.20
Nickel	mg/kg dry wt	0.05	8.77	9.42	10.6	6.27	12.9
Zinc	mg/kg dry wt	0.05	66.0	75.7	77.5	59.7	76.1

## Heavy Metals in Soil

Client Sample ID			HA3 2.0	HA3 3.0	HA4 0-0.1	HA4 1.0	HA4 2.0
Date Sampled			07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Analyte	Unit	Reporting Limit	21-15906-11	21-15906-12	21-15906-13	21-15906-14	21-15906-15
Arsenic	mg/kg dry wt	0.125	3.4	1.6	4.9	4.9	3.1
Beryllium	mg/kg dry wt	0.013	0.62	0.48	0.41	0.40	0.44
Boron	mg/kg dry wt	1.25	22	29	4.4	12	22
Cadmium	mg/kg dry wt	0.005	0.092	0.052	0.043	0.023	0.048
Chromium	mg/kg dry wt	0.125	8.4	8.7	9.5	9.2	7.0
Copper	mg/kg dry wt	0.075	22.8	19.4	8.96	21.2	16.4
Lead	mg/kg dry wt	0.25	18.7	17.3	17.1	19.2	14.8
Mercury	mg/kg dry wt	0.025	0.20	0.23	0.11	0.23	0.18
Nickel	mg/kg dry wt	0.05	12.4	7.53	5.10	3.5	6.38
Zinc	mg/kg dry wt	0.05	89.3	75.6	29.9	36.4	57.9

## Heavy Metals in Soil

Client Sample ID			HA4 3.0	HA5 1.0	HA5 2.0	HA5 3.0	DUP B
Date Sampled			07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Analyte	Unit	Reporting Limit	21-15906-16	21-15906-17	21-15906-18	21-15906-19	21-15906-20
Arsenic	mg/kg dry wt	0.125	2.7	4.6	6.0	11	4.3
Beryllium	mg/kg dry wt	0.013	0.53	0.61	0.55	0.35	0.59
Boron	mg/kg dry wt	1.25	18	12	11	16	13
Cadmium	mg/kg dry wt	0.005	0.11	0.036	0.042	0.015	0.080
Chromium	mg/kg dry wt	0.125	7.8	11	10	9.1	12
Copper	mg/kg dry wt	0.075	19.9	16.7	18.4	16.5	16.6
Lead	mg/kg dry wt	0.25	17.1	16.9	21.6	31.1	18.0
Mercury	mg/kg dry wt	0.025	0.18	0.23	0.14	0.20	0.24
Nickel	mg/kg dry wt	0.05	10.4	5.77	8.00	3.5	5.28
Zinc	mg/kg dry wt	0.05	81.1	47.4	70.3	28.8	44.1

## Heavy Metals in Soil

Client Sample ID			DUP A
Date Sampled			07/04/2021
Analyte	Unit	Reporting Limit	21-15906-21
Arsenic	mg/kg dry wt	0.125	3.1
Beryllium	mg/kg dry wt	0.013	0.48
Boron	mg/kg dry wt	1.25	45
Cadmium	mg/kg dry wt	0.005	0.077
Chromium	mg/kg dry wt	0.125	7.6
Copper	mg/kg dry wt	0.075	19.1
Lead	mg/kg dry wt	0.25	16.3
Mercury	mg/kg dry wt	0.025	0.17

## Heavy Metals in Soil

Client Sample ID		DUP A	
Date Sampled		07/04/2021	
Nickel	mg/kg dry wt	0.05	9.54
Zinc	mg/kg dry wt	0.05	71.3

## Method Summary

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



Maddison Berry, B.Sc.(Tech)  
Senior Technician



## Certificate of Analysis

EHS Support New Zealand Ltd  
 PO Box 15887  
 Auckland 0604

Attention: Andrew Rumsby  
 Phone: 0211020533  
 Email: andrew.rumsby@ehs-support.com

Sampling Site: Huntly Q

Lab Reference: 21-18868  
 Submitted by: JH  
 Date Received: 27/04/2021  
 Testing Initiated: 10/04/2021  
 Date Completed: 30/04/2021  
 Order Number: Huntly Q  
 Reference: Huntly Q

### Report Comments

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

#### Elements in Soil

Client Sample ID			HA1 0-0.1	HA1 1.0	HA1 2.0	HA1 3.0	HA2 0-0.1
Date Sampled							
Analyte	Unit	Reporting Limit	21-18868-1	21-18868-2	21-18868-3	21-18868-4	21-18868-5
Aluminium*	mg/kg dry wt	2.5	23,300	14,300	12,200	12,200	12,600
Cobalt	mg/kg dry wt	0.025	4.26	10.6	6.92	7.19	7.03
Thallium	mg/kg dry wt	0.025	0.28	0.19	0.16	0.16	0.13

#### Elements in Soil

Client Sample ID			HA2 1.0	HA2 2.0	HA2 3.0	HA3 0-0.1	HA3 1.0
Date Sampled							
Analyte	Unit	Reporting Limit	21-18868-6	21-18868-7	21-18868-8	21-18868-9	21-18868-10
Aluminium*	mg/kg dry wt	2.5	12,000	14,000	13,300	24,200	15,800
Cobalt	mg/kg dry wt	0.025	9.02	8.85	9.73	8.06	14.2
Thallium	mg/kg dry wt	0.025	0.16	0.16	0.18	0.18	0.32

#### Elements in Soil

Client Sample ID			HA3 2.0	HA3 3.0	HA4 0-0.1	HA4 1.0	HA4 2.0
Date Sampled							
Analyte	Unit	Reporting Limit	21-18868-11	21-18868-12	21-18868-13	21-18868-14	21-18868-15
Aluminium*	mg/kg dry wt	2.5	14,700	12,900	53,500	18,400	12,400
Cobalt	mg/kg dry wt	0.025	14.8	6.76	5.80	4.13	5.63

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked \*, which are not accredited. This test report shall not be reproduced except in full, without the written permission of Analytica Laboratories.

## Elements in Soil

Client Sample ID			HA3 2.0	HA3 3.0	HA4 0-0.1	HA4 1.0	HA4 2.0
Date Sampled							
Thallium	mg/kg dry wt	0.025	0.23	0.16	0.21	0.21	0.15

## Elements in Soil

Client Sample ID			HA4 3.0	HA5 1.0	HA5 2.0	HA5 3.0	DUP B
Date Sampled							
Analyte	Unit	Reporting Limit	21-18868-16	21-18868-17	21-18868-18	21-18868-19	21-18868-20
Aluminium*	mg/kg dry wt	2.5	14,200	30,000	55,500	24,500	27,100
Cobalt	mg/kg dry wt	0.025	9.37	4.24	9.35	3.31	3.79
Thallium	mg/kg dry wt	0.025	0.16	0.23	0.20	0.45	0.23

## Elements in Soil

Client Sample ID			DUP A
Date Sampled			
Analyte	Unit	Reporting Limit	21-18868-21
Aluminium*	mg/kg dry wt	2.5	11,400
Cobalt	mg/kg dry wt	0.025	9.39
Thallium	mg/kg dry wt	0.025	0.17

## Method Summary

### Elements in Soil

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



Emily Hanna, B.Sc.

Trace Elements Team Leader



## Certificate of Analysis

<b>Client:</b>	EHS Support New Zealand Limited	<b>Lab No:</b>	2579454	SPv3
<b>Contact:</b>	Andrew Rumsby C/- EHS Support New Zealand Limited PO Box 15887 New Lynn Auckland 0604	<b>Date Received:</b>	09-Apr-2021	
		<b>Date Reported:</b>	03-May-2021	(Amended)
		<b>Quote No:</b>	92248	
		<b>Order No:</b>		
		<b>Client Reference:</b>		
		<b>Submitted By:</b>	Andrew Rumsby	

### Sample Type: Soil

Sample Name:	BH301 - 1.0m 06-Apr-2021 10:00 am	BH301 - 1.5m 06-Apr-2021 10:00 am	BH301 - 3.0m 06-Apr-2021 10:00 am	BH301 - 6.0m 06-Apr-2021 10:00 am	BH301 - 8.7m 06-Apr-2021 10:00 am
<b>Lab Number:</b>	2579454.1	2579454.2	2579454.3	2579454.4	2579454.5

#### Individual Tests

SPLP Sample Weight	g	50	50	50	50	50
SPLP Extractant Type*		De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4
SPLP Final pH	pH Units	9.0	9.3	8.1	8.9	9.6
Total Recoverable Aluminium	mg/kg dry wt	4,700	5,000	5,500	4,600	4,100
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	26	22	22
Total Recoverable Cobalt	mg/kg dry wt	3.1	5.7	6.7	5.5	8.3
Total Recoverable Thallium	mg/kg dry wt	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

#### Heavy Metals, Screen Level

Total Recoverable Arsenic	mg/kg dry wt	< 2	2	< 2	< 2	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	0.10
Total Recoverable Chromium	mg/kg dry wt	5	6	7	5	5
Total Recoverable Copper	mg/kg dry wt	20	21	20	17	22
Total Recoverable Lead	mg/kg dry wt	19.1	16.1	17.2	15.0	15.8
Total Recoverable Nickel	mg/kg dry wt	3	8	6	7	7
Total Recoverable Zinc	mg/kg dry wt	66	59	55	54	84

Sample Name:	BH301 - 10.0m 06-Apr-2021 10:00 am	BH302 - 1.0m 06-Apr-2021 10:00 am	BH302 - 1.8m 06-Apr-2021 10:00 am	BH302 - 3.0m 06-Apr-2021 10:00 am	BH302 - 6.0m 06-Apr-2021 10:00 am
<b>Lab Number:</b>	2579454.6	2579454.7	2579454.8	2579454.9	2579454.10

#### Individual Tests

SPLP Sample Weight	g	50	50	50	50	50
SPLP Extractant Type*		De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4
SPLP Final pH	pH Units	9.1	9.2	9.3	7.4	8.7
Total Recoverable Aluminium	mg/kg dry wt	6,700	4,300	4,900	11,000	6,300
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
Total Recoverable Cobalt	mg/kg dry wt	2.1	19.3	9.1	11.0	12.2
Total Recoverable Thallium	mg/kg dry wt	0.2	< 0.2	< 0.2	0.2	< 0.2

#### Heavy Metals, Screen Level

Total Recoverable Arsenic	mg/kg dry wt	4	3	4	6	12
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	5	5	6	5	6
Total Recoverable Copper	mg/kg dry wt	34	19	23	20	20
Total Recoverable Lead	mg/kg dry wt	20	22	17.7	17.3	17.8
Total Recoverable Nickel	mg/kg dry wt	3	15	9	7	10
Total Recoverable Zinc	mg/kg dry wt	83	91	86	50	92



This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.

The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked \* or any comments and interpretations, which are not accredited.

Sample Type: Soil						
<b>Sample Name:</b>	BH302 - 7.6m 06-Apr-2021 10:00 am	BH302 - 10.0m 06-Apr-2021 10:00 am				
<b>Lab Number:</b>	2579454.11	2579454.12				
Individual Tests						
SPLP Sample Weight	g	50	50	-	-	-
SPLP Extractant Type*		De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	-	-	-
SPLP Final pH	pH Units	8.7	9.1	-	-	-
Total Recoverable Aluminium	mg/kg dry wt	5,300	9,700	-	-	-
Total Recoverable Boron	mg/kg dry wt	< 20	< 20	-	-	-
Total Recoverable Cobalt	mg/kg dry wt	1.0	9.6	-	-	-
Total Recoverable Thallium	mg/kg dry wt	< 0.2	< 0.2	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	7	13	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt	5	9	-	-	-
Total Recoverable Copper	mg/kg dry wt	23	19	-	-	-
Total Recoverable Lead	mg/kg dry wt	11.7	23	-	-	-
Total Recoverable Nickel	mg/kg dry wt	< 2	9	-	-	-
Total Recoverable Zinc	mg/kg dry wt	15	55	-	-	-
Sample Type: Aqueous						
<b>Sample Name:</b>	BH301 - 1.0m [SPLP Extract]	BH301 - 1.5m [SPLP Extract]	BH301 - 3.0m [SPLP Extract]	BH301 - 6.0m [SPLP Extract]	BH301 - 8.7m [SPLP Extract]	
<b>Lab Number:</b>	2579454.13	2579454.14	2579454.15	2579454.16	2579454.17	
Individual Tests						
Total Aluminium	g/m <sup>3</sup>	1.98	4.7	1.25	2.1	2.8
Total Boron	g/m <sup>3</sup>	0.25	1.51	0.29	0.32	1.30
Total Cobalt	g/m <sup>3</sup>	< 0.0042	< 0.0042	< 0.0042	< 0.0042	< 0.0042
Total Thallium	g/m <sup>3</sup>	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Arsenic	g/m <sup>3</sup>	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021
Total Cadmium	g/m <sup>3</sup>	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Total Chromium	g/m <sup>3</sup>	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011
Total Copper	g/m <sup>3</sup>	< 0.011	0.014	< 0.011	< 0.011	< 0.011
Total Lead	g/m <sup>3</sup>	0.0088	0.0178	0.0049	0.0076	0.0096
Total Nickel	g/m <sup>3</sup>	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011
Total Zinc	g/m <sup>3</sup>	0.044	0.029	< 0.021	< 0.021	0.027
<b>Sample Name:</b>	BH301 - 10.0m [SPLP Extract]	BH302 - 1.0m [SPLP Extract]	BH302 - 1.8m [SPLP Extract]	BH302 - 3.0m [SPLP Extract]	BH302 - 6.0m [SPLP Extract]	
<b>Lab Number:</b>	2579454.18	2579454.19	2579454.20	2579454.21	2579454.22	
Individual Tests						
Total Aluminium	g/m <sup>3</sup>	4.8	4.5	3.8	0.63	3.0
Total Boron	g/m <sup>3</sup>	0.16	0.20	0.29	< 0.11	0.17
Total Cobalt	g/m <sup>3</sup>	< 0.0042	< 0.0042	< 0.0042	0.0139	< 0.0042
Total Thallium	g/m <sup>3</sup>	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Arsenic	g/m <sup>3</sup>	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021
Total Cadmium	g/m <sup>3</sup>	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Total Chromium	g/m <sup>3</sup>	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011
Total Copper	g/m <sup>3</sup>	0.027	< 0.011	< 0.011	< 0.011	< 0.011
Total Lead	g/m <sup>3</sup>	0.0098	0.0080	0.0043	< 0.0021	< 0.0021
Total Nickel	g/m <sup>3</sup>	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011
Total Zinc	g/m <sup>3</sup>	0.061	0.022	< 0.021	< 0.021	< 0.021
<b>Sample Name:</b>	BH302 - 7.6m [SPLP Extract]	BH302 - 10.0m [SPLP Extract]				
<b>Lab Number:</b>	2579454.23	2579454.24				



**Sample Type: Aqueous**

<b>Sample Name:</b>	BH302 - 7.6m [SPLP Extract]	BH302 - 10.0m [SPLP Extract]			
<b>Lab Number:</b>	2579454.23	2579454.24			

Individual Tests						
Total Aluminium	g/m <sup>3</sup>	3.9	3.2	-	-	-
Total Boron	g/m <sup>3</sup>	< 0.11	0.13	-	-	-
Total Cobalt	g/m <sup>3</sup>	< 0.0042	< 0.0042	-	-	-
Total Thallium	g/m <sup>3</sup>	< 0.0011	< 0.0011	-	-	-
Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Arsenic	g/m <sup>3</sup>	< 0.021	< 0.021	-	-	-
Total Cadmium	g/m <sup>3</sup>	< 0.0011	< 0.0011	-	-	-
Total Chromium	g/m <sup>3</sup>	< 0.011	< 0.011	-	-	-
Total Copper	g/m <sup>3</sup>	< 0.011	< 0.011	-	-	-
Total Lead	g/m <sup>3</sup>	0.0048	0.0039	-	-	-
Total Nickel	g/m <sup>3</sup>	< 0.011	< 0.011	-	-	-
Total Zinc	g/m <sup>3</sup>	< 0.021	< 0.021	-	-	-

**Analyst's Comments**

**Amended Report:** This certificate of analysis replaces report '2579454-SPv2' issued on 27-Apr-2021 at 2:49 pm.  
Reason for amendment: Additional testing added.

**Summary of Methods**

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

**Sample Type: Soil**

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-12
Total Recoverable Aluminium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	10 mg/kg dry wt	1-12
Total Recoverable Boron	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	20 mg/kg dry wt	1-12
Total Recoverable Cobalt	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	1-12
Total Recoverable Thallium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.2 mg/kg dry wt	1-12
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-12
SPLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1312.	-	1-12
SPLP Profile			
SPLP Sample Weight	Gravimetric. US EPA 1312.	0.1 g	1-12
SPLP Extractant Type*	US EPA 1312 (Modified for New Zealand conditions to use De-ionised Water unless otherwise specified).	-	1-12
SPLP Final pH	pH meter. US EPA 1312.	0.1 pH Units	1-12

**Sample Type: Aqueous**

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E (modified) 23 <sup>rd</sup> ed. 2017.	-	13-24
Total Aluminium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23 <sup>rd</sup> ed. 2017.	0.063 g/m <sup>3</sup>	13-24
Total Boron	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23 <sup>rd</sup> ed. 2017.	0.11 g/m <sup>3</sup>	13-24
Total Cobalt	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23 <sup>rd</sup> ed. 2017.	0.0042 g/m <sup>3</sup>	13-24

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Total Thallium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23 <sup>rd</sup> ed. 2017.	0.0011 g/m <sup>3</sup>	13-24
Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 23 <sup>rd</sup> ed. 2017.	0.0011 - 0.021 g/m <sup>3</sup>	13-24

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

Testing was completed between 13-Apr-2021 and 03-May-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)  
Client Services Manager - Environmental

## Appendix H – Summary of Analytical Results

Total Metals in Soils in Mannaged Fill Area 3 (Exisiting Soils)													
Reference	Sample Description	Sample Date	Arsenic (As)	Boron (B)	Cadmium (Cd)	Cobalt (Co)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Nickel (Ni)	Thallium (Tl)	Zinc (Zn)
mg/kg dry wt													
21-15906	HA1 0-0.1	07 April 2021	14.5	11	0.031	4.26	9.4	16.8	24.7	0.11	4.2	0.28	33.5
21-15906	HA1 1.0	07 April 2021	3.7	21	0.074	10.6	8.8	21.2	17.2	0.19	12.3	0.19	77.8
21-15906	HA1 2.0	07 April 2021	3	24	0.063	6.92	8.5	19.7	16.9	0.19	7.91	0.16	77
21-15906	HA1 3.0	07 April 2021	3.6	20	0.065	7.19	8.6	19.6	15.5	0.21	8.14	0.16	86.8
21-15906	HA2 0-0.1	07 April 2021	2.2	48	0.045	7.03	9.6	15.5	13.3	0.13	6.2	0.13	34.8
21-15906	HA2 1.0	07 April 2021	2.7	68	0.068	9.02	7.9	19.4	15.4	0.16	8.77	0.16	66
21-15906	HA2 2.0	07 April 2021	3.8	37	0.064	8.85	7.7	20	16.2	0.19	9.42	0.16	75.7
21-15906	HA2 3.0	07 April 2021	3	45	0.082	9.73	8.7	20.4	23.4	0.19	10.6	0.18	77.5
21-15906	HA3 0-0.1	07 April 2021	11	12	0.031	8.06	9.7	17.1	22.3	0.095	6.27	0.18	59.7
21-15906	HA3 1.0	07 April 2021	5.2	16	0.13	14.2	8.5	26.5	18.9	0.2	12.9	0.32	76.1
21-15906	HA3 2.0	07 April 2021	3.4	22	0.092	14.8	8.4	22.8	18.7	0.2	12.4	0.23	89.3
21-15906	HA3 3.0	07 April 2021	1.6	29	0.052	6.76	8.7	19.4	17.3	0.23	7.53	0.16	75.6
21-15906	HA4 0-0.1	07 April 2021	4.9	4.4	0.043	5.80	9.5	8.96	17.1	0.11	5.1	0.21	29.9
21-15906	HA4 1.0	07 April 2021	4.9	12	0.023	4.13	9.2	21.2	19.2	0.23	3.5	0.21	36.4
21-15906	HA4 2.0	07 April 2021	3.1	22	0.048	5.63	7	16.4	14.8	0.18	6.38	0.15	57.9
21-15906	HA4 3.0	07 April 2021	2.7	18	0.11	9.37	7.8	19.9	17.1	0.18	10.4	0.16	81.1
21-15906	HA4 3.0	07 April 2021	5.1	20	0.099	-	9	20.5	17.1	0.19	11.1	-	78.4
21-15906	HA5 1.0	07 April 2021	4.6	12	0.036	4.24	11	16.7	16.9	0.23	5.77	0.23	47.4
21-15906	HA5 2.0	07 April 2021	6	11	0.042	9.35	10	18.4	21.6	0.14	8	0.20	70.3
21-15906	HA5 3.0	07 April 2021	11	16	0.015	3.31	9.1	16.5	31.1	0.2	3.5	0.45	28.8
2579454	BH301 - 1.0m	06 April 2021	< 2	< 20	< 0.10	3.1	5	20	19.1	N/A	3	<0.2	66
2579454	BH301 - 1.5m	06 April 2021	2	< 20	< 0.10	5.7	6	21	16.1	N/A	8	<0.2	59
2579454	BH301 - 3.0m	06 April 2021	< 2	26	< 0.10	6.7	7	20	17.2	N/A	6	<0.2	55
2579454	BH301 - 6.0m	06 April 2021	< 2	22	< 0.10	5.5	5	17	15	N/A	7	<0.2	54
2579455	BH301 - 8.7m	06 April 2021	3	22	0.1	8.3	5	22	15.8	N/A	7	<0.2	84
2579455	BH301 - 10.0m	06 April 2021	4	< 20	< 0.10	2.1	5	34	20	N/A	3	0.2	83
2579455	BH302 - 1.0m	06 April 2021	3	< 20	< 0.10	19.3	5	19	22	N/A	15	<0.2	91
2579455	BH302 - 1.8m	06 April 2021	4	< 20	< 0.10	9.1	6	23	17.7	N/A	9	<0.2	86
2579455	BH302 - 3.0m	06 April 2021	6	< 20	< 0.10	11.0	5	20	17.3	N/A	7	0.2	50
2579454	BH302 - 6.0m	06 April 2021	12	< 20	< 0.10	12.2	6	20	17.8	N/A	10	<0.2	92
2579454	BH302 - 7.6m	06 April 2021	7	< 20	< 0.10	1.0	5	23	11.7	N/A	< 2	<0.2	15
2579454	BH302 - 10.0m	06 April 2021	13	< 20	< 0.10	9.6	9	19	23	N/A	9	<0.2	55
95% UCL			6.524	29.43	0.0741	9.025	8.24	21.03	19.48	0.193	8.808	0.233	70.34
Huntly Waste Acceptance Criteria			100	45 (260)	7.5	NA	400	325	250 (1000)	1.5	63 (320)	23	400 (2,000)
SCS - commercial / industrial outdoor worker (unpaved)			70	>10,000	1,300	350 <sup>1</sup>	6,300	>10,000	3,300	4,200	NA	23 <sup>1</sup>	350,000 <sup>1</sup>
Waikato Background Levels (95%)			6.8	6.7	0.22	NA	30	25	20	0.23	7.6	0.47	53
Waikato Background Levels (maximum)			25	8.5	0.3	NA	150	55	32	0.5	21	NA	58

Highlighted Yellow: above the proposed Huntly Managed Fill waste acceptance criteria

Bold: above the published background concentrations for the Waikato region



<sup>1</sup> Guideline values based on US EPA Regional Screening Levels for industrial sites (May 2021, see <https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables>)

## Appendix I – RPD Calculations

Reference	21-18868	21-18868	<b>RPDs (%)</b>
Description	Huntly Q	Huntly Q	
Sample Description	HA5 3.0	DUP B	
Sample Date			
Sample No.	19	20	
QC Type	Regular	Regular	
Depth			
Submitted Sample Type	Soil	Soil	
Aluminium*	24500	27100	<b>10</b>
Cobalt	3.31	3.79	<b>14</b>
Thallium	0.45	0.23	<b>65</b>
Reference	21-18868	21-18868	
Description	Huntly Q	Huntly Q	
Sample Description	HA2 3.0	DUP A	
Sample Date			
Sample No.	8	21	
QC Type	Regular	Regular	
Depth			
Submitted Sample Type	Soil	Soil	
Aluminium*	13300	11400	<b>15</b>
Cobalt	9.73	9.39	<b>4</b>
Thallium	0.18	0.17	<b>6</b>
<b>Mean RPD (%)</b>			<b>19</b>