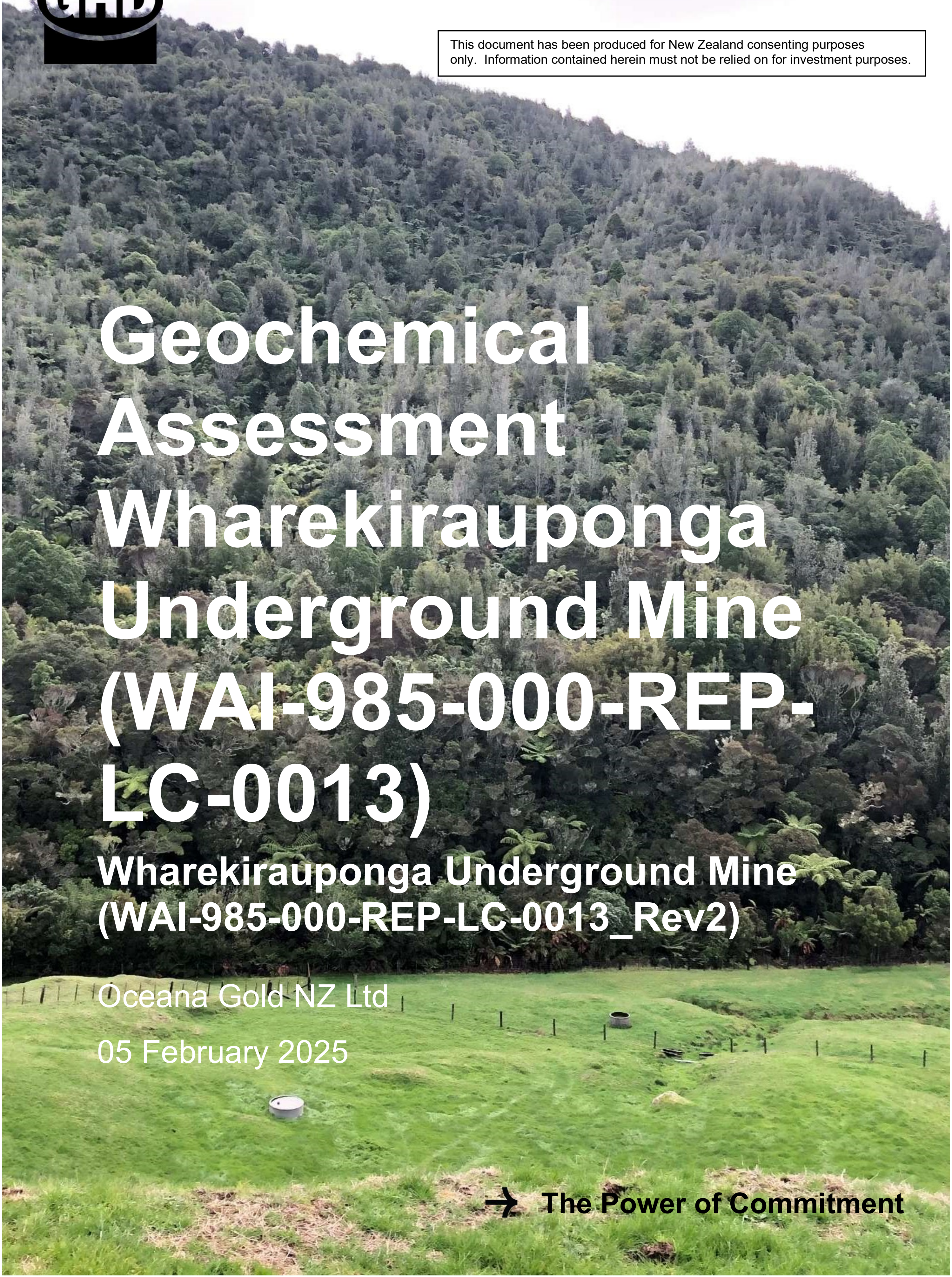

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Geochemical Assessment Wharekirauponga Underground Mine (WAI-985-000-REP-LC-0013)

Wharekirauponga Underground Mine (WAI-985-000-REP-LC-0013_Rev2)

Oceana Gold NZ Ltd

05 February 2025

→ The Power of Commitment

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Executive Summary

Oceana Gold NZ Ltd (OceanaGold) are in the process of developing a new underground mine at Wharekirauponga referred to as the “Wharekirauponga Underground” or “WUG Mine”. Development of the mine initially involves developing a dual tunnel drive (the Willows Access Tunnel) to link the Wharekirauponga gold resource and a portal located on farmland near Willows Road (Willows Road Farm) approximately 5 km north of Waihi and OceanaGold’s current Martha operations. The portal area will be linked to the current Waihi site via road and an additional access tunnel. The WUG Mine is a component of OceanaGold’s Waihi North Project.

This report comprises the following studies for the WUG Mine component of the Waihi North Project:

- Review of available geochemical data, characterisation and assessment of the acid forming properties of the Willows Access Tunnel and WUG Mine spoil material and how this will influence spoil storage, runoff and seepage;
- Outline of recommended strategies to minimise the onset of acidification (where applicable) and predict likely groundwater inflow, leachate and runoff water quality from the access tunnels, mine, and rock storage area in order to inform collection and treatment requirements.

The Willows Access Tunnel alignment, as in OceanaGold’s current operations at Waihi, is situated in predominantly andesite material, with minor occurrences of more felsic rocks (rhyolite and ignimbrite) encountered toward the northern terminus. The WUG Mine is hosted predominantly in rhyolitic material overlain by andesitic material.

Representative spoil material has been selected from exploration core in both the WUG Mine ore body and the tunnel portal area and analysed for multi-element and acid base accounting (ABA) data in order to characterise the geochemical makeup of the two areas and explore similarities / differences to material encountered at OceanaGold’s current Waihi operations.

Analysis suggests that spoil material from the portal area and within the majority of the Willows Access Tunnel alignment is comparable in trace element composition and acid generating potential to spoil material currently encountered at OceanaGold’s Waihi operations based on the data collected to date.

Multi-element analysis data for the WUG Mine show that arsenic is elevated and iron is depressed with respect to the current Martha dataset. In addition, both sulphur (and hence maximum potential acidity (MPA)) and the acid neutralising capacity (ANC) of spoil material within the WUG Mine is depressed compared to spoil within the WUG Access Tunnel alignment. Similar to the current operations at Waihi, element enrichment and a greater abundance of trace elements is apparent in both the rhyolitic and andesitic spoil material as depth increases.

As the majority of the spoil material to be stored in a rock stack at Willows Farm (the WRS) will be sourced from the Willows Access Tunnel (spoil from the WUG Mine will form a minor component), the WRS is expected to behave geochemically similar to rock stacks at OceanaGold’s existing operations at Waihi.

Groundwater inflow (into the WUG Mine and Willows Access Tunnel), WRS runoff and seepage water quality predictions are conservatively based on 95th percentile data from the current Waihi operations. This is considered appropriate when considering the similarities between the geology of the current Waihi operations and the Willows Access Tunnel, but also takes into account observed geochemical differences within the WUG Mine. The predicted water quality is utilised within the water balance assessment (reported separately), which takes into account the water treatment capacity and availability, trace element removal rates and consented discharge requirements.

Field column testing utilising spoil from the WUG Mine was considered necessary to determine, inform and enable refinement of this assessment with time and give greater certainty of predicted leachate quality. The test columns have been constructed at OceanaGold’s current Waihi operations and the leachate data was utilised to confirm predictions outlined.

Appropriate management of the rock material (both from the Willows Access Tunnel and the WUG Mine) is crucial to limit potential impacts on the surrounding environment and to limit the volume of water requiring treatment. Similar management practises for spoil material that have been successfully employed at OceanaGold's current Waihi operations are to be utilised at the WRS (e.g., compaction, limestone amendment and seepage/runoff collection).

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1. Introduction

1.1 Project Description and Background

Oceana Gold NZ Ltd (OceanaGold) proposes to proceed with developing a new underground mine at Wharekirauponga referred to as the “Wharekirauponga Underground” or “WUG” Mine. Development of the mine initially involves developing a tunnel drive (the Willows Access Tunnel) to link the Wharekirauponga gold resource and a portal located on farmland near Willows Road, approximately 5 km north of Waihi. This portal area will be linked to the current Waihi site via road, water conveyance pipelines and an additional access tunnel. For the following assessment the Willows Access Tunnel and WUG Mine are being treated as distinct entities and have been consequently separated into the following groupings as shown in Figure 1:

Willows Access Tunnel – Comprising a single decline from Willows Road Farm to vent raise 1, then dual parallel tunnels to the Wharekirauponga Orebodies and a single decline from the Waihi plant to the base of vent raise 1. Predominately for ore and rock transportation, development, exploration and vent drives.

WUG Mine – T-Stream and East-Graben-Vein (EG-Vein) orebodies

The location of the surface facilities area (SFA) and the WUG Mine in relation to the current OceanaGold Waihi operations is shown on Figure 1. The key components of the portal infrastructure are outlined in Figure 2 .

The WUG Mine and associated infrastructure will be progressed under the wider project – Waihi North Project. Key components of the project pertaining to the WUG Mine portion of the site include:

- Development of an access tunnel, associated portal and infrastructure located on Willows Road Farm, located approximately 5 km north of the current site processing plant, to access the WUG Mine;
- A new underground mine targeting the Wharekirauponga orebodies located approximately 11 km northwest of the township of Waihi;
- A pipeline connecting the Willows Access Tunnel portal area with the site Water Treatment Plant (WTP);
- An additional access tunnel connecting the orebodies and portal area with the current site Processing Plant; and
- A new temporary rock stack (WRS) adjacent the Willows Road Farm portal to store tunnel spoil during the exploration and operation of the WUG Mine.

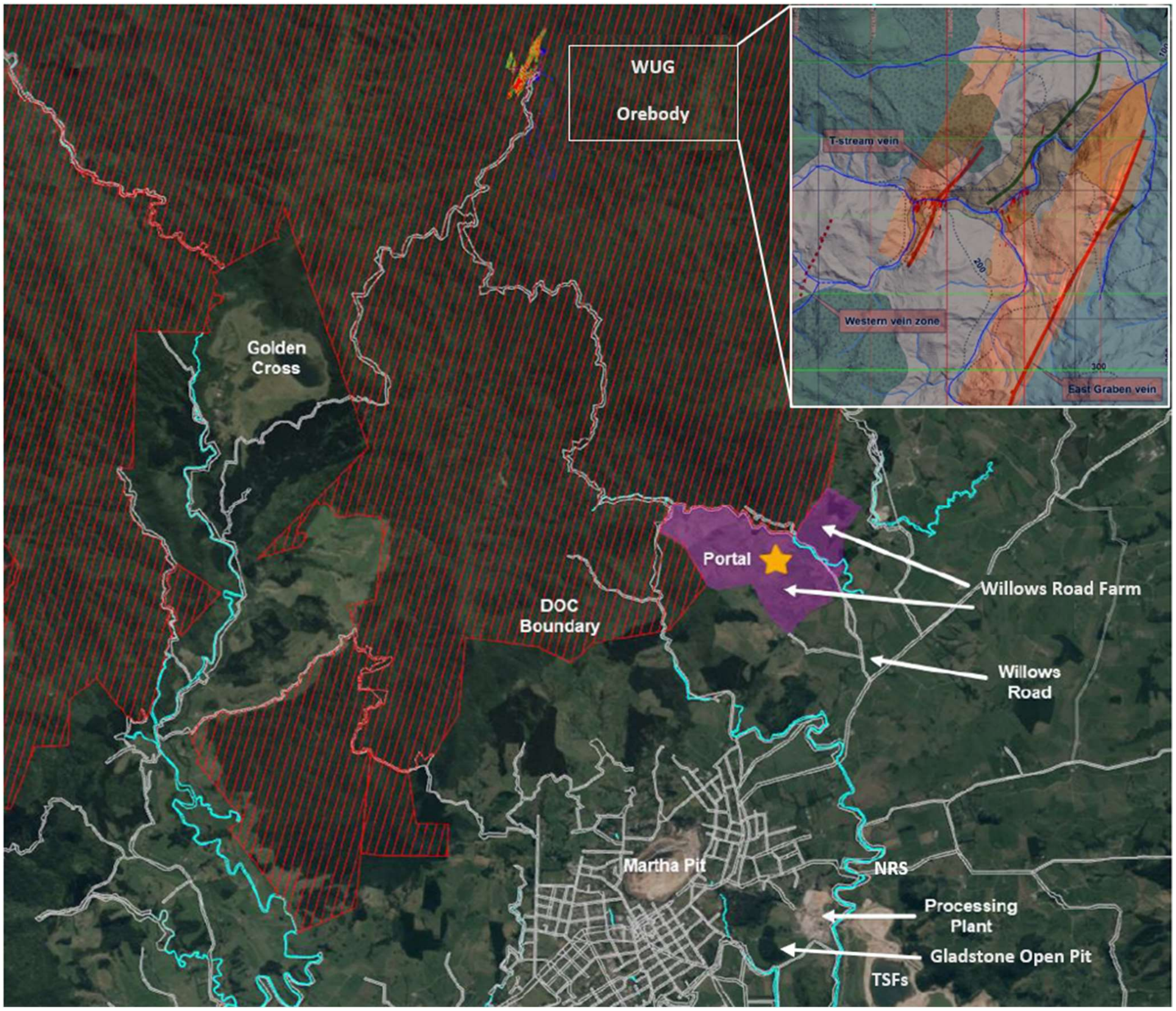

Figure 1 ***Overview of the WUG components showing the Willows Road Portal area and the Wharekirauponga orebodies in relation to the current OceanaGold facilities at Waihi.***

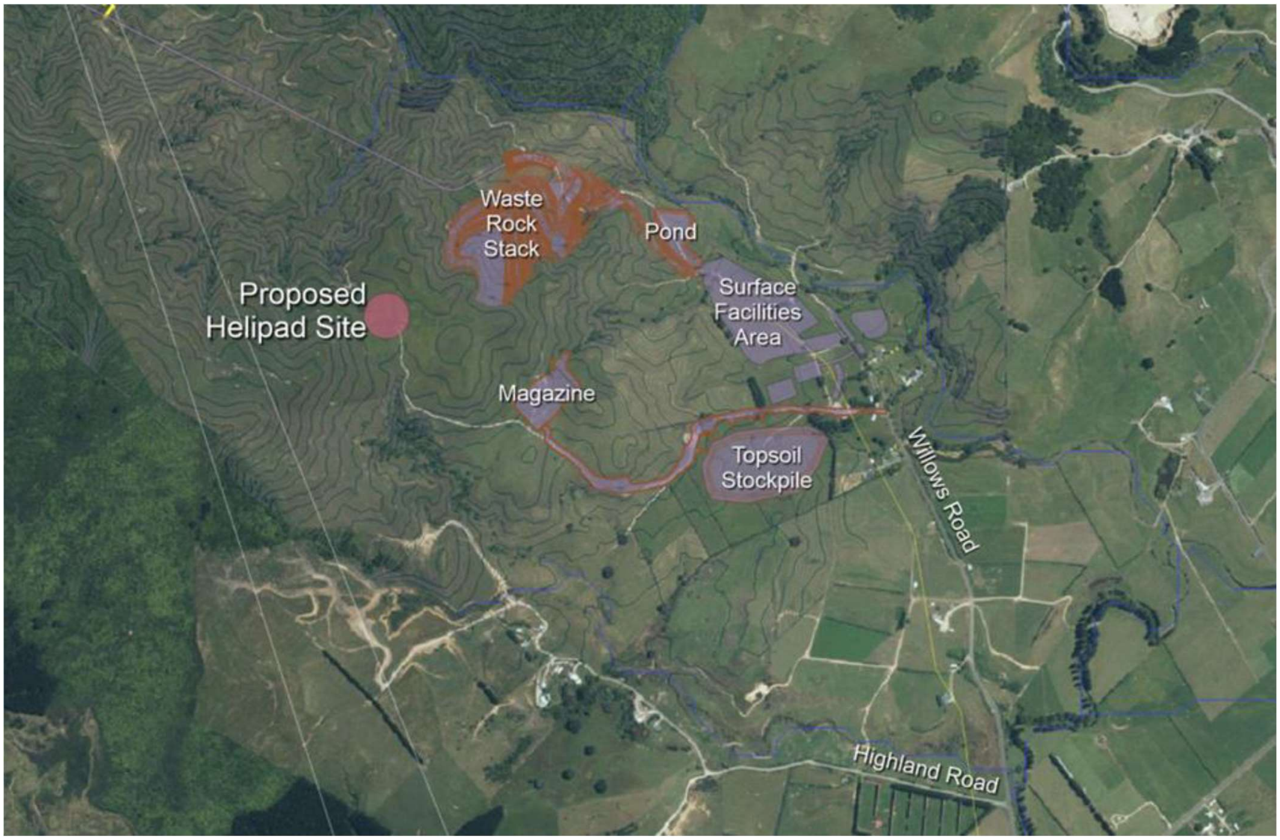

Figure 2 Willows Road Farm Portal Area and Associated Surface Facilities Area

1.2 Scope of Works

GHD Limited (GHD) has been commissioned by OceanaGold to build on work previously completed and to deliver the following studies relating to geochemistry for the Wharekirauponga component of the Waihi North Project:

- Review of available geochemical data, characterisation and assessment of the acid forming properties of the Willows Access Tunnel spoil material and how this will influence spoil storage and resultant runoff and seepage;
- Review of available geochemical data, characterisation and assessment of the acid forming properties of the WUG Mine and how this will influence spoil storage and resultant runoff and seepage;
- Outline any recommended strategies to minimise the onset of acidification (where applicable) and likely leachate and runoff water quality from the rock storage area;
- Derive representative water quality for the Willows Access Tunnel / mine groundwater inflow and WRS runoff and seepage in order to inform collection and treatment requirements.

1.3 Scope and limitations

This report: has been prepared by GHD for OceanaGold NZ Ltd and may only be used and relied on by OceanaGold NZ Ltd. for the purpose agreed between GHD and the OceanaGold NZ Ltd as set out in the document "Waihi North Project

Technical Studies to Support Resource Consent Application – Water Studies (Project Scope and Cost Estimate) dated 08 June 2021 and subsequent variations to this scope".

GHD otherwise disclaims responsibility to any person other than Oceana Gold NZ Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (Section 1.4). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Oceana Gold NZ Ltd and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

1.4 Assumptions

Notwithstanding the assumptions outlined in the respective sections of this report, the following list of key assumptions are applicable to the assessment provided:

- The current geochemical dataset is limited to samples taken from drill cores located in the vicinity of proposed Willows Access Tunnel and adjacent Willows Road Farm area and exploration drilling core material within the Wharekirauponga orebodies. It has been assumed that this dataset is representative of all spoil material.
- Based on the assumption that all spoil material is acid-producing, it is assumed that the WRS is constructed in a manner that will limit oxidation (i.e., placed on low permeability material, placed in compacted lifts, amended with limestone).

2. Geology and Mineralogy

2.1 Local Geology

The Willows Access Tunnel alignment is situated in largely monolithic Miocene aged volcanic rocks, predominantly comprised of intermediary composition andesite, with minor occurrences of more felsic rocks (rhyolite and ignimbrite) encountered toward the northern terminus of the Willows Access Tunnel. Felsic rocks dominate the area within which the WUG Mine is located.

The andesite predominantly comprises two units, termed “Waipupu Formation” and “Whiritoa Formation”, which are both mineralogically similar, iron-magnesium silicates, with quartz phenocrysts common. Texturally, the rock fabric alternates between porphyritic lava flows to more broken and rubbly breccia/autoclastic breccia, with less common tuff (aerial ash) deposits. Isolated occurrences of diorite intrusions are also present. At surficial depths, a relatively thin but extensive brecciated tuff mantles the central section of the Willows Access Tunnel alignment (Whakamoehau Andesite). The stratigraphy of the Waipupu and Whiritoa Formations is often non-sequential and cross cutting, with the depositional age of each unit being significantly overlapped. However, the Waipupu Formation Andesite underlies the majority of materials expected to be encountered. This unit extends further south and hosts the Martha Mine open pit and therefore similarities in mineralogy and hydrothermal alteration between the sites are expected.

At the location of the ore deposit, the local host geology is characterised by several rhyolitic deposits (part of the Coroglen Subgroup). These vary between volcaniclastic breccias (predominant material) and more massive lava. The rhyolite is likely to be laterally confined at depth (as a function of several notable faults; Edmonds Fault and several splays of this), and to be locally intruded into the surrounding andesitic basement rock (outlined above). At the surface, the material locally overlies the surrounding andesite host rock, which is typical of the relative stratigraphy between these deposits within the Coromandel Region.

Associated with the rhyolite in this region of the site is intense silicification (secondary remineralisation with quartz). Through available borehole core and surface sampling, in the area immediately surrounding the ore deposit, the rhyolite and ignimbrite rock has been almost completely replaced with quartz. This is attributed to post deposition hydrothermal re-mineralisation of the rock, via several notable faults as outlined above and in further detail below.

The region surrounding Waihi and including the site is strongly influenced by the presence of multiple faults with a distinct set of structural orientations that frequently intersect the Access Tunnel alignment: Northeast – Southwest (primary) and Northwest-Southeast (auxiliary) comprise the main fault sequences. The nature of faulting is typically steep walled extensional (dipping greater than 60 degrees). The faulting has provided the primary conduit for post-depositional hydrothermal circulation to occur (5-10 Mya) that has resulted in extensive remineralisation of the host rock, hydrothermal alteration and deposition of heavy metal and mineral assemblages (i.e., gold and silver bearing minerals). The alteration geochemistry within host rock is typically confined to the major Andesite sequences outlined above. It predominantly comprises wide-field chlorite and acidic clay alternation halos (tens of kilometres from source) with quartz replacement (‘silicification’), sulphur and iron remineralisation being confined more directly to the vein/fault system (<1 km).

The geological conceptual site model outlining the Willows Access Tunnel alignment with respect to the main geological features is provided in Appendix A.

3. Geochemical Assessment

3.1 Acid and Metalliferous Drainage

Acid and metalliferous drainage (AMD) is a broad term for the natural process of sulphide oxidation (which occurs when rocks containing sulphide minerals such as pyrite are exposed to air and water) leading to the formation of acid drainage and metalliferous drainage. Although AMD is a naturally occurring phenomenon, this process can be exacerbated by external activities such as mining that reduce particle size and increase oxidising surface areas.

Contaminants are often mobilised by water and can then report into the downstream receiving environment. Elevated metal concentrations and depressed pH levels in waterways need to be avoided as they can create toxicity issues for aquatic ecology leading to chronic or acute health issues.

AMD can be subdivided into three main categories:

1. **Acid Rock Drainage (ARD)** – acidic, low pH drainage caused by the oxidation of acid producing sulphide minerals and generally contains toxic heavy metals.
2. **Neutral Metalliferous Drainage (NMD)** – where the acid generated from sulphide mineral oxidation is neutralised by other minerals such as carbonates resulting in the drainage has circum-neutral pH values while containing toxic heavy metals
3. **Saline Mine Drainage (SMD)** – circum-neutral to alkaline in pH with elevated sulphate concentrations.

Adverse environmental effects from AMD due to a depressed pH and/or elevated trace metal concentrations can be avoided by sufficient characterisation, handling practices, and storage and/or treatment strategies.

As outlined in this report, characterisation of the spoil material generated from the advancement and excavation of an access tunnel and excavation associated with mining out the Wharekirauponga Orebodies and its AMD potential is a key consideration in the development of appropriate practices and strategies to manage potential adverse outcomes from AMD. This is because the nature and likely geochemical composition of the highly mineralised spoil material from the project (at least in part) suggests that that the spoil may generate AMD.

Pyrite (FeS_2) is the predominant “acid” forming sulphide mineral present in the area. When pyrite is exposed to air and water, it decomposes into water-soluble components, including ferrous iron (Fe^{2+}) and sulphate (SO_4) and generates acid (H^+). The reduced water-soluble components are then further oxidised to form ferric iron (Fe^{3+}) and water. The formation of low solubility ferric iron (Fe^{3+}) in water leads to the precipitation of ferric hydroxide type minerals ($Fe(OH)_3$ - an orange precipitate); a process that generates additional acidity (H^+).

This process can be described using the following chemical reaction:

$$FeS_2 + 3.75\ O_2 + 3.5\ H_2O \rightarrow Fe(OH)_3 + 2SO_4^{2-} + 4H^+$$

Acidic waters increase the mobility of trace elements that can be elevated as a result of the mineralisation. Acid (H^+ ions) generated by sulphide mineral oxidation can be neutralised by carbonate minerals such as limestone ($CaCO_3$) such that the drainage is no longer acidic (low pH), but can still contain elevated metals concentrations:

$$CaCO_3 + 2H^+ \rightarrow Ca^{2+} + H_2O + CO_2$$

The actual potential for, and rate of oxidation of pyrite (and other sulphide minerals), and the potential impact to the receiving environment is dependent on many factors. These factors include the concentration of the sulphides in the spoil material, morphology of the sulphides, oxygen concentration and exposure time, wetting and drying cycles, temperature, presence of bacteria, and presence of acid consuming materials (neutralisation capacity).

The following analytical testing methods are commonly used to characterise spoil material with respect to its acid generating potential:

- Multi-element analysis – whole-rock testing for a range of trace and major elements to allow characterisation of the rock for potential contaminants that may leach and adversely influence water quality.
- Kinetic testing – accelerated weathering of selected crushed spoil samples to assess the potential acid generation and trace element leaching.
- Column testing – on site weathering of selected crushed spoil samples exposed to atmospheric conditions to assess the rate of reactions and management practices.

The geochemistry of the area associated with mining activities in and surrounding the Waihi area is well understood and characterised as a result of 30 years of mining by OceanaGold at its Waihi operations. During this time existing spoil management practices on the Waihi site have been developed and refined. These practices have proven to be appropriate for controlling AMD. It is considered that due to the location of the proposed Willows Access Tunnel and WUG Mine in relation to the well characterised material (associated with the operations at Waihi), and the conceptual knowledge of the geology and geochemistry of the area of interest (i.e., the Access Tunnel and WUG Mine), the spoil material is likely to behave in a manner that is geochemically similar to spoil associated with operations at Waihi.

4. Spoil Geochemistry

The geochemistry of the Willows Access Tunnel and spoil from the WUG Mine has been assessed using multi-element and acid-base accounting (ABA) analysis of drill core material thought to best represent the likely spoil material. At the time of writing the available data is sourced from the following locations: The Willows Access Tunnel at Willows Road Farm, and the T-Stream and EG-Vein orebodies at Wharekirauponga. It should be noted that there is no data available along the majority of Willows Access Tunnel. However, data from the Willows Road Farm area in the vicinity between the tunnel portal to the DOC reserve border is considered to be representative of the majority of the tunnel spoil material based on the conceptual model of the geology (as shown in Appendix A). In addition, field columns utilising material from the WUG Mine, and leachate data collected from them, will further inform the assessment when available.

As with past OceanaGold Waihi mining projects, geochemical analyses will continue for a period beyond the start of the physical works. This will ensure that spoil management practises can be refined and updated if required and that they are suitable based on the waste geochemical properties.

4.1 Data Sources

4.1.1 Willows Access Tunnel

Two drill cores (WNDD005 and WNDD006) located approximately 300-500m south and southeast of the proposed Willows Access Tunnel route, drill core material from the location of the proposed vent shaft located within the Willows Road Farm (WNDD007) and a drill core (WNDD008) running parallel to the proposed Access Tunnel within the Willows Road Farm area, have been utilised to characterise the Willows Access Tunnel spoil beneath the Willows Road Farm area extending into the adjacent DOC estate.

Spoil from the far end of the Willows Access Tunnel is considered to be reflective of the orebody characterisation (Section 4.1.2), however based on the conceptual geological understanding, it is considered that the majority of the tunnel spoil material is likely represented by samples from the Willows Road Farm area.

The location of the drill cores in relation to the Willows Access Tunnel alignment is indicated on Figure 3 and Figure 4. The vent shaft (from which core and analytical data exists) is located near the border of the Willows Road Farm and DOC estate on the Willows Access Tunnel alignment, due north of the surface of drill core WNDD006.

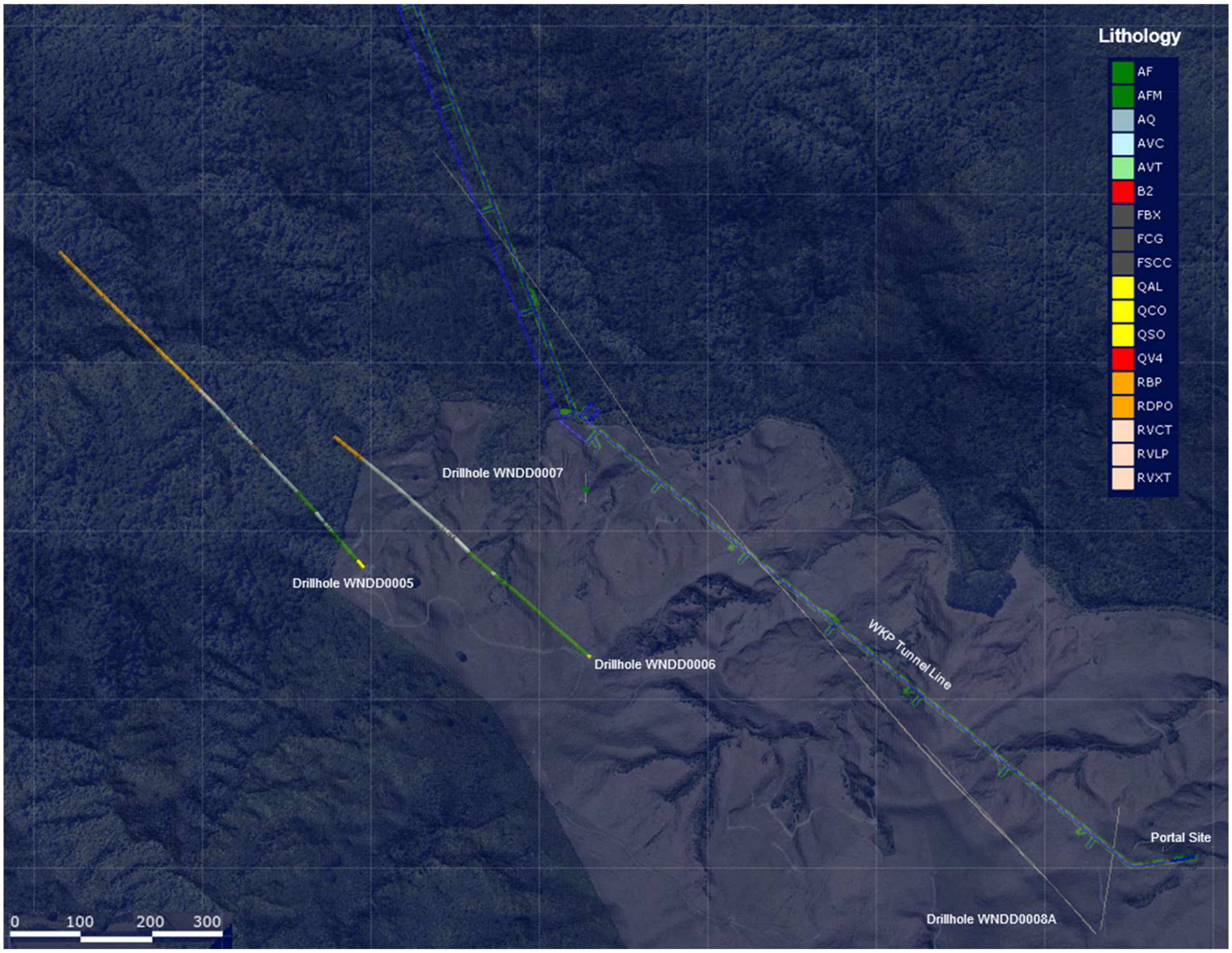

Figure 3 Map showing location of drill core in relation to Willows Access Tunnel alignment

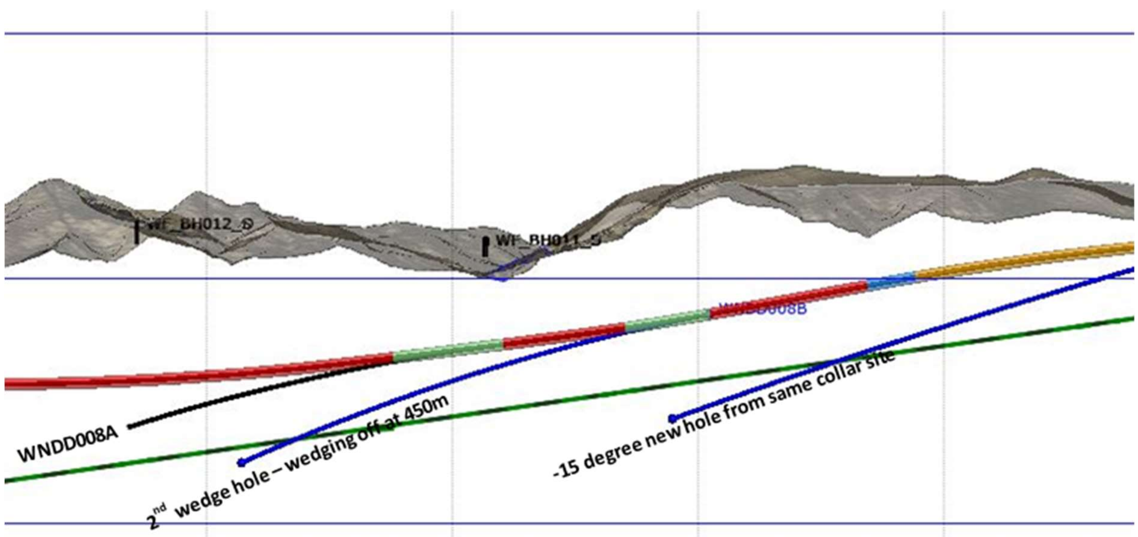

Figure 4 Cross section showing location of core and its daughter holes following the Willows Access Tunnel alignment

4.1.2 WUG Mine (Wharekirauponga Orebodies)

For this assessment exploration drilling has been utilised to characterise the spoil surrounding the Wharekirauponga orebodies. Core samples consist of material taken from the T-Stream and the EG-Vein orebodies. Drillhole locations in relation to each orebody are indicated on Figure 5. To better characterise the EG-Vein orebody geochemistry, it has been separated into two distinct areas (North and South) which roughly coincide with areas covered from Drill Site 4 – North and Drill Site 1 – South. Drill core from Drill Site 2 is used as representative of the T-Stream Vein. In addition, core from drill hole location WKP100 and WKP102 located at the southern boundary of the identified orebody and close to where the Willows Access Tunnel alignment meets the WKP Mine are considered representative of spoil from the far end of the Willows Access Tunnel.

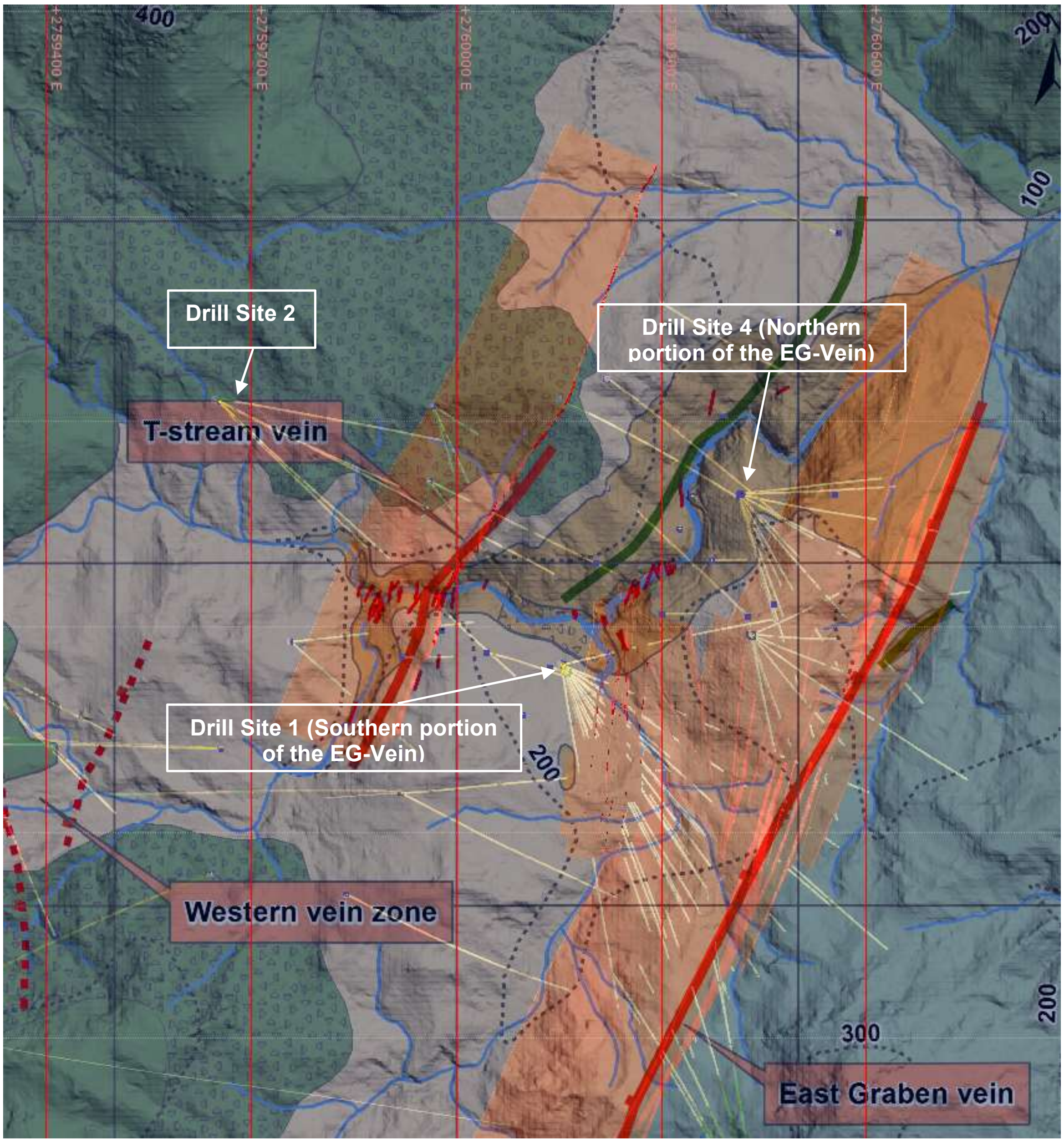

Figure 5 Map showing the drillhole distribution within the T-Stream and EG-Veins

4.2 Spoil Composition

4.2.1 Willows Access Tunnel – Multi Element Analysis

Analytical results from spoil representative of the Willows Access Tunnel at the Willows Road Farm end are summarised in Table 1. The dataset includes the results from drill core samples that intersect with the proposed Willows Access Tunnel (WNDD005 and WNDD006) and core samples collected from the vent shaft location. Additionally, samples have been taken from the southern boundary of the identified orebody - (WKP100 – WKP102) and are considered to be comparable to the deeper sections of the Willows Access Tunnel in the vicinity of the orebodies. These samples are represented in WUG Mine dataset (Table 2).

Based on the conceptual model of the geology (shown in Appendix A), spoil from the Willows Access Tunnel is expected to be predominantly sourced from the andesitic material. The data presented in Table 1 is considered to be comparative to the geochemistry of spoil material from current operations at Waihi (AECOM, 2018; AECOM, 2025).

The acid generating potential and trace element composition of the Willows Access Tunnel is therefore considered comparable to that currently encountered at OceanaGold’s Waihi operations based on the data collected to date.

Table 1 Geochemistry of Spoil Material – Willows Access Tunnel

Parameter	Willows Access Tunnel					Mean Concentration in Earth's Crust [1]	Geochemical Abundance Index[2]	Martha Material Abundance Index[2/5]
	n	Arithmetic Mean	Median	Minimum	Maximum			
Acid Generating Potential								
Total Sulphur (%)	48	**3.57**	**3.18**	0.01	19.1	0.03	**6**	**4-6**
Total Carbon (%)[3]	49	0.53	0.29	0.01	2.36	-	-	-
MPA (%$CaCO_3$)	49	11.2	9.93	0.02	59.6	-	-	-
ANC (%$CaCO_3$)[6]	49	6.09	4.10	0.60	22.8	-	-	-
ANC/MPA	49	8.83	0.54	0.02	12.5	-	-	-
NPR	49	4.47	0.20	0.00	7.21	-	-	-
NAG pH	49	5.10	3.10	2.00	11.1	-	-	-
Major Elements								
Aluminium (%)	19	7.50	7.48	6.01	9.69	8.2	0	0
Iron (%)	20	**4.21**	4.06	3.02	7.45	4.1	0	0
Calcium (%)	20	1.97	1.58	0.26	5.90	4.1	0	0
Magnesium (%)	20	0.99	1.06	0.32	2.20	2.3	0	0
Sodium (%)	20	0.11	0.06	0.03	0.65	2.3	0	0
Potassium (%)	20	1.63	1.74	0.44	2.81	2.1	0	**0-1**
Trace Elements [4]								
Antimony	20	**0.78**	**0.87**	0.06	1.89	0.2	**1**	**2-6**
Arsenic	20	**44.8**	**36.6**	1.95	221	1.5	**4**	**2-5**
Barium	19	210	201	90.0	412	500	0	0
Cadmium	20	**0.12**	0.10	0.02	0.27	0.1	0	**0-2**
Cobalt	20	15.0	15.5	11.5	19.3	20	0	0
Chromium	20	4.44	2.37	0.78	33.6	100	0	0
Copper	20	18.8	17.2	9.54	43.5	50	0	**0-3**
Lead	20	**17.2**	13.8	6.81	37.0	14	0	**0-1**
Mercury	20	**0.11**	**0.08**	0.02	0.51	0.05	0	**0-3**

Manganese	20	448	402	139	1,000	950	0	0
Molybdenum	20	1.34	1.25	0.74	2.59	1.5	0	**0-1**
Nickel	20	14.7	14.4	11.0	20.6	80	0	0
Selenium	20	**3.04**	**2.74**	0.15	10.1	0.05	**5**	**4-6**
Vanadium	20	111	109	79.3	167	160	0	0
Zinc	20	71.1	57.1	21.0	219	75	0	0

Notes:

Units are in mg/kg unless stated otherwise

Arithmetic Mean (and lower bound range) assumes values reported at analytical detection limit are equal to analytical detection limit

Bold - Concentrations exceed the mean value for the Earth's crust

Red - Geochemical Abundance Indices of 3 or greater

- No data or number of points insufficient to generate a meaningful value

1. Bowen, HJM, 1979, Environmental Geochemistry of the Elements.
2. Geochemical Abundance Indices - The Gardguide version 1.0 - National Institute of Acid Prevention.
3. Where Total Carbon data is unavailable, a Total Carbon value of 0.01 % was applied.
4. Trace element sample analysis was undertaken using 4-acid digestion method which is likely to result in given concentrations of volatile elements (such as mercury) being underrepresented
5. Based on Project Martha Geochemical Assessment, AECOM, 2018 and Waihi North Project Geochemical Assessment, AECOM, 2025.
6. ANC determined by titration, not derived from Total Carbon

4.2.2 WUG Mine – Multi Element Analysis

Analytical results from core representative of WUG Mine spoil surrounding the EG-Vein and the T-Stream orebodies are summarised in Table 2. The dataset includes the multi-element analysis from core samples collected from drill cores that intersect with each of the orebodies. Data from EG-Vein and T-Stream were considered comparable and therefore these datasets have been combined throughout the assessment.

When assessing the trace and major elements, arsenic concentrations (Table 2) have an elevated geochemical abundance index of 6 compared to the range observed at Waihi (geochemical abundance index of 2 – 5). Average iron concentrations at the WUG Mine (1.5 %) are lower compared to mean concentrations for the various Waihi areas (3.1 % – 6.6 %) (AECOM, 2025).

Other trace and major elements have either lower or comparable concentrations (and range) to the existing Waihi datasets outlined in both AECOM 2018 and AECOM 2025.

Table 2 *Geochemistry of Spoil Material – WUG Mine*

Parameter	WUG Mine					Mean Concentration in Earth's Crust [1]	Geochemical Abundance Index[2]	Martha Material Abundance Index[2/5]
	n	Arithmetic Mean	Median	Minimum	Maximum			
Acid Generating Potential								
Total Sulphur (%)	9,495	**0.91**	**0.84**	0.01	10.0	0.03	**4**	**4-6**
Total Carbon (%)[3]	34	0.02	0.01	0.01	0.18	-	-	-
MPA (%$CaCO_3$)	34	2.60	2.15	0.04	8.77	-	-	-
ANC (%$CaCO_3$)	34	0.73	0.40	-0.40	2.90	-	-	-
ANC/MPA	34	0.89	0.20	-0.31	8.01	-	-	-
AP (kg $CaCO_3$/tonne)	34	26.1	21.9	0.37	87.8	-	-	-
NP (kg $CaCO_3$/tonne)[3]	34	1.30	0.83	0.83	15.0	-	-	-
NNP (kg $CaCO_3$/tonne)	34	-10.6	-8.9	-86.1	81.0	-	-	-
NPR	34	0.19	0.04	0.01	2.27	-	-	-
NAG pH	34	4.10	3.80	2.70	7.30	-	-	-
Major Elements								
Aluminium (%)	9,495	3.32	4.67	0.02	14.3	8.2	0	0
Iron (%)	9,495	1.52	1.46	0.10	10.2	4.1	0	0
Calcium (%)	9,495	0.18	0.06	0.01	9.78	4.1	0	0
Magnesium (%)	9,495	0.14	0.07	0.01	2.54	2.3	0	0
Sodium (%)	9,495	0.09	0.04	0.01	1.85	2.3	0	0
Potassium (%)	9,495	**2.80**	**2.88**	0.01	7.83	2.1	0	**0-1**
Trace Elements [4]								
Antimony	14,736	**9.08**	**5.26**	0.02	460	0.2	**5**	**2-6**
Arsenic	14,773	**214**	**136**	0.50	10,000	1.5	**6**	**2-5**
Barium	10,894	323	120	0.50	3,790	500	0	0
Cadmium	10,894	0.05	0.03	0.02	0.99	0.1	0	0-**2**
Cobalt	10,894	2.46	1.90	0.10	48.1	20	0	0
Trace Elements [4]								

Parameter	WUG Mine					Mean Concentration in Earth's Crust [1]	Geochemical Abundance Index[2]	Martha Material Abundance Index[2/5]
	n	Arithmetic Mean	Median	Minimum	Maximum			
Chromium	9,495	9.62	8.00	1.00	130	100	0	0
Copper	14,736	9.08	5.26	0.02	460	50	0	0-**3**
Lead	14,773	10.9	10.2	0.50	1,230	14	0	0-**1**
Mercury	10,894	**0.19**	**0.06**	0.01	18.7	0.05	**1**	0-**3**
Manganese	10,894	0.05	0.03	0.02	0.99	950	0	0
Molybdenum	10,894	2.46	1.90	0.10	48.1	1.5	0	0-1
Nickel	10,894	2.21	1.50	0.20	74.5	80	0	0
Selenium	10,894	**0.63**	**0.50**	0.50	12.0	0.05	**3**	**4-6**
Vanadium	9,495	11.4	8.00	0.25	135	160	0	0
Zinc	14,773	25.1	25.0	5.00	510	75	0	0

Notes:

Units are in mg/kg unless stated otherwise

Arithmetic Mean (and lower bound range) assumes values reported at analytical detection limit are equal to analytical detection limit

Bold - Concentrations exceed the mean value for the Earth's crust

Red - Geochemical Abundance Indices of 3 or greater

- No data or number of points insufficient to generate a meaningful value

1. Bowen, HJM, 1979, Environmental Geochemistry of the Elements.
2. Geochemical Abundance Indices - The Gardguide version 1.0 - National Institute of Acid Prevention.
3. Where Total Carbon data is unavailable, a Total Carbon value of 0.01 % was applied.
4. Trace element sample analysis was undertaken using 4-acid digestion method which is likely to result in given concentrations of volatile elements (such as mercury) being underrepresented
5. Based on Project Martha Geochemical Assessment, AECOM, 2018 and Waihi North Project Geochemical Assessment, AECOM, 2025.

4.2.3 Statistical Analysis of Spoil Geochemistry

Spoil geochemistry datasets for the proposed Willows Access Tunnel and the WUG Mine were assessed to determine whether significant variation exists between each of the sites. The following analytes were selected due to having either elevated geochemical abundance indexes or elevated mean values compared to the Earth's crust:

- Arsenic (As);
- Iron (Fe);
- Selenium (Se); and
- Antimony (Sb).

Figure 6 to Figure 9 show the summarised results and show the distribution from highest node to lowest node: maximum / 75%ile / Median / 25%ile / minimum concentrations. Each of the box plots assumes that values reported at the laboratory analytical detection limit are equal to the analytical detection limit.

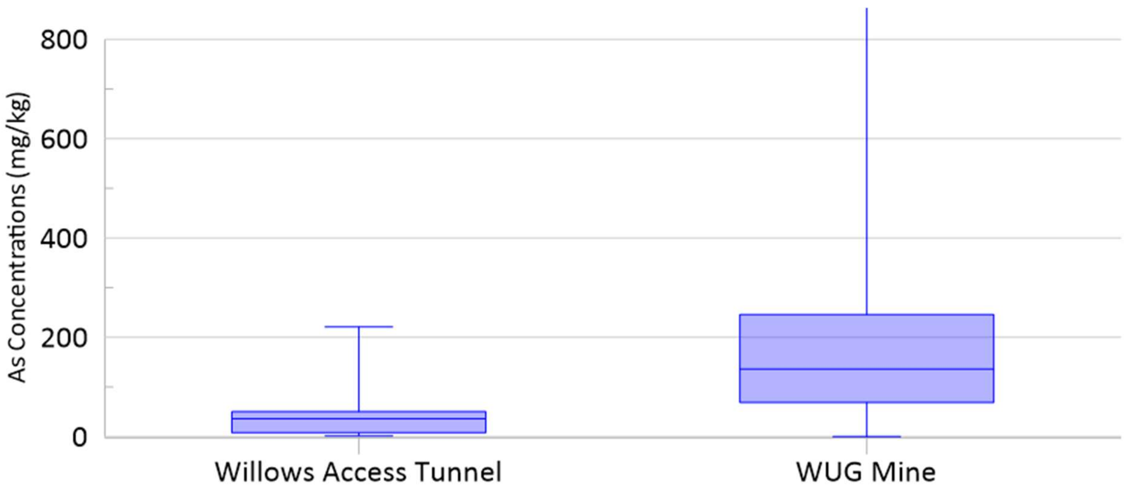

Figure 6 ***Box plot showing the concentration ranges of arsenic in spoil material***

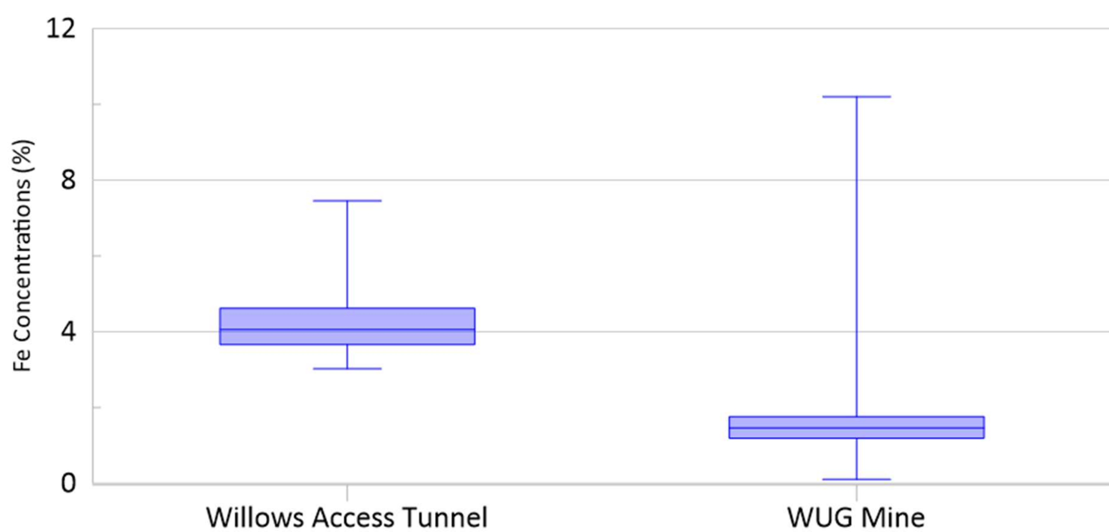

Figure 7 ***Box plot showing the concentration ranges of iron in spoil material***

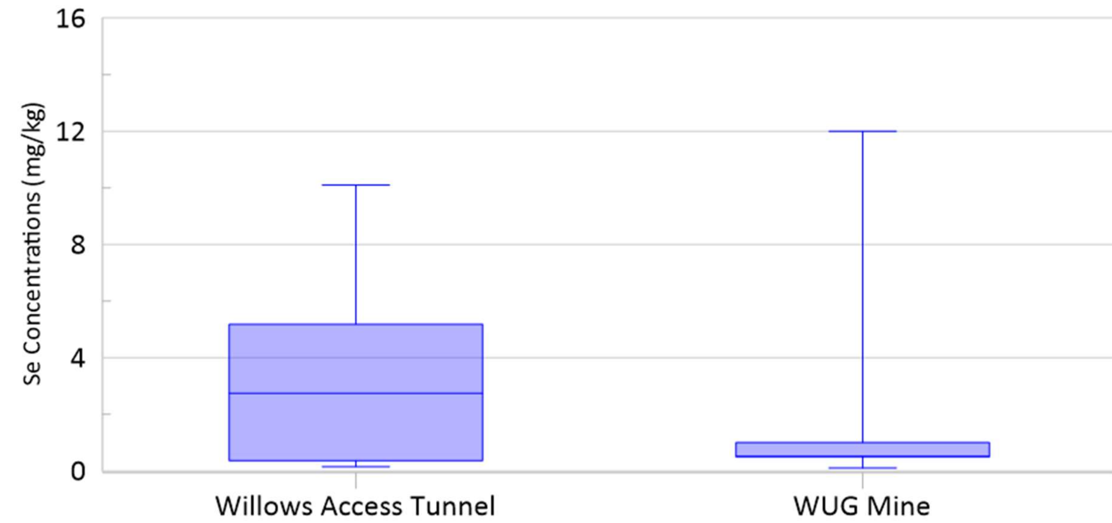

Figure 8 **Box plot showing the concentration ranges of selenium in spoil material**

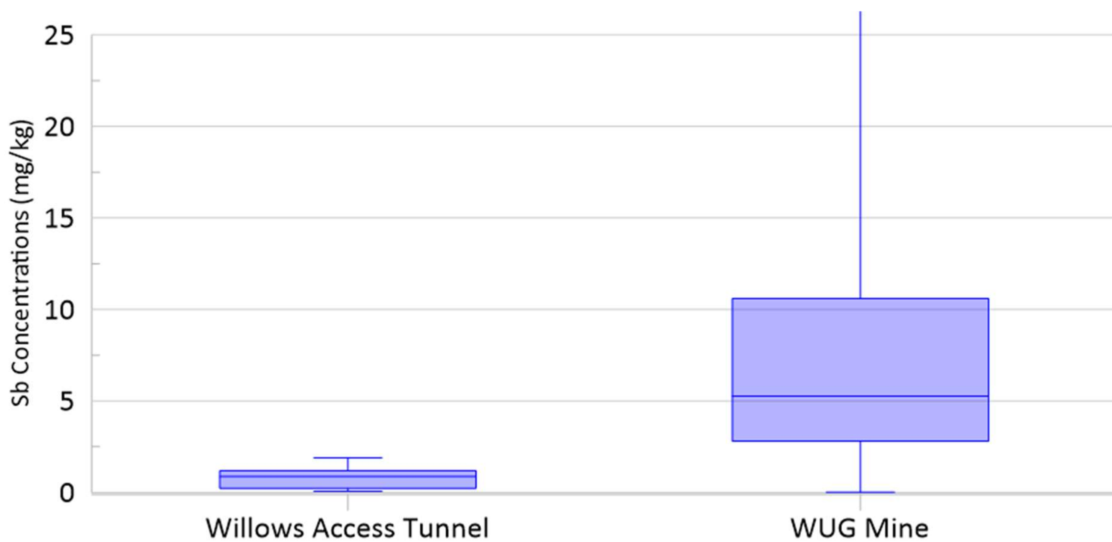

Figure 9 **Box plot showing the concentration ranges of antimony in spoil material**

The box and whisker data show that statistical variation exists between each of sites. Arsenic and antimony show elevated concentrations surrounding the orebodies while iron and selenium are comparatively depressed. Spoil material from the portal area and within the Willows Access Tunnel alignment is comparable in trace element composition currently encountered at OceanaGold's Waihi operations. The WUG Mine shows that arsenic is elevated while iron shows relatively depressed concentrations in respect to the Willows Access Tunnel and the current Martha dataset.

4.2.4 Distribution of Trace and Major Elements

An assessment of the distribution of the trace and major elements within the spoil shows that elevated concentrations are most prevalent the closer to the orebody the cores are located. Figure 10 - Figure 12 show cross section profiles of the T-Stream and EG-Vein orebodies with associated drill holes and cores showing categorised concentrations.

From Figure 10 - Figure 12 a pattern of increasing concentrations with depth (and closeness to the identified ore bodies) can be observed with the higher concentrations (signified as red and pink) focused within the rhyolitic material closest to the orebodies. This pattern is evident throughout the drillhole profiles in both orebodies.

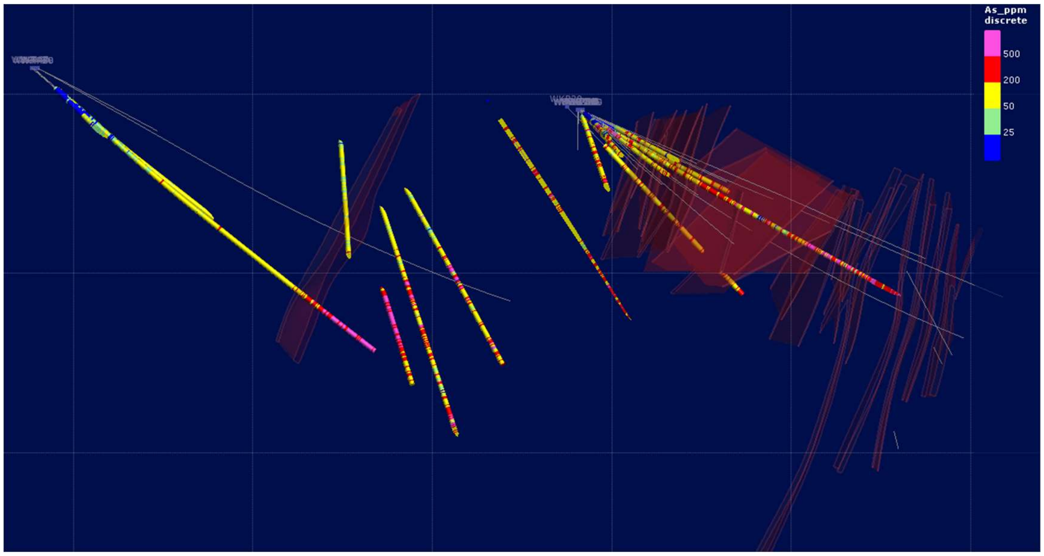

Figure 10 Cross-sectional View displaying Arsenic Concentrations for the EG-Vein (right) and T-Stream (left) Orebodies

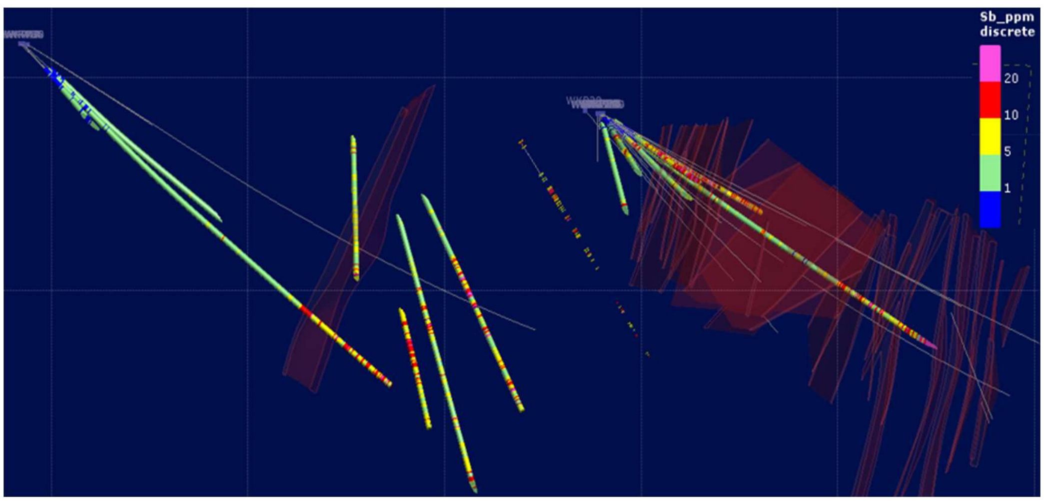

Figure 11 Cross-sectional View displaying Antimony Concentrations for the EG-Vein (right) and T-Stream (left) Orebodies

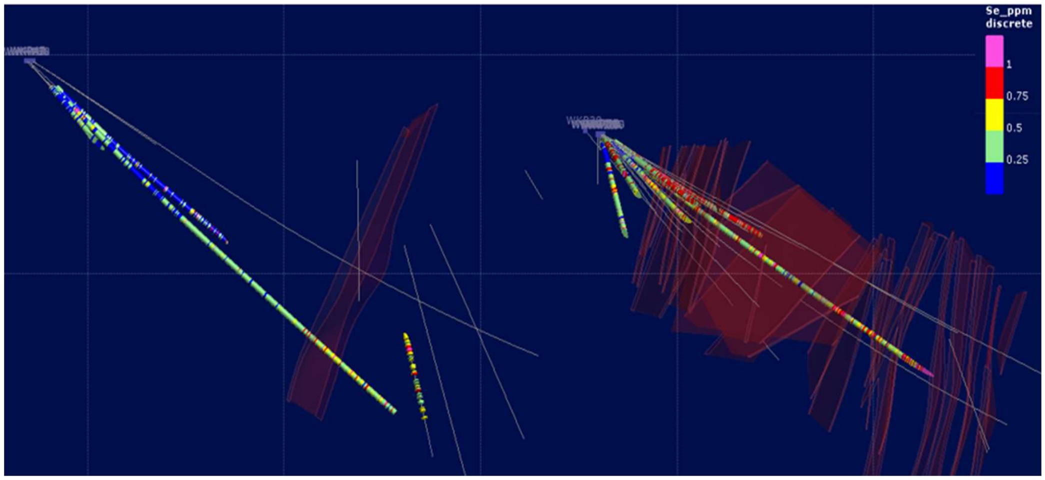

Figure 12 **Cross-sectional View displaying Selenium Concentrations for the EG-Vein (right) and T-Stream (left) Orebodies**

4.3 Spoil Acid Generating Potential

4.3.1 Static Testing

Similar to the trace and major elements, datasets relating the acid generating potential of the spoil associated with the Willows Access Tunnel and the WUG Mine were assessed to determine whether significant variation exists between the each of the sites. Data for the WUG Mine is combined (both EG-Vein and T-Stream) based on there being no significant observed differences in the datasets between these two areas.

- Sulphur (S); and
- Acid Neutralising Capacity (ANC).

Figure to Figure 14 show the summarised results show the distribution from highest node to lowest node: maximum / 75%ile / Median / 25%ile / minimum concentrations.

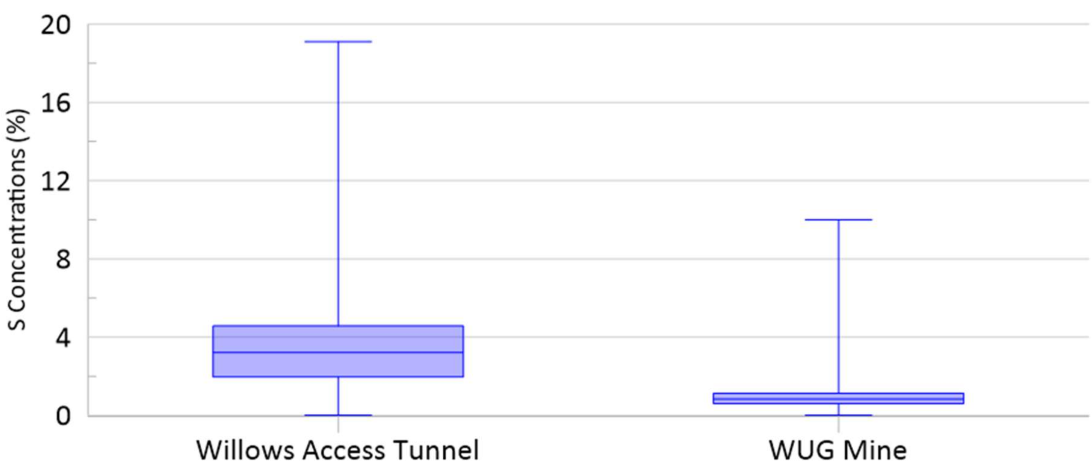

Figure 13 **Box plot showing the concentration ranges of sulphur in spoil material**

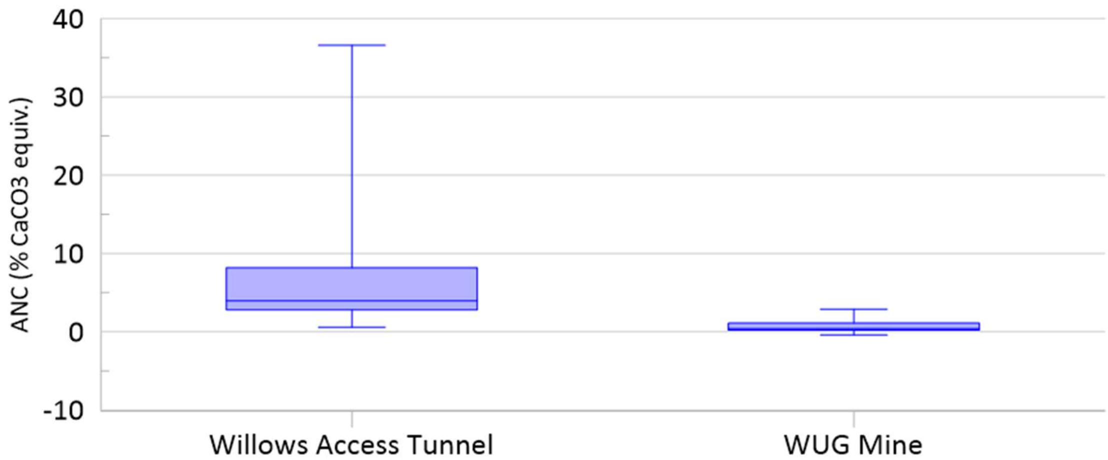

Figure 14 ***Box plot showing the acid neutralising capacity in spoil material***

Figure 13 shows that data associated with the WUG Mine has a significantly lower mean sulphur concentration of 0.91 % when compared to the Willows Access Tunnel dataset (mean concentration of 3.57 %). Moreover, sulphur concentrations for Willows Access Tunnel are comparable to the current Waihi dataset (AECOM, 2018; AECOM, 2025) which ranges from 0.1 % to 3.0 %. It should be noted that the geochemical abundance index for WUG Mine still has a value of four which is on par with the lower limits of the existing Waihi dataset (Table 1 and Table 2).

Similar to the trace and major elements, the distribution of sulphur in Figure 15 shows a pattern of increasing concentrations for sulphur with depth or within the rhyolitic material closest to the orebodies.

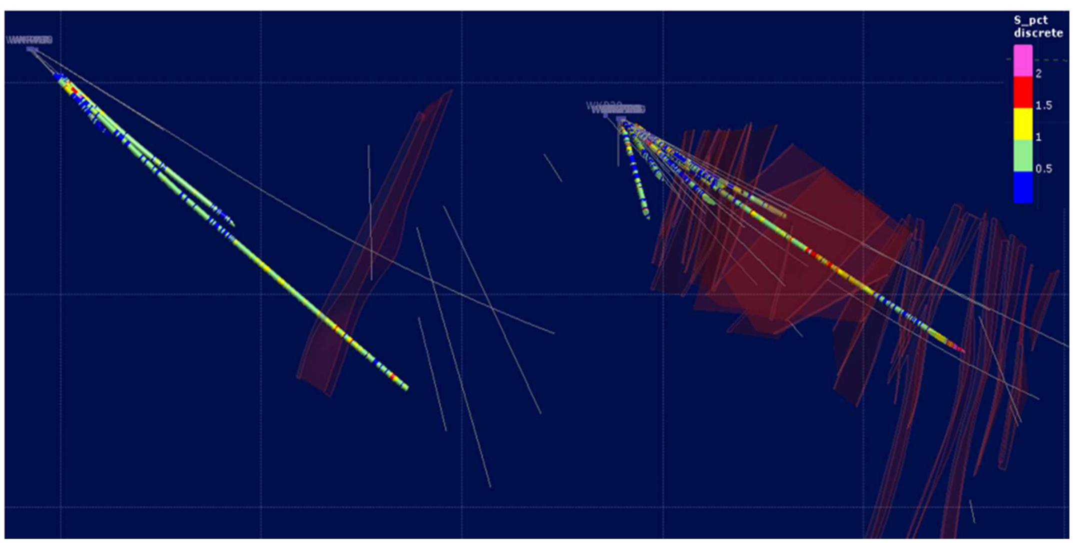

Figure 15 ***Cross-sectional View displaying Sulphur Concentrations for the EG-Vein (right) and T-Stream (left) Orebodies***

ANC values derived from core representative of the Willows Access Tunnel are comparable to the Waihi dataset. AECOM (2025) noted that historic overburden concentrations for the Waihi Martha material had a mean ANC value of approximately 6.0 % $CaCO_3$ equiv. ANC values derived from core representative of the WUG Mine are depressed when compared to the Willows Access Tunnel (mean values of 0.73 % $CaCO_3$ equiv. and 6.09 % $CaCO_3$ equiv. respectively). AECOM (2025) noted that historic overburden concentrations for the Waihi Martha material had a mean ANC value of approximately 6.0 % $CaCO_3$ equiv. which is comparable to ANC values observed within the Willows Access Tunnel.

The ABA data is visualised on Figure 16 which assesses the likelihood of the spoil material to be acid generating based on the net acid generation (NAG) pH and the neutralisation potential ratio (NPR) (GARD, 2021). The data shows that the majority of the spoil is currently categorised as potentially acid forming (PAF). The vent shaft material appears less acid producing than the Willows Access Tunnel alignment data and the WUG Mine data. When looking at the data in the context of depth to surface, core representative of the Willows Access Tunnel alignment and the WUG Mine spoil generally appears more susceptible to oxidation and the generation of ARD compared to material representative of the vent shaft. The PAF characterisation of the Willows Access Tunnel alignment is likely a function of the oxidised state of the rock, with material closer to the surface being more oxidised than the deeper material whereas the WUG Mine spoil is likely a function of the rhyolitic material closest to the orebodies.

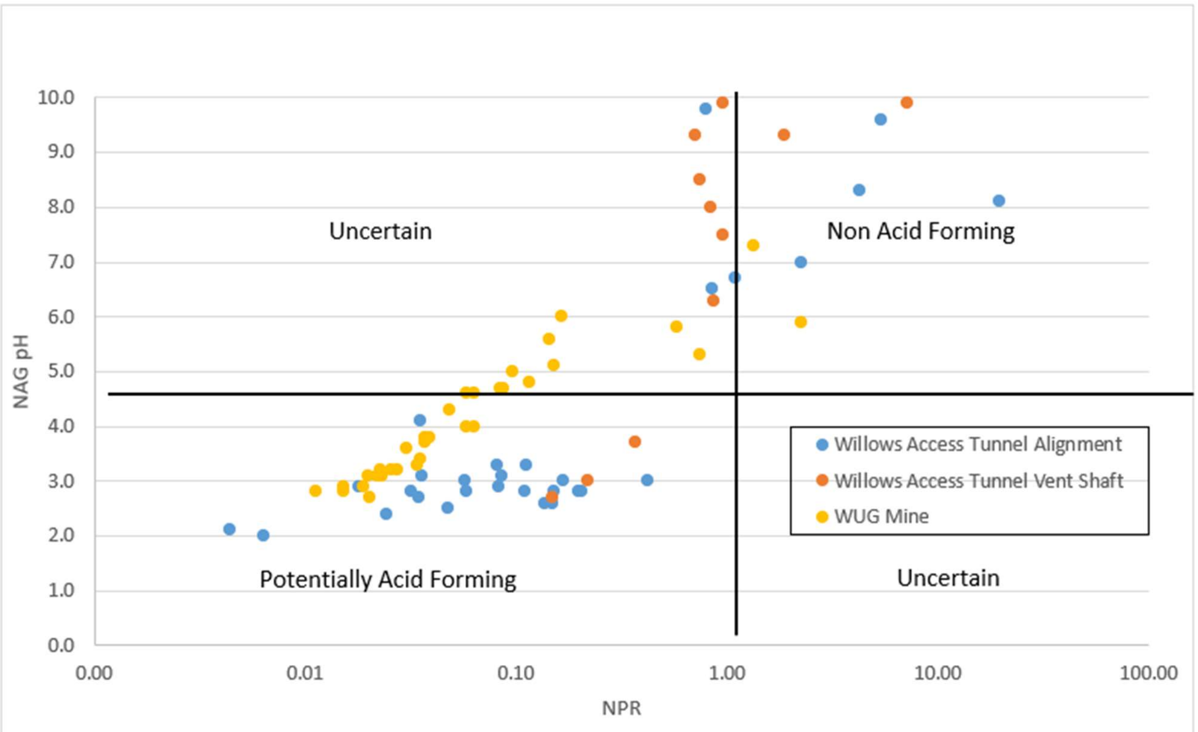

Figure 16 NPR/NAH pH Diagram for WUG Mine and Willows Access Tunnel

4.3.2 Column Testing

The purpose of the column tests is to investigate the onset of acid producing conditions and leachate water quality from the spoil material associated with the WUG Mine. Column testing was considered necessary to determine any geochemical differences in spoil leachate between WUG Mine spoil and the existing Waihi dataset, to provide greater confidence in the water quality predictions and, should there be any difference, provide guidance as to any amendments required to the current waste management practices.

Three separate columns were set-up on site using core material representative of waste rock and/or access tunnel/stope lining material from the WUG Mine. One column consists of material surrounding the T-Stream Vein (Drill Site 2) and two columns consist of material associated with the EG-Vein (Drill Site 4 (Northern area) and Drill Site 1 (Southern area) (Figure 5). Full column specifications are described in Appendix B.

The rock sample selection criteria were based on the following:

- Core intervals were selected from cores spatially distributed across the projected areas of interest;

- Core intervals that contained concentrations of gold (where existing data was available) and veins of highly silicified zones were excluded;
- Core intervals logged as not having an ‘Argillic’ or strong clay alteration were excluded; and
- Core intervals logged as heavily weathered or, displaying prevalent oxidation were excluded.

Figure 17 shows a visual comparison of some of the sample cores selected for column testing.

Figure 17 ***Visual comparison between selected core samples utilised for column testing***

These columns were set up at OceanaGold’s existing operations at Waihi in October 2021. Results are included in Appendix B.

6. Spoil Management

A single rock stack with a footprint of 6.48 ha will be required to be constructed to store tunnel and mine spoil at Willows Road Farm. The temporary WRS is proposed to be constructed in a valley to the south of the portal area at Willows Road Farm as shown on Figure 18. The WRS will be built in a manner that will limit the oxidation of PAF material stored within and will be progressively built over the duration of the tunnelling activities.

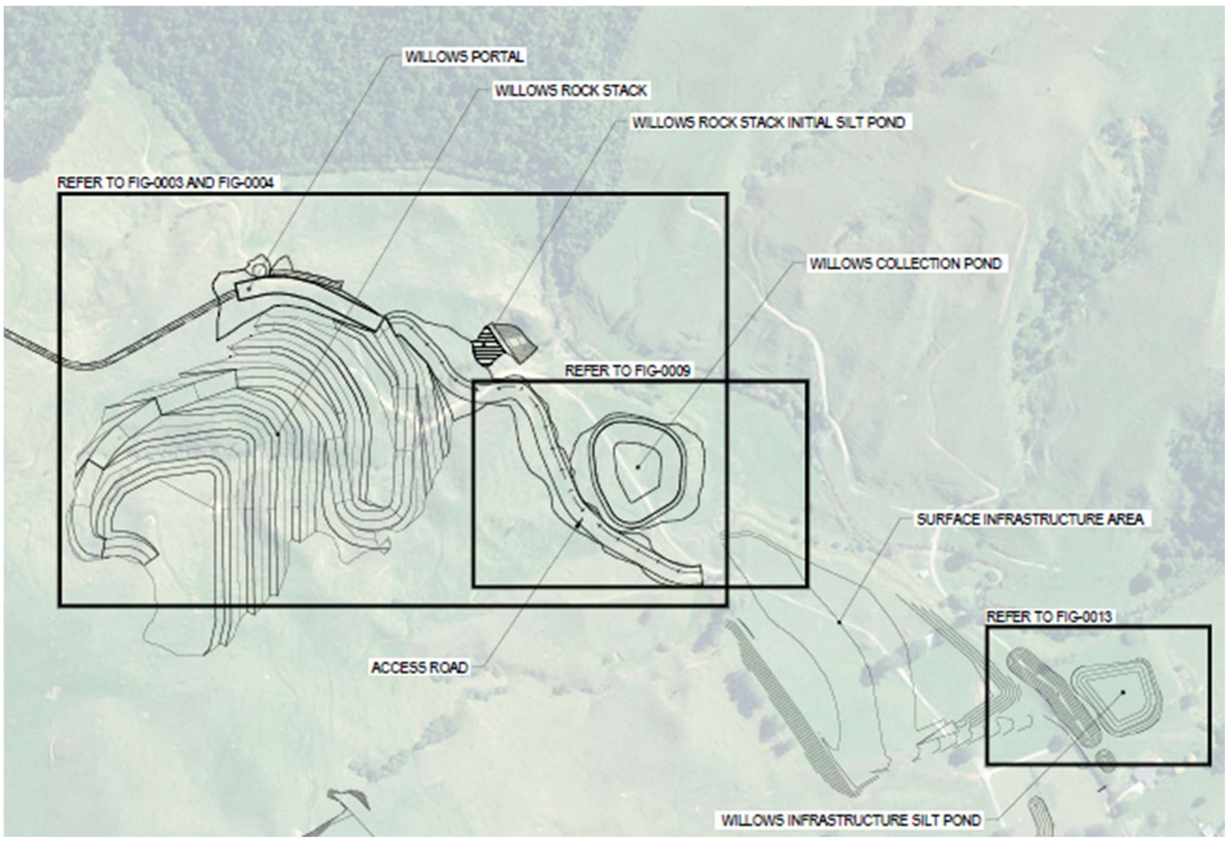

Figure 18 WRS and Collection Pond Outline (from EGL, 2025)

It is assumed the working area of the WRS is proportional to the tunnel spoil produced as per the provided production schedule. Eventually the spoil within the WRS will be returned to the tunnel as backfill. The assumed WRS development is outlined in Figure 19.

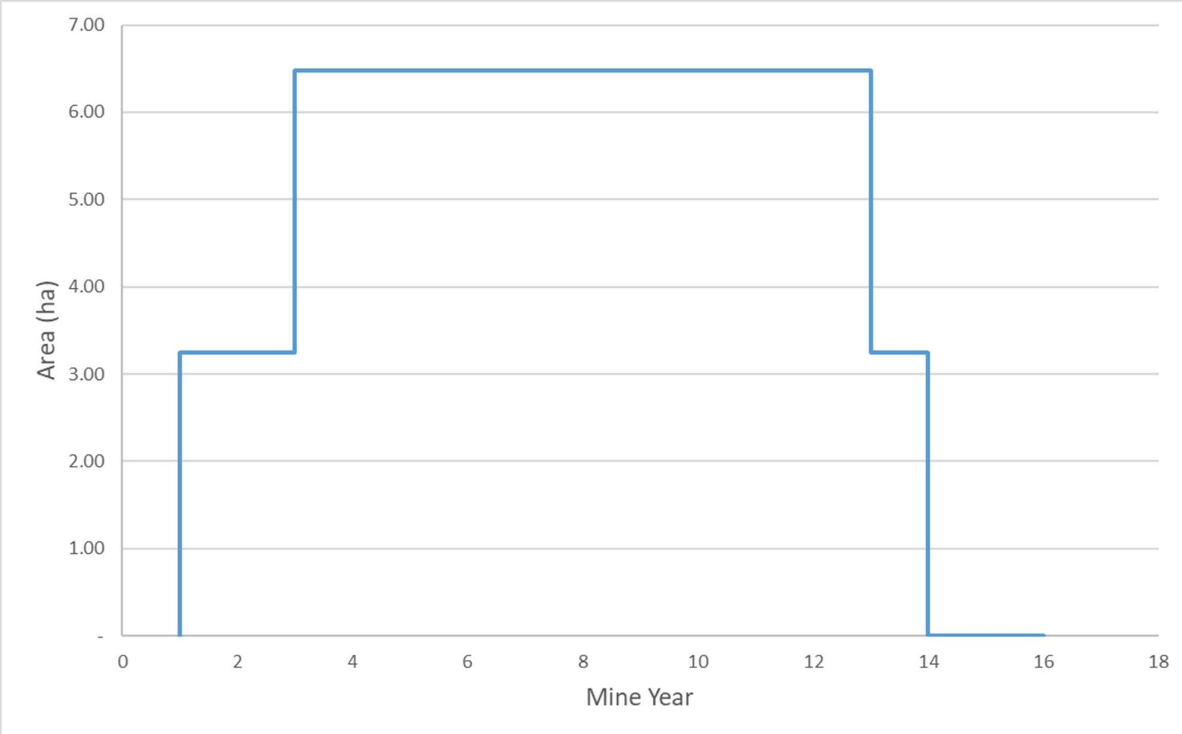

Figure 19 WRS Development

All WRS runoff and collected seepage will be collected in collection ponds and pumped to Waihi for treatment at the existing WTP. As the available dataset is expanded, consideration will be given to the segregation of non-acid forming (NAF) material should it be present.

6.1 General Management Philosophy

To ensure appropriate geochemical management of PAF spoil and to reduce potential effects on water quality, the implementation of an appropriate spoil management strategy is required. Commonly used methods for the management of mine spoil that have the potential to mitigate adverse effects to water quality include:

- Oxidation control – Control of oxygen flux to reactive sulphides, such as by deposition under water or through the application of low permeability layers;
- Geochemical control - Blending rock types or addition of neutralising materials to control pH and oxidation rates; and
- Hydrological control - Placement of low permeability layers, evapotranspiration layers and spoil management structures to control the potential leaching rate from the disposal facility.

OceanaGold has utilised a combination of these methods to effectively manage spoil at its Waihi operations to date and it is envisaged that management of rock sourced from the Willows Access tunnel and WUG Mine will employ similar methods. The means of minimising acid generation of the spoil from the WUG development is likely to include:

- Limiting exposure time of spoil between excavation and disposal to the WRS;
- Blending and/or layering the spoil with limestone, in order to prevent the onset of acidification where the specific acid forming characteristics of the material being excavated suggest that the material is at risk of producing ARD;

- Compaction of placed spoil material in the WRS to reduce permeability, limiting oxygen and water ingress; and
- Covering PAF spoil with NAF material to sufficient thickness to limit oxygen ingress to the encapsulated PAF material.

The design of the WRS is outlined in EGL (2025)and will be constructed with the above principles in mind. These principals are implemented at OGNZL current Waihi operations and have proven to be successful throughout the mine's operations.

7. Water Quality

Based on the current geochemical dataset outlined in Section 4, the geochemistry of the Willows Access Tunnel is deemed to be not significantly different from what has been previously observed from OceanaGold's Waihi operations. The WUG Mine data however, does show some variation and therefore a conservative approach to water quality predictions has been applied. As the spoil within the WRS at Willows Farm will be dominated by the Willow Access Tunnel, it is considered that runoff and leachate water quality will therefore likely be in line with what has been observed at the current Waihi operations. Data from the field column tests can be utilised to inform differences in leachate characteristics and inform amendments to the rock management when it is available.

It is considered that in general, water (ground and surface) interacting with PAF rock material will require treatment before discharge to the receiving surface water environment.

The quality of water requiring treatment has been estimated for representative WRS seepage, WRS active area runoff and dewatering water from the Willows Access Tunnel and WUG Mine. Water quality from these respective sources have been derived from monitoring data from the operational mine at Waihi and other available data. The water qualities derived here are utilised in the Water Balance assessment which takes into account the water treatment capacity and availability, trace element removal rates and consented discharge requirements. This assessment is detailed in Waihi North Water Management Assessment (GHD, 2024).

It is considered that the water quality data from the Waihi operations is reflective of water quality associated with the Willows Access Tunnels due to similarities in the whole rock trace element concentrations. However, due to the nature of the host rock and observed geochemical differences associated with the WUG Mine it is possible that the concentrations of some elements may differ. A conservative approach has therefore been applied to account for uncertainty in the contaminant concentrations and acid producing potential from the WUG Mine. Comparative datasets from OceanaGold's Waihi operations have been utilised and the 95%ile concentrations from monitoring data records have been utilised. This approach allows for likely variability in actual runoff, seepage, and inflow water quality, while also capturing periods where monitoring data suggests the waste stream has a higher trace element load. Ultimately, leachate data from the on-site column tests comprising material from the WUG Mine (when available) can be utilised to refine these numbers.

Runoff Water Quality

It is considered that existing water quality data from collection ponds associated with embankments at the active tailings facilities at Waihi (TSF1A), temporary spoil storage areas and the water treatment plant (WTP) area is likely to be representative of water quality associated with runoff from the active WRS at the WUG portal site.

Seepage Water Quality

It is considered that seepage water quality from the TSF1A embankment is likely to be representative of water quality associated with seepage from the active WRS at the WUG portal site owing to inferred similarities between Martha spoil, from which the TSF1A embankment is constructed, and Willows Access Tunnel. The 95%ile from the dataset is utilised to allow for geochemical differences and geological variation. The following design components are assumed:

- Leachate drains;
- Naturally or engineered liner;
- Spoil placed in small, compacted lifts; and

- Capping (with NAF material) and rehabilitation.

Willows Access Tunnel and WUG Mine Inflow Water Quality

The data presented in Table 4 illustrates the considered conservative estimates required to assess both the water treatment requirements and the impact on the receiving environment and has been sourced from the operational water quality monitoring. The Willows Access Tunnel will likely intersect areas of lower mineralisation and portions of the Willows Access Tunnel are expected to be lined with grout / shotcrete to limit groundwater inflow in high inflow zones (i.e., fracture zones). This will likely introduce alkalinity into the discharge water and will, to some degree, provide some buffering capacity to AMD affected waters. This has not been considered within this assessment, however, it is noted that the mine water from the MUG also includes similar influences.

Underground dewatering water quality data for Waihi mine operations is assumed to be representative of potential water quality of groundwater inflow to the Willows Access Tunnel due to the similarity in geology and host rock between the sites. This assumption may not hold for the WUG Mine portion; however, it is considered that utilising the 95%ile of the Waihi dewatering data provides sufficient conservatism to account for geochemical differences observed. The relative volume of water from the WUG Mine compared to the Willows Access Tunnel is also small which adds in additional conservatism to the estimates provided. This is considered appropriate given that the Waihi dewatering water is exposed to significant areas of underground workings and backfill areas, resulting in elevated trace element concentrations in water, whereas the oxidation profile of the Willows Access Tunnel walls is expected to be small in comparison.

Field Column Derived Inflow Water Quality

WUG field column data (Refer Appendix B) has been used to validate the assumptions made for deriving WUG Mine inflow water quality. Antimony, arsenic, selenium, and sulphur have been found to be elevated in the WUG spoil relative to the Martha dataset (Table 3) therefore these elements have been the focus of the field column leachate data. Antimony and selenium were found to not be significantly elevated in the field leachate data (relative to the high sulphate oxidation rates observed), however significantly elevated sulphate and arsenic leachate concentrations were observed (Appendix B). Based on these observations, the field column results have been utilised to predict WUG Mine inflow water quality for arsenic and sulphate to compare to the Waihi Dewatering derived water quality (Table 4). This ensures that the infiltrating groundwater used within the water balance model (GHD, 2025) is appropriate.

To reflect the differences in rock mineralogy, the findings of WUG spoil field column leachate data has been used as the basis for predicting sulphate and arsenic concentrations of WUG inflow (Refer Table 4) using the following methodology:

1. Field column sulphate oxidation rates (mg SO_4/kg/day) have been calculated for the acidity producing columns (defined as when leachate pH <3);
2. The total exposed area within the WUG tunnel walls has been estimated based on oxidation profile, roughness;
3. The calculated sulphate oxidation has been factored to account for differences in the mean spoil NAPP and the field spoil NAPP;
4. The total volume of daily oxidation products has been calculated based 1 and 2;
5. The sulphate concentration is calculated based on the daily total expected WUG tunnel inflow water (WWLA, 2024) and the daily total oxidation products;
6. The column leachate arsenic / sulphate relationship was determined
7. Based on 5 and 6, the derived WUG tunnel inflow arsenic concentration was calculated. .

The methodology as outlined is considered conservative as it assumes all oxidation products are mobilised daily and that the tunnel walls are represented by WUG mine spoil along its entire length. The column leachate sulphate and arsenic relationship is provided in (Figure 20).

Utilising this methodology, the predicted WUG tunnel inflow sulphate concentration was estimated at 872 mg/L and the predicted arsenic concentration of the leachate is estimated at a concentration of 0.050 mg/L (Table 3). The column derived arsenic concentration compares well with the derived arsenic concentration based on the 95th percentile Waihi dewatering data – 0.036 mg/L (Table 4). Calculated sulphate and arsenic concentrations based on conservative sensitivity parameters (Spoil NAPP concentration, tunnel roughness factor, oxidation profile depth, PAF fraction of tunnel exposed walls and inflow volume of water) are up to 2,958 mg/L and 0.374 mg/L respectively (Table 3) and likely represent the upper bounds of the tunnel and mine inflow water.

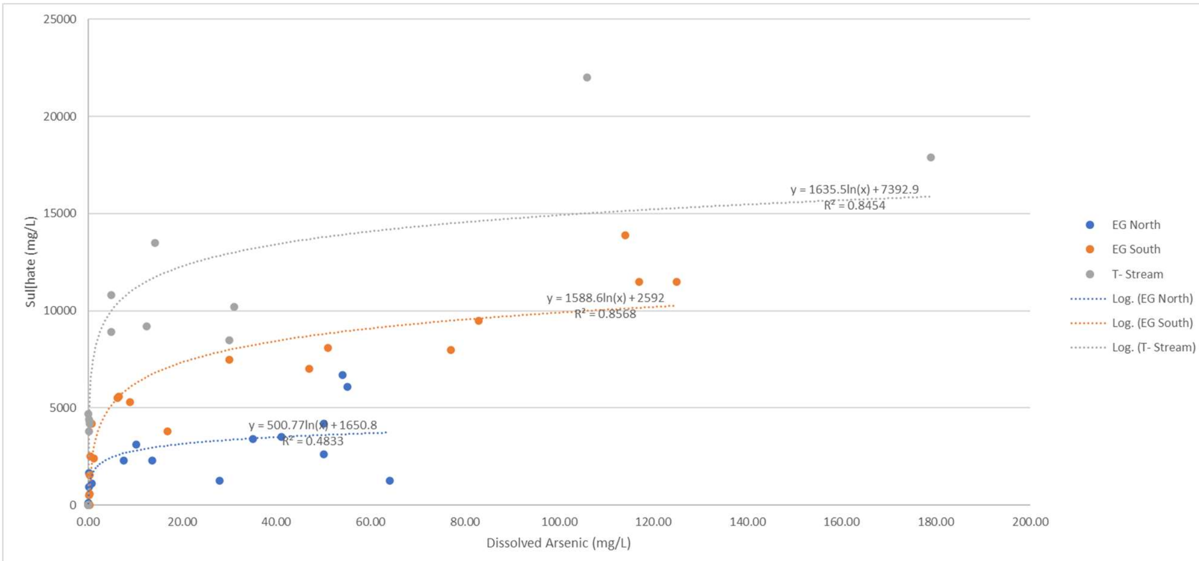

Figure 20 ***Column sulphate / arsenic leachate relationship***

Table 3 ***Predicted sulphate and arsenic concentrations based on column sulphate generation rate***

		Column Data	Predicted Flow med O2 profile Mean	High Flow med O2 profile Mean	Predicted Flow med O2 profile 95%ile	Predicted Flow High O2 profil Mean	Predicted Flow med O2 profile Mean	Predicted Flow med O2 profile Mean
			Sulphate Generation Rate (mg SO4/kg/day)					
NAPP Column mean	H_2SO_4	25	33	33	33	33	33	33
NAPP Spoil mean	H_2SO_4	18	24	24		24	24	24
NAPP Spoil 95%ile	H_2SO_4	61			80			
Length of tunnel*	km		11	11	11	11	11	11
Tunnel Roughness Factor			5	5	5	5	10	5
Area per m	m2		118	118	118	118	236	118
Total surface area	m2		1,298,000	1,298,000	1,298,000	1,298,000	2,596,000	1,298,000
Oxidation Profile	m		0.2	0.2	0.2	0.3	0.2	0.2
Total oxidising area	m3		259,600	259,600	259,600	389,400	519,200	259,600
Vol of water*	m3/day		7,417	22,475	7,417	22,475	7,417	22,475
Vol/tonne (in-situ)			2.1	2.1	2.1	2.1	2.1	2.1
Percentage PAF	%		0.5	0.5	0.5	0.5	0.5	0.75
Tonnes of oxidising material	t		272,580	272,580	272,580	408,870	545,160	408,870
Sulphate generation per day	kg		6,464	6,464	21,942	9,696	12,928	9,696
SO4 concentration	mg/L		872	288	2,958	431	1,743	431
As Concentration	mg/L		0.050	0.029	0.374	0.033	0.116	0.033

*Based on assumed inflow as per WWLA, 2024 and assumed dual tunnel length between Willows Farm and WUG Mine (5.5 km *2). Calculated oxidising volume and water inflow is proportional at any length
#Highlighted values depict the sensitivities applied

When considering the conservatism built into the predicted arsenic concentration (from column leachate data), the generally depressed field column leachate concentrations of other WUG spoil elevated elements (relative to Martha) and the lower concentrations of other trace elements in the WUG soil dataset compared to the Martha dataset, the assumed water quality dataset adopted for water balance modelling in Table 4 is considered representative and suitable for use in the site wide water balance model.

Table 4 Assumed Water Quality Dataset from Waihi

Source	Statistic	Model Input	pH (pH Units)	Nickel Dissolved	Selenium Dissolved	Copper Dissolved	Arsenic Dissolved	Lead Dissolved	Antimony Dissolved	Aluminium Dissolved	Mercury Dissolved	Zinc Dissolved	Sulphate	Iron Dissolved	Manganese Dissolved
TSF1A Seepage	Median	RS Seepage	6.3	0.004	0.001	0.001	0.001	0.0001	0.0002	0.01	0.00008	0.02	194	0.04	0.56
TSF1A Seepage	95%ile[1]	RS Seepage	5.4	0.300	0.005	0.003	0.003	0.0004	0.0050	0.33	0.00054	0.19	2,400	19	48
Waihi Dewatering	Median	Infiltrating Ground	7.3	0.020	0.009	0.001	0.010	0.0002	0.0067	0.02	0.00008	0.32	1,550	27	9
Waihi Dewatering	95%ile[1]	Infiltrating Ground	6.7	0.079	0.009	0.011	0.050[2]	0.0046	0.0107	0.05	0.00008	1.21	1,780	62	10
Collection Ponds	Median	RS Runoff (Development)	7.2	0.100	0.001	0.001	0.001	0.0001	0.0010	0.10	0.00008	0.01	93	0.02	0.35
Collection Ponds	95%ile[1]	RS Runoff (Development)	6.7	0.194	0.001	0.001	0.001	0.0001	0.0010	0.19	0.00008	0.02	492	0.07	1.69

Notes:

Units are in mg/L unless stated otherwise.

[1] Given pH is based on the 5th percentile

[2] Reflects calculated mean concentrations in Table 3.

8. Conclusions

Antimony, arsenic, selenium, and sulphur concentrations are elevated (geochemical abundance indexes of greater than three) in the spoil from both the Willows Access Tunnel and spoil associated with the WUG Mine. With the exception of arsenic, the geochemical abundance indexes for the Willows Access Tunnel, the WUG Mine and the existing Waihi dataset, exhibit similar ranges. Based on the available data, the WUG Mine area has a higher average arsenic concentration and geochemical abundance index and a lower average iron concentration compared to the Willows Access Tunnel and the existing Waihi dataset. Similar to the current operations at Waihi, element enrichment and a greater abundance of trace elements is apparent in both the rhyolitic and andesitic spoil material as depth increases.

The acid-generating potential data for spoil from the Willows Access Tunnel and WUG Mine suggests that the spoil has similar low ANC values compared to the existing Waihi dataset and may result in acid generation and leaching of trace elements unless appropriate control measures are implemented.

Appropriate management of the spoil material (from the Willows Access Tunnel and the WUG Mine) is crucial to limit potential impacts on the surrounding environment and to limit the volume of water requiring treatment. Based on existing operations at Waihi, OceanaGold has utilised a combination of methods to effectively manage spoil. It is envisaged that management of spoil sourced from the Willows Access Tunnel and WUG Mine will employ similar methods. The means of minimising acid generation of the spoil from the WUG development should consider:

- Limiting exposure time of rock between excavation and disposal to the WRS;
- Blending and/or layering the rock with limestone, in order to prevent the onset of acidification where the specific acid forming characteristics of the material being excavated suggest that the material is at risk of producing ARD;
- Compaction of placed spoil material in the WRS to reduce permeability, limiting oxygen and water ingress; and
- Covering PAF spoil with NAF material, of sufficient thickness to limit oxygen ingress to the encapsulated PAF.

Water quality predictions are based on $95^{\%}$ile data from the current Waihi operations. This is considered appropriate when considering the similarities between the geology of Waihi and the Willows Access Tunnel and WUG Mine, and proposed spoil management practises, but also takes into account the observed geochemical differences (i.e., increased arsenic concentration in the WUG Mine geochemical dataset). Leachate data from field columns utilising rock from the WUG Mine have enabled comparison to the derived WUG inflow water quality. The comparison suggests the assumed water quality dataset adopted for water balance modelling is considered appropriate for use in the water balance model which takes into account the water treatment capacity and availability, trace element removal rates and consented discharge requirements.

Additional trace element and ABA data collection and analysis will enable further characterisation and a refinement of this assessment.

9. References

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Appendices

Appendix A

Conceptual Geological Model –Access Tunnel Alignment

19 August 2020

Rory McNeil
Project Manager
OceanaGold Limited

Our ref: 125/336/58

Your ref:

Dear Rory

WKP Exploration Tunnel - Water Assessment
Conceptual Geological Model Data Report: August 2020

1 Introduction

1.1 General

GHD Limited have been commissioned by OceanaGold New Zealand Limited (OGL) to provide a preliminary Conceptual Geological Site Model (CSM) for the proposed underground exploration tunnel from a tunnel portal located on the Willows Farm block directly north of Waihi township, extending northward for approximately 7 km to terminate underground in the vicinity of the Wharekirauponga (WKP) Stream (referred to as the WKP Tunnel). The development of a CSM is required to provide an initial interpretation of the ground conditions along the alignment of the tunnel to support both the surface water and groundwater assessments of effects associated with the proposed WKP Tunnel.

1.2 Scope of Conceptual Geological Site Model

The scope of the CSM was to develop a high level geological model. Due to a limited amount of engineering geological subsurface data, no interpretation of engineering geological conditions has been completed at this time. The model has been developed for the following end-use requirements:

- To support high level 2D groundwater modelling by others (GWS): along tunnel alignment
- To support high level surface water and surface water geochemistry modelling

As such, the following features have been given focus:

- Significant faults / lineaments that are identifiable from surface mapping – likely to locally effect subsurface permeability's and hydrothermal alteration/mineralisation
- Known rock-water hydrothermal alteration zones, with focus given to those that have an effect of groundwater permeability values (argillite sequences and silicification/quartz replacement).

1.3 Data Sources

1.3.1 Used data

The development of the ground model has made use of the following data sources:

- 1:50,000 GNS Geological Map “Geology of the Waihi Area, map 21, 1996”
- Historical Aerial Photographs (1940’s and 1960’s, 1:16,000 set (GHD Sourced)
- LiDAR generated Digital Elevation Model, 0.1 m vertical resolution (OGL sourced)
    - Rendering of hill shade and topographic contour sets by GHD
- Geochemical surface field mapping shape files, corresponding alteration halos (OGL sourced)
    - Simplification of data into broader regions of alteration by GHD
- Proposed route alignment (OGL supplied)

1.3.2 Unused Data

Data made available to GHD that has not been used for the development of the CSM is as follows:

- Window Sample 005 and 006 boreholes (OGL supplied)
    - Referred to for general interpretation of ground conditions. To be included within future developments of geological model when made into a 3D dataset.
- CSMAT survey lines (OGL Supplied)
    - Referred to for general interpretation of ground conditions and presence of faulting however seen as being located too far west, south and east of the proposed site to be extrapolated reliably.

1.4 Datum and Scale

1.4.1 Datum

The data supplied to GHD from OGL has been recorded to the following projection and datum. GHD has produced the CSM to the same datum and projection:

- Map Projection: New Zealand Map Grid (NZMG)
- Datum: New Zealand 1949

1.4.2 Scale

Surface Maps

The topographic scale shown on the maps (see section 1.6 below) is 1:8,000.

The lithological data shown on the maps is based off the 1:50,000 scale mapping undertaken by GNS (see section 1.3.1 for map reference).

Tunnel Long Section

The scale on the tunnel long-section (see section 1.6) is 1:2,500.

1.5 Assumptions and Interpretations

The following geological assumptions and interpretations have been made during the development of the CSM:

- Mapped structural features (faults, lineaments) have been classified per the orientation of their trend line.

- North-east orientated faults or lineaments represent extensional/normal displacements (where displacement is inferred) and generally dip to the north-northwest. This inference is made based on general knowledge of the structural relationships of the region, as well as various anecdotal level conversations with the OGL and supporting consultants.
    - Dip has been set at 60°
- South-east, east-west and north-north-west (i.e. south-south-east) orientated lineaments have been inferred to dip vertically/ near vertically. This is under the presumption that the local stress field within the region would see these orientations typically comprising more strike-slip displacement as opposed to extensional displacement.
- Faults or lineaments with surface exposures that project further than several hundred meters across the ground have been inferred to extend to significant depths and therefore have been extrapolated to the boundaries of the long-section. Where this is not the case, the lineaments have been extended a nominal 200 – 250 m depth below ground.
- Lithologies shown on the CSM are taken directly from the 1:50,000 GNS Waihi area map with the following simplifications made:
    - Tauranga Group and Whitianga Group Deposits that outcrop at the southern end of the map series have been grouped into a single unit
    - Ryolite and tuff eruptive sequences outcropping at the northern end of the map series have been grouped into a single unit, "Coroglen Subgroup"
- Standard relative stratigraphical relationships have been observed for the lithology shown, based on the ageing data for the various units presented by the 1:50,000 GNS Waihi area map
- Geochemical surface mapping data supplied by OGl has been simplified to show only the significant argillic alteration zones, and zones were strong quartz replacement (silicification) has been recorded.
    - The relatively large halos of smectite alteration have been assumed to represent predominantly surficial weathering processes however this is unconfirmed. As such, the projection of this zone within the long-section remains shallow.
    - Illite-smectite and silification mapped zones have been inferred to be more directly controlled by subsurface hydrothermal upwelling's (based on typical hydrothermal epithermal mineral assemblages known for the Waihi region), and as such to be fault-controlled. Accordingly, they have been projected below ground to be orientated to the dominant structural fabric (NE orientated, NW dipping).
    - Some extrapolation and inclusion of geochemical alteration zones has been made by GHD based on interpretation of surface features identifiable from review of historical aerial photographs).
- The lithological contact and distinction between Waipupu Formation Andesite and Whiritoa Andesite has been extended from the interpretation of thse units per the mapped 1:50,000 GNS Waihi geology. In reality, we expect these two units to be largely monolithic.

1.6 Output

The CSM is given is presented in the following outputs:

- Surface 1:8000 scale Geological Map Series
- 1:2500 scale 2D tunnel long-section (project looking west)

GHD is able to provide, on request and at the permission of OGL, the following supporting data:

- Shape files and map files associated with all geological features shown on the above outputs

1.7 Limitations

This report has been prepared by GHD Limited for OceanaGold New Zealand Limited and may only be used and relied on by For OceanaGold New Zealand Limited for the purpose agreed between GHD and For OceanaGold New Zealand Limited as set out in Section 1.0 of this report.

GHD otherwise disclaims responsibility to any person other than for OceanaGold New Zealand Limited arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The development the CSM has been based on interpretations and processing of the data provided to GHD by OGL, and supplementary data sourced directly by GHD (see section 1.3). A brief walkover of the Willows Farm site where the portal is located was made. No site specific field mapping or subsurface investigations have been conducted to support the development of the CSM, at this time. The interpretations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

GHD has prepared this report on the basis of information provided by OceanaGold New Zealand Limited and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

An understanding of the geological site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experienced based. Hence this report should not be altered, amended, abbreviated, or issued in part in any way without prior written approval by GHD. GHD does not accept liability in connection with the issuing of an unapproved or modified version of this report.

The interpretations made in this report and attached CSM are intended to support high level groundwater and surface water modelling. The level of technical detail shown is correspondingly low. As such, reliance of the CSM in its current form should not be relied on for tasks that extend beyond the above stated.

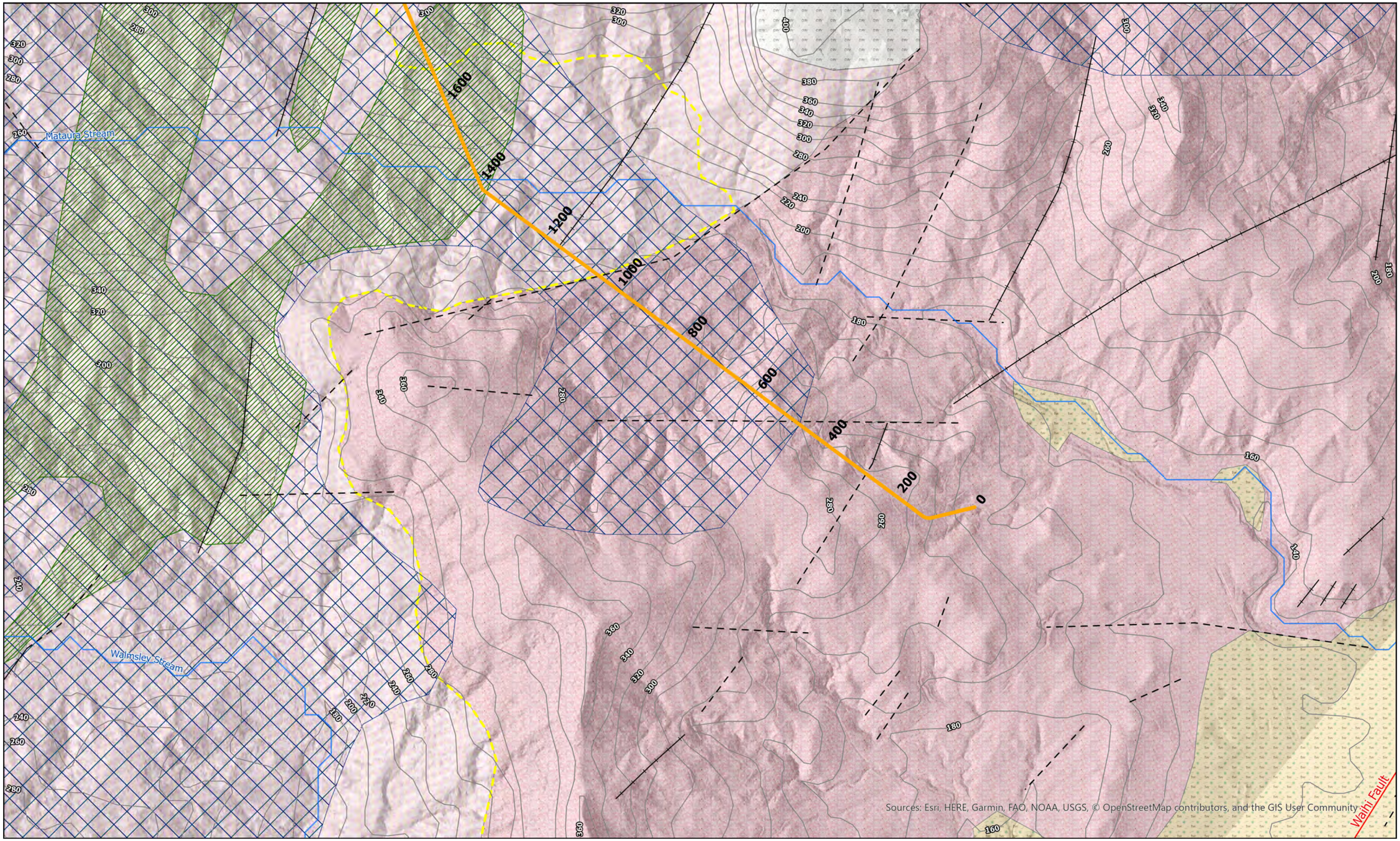
Sincerely
GHD Limited

Nick Burke
Senior Engineering Geologist

Nick Eldred
Principal Engineering Geologist

<u>Attachments:</u>

- **Geological Map Series**
- **Geological Long-Section (Tunnel)**



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Map Projection: New Zealand Map Grid
Horizontal Datum: New Zealand 1949
Grid: GD 1949 New Zealand Map Grid

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LEGEND

GNS 1:50k geological lithological units

- Tauranga Group and Whitianga Group
- Ratarua Ignimbrite: Welded, dacitic ignimbrite
- Whakamoehau Andesite: Andesite and dacite with minor quartz phenocrysts. Andesite tuff breccias
- Whiritoa Andesite : Phyric andesite and dacite flows and domes with tuff-breccias and lithic crystal tuff
- Waipupu Formation : Andesite and dacite, locally with quartz phenocrysts. Minor tuff breccia, crystal tuff and lacustrine sediments

Geologic features

- Fault
- Inferred liniament
- Liniament
- GNS-mapped hydrothermal alteration zone
- Watercourse
- OGL tunnel centreline

OGL-mapped and GHD-inferred surface hydrothermal alteration

- Argilite Alt - Illite / Illite, Smectite
- Argilite Alt - Smectite Surficial
- Quartz Alt / Silicification

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Oceana Gold
WKP Exploration Tunnel - Water Assessment

Job Number	125336958
Revision	0
Date	19 Aug 2020

Conceptual Engineering Geological Model

Figure 1
Page 1 of 5

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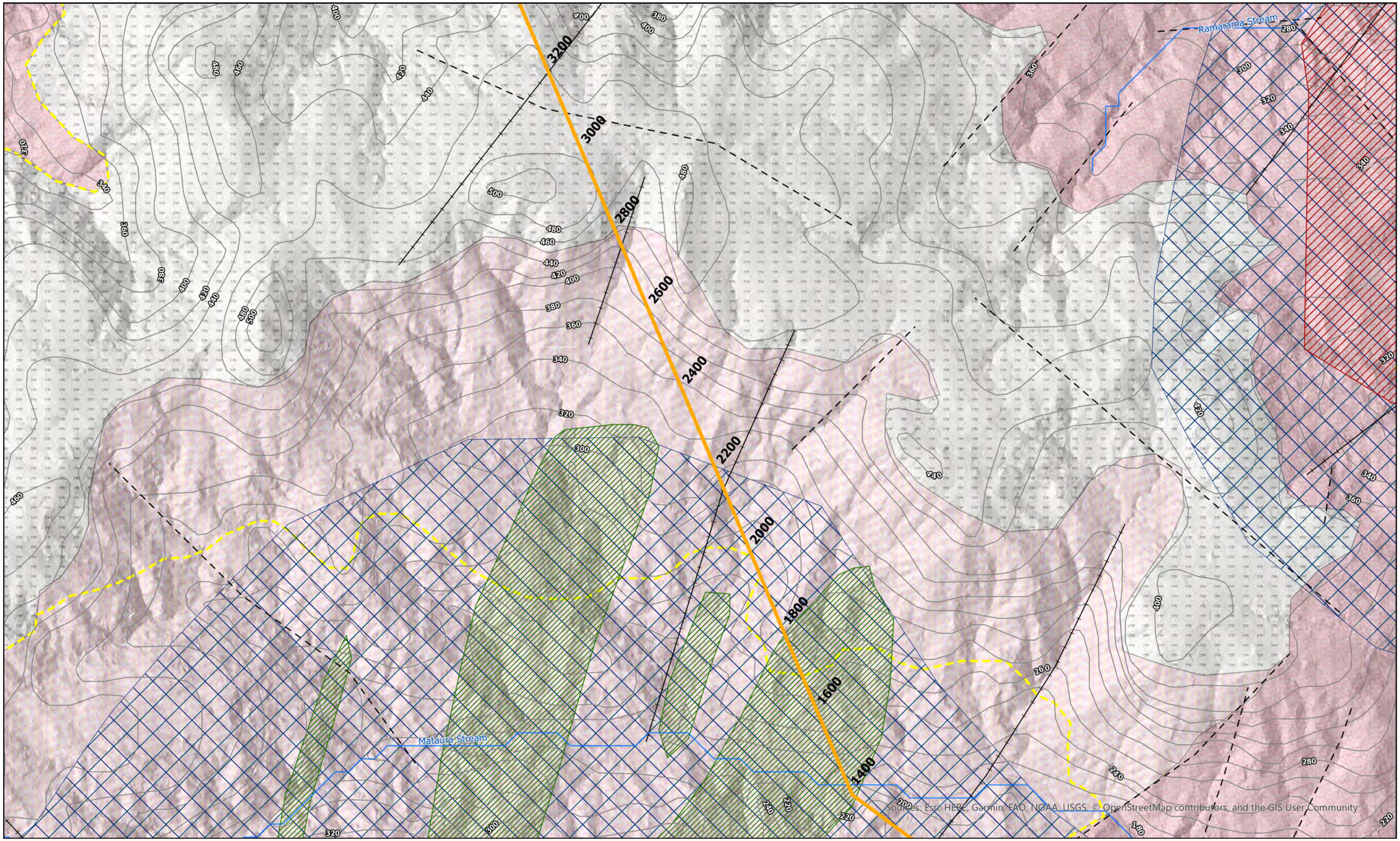
Data source: ESRI: World topographic Map and World Hillshade; Oceanea Gold: DEMs (20190503); GNS: 1:50k 1996 Waihi Area map, pdf; Waikato Regional Council: REC named watercourses (20200715); LINZ: 1:50k contours (20200721); GHD: tunnel diagram (20200715) Created by:nrama



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Conceptual Engineering Geological Model

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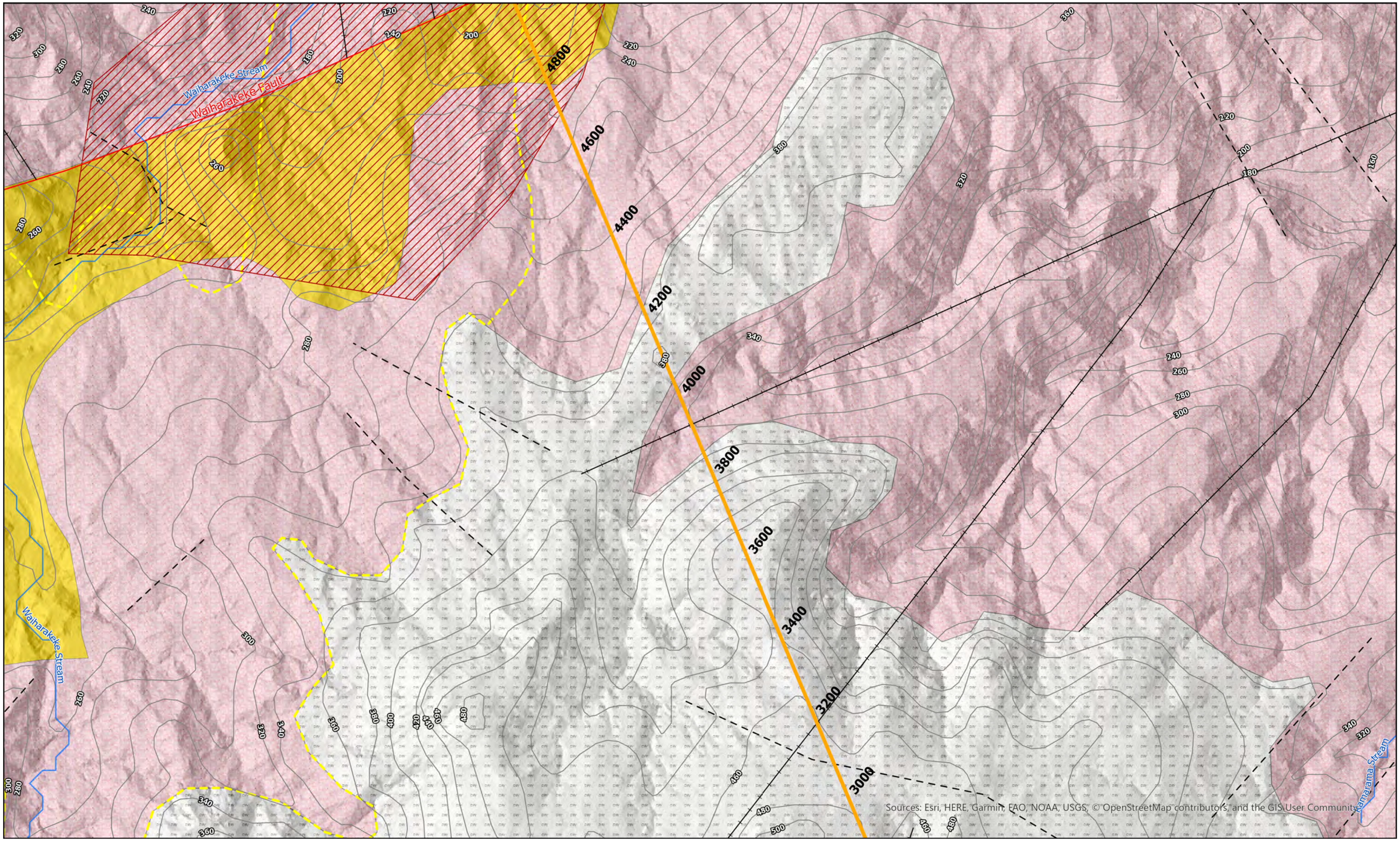

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- Whiritoa Andesite : Phyric andesite and dacite flows and domes with tuff-breccias and lithic crystal tuff
- Waiharakeke Dacite : Dacite flows, tuff breccia and minor tuff. Local intercalated rhyolite flows and tuffs

Geologic features

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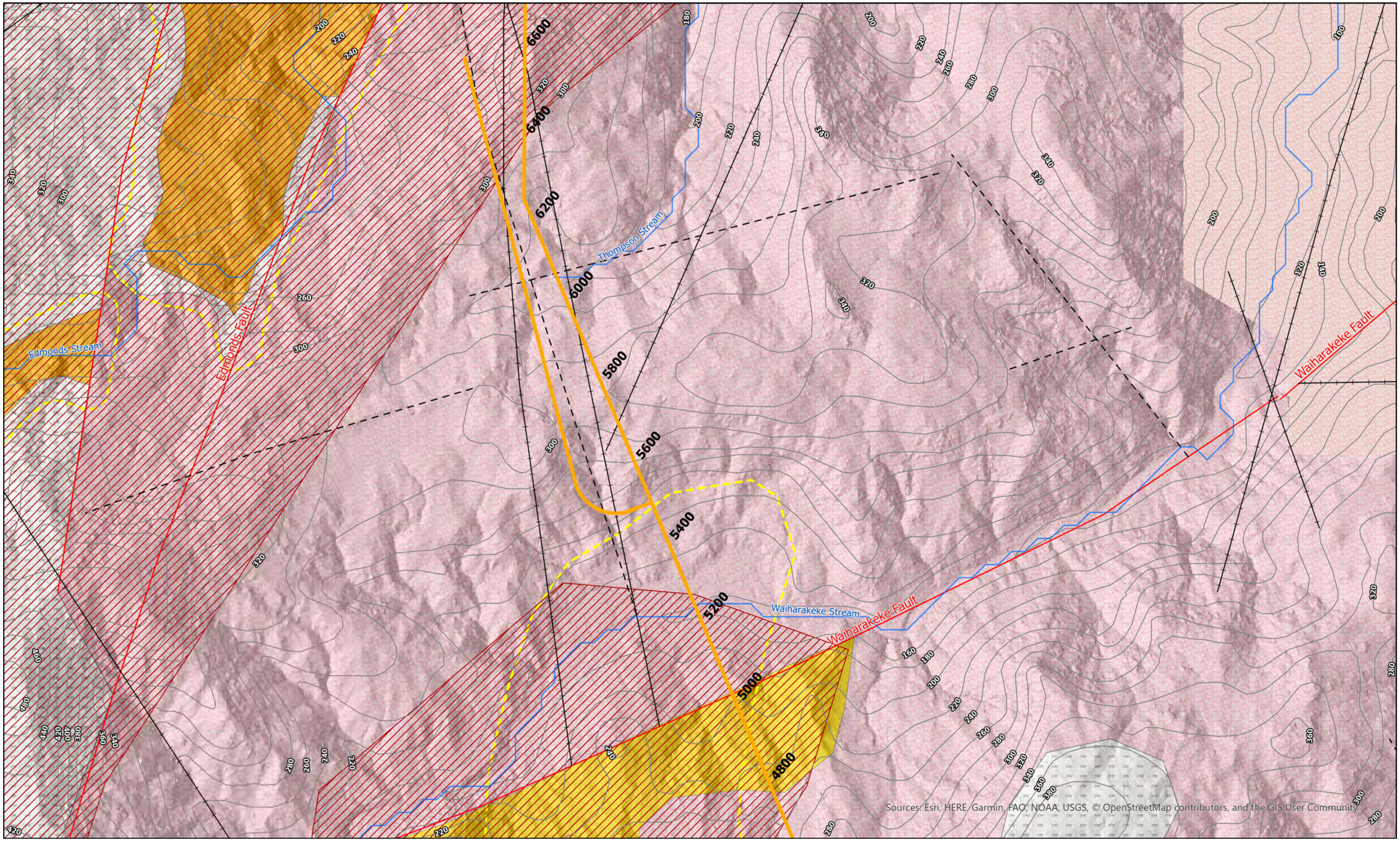

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- Coroglen Subgroup : Rhyolitic tuff - crystal, lithic and lapille tuff
- Waiharakeke Dacite : Dacite flows, tuff breccia and minor tuff. Local intercalated rhyolite flows and tuffs

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Conceptual Engineering Geological Model

Figure 1
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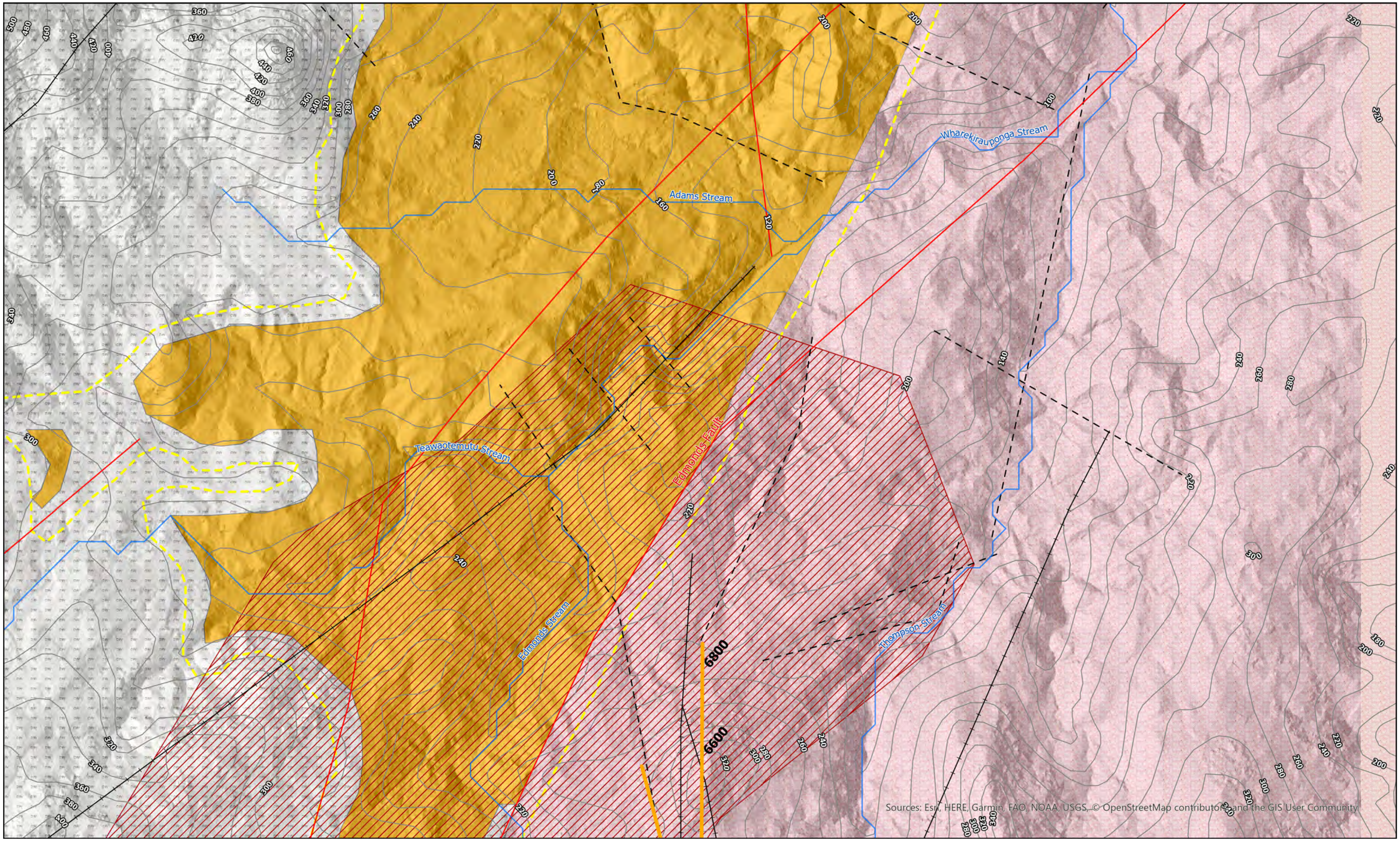

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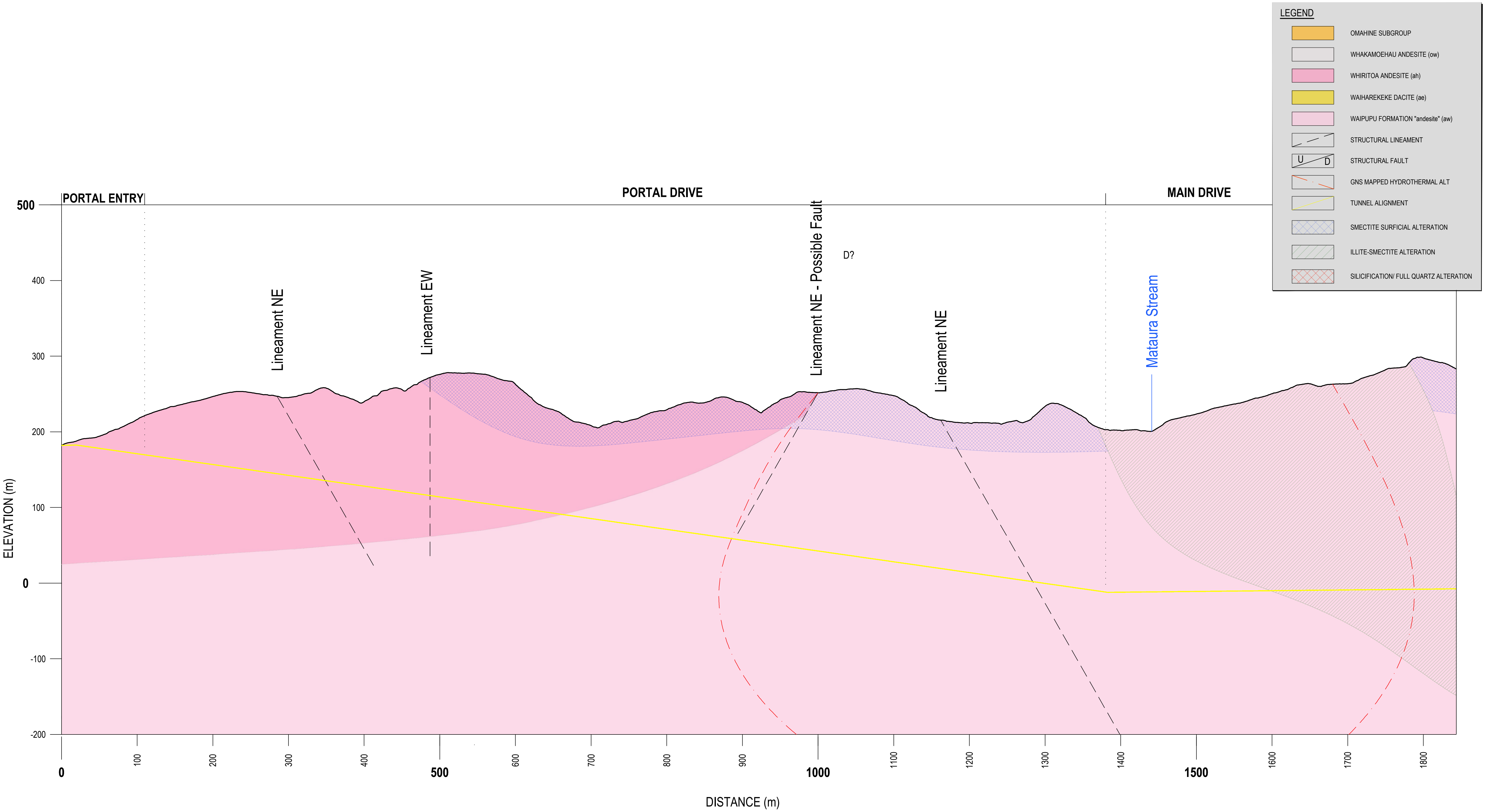

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SCALE 1:2500 AT ORIGINAL SIZE

PRELIMINARY

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Drafting Check DM	Design Check NE
Approved (Project Director) NE	
Date 17082020	
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Client **OCEANA GOLD LIMITED**

Project **WKP EXPLORATION TUNNEL - WATER ASSESSMENT**

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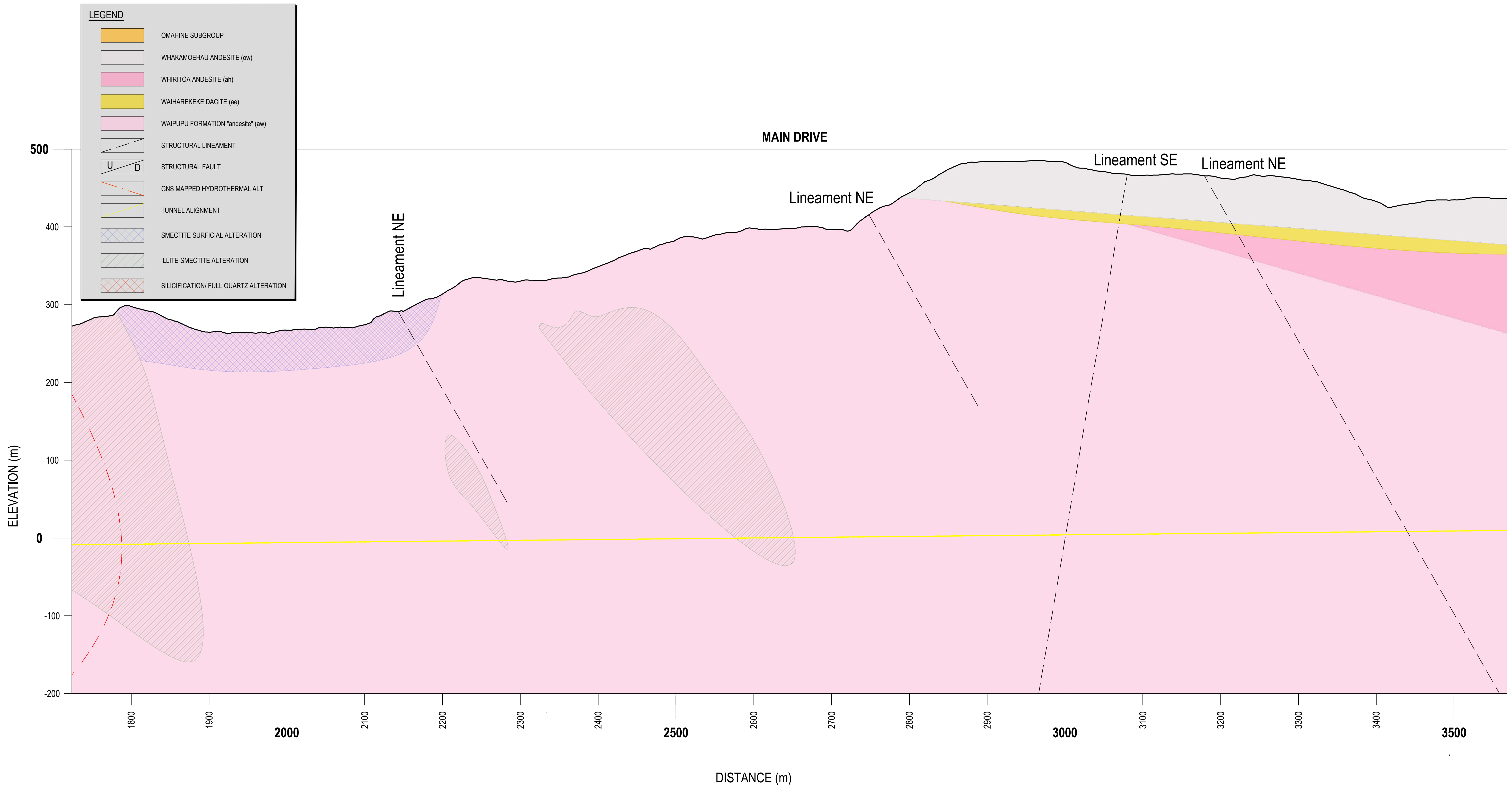

LONGSECTION 2 - CH 1723 TO CH 3567

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GHD

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Drafting Check DM | Design Check NE
Approved (Project Director) NE
Date 17082020
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Project **WKP EXPLORATION TUNNEL - WATER ASSESSMENT**
Title **CONCEPTUAL GEOLOGICAL LONGSECTION DRAFT 17082020**

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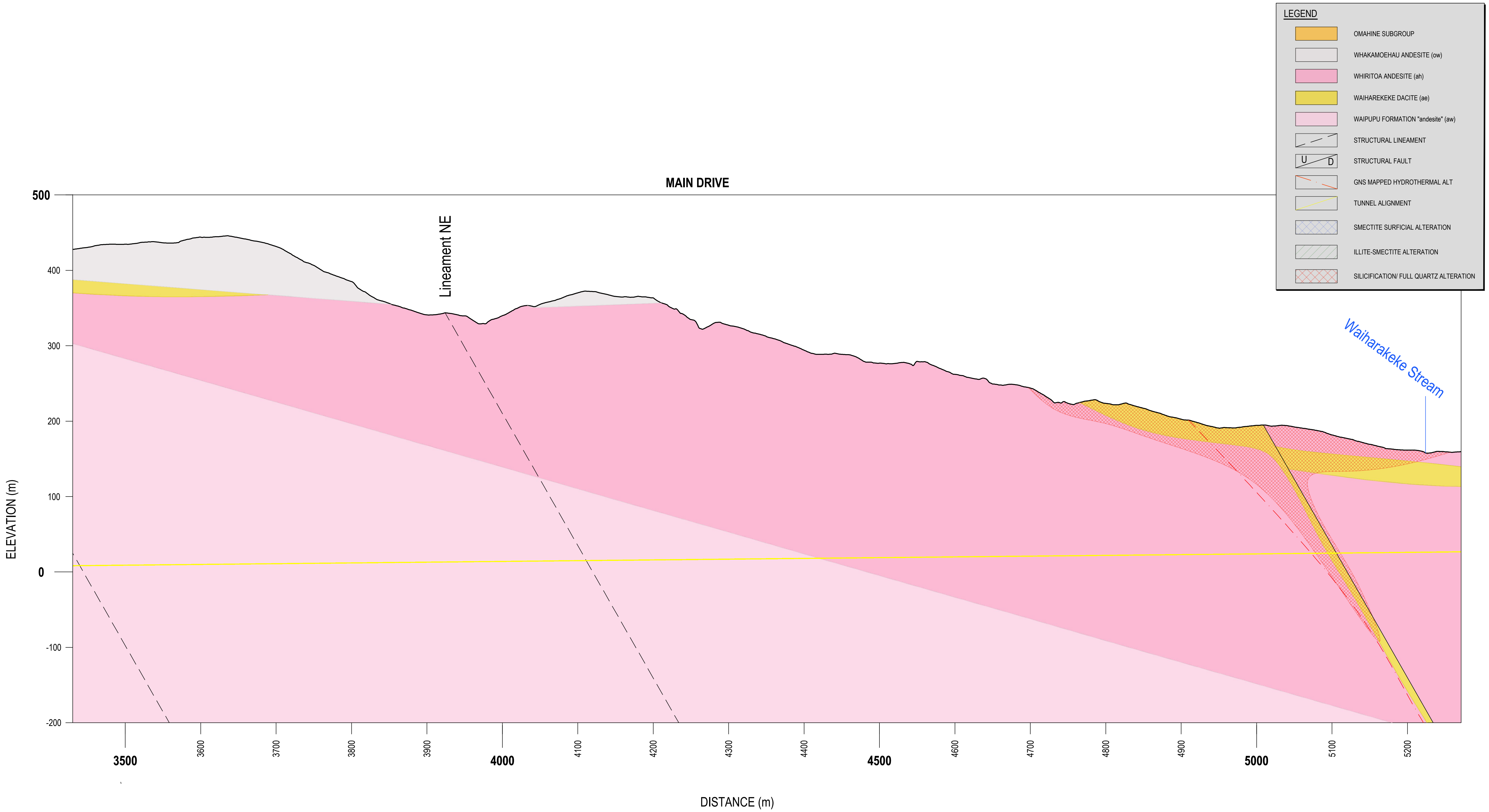

LONGSECTION 3 - CH 3430 TO CH 5271

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SCALE 1:2500 AT ORIGINAL SIZE

PRELIMINARY

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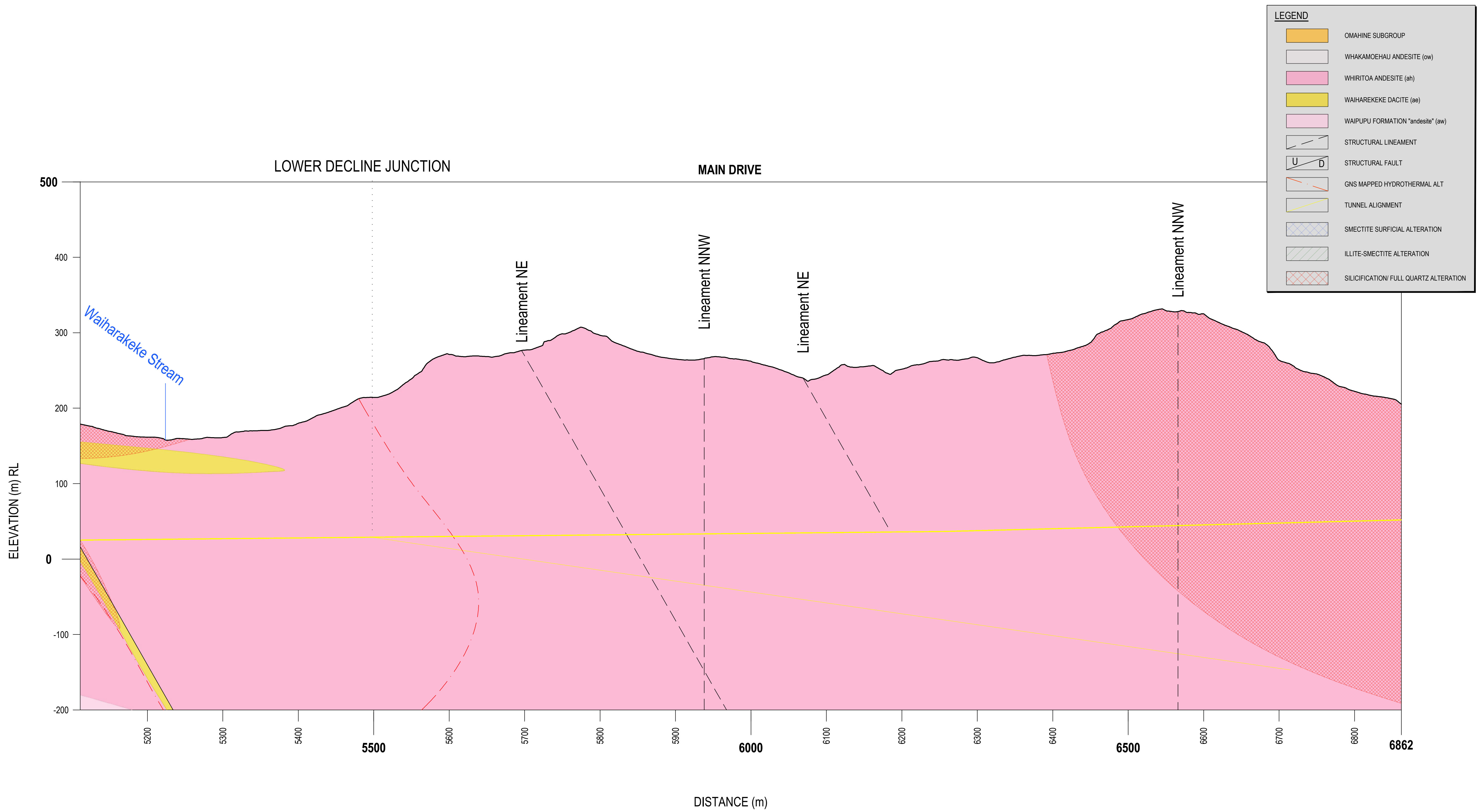
Drafting Check	DM	Design Check	NE
Approved (Project Director)	NE		
Date	17082020		
Scale	1:2500 @ A1	This Drawing must not be used for Construction unless signed as Approved	

Client **OCEANA GOLD LIMITED**
Project **WKP EXPLORATION TUNNEL - WATER ASSESSMENT**
Title **CONCEPTUAL GEOLOGICAL LONGSECTION DRAFT 17082020**

Original Size **A1** **Drawing No: Q003** **Rev: A**

Plot Date: 17 August 2020 - 2:32 PM Plotted by: Nick Burke Cad File No: C:\Users\nburke\Desktop\WKP C drive\master_section_newalignment.dwg



LONGSECTION 4 - CH 5112 TO CH 6862

SCALE 1:2500

0 25 50 75 100 125m

SCALE 1:2500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	CONCEPTUAL	NB	TM	NE	082020Y

Note: * indicates signatures on original issue of drawing or last revision of drawing

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Drawn	NICK BURKE	Designer	NICK BURKE
Drafting Check	DM	Design Check	NE
Approved (Project Director)	NE		
Date	17082020		
Scale	1:2500 @ A1	This Drawing must not be used for Construction unless signed as Approved	

Client **OCEANA GOLD LIMITED**
Project **WKP EXPLORATION TUNNEL - WATER ASSESSMENT**
Title **CONCEPTUAL GEOLOGICAL LONGSECTION DRAFT 17082020**

Original Size **A1** Drawing No: **Q004** Rev: **A**

Plot Date: 17 August 2020 - 2:32 PM Plotted by: Nick Burke Cad File No: C:\Users\nburke\Desktop\WKP C drive\master_section_newalignment.dwg

Appendix B

Column Specifications and Results

September 9, 2024

To	Mark Burroughs, Euan Leslie (Oceana Gold)	**Contact No.**	
Copy to	Ian Jenkins (AECOM)	**Email**	**tim.mulliner@ghd.com**
From	Tim Mulliner	**Project No.**	12552081
Project Name	Waihi North Project		
Subject	Wharekirauponga Column Summary		

1. Introduction

This technical memorandum summarises laboratory analytical acid base accounting (ABA), whole rock geochemistry and leachate data from field columns set up consisting of representative waste rock material associated with the Wharekirauponga Ore Body. The column set up methodology is provided in Appendix A of this document.

2. Column Set up Analysis

Representative sub-samples of the mixed and crushed column material were assessed using multi-element and acid base accounting (ABA) accounting. The collated data is summarised in Table 2.1 and the laboratory data is provided in Appendix B.

In addition, particle size distribution (PSD) analysis was undertaken on the columns. This data is provided in Appendix C.

Before placement in each column, material was weighed so that the total weight of the material in the column was known. This data is summarised and presented in Table 2.2.

Table 2.1 Column Weights

	T-Stream	EG-South	EG-North
Volume of Waste in Column (kg)	63.506	70.106	80.442

Table 2.2 Whole Rock Geochemistry – Column Setup

Sample Origin		**T-Stream**	**EG-North**	**EG-South**
Sample Name		**T-Stream (B1-SS3)**	**EG-North (B2-SS3)**	**EG-South (B3-SS3)**
Date and Time		**11/24/2021**	**11/24/2021**	**11/24/2021**
Laboratory Reference	**Unit**	**WP21-09045**	**WP21-09045**	**WP21-09045**
Total Sulphur (S)	%	1.05	0.77	0.94
Total Carbon (C)	%	0.03	0.02	0.02
Acid Neutralising Capacity (ANC)	kg H_2SO_4/T	2.00	2.00	5.00
Acid Neutralising Capacity (ANC)	% $CaCO_3$ equiv.	0.20	0.20	0.50
Total Acid Producing (TAP)	kg H_2SO_4/T	32.0	24.0	29.0
Total Acid Producing (TAP)	kg $CaCO_3$/T	32.7	24.5	29.6
Acid Producing	kg H_2SO_4/T	32.13	23.56	28.70
Acid Producing	% $CaCO_3$ equiv.	3.28	2.40	2.93
Acid Neutralising Capacity / Total Acid Producing (ANC/PA Ratio)		0.06	0.08	0.17
Net Acid Producing Potential (NAPP)	kg H_2SO_4/T	31.0	21.0	24.0
Net Acid Generation pH (NAG pH)	pH unit	3.10	3.30	3.20
Net Acid Generation (NAG)	kg H_2SO_4/T	30.0	21.0	25.0
NP	kg H2SO4/T	2.33	1.67	1.58
NNP	kg $CaCO_3$/T	-30.32	-22.82	-28.01
NPR Ratio	%	0.07	0.07	0.05
Sulphide Sulphate (S-)	%	0.83	0.62	0.78
S	%	1.06	0.75	0.95
Major Elements				
Al	%	7.37	5.18	5.71
Fe	%	1.33	1.32	1.64
Ca	%	0.46	0.18	0.4
Mg	%	0.12	0.04	0.15
Na	%	0.07	0.15	0.13
K	%	3.1	4.19	3.39
Trace Elements				
Sb	ppm	7.6	11.5	9.23
As	ppm	134.5	201	228
Ba	ppm	390	600	630
Cd	ppm	0.02	0.02	0.03
Co	ppm	2.5	1.3	2.8
Cr	ppm	9	7	10
Cu	ppm	12.9	6.2	6.5
Pb	ppm	15.8	11.4	10.7
Hg	ppm	0.55	0.076	0.064
Mn	ppm	79	90	216
Mo	ppm	2	1.41	1.65
Ni	ppm	3.1	1.6	2.6
Se	ppm	<1	<1	<1
V	ppm	38	10	16
Zn	ppm	13	19	32

3. Column Leachate Data

Leachate data has been collected throughout the column operation on a weekly basis. Field parameters and measurements taken along with analytical laboratory data are presented for each three columns in Figures 1-3.

Sample Origin		Figure 3. T-Stream Vein Column Results							
Sample Name		Column Set-Up	1836721 09-Nov-2021	1838000 19-Nov-2021	1838180 24-Nov-2021	1838288 02-Dec-2021	1838669 13-Dec-2021	1838694 20-Dec-2021	1838737 22-Dec-2021
Date and Time		21/10/2021	8-Nov-21	19-Nov-21	24-Nov-21	2-Dec-21	13-Dec-21	20-Dec-21	22-Dec-21
Laboratory Reference		-	2763341.3	2773857.1	2778761.3	2787988.3	2798790.3	2807535.3	2812321.1
Field Parameters									
FLS Electrical Conductivity	mS/m	-		19.13	2.566	7.8			2.5
FLS pH	pH Units	-		6.2	6.18	5.57	7.01		5.7
FLS Temperature	°C	-		22.7	23.5	18.8	18.5		27
Acidity and Alkalinity									
Acidity (pH 3.7)	m^3 as CaC	-	1.0	1.0		1.0	1.0	1	1
Alkalinity - Total	m^3 as CaC	-	3.6	4.3		4.0	17.6	1.0	2.2
Dissolved Heavy Metals and Trace Elements									
Aluminium-Dissolved	g/m^3	-	0.003	0.009	0.008		0		30
Antimony-Dissolved	g/m^3	-	0.000	0.000	0.000		0.000		0.002
Arsenic-Dissolved	g/m^3	-	0.004	0.016	0.005	0.005	0.005	0.144	0.096
Barium-Dissolved	g/m^3	-	0.005	0.005	0.005		0.005		0.064
Cadmium-Dissolved	g/m^3	-	0.00005	0.00005	0.00005	0.00005	0.00005	0.0105	0.0107
Calcium-Dissolved	g/m^3	-	0.38	1.02	1.24		1.73		560
Chromium-Dissolved	g/m^3	-	0.0012	0.0035	0.0014	0.0021	0.003	0.005	0.006
Cobalt-Dissolved	g/m^3	-	0.0002	0.0002	0.0002		0.0002		2.3
Copper-Dissolved	g/m^3	-	0.002	0.0064	0.0086	0.0052	0.0117	2.5	3.7
Iron-Dissolved	g/m^3	-	0.02	0.02	0.02		0.02		28
Lead-Dissolved	g/m^3	-	0.0001	0.0001	0.0001	0.0001	0.0001	0.0015	0.0019
Magnesium-Dissolved	g/m^3	-	0.1	0.24	0.44		0.82	-	440
Manganese-Dissolved	g/m^3	-	0.0037	0.0015	0.006		0.0043	-	12.4
Mercury-Dissolved	g/m^3	-	0.00008	0.00008	0.00039	0.00008	0.00008	0.00017	0.00008
Molybdenum-Dissolved	g/m^3	-	0.0002	0.0002	0.0002		0.0002		0.002
Nickel-Dissolved	g/m^3	-	0.0005	0.0005	0.0005	0.0005	0.0005	1.26	1.32
Potassium-Dissolved	g/m^3	-	0.1	0.65	1.1		2.5		94
Selenium-Dissolved	g/m^3	-	0.001	0.001	0.001		0.001		0.126
Silver-Dissolved	g/m^3	-	0.0001	0.0001	0.0001		0.0001		0.001
Sodium-Dissolved	g/m^3	-	0.7	1.4	2.1		5.5		175
Strontium-Dissolved	g/m^3	-	0.001	0.0027	0.0033		0.0056		2.7
Sulphate	g/m^3	-	5	5	5	1.9	5	3,800	4.1
Uranium-Dissolved	g/m^3	-	0.00002	0.00002	0.00002		0.00002		0.042
Vanadium-Dissolved	g/m^3	-			0.001		0.001		0.01
Zinc-Dissolved	g/m^3	-	0.024	0.053	0.027	0.026	0.019	4.1	4.6
Laboratory Field Parameters									
pH(pH units)	pH units	-	5.9	6.2	7.3	6.3	7.1	4.5	5.4
Electrical Conductivity	(mS/m)	-	0.8	1.8	2.5	1.8	8.2	546	2.3
Leachate									
Volume in Tubing	mL						0	355	80
Volume in Bucket	mL	-					700	600	450
Volume Sampled	mL	-	1,800	1,000	200	350	700	955	530

Notes

NES - Not enough to sample

Cells shaded yellow are below the laboratory limit of reporting

Sample Origin									
Sample Name		1838748 30-Dec-2021	1838759 06-Jan-2022	1838826 12-Jan-2022	1838925 20-Jan-2022	1839225 03-Feb-2022	1839308 11-Feb-2022	1839336 15-Feb-2022	1839576 28-Feb-2022
Date and Time		30-Dec-21	6-Jan-22	12-Jan-22	20-Jan-22	3-Feb-22	11-Feb-22	15-Feb-22	28-Feb-22
Laboratory Reference		281.5489.1	2823026.3	2825714.3	2836064.3	2854592.3	2867192.3	2873486.3	2900847.3
Field Parameters									
FLS Electrical Conductivity	mS/m		566.9	569	568	558.6	896.4	964.2	
FLS pH	pH Units		3.43	3.2	3.3	3.09	3.14	2.14	
FLS Temperature	°C		26.1	29.2	23	22.7	23.6	26.2	
Acidity and Alkalinity									
Acidity (pH 3.7)	m^3 as CaC(		156	156	440	340	2,700	2800	2200
Alkalinity - Total	m^3 as CaC(		1.0	1	1.0	1.0	1.0	1.0	1.0
Dissolved Heavy Metals and Trace Elemen									
Aluminium-Dissolved	g/m^3		76		131	123		370	
Antimony-Dissolved	g/m^3	-	0.002		0.002	0.001		0.004	
Arsenic-Dissolved	g/m^3	0.057	0.119	0.220	0.280	0.290	30.000	31.000	12.400
Barium-Dissolved	g/m^3	-	0.047		0.035	0.024		0.009	
Cadmium-Dissolved	g/m^3	0.0064	0.0129	0.0124	0.0119	500	0.015	0.0164	0.0169
Calcium-Dissolved	g/m^3		520		510	0.0122		440	
Chromium-Dissolved	g/m^3	0.006	0.037	0.083	0.074	0.072	0.26	0.36	0.37
Cobalt-Dissolved	g/m^3		2.4		2.2	2.3		2.7	
Copper-Dissolved	g/m^3	1.76	6.6	10.5	9.2	9.3	12.5	13.9	16
Iron-Dissolved	g/m^3		34		196	141		1390	
Lead-Dissolved	g/m^3	0.0014	0.0118	0.024	0.0124	0.0066	0.0005	0.001	0.0005
Magnesium-Dissolved	g/m^3		440		430	460		480	
Manganese-Dissolved	g/m^3		11.4		9.5	9.7		16	
Mercury-Dissolved	g/m^3	0.00008	0.00008	0.00008	0.00008	0.00008	0.00015	0.00015	0.00015
Molybdenum-Dissolved	g/m^3		0.002		0.002	0.001		0.016	
Nickel-Dissolved	g/m^3	0.7	1.44	1.63	1.47	1.49	1.62	1.88	2
Potassium-Dissolved	g/m^3		91		80	78		48	
Selenium-Dissolved	g/m^3		0.086		0.042	0.038		0.018	
Silver-Dissolved	g/m^3		0.001		0.001	0.0005		0.001	
Sodium-Dissolved	g/m^3		126		64	63		18.7	
Strontium-Dissolved	g/m^3		2.6		2.5	2.5		2.5	
Sulphate	g/m^3		4,700	4,400	4,300	4,200	8,500	10,200	9,200
Uranium-Dissolved	g/m^3		0.118		0.125	0.117		0.197	
Vanadium-Dissolved	g/m^3		0.013		0.066	0.048		0.76	
Zinc-Dissolved	g/m^3	2.6	5.4	6.1	5.7	5.5	7.9	8.1	9.3
Laboratory Field Parameters									
pH(pH units)	pH units		3.1	3.1	3.2	3.3	2.4	2.3	2.4
Electrical Conductivity	(mS/m)		563	523	511	534	811	937	895
Leachate									
Volume in Tubing	mL	10	170	1,190	1,190	1,150	1,180	1,180	1,100
Volume in Bucket	mL	80	0	500	0	360	4,300	680	600
Volume Sampled	mL	85	170	1,690	1,190	1,510	5,480	1,860	1,700

Notes

NES - Not enough to sample

Cells shaded yellow are below the laboratory

Sample Origin									
Sample Name		1839846 07-Mar-2022	1839988 10-Mar-2022	1840317 18-Mar-2022	1840622 25-Mar-2022				
Date and Time		7-Mar-22	10-Mar-22	18-Mar-22	25-Mar-22	31-Mar-22	7-Apr-22	13-Apr-22	21-Apr-22
Laboratory Reference		2909016.3	2914098.1	2925270.3	2934532.3				
Field Parameters									
FLS Electrical Conductivity	mS/m	906.1	913.9	1215.9	1517.1				
FLS pH	pH Units	2.36	2.34	2.2	1.68				
FLS Temperature	°C	26	24.2	20.5	20.1				
Acidity and Alkalinity									
Acidity (pH 3.7)	m^3 as CaC	2,200	1,900	3,100	11,400				
Alkalinity - Total	m^3 as CaC	1.0	1.0	1.0	6				
Dissolved Heavy Metals and Trace Elemen									
Aluminium-Dissolved	g/m^3	460		760					
Antimony-Dissolved	g/m^3	0.003		0.006					
Arsenic-Dissolved	g/m^3	4.900	4.900	14.200	179.000				
Barium-Dissolved	g/m^3	0.005		0.005					
Cadmium-Dissolved	g/m^3	0.0199	0.019	0.024	0.0141				
Calcium-Dissolved	g/m^3	430		410					
Chromium-Dissolved	g/m^3	0.39	0.4	0.71	0.7				
Cobalt-Dissolved	g/m^3	3.4		3.3					
Copper-Dissolved	g/m^3	19.4	17.3	20	10.6				
Iron-Dissolved	g/m^3	780		1870					
Lead-Dissolved	g/m^3	0.0005	0.0005	0.0005	0.002				
Magnesium-Dissolved	g/m^3	630		660					
Manganese-Dissolved	g/m^3	22		18.8					
Mercury-Dissolved	g/m^3	0.00015	0.00008	0.00016	0.0004				
Molybdenum-Dissolved	g/m^3	0.0018		0.0029					
Nickel-Dissolved	g/m^3	2.3	2.3	2.4	1.5				
Potassium-Dissolved	g/m^3	22		32					
Selenium-Dissolved	g/m^3	0.019		0.014					
Silver-Dissolved	g/m^3	0.0005		0.0005					
Sodium-Dissolved	g/m^3	19.7		11.3					
Strontium-Dissolved	g/m^3	2.8		2.6					
Sulphate	g/m^3	8,900	10,800	13,500	17,900				
Uranium-Dissolved	g/m^3	0.27		0.3					
Vanadium-Dissolved	g/m^3	0.88		1.47					
Zinc-Dissolved	g/m^3	10.1	10	11.5	8				
Laboratory Field Parameters									
pH(pH units)	pH units	2.5	2.6	2.4	1.8				
Electrical Conductivity	(mS/m)	862	796	1161	1608				
Leachate									
Volume in Tubing	mL	1,140	820	2,000	2,900		180	610	4,400
Volume in Bucket	mL	0	50				310	0	3100
Volume Sampled	mL	1,140	870	2,000	2,900	2,000	490	610	7,500

Notes

NES - Not enough to sample

Cells shaded yellow are below the laboratory

Sample Origin											
Sample Name		1841582 28-Apr-2022	1843237 26-May-2022				1843667 23-Jun-2022				1844015 21-Jul-2022
Date and Time		28-Apr-22	26-May-22	2-Jun-22	10-Jun-22	16-Jun-22	23-Jun-22	30-Jun-22	7-Jul-22	14-Jul-22	21-Jul-22
Laboratory Reference		2972202.3	2999688.3				3020815.3				3039091.3
Field Parameters											
FLS Electrical Conductivity	mS/m										
FLS pH	pH Units										
FLS Temperature	°C										
Acidity and Alkalinity											
Acidity (pH 3.7)	m^3 as CaC	11,900	10,900				3,700				1300
Alkalinity - Total	m^3 as CaC	1.0	1.0				1				1.0
Dissolved Heavy Metals and Trace Elemen											
Aluminium-Dissolved	g/m^3	540	460				125				26
Antimony-Dissolved	g/m^3	0.007	0.02				0.0027				0.0013
Arsenic-Dissolved	g/m^3	106.000	61				9.1				0.87
Barium-Dissolved	g/m^3	0.005	0.01				0.005				0.005
Cadmium-Dissolved	g/m^3	0.0088	0.007				0.0019				0.0003
Calcium-Dissolved	g/m^3	420	440				350				90
Chromium-Dissolved	g/m^3	0.53	0.46				0.111				0.023
Cobalt-Dissolved	g/m^3	1.1	0.98				0.22				0.067
Copper-Dissolved	g/m^3	5.5	4.1				0.83				0.24
Iron-Dissolved	g/m^3	4900	4,300				1,160				330
Lead-Dissolved	g/m^3	0.0005	0.01				0.0005				0.0005
Magnesium-Dissolved	g/m^3	230	193				61				14.5
Manganese-Dissolved	g/m^3	12.4	13.8				4.7				1.01
Mercury-Dissolved	g/m^3	0.0004	0.00016				0.00008				0.00008
Molybdenum-Dissolved	g/m^3	0.139	0.1				0.026				0.0059
Nickel-Dissolved	g/m^3	0.96	0.85				0.173				0.051
Potassium-Dissolved	g/m^3	0.4	5				0.3				0.3
Selenium-Dissolved	g/m^3	0.03	0.1				0.007				0.005
Silver-Dissolved	g/m^3	0.0005	0.01				0.0005				0.0005
Sodium-Dissolved	g/m^3	2.1	3				2.7				1.47
Strontium-Dissolved	g/m^3	0.84	0.55				0.29				0.089
Sulphate	g/m^3	22,000	17,100				5,600				1590
Uranium-Dissolved	g/m^3	0.053	0.036				0.0105				0.0026
Vanadium-Dissolved	g/m^3	1.37	1.32				0.31				0.071
Zinc-Dissolved	g/m^3	6.1	4.9				1.36				0.3
Laboratory Field Parameters											
pH(pH units)	pH units	1.8	1.8				2.1				2.2
Electrical Conductivity	(mS/m)	1569	1,542				719				402
Leachate											
Volume in Tubing	mL	1,850	1,000	4,200	3,800	2,700	1,150	3,700	2,700	3,700	4,120
Volume in Bucket	mL	500	0	7,700	300	0	900	120	70	10,300	1,700
Volume Sampled	mL	2,350	1000	11,900	4,100	2,700	2,050	3,820	3,400	14,000	5,820

Notes

NES - Not enough to sample

Cells shaded yellow are below the laboratory

Sample Origin		
Sample Name		1844072 28-Jul-2022
Date and Time		28-Jul-22
Laboratory Reference		3043493.2
Field Parameters		
FLS Electrical Conductivity	mS/m	
FLS pH	pH Units	
FLS Temperature	°C	
Acidity and Alkalinity		
Acidity (pH 3.7)	m^3 as CaC(	910
Alkalinity - Total	m^3 as CaC(	1.0
Dissolved Heavy Metals and Trace Elemen		
Aluminium-Dissolved	g/m^3	10.1
Antimony-Dissolved	g/m^3	0.0011
Arsenic-Dissolved	g/m^3	0.34
Barium-Dissolved	g/m^3	0.005
Cadmium-Dissolved	g/m^3	0.00023
Calcium-Dissolved	g/m^3	26
Chromium-Dissolved	g/m^3	0.01
Cobalt-Dissolved	g/m^3	0.034
Copper-Dissolved	g/m^3	0.117
Iron-Dissolved	g/m^3	191
Lead-Dissolved	g/m^3	0.0001
Magnesium-Dissolved	g/m^3	6.8
Manganese-Dissolved	g/m^3	0.49
Mercury-Dissolved	g/m^3	0.00008
Molybdenum-Dissolved	g/m^3	0.0026
Nickel-Dissolved	g/m^3	0.025
Potassium-Dissolved	g/m^3	0.29
Selenium-Dissolved	g/m^3	0.001
Silver-Dissolved	g/m^3	0.00011
Sodium-Dissolved	g/m^3	1.42
Strontium-Dissolved	g/m^3	0.036
Sulphate	g/m^3	1120
Uranium-Dissolved	g/m^3	0.00146
Vanadium-Dissolved	g/m^3	0.038
Zinc-Dissolved	g/m^3	0.149
Laboratory Field Parameters		
pH(pH units)	pH units	2.3
Electrical Conductivity	(mS/m)	371
Leachate		
Volume in Tubing	mL	2,500
Volume in Bucket	mL	3,000
Volume Sampled	mL	5,500

Notes

NES - Not enough to sample

Cells shaded yellow are below the laboratory

Sample Origin		Figure 1. EG-Vein (Northern Area) Column Results							
Sample Name		**Column Set-Up**	1836721 09-Nov-2021	1838001 19-Nov-2021	1838178 24-Nov-2021	1838286 02-Dec-2021	1838667 13-Dec-2021	1838692 20-Dec-2021	1838749 30-Dec-2021
Date and Time		**21/10/2021**	8-Nov-21	19-Nov-21	24-Nov-21	2-Dec-21	13-Dec-21	20-Dec-21	30-Dec-21
Laboratory Reference		-	2763341.1	2773857.2	2778761.1	2787988.1	2798790.1	2807535.1	2815489.2
Field Parameters									
FLS Electrical Conductivity	mS/m	-		149.7	225.7	280.9			469.6
FLS pH	pH Units	-		3.99	3.78	4.77	4.65	4.65	3.51
FLS Temperature	°C	-		21.3	24.1	19.7	17.7	17.7	24.2
Acidity and Alkalinity									
Acidity (pH 3.7)	g/m^3 as $CaCO_3$	-	1.0	1.0	1.0	1.0	1.0		
Alkalinity - Total	g/m^3 as $CaCO_3$	-	3.4	1.0	1.0	1.0	1.0		
Dissolved Heavy Metals and Trace Elements									
Aluminium-Dissolved	g/m^3	-	0.004	105	196		1,280		
Antimony-Dissolved	g/m^3	-	0.0002	0.002	0.0004		0.002		
Arsenic-Dissolved	g/m^3	-	0.10	0.16	0.21	0.03	0.83	4.00	0.15
Barium-Dissolved	g/m^3	-	0.005	0.016	0.021		0.012		
Cadmium-Dissolved	g/m^3	-	0.00005	0.0088	0.0154	0.0083	0.115	0.066	0.0049
Calcium-Dissolved	g/m^3	-	0.35	52	86	-	510		
Chromium-Dissolved	g/m^3	-	0.023	0.168	0.29	0.121	2	2.1	0.151
Cobalt-Dissolved	g/m^3	-	0.0002	0.59	1.05		6.5		
Copper-Dissolved	g/m^3	-	0.028	1.69	3.4	1.63	21	18.2	1.14
Iron-Dissolved	g/m^3	-	0.02	71	122		670		
Lead-Dissolved	g/m^3	-	0.0001	0.0013	0.0016	0.0002	0.0029	0.001	0.001
Magnesium-Dissolved	g/m^3	-	0.11	32	52		250		
Manganese-Dissolved	g/m^3	-	0.0051	6.8	11.1		67		
Mercury-Dissolved	g/m^3	-	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
Molybdenum-Dissolved	g/m^3	-	0.0002	0.002	0.0004		0.002		
Nickel-Dissolved	g/m^3	-	0.0005	0.2	0.34	0.173	2.3	1.22	0.099
Potassium-Dissolved	g/m^3	-	0.17	31	58		310		
Selenium-Dissolved	g/m^3	-	0.001	0.01	0.013		0.11		
Silver-Dissolved	g/m^3	-	0.0001	0.001	0.0002		0.001		
Sodium-Dissolved	g/m^3	-	0.81	29	45		220		
Strontium-Dissolved	g/m^3	-	0.0008	0.44	0.72		4.1		
Sulphate	g/m^3	-	5	940	1,640	114	1,110		
Uranium-Dissolved	g/m^3	-	0.00002	0.046	0.088		0.58		
Vanadium-Dissolved	g/m^3	-			0.006		0.064		
Zinc-Dissolved	g/m^3	-	0.065	9.4	16.4	8.5	104	45	5
Laboratory Field Parameters									
pH(pH units)	pH units	-	6	4.2	4.1	4.5	4		
Electrical Conductivity	(mS/m)	-	1	141.8	216	26.2	155.9		
Leachate									
Volume in Tubing	mL						80	100	200
Volume in Bucket	mL	-					500		40
Volume Sampled	mL	-	2,100	1,000	400	350	580	100	240

Notes

NES - Not enough to sample

Cells shaded yellow are below the laboratory limit of reporting

Sample Origin									
Sample Name		1838757 06-Jan-2022	1838824 12-Jan-2022	1838923 20-Jan-2022	1839223 03-Feb-2022	1839306 11-Feb-2022	1839334 15-Feb-2022	1839575 28-Feb-2022	1839844 07-Mar-2022
Date and Time		6-Jan-22	12-Jan-22	20-Jan-22	3-Feb-22	11-Feb-22	15-Feb-22	28-Feb-22	7-Mar-22
Laboratory Reference		2823026.2	2825714.1	2836064.1	2854592.1	2867192.1	2873486.1	2900847.2	2909016.1
Field Parameters									
FLS Electrical Conductivity	mS/m	991.7	789.3	620	915.9	897.9	821.8		977.1
FLS pH	pH Units	2.12	2.1	2.2	2.09	2.08	1.77		1.6
FLS Temperature	°C	19.2	26.7	21	22.8	21.9	20.6		27.7
Acidity and Alkalinity									
Acidity (pH 3.7)	g/m^3 as $CaCO_3$	780	1,950		2,500	3,800	2,900	1060	
Alkalinity - Total	g/m^3 as $CaCO_3$	1.0	1.0		1.0	1.0	1.0	1.0	
Dissolved Heavy Metals and Trace Elements									
Aluminium-Dissolved	g/m^3	290		75	150		95		127
Antimony-Dissolved	g/m^3	0.004		0.002	0.0034		0.0036		0.0056
Arsenic-Dissolved	g/m^3	64.00	41.00	13.60	50.00	50.00	35.00	28.00	61.00
Barium-Dissolved	g/m^3	0.005		0.005	0.005		0.005		0.005
Cadmium-Dissolved	g/m^3	0.0191	0.0073	0.0043	0.0072	0.0053	0.0033	0.0031	0.0041
Calcium-Dissolved	g/m^3	310		48	61		21		21
Chromium-Dissolved	g/m^3	1.06	0.46	0.22	0.46	0.35	0.22	0.193	0.28
Cobalt-Dissolved	g/m^3	0.91		0.195	0.32		0.21		0.26
Copper-Dissolved	g/m^3	5.4		1.09	1.76	1.25	0.94	0.8	1.1
Iron-Dissolved	g/m^3	1,050	2	440	1,170		960		1,570
Lead-Dissolved	g/m^3	0.001	0.001	0.001	0.0005	0.0006	0.0005	0.0005	0.0005
Magnesium-Dissolved	g/m^3	33		8.1	15.3		11.1		14.4
Manganese-Dissolved	g/m^3	7.5		2.6	4.2		3.5		4.5
Mercury-Dissolved	g/m^3	0.00015	0.00008	0.00015	0.00015	0.00015	0.00015	0.00015	0.00008
Molybdenum-Dissolved	g/m^3	0.02		0.005	0.0128		0.0157		0.026
Nickel-Dissolved	g/m^3	0.33	0.118	0.07	0.121	0.081	0.064	0.057	0.075
Potassium-Dissolved	g/m^3	68		5.2	1.2		1.5		0.4
Selenium-Dissolved	g/m^3	0.019		0.01	0.008		0.011		0.02
Silver-Dissolved	g/m^3	0.001		0.001	0.0005		0.0005		0.0008
Sodium-Dissolved	g/m^3	13		1.5	2.3		1.58		1.73
Strontium-Dissolved	g/m^3	0.8		0.105	0.121		0.045		0.048
Sulphate	g/m^3	1,240	3,500	2,300	2,600	4,200	3,400	1,270	
Uranium-Dissolved	g/m^3	0.14		0.0158	0.029		0.0155		0.0199
Vanadium-Dissolved	g/m^3	0.24		0.083	0.23		0.109		0.147
Zinc-Dissolved	g/m^3	19.6	8.7	5.3	8.4	7.2	5.1	4.3	5.6
Laboratory Field Parameters									
pH(pH units)	pH units	2.4	1.9	2.0	2.0	1.8	1.9	2.2	
Electrical Conductivity	(mS/m)	259	677	582	550	798	688	328	
Leachate									
Volume in Tubing	mL	200	1,190	1,000	430	1,150	730	420	240
Volume in Bucket	mL	330			325	1,050	140	620	0
Volume Sampled	mL	530	1,190	1,000	755	2,200	870	1,040	240

Notes

NES - Not enough to sample

Cells shaded yellow are below the laboratory limit of rep

Sample Origin									
Sample Name		1839990 10-Mar-2022	1840315 18-Mar-2022	1840620 25-Mar-2022					1841580 28-Apr-2022
Date and Time		10-Mar-22	18-Mar-22	25-Mar-22	31-Mar-22	7-Apr-22	13-Apr-22	21-Apr-22	28-Apr-22
Laboratory Reference		2914098.3	2925270.1	2934532.1					2972202.1
Field Parameters									
FLS Electrical Conductivity	mS/m	987.7	1073.7	454.8					
FLS pH	pH Units	1.65	1.66	1.77					
FLS Temperature	°C	24.2	22.5	19.8					
Acidity and Alkalinity									
Acidity (pH 3.7)	g/m^3 as $CaCO_3$	5,500	6,200	2,800					2,200
Alkalinity - Total	g/m^3 as $CaCO_3$	1.0	1.0	1.0					1.0
Dissolved Heavy Metals and Trace Elements									
Aluminium-Dissolved	g/m^3		109						29
Antimony-Dissolved	g/m^3		0.0077						0.0029
Arsenic-Dissolved	g/m^3	55.00	54.00	10.30					7.60
Barium-Dissolved	g/m^3		0.005						0.005
Cadmium-Dissolved	g/m^3	0.0031	0.0031	0.001					0.0008
Calcium-Dissolved	g/m^3		15.3						3.5
Chromium-Dissolved	g/m^3	0.26	0.25	0.072					0.045
Cobalt-Dissolved	g/m^3		0.24						0.088
Copper-Dissolved	g/m^3	0.97	0.96	0.4					0.3
Iron-Dissolved	g/m^3		1,620						470
Lead-Dissolved	g/m^3	0.0005	0.0005	0.0005					0.0005
Magnesium-Dissolved	g/m^3		11.8						3
Manganese-Dissolved	g/m^3		4.3						0.74
Mercury-Dissolved	g/m^3	0.00015	0.00015	0.00008					0.00008
Molybdenum-Dissolved	g/m^3		0.03						0.0056
Nickel-Dissolved	g/m^3	0.187	0.098	0.034					0.029
Potassium-Dissolved	g/m^3		0.5						0.3
Selenium-Dissolved	g/m^3		0.023						0.007
Silver-Dissolved	g/m^3		0.0006						0.0005
Sodium-Dissolved	g/m^3		2						2.2
Strontium-Dissolved	g/m^3		0.044						0.016
Sulphate	g/m^3	6,100	6,700	3,100					2,300
Uranium-Dissolved	g/m^3		0.0193						0.0046
Vanadium-Dissolved	g/m^3		0.134						0.021
Zinc-Dissolved	g/m^3	4.8	4.5	1.58					0.87
Laboratory Field Parameters									
pH(pH units)	pH units	1.8	1.7	1.9					2.00
Electrical Conductivity	(mS/m)	1,030	1,086	677					595
Leachate									
Volume in Tubing	mL	730	400	1,600		100	30	2,000	300
Volume in Bucket	mL	0	0			290	0	500	400
Volume Sampled	mL	730	400	1,600	550	390	30	2,500	700

Notes
NES - Not enough to sample
Cells shaded yellow are below the laboratory limit of rep

Sample Origin									
Sample Name		1843235 26-May-2022	1843317 02-Jun-2022	1843474 10-Jun-2022	1843606 16-Jun-2022	1843665 23-Jun-2022	1843708 30-Jun-2022	1843745 07-Jul-2022	1843822 14-Jul-2022 2:00 pm
Date and Time		26-May-22	2-Jun-22	10-Jun-22	16-Jun-22	23-Jun-22	30-Jun-22	7-Jul-22	14-Jul-22
Laboratory Reference		2999688.1	3006218.1	3012885.1	3015917.1	3020815.1	3024538.1	3029804.1	3034512.1
Field Parameters									
FLS Electrical Conductivity	mS/m								
FLS pH	pH Units								
FLS Temperature	°C								
Acidity and Alkalinity									
Acidity (pH 3.7)	g/m^3 as $CaCO_3$	5,600	1,540	1,250	1,420	2,100	1,200	870	260
Alkalinity - Total	g/m^3 as $CaCO_3$	1	1.0	1	1.0	1.0	1.0	1.0	1.0
Dissolved Heavy Metals and Trace Elements									
Aluminium-Dissolved	g/m^3	68	12.4	12.6	16	30	17.7	7.9	0.88
Antimony-Dissolved	g/m^3	0.0063	0.0026	0.0022	0.0021	0.0023	0.0019	0.0016	0.001
Arsenic-Dissolved	g/m^3	43	3.1	2.3	3.2	7.3	3.1	1.27	0.193
Barium-Dissolved	g/m^3	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Cadmium-Dissolved	g/m^3	0.0013	0.0003	0.00034	0.0003	0.0005	0.0003	0.0003	0.0003
Calcium-Dissolved	g/m^3	5.6	5.3	13.2	18.3	35	36	29	8.1
Chromium-Dissolved	g/m^3	0.105	0.016	0.016	0.02	0.034	0.02	0.009	0.003
Cobalt-Dissolved	g/m^3	0.191	0.057	0.056	0.065	0.076	0.047	0.032	0.0087
Copper-Dissolved	g/m^3	0.59	0.143	0.142	0.162	0.23	0.145	0.074	0.015
Iron-Dissolved	g/m^3	1,540	340	290	390	560	340	200	44
Lead-Dissolved	g/m^3	0.0005	0.0005	0.0001	0.0005	0.0005	0.0005	0.0005	0.0005
Magnesium-Dissolved	g/m^3	5.8	1.69	1.8	1.93	2.7	2.3	1.62	0.43
Manganese-Dissolved	g/m^3	1.46	1.01	1.09	1.1	0.57	0.23	0.69	0.24
Mercury-Dissolved	g/m^3	0.00015	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
Molybdenum-Dissolved	g/m^3	0.03	0.0033	0.0024	0.0032	0.0071	0.003	0.0017	0.001
Nickel-Dissolved	g/m^3	0.053	0.013	0.014	0.016	0.021	0.012	0.007	0.003
Potassium-Dissolved	g/m^3	0.3	0.5	0.6	0.4	0.3	0.4	0.3	0.3
Selenium-Dissolved	g/m^3	0.027	0.005	0.0038	0.005	0.007	0.005	0.005	0.005
Silver-Dissolved	g/m^3	0.0009	0.0005	0.00026	0.0005	0.0005	0.0005	0.0005	0.0005
Sodium-Dissolved	g/m^3	3.7	2.1	1.56	1.51	1.55	1.28	1.44	0.54
Strontium-Dissolved	g/m^3	0.025	0.013	0.016	0.018	0.021	0.015	0.012	0.005
Sulphate	g/m^3	6,200	1,580	1,310	1,600	2,400	1,530	1,000	310
Uranium-Dissolved	g/m^3	0.0106	0.0018	0.0022	0.0026	0.0033	0.00156	0.00104	0.00025
Vanadium-Dissolved	g/m^3	0.054	0.015	0.013	0.016	0.014	0.006	0.008	0.005
Zinc-Dissolved	g/m^3	1.67	0.4	0.4	0.44	0.59	0.34	0.17	0.046
Laboratory Field Parameters									
pH(pH units)	pH units	1.7	2.0	2.1	2.1	2.0	2.1	2.2	2.6
Electrical Conductivity	(mS/m)	1,010	480	395	433	529	418	320	136.4
Leachate									
Volume in Tubing	mL	550	2,100	1,050	600	800	800	500	2,200
Volume in Bucket	mL	0	900	900	0	800	90	0	900
Volume Sampled	mL	550	300	1,950	600	1,600	890	500	3,100
Notes NES - Not enough to sample Cells shaded yellow are below the laboratory limit of rep		1 kg Limestone Slurry Added							

Sample Origin			
Sample Name		1844013 21-Jul-2022	1844082 28-Jul-2022
Date and Time		21-Jul-22	28-Jul-22
Laboratory Reference		3039091.1	3043493.3
Field Parameters			
FLS Electrical Conductivity	mS/m		
FLS pH	pH Units		
FLS Temperature	°C		
Acidity and Alkalinity			
Acidity (pH 3.7)	g/m^3 as $CaCO_3$	870	200
Alkalinity - Total	g/m^3 as $CaCO_3$	1.0	1.0
Dissolved Heavy Metals and Trace Elements			
Aluminium-Dissolved	g/m^3	8.9	1.11
Antimony-Dissolved	g/m^3	0.0023	0.0011
Arsenic-Dissolved	g/m^3	1.22	0.12
Barium-Dissolved	g/m^3	0.005	0.005
Cadmium-Dissolved	g/m^3	0.0003	0.00005
Calcium-Dissolved	g/m^3	50	16.1
Chromium-Dissolved	g/m^3	0.01	0.0016
Cobalt-Dissolved	g/m^3	0.03	0.0059
Copper-Dissolved	g/m^3	0.087	0.014
Iron-Dissolved	g/m^3	194	29
Lead-Dissolved	g/m^3	0.0005	0.0001
Magnesium-Dissolved	g/m^3	1.92	0.43
Manganese-Dissolved	g/m^3	0.21	0.074
Mercury-Dissolved	g/m^3	0.00008	0.00008
Molybdenum-Dissolved	g/m^3	0.002	0.0003
Nickel-Dissolved	g/m^3	0.01	0.0015
Potassium-Dissolved	g/m^3	0.4	0.27
Selenium-Dissolved	g/m^3	0.005	0.001
Silver-Dissolved	g/m^3	0.0005	0.0001
Sodium-Dissolved	g/m^3	0.86	1.06
Strontium-Dissolved	g/m^3	0.011	0.0039
Sulphate	g/m^3	930	250
Uranium-Dissolved	g/m^3	0.00139	0.00021
Vanadium-Dissolved	g/m^3	0.005	0.001
Zinc-Dissolved	g/m^3	0.193	0.033
Laboratory Field Parameters			
pH(pH units)	pH units	2.3	2.8
Electrical Conductivity	(mS/m)	294	106.4
Leachate			
Volume in Tubing	mL	1,800	1,600
Volume in Bucket	mL	600	50
Volume Sampled	mL	2,400	1,650

Notes
NES - Not enough to sample
Cells shaded yellow are below the laboratory limit of rep

Sample Origin		Figure 2. EG-Vein (Southern Area) Column Results							
Sample Name		**Column Set-Up**	1836722 09-Nov-2021	1838002 19-Nov-2021	1838179 24-Nov-2021	1838287 02-Dec-2021	1838668 13-Dec-2021	1838693 20-Dec-2021	1838738 - 22-Dec-2021
Sample Date and Time		**21/10/2021**	8-Nov-21	19-Nov-21	24-Nov-21	2-Dec-21	13-Dec-21	20-Dec-21	22-Dec-21
Laboratory Reference		-	2763341.2	2773857.3	2778761.2	2787988.2	2798790.2	2807535.2	2812321.2
Field Parameters									
FLS Electrical Conductivity	mS/m	-		0.3	251.2	65.5			336.9
FLS pH	pH Units	-		3.96	4.07	4.96	5.09		3.28
FLS Temperature	°C	-		22.2	23.7	19.8	18.2		25.7
Acidity and Alkalinity									
Acidity (pH 3.7)	m^3 as CaC	-	1.0	1.0	1.0	1.0	1.0	46	32
Alkalinity - Total	m^3 as CaC	-	9.4	1.0	1.0	1.0	1.0	1.0	1.0
Dissolved Heavy Metals and Trace Elements									
Aluminium-Dissolved	g/m^3	-	0.012	230	70		166		230
Antimony-Dissolved	g/m^3	-	0.0003	0.002	0.0004		0.001		0.002
Arsenic-Dissolved	g/m^3	-	0.32	0.43	0.40	0.41	0.22	0.75	1.18
Barium-Dissolved	g/m^3	-	0.005	0.093	0.026		0.063		0.044
Cadmium-Dissolved	g/m^3	-	0.00005	0.106	0.029	0.09	0.09	0.082	0.062
Calcium-Dissolved	g/m^3	-	1.45	530	162		530		480
Chromium-Dissolved	g/m^3	-	0.071	0.053	0.061	0.039	0.023	0.047	0.075
Cobalt-Dissolved	g/m^3	-	0.0002	6.4	1.84		5.2		3
Copper-Dissolved	g/m^3	-	0.075	6	1.95	5.7	5.2	8.1	7.8
Iron-Dissolved	g/m^3	-	0.02	91	26		5.7		1
Lead-Dissolved	g/m^3	-	0.00013	0.0132	0.0028	0.0102	0.0101	0.006	0.0073
Magnesium-Dissolved	g/m^3	-	0.35	480	144		330		200
Manganese-Dissolved	g/m^3	-	0.024	137	39		108		65
Mercury-Dissolved	g/m^3	-	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
Molybdenum-Dissolved	g/m^3	-	0.0002	0.002	0.0004		0.001		0.002
Nickel-Dissolved	g/m^3	-	0.0005	2.2	0.64	1.91	1.8	1.55	1.11
Potassium-Dissolved	g/m^3	-	0.57	380	110		340		270
Selenium-Dissolved	g/m^3	-	0.001	0.086	0.023		0.063		0.045
Silver-Dissolved	g/m^3	-	0.0001	0.001	0.0002		0.0005		0.001
Sodium-Dissolved	g/m^3	-	2.6	184	57		145		49
Strontium-Dissolved	g/m^3	-	0.003	3.8	1.06		3.2		1.94
Sulphate	g/m^3	-	6	2500	1,540	590	520	4,200	2400
Uranium-Dissolved	g/m^3	-	0.00002	0.136	0.042		0.131		0.163
Vanadium-Dissolved	g/m^3	-			0.002		0.005		0.01
Zinc-Dissolved	g/m^3	-	0.069	59	16.9	53	45	45	34
Laboratory Field Parameters									
pH(pH units)	pH units	-	6.4	4.1	4.7	4.5	4.3	3.6	3.7
Electrical Conductivity	(mS/m)	-	3.5	353	240	107.8	99.2	520	318
Leachate									
Volume in Tubing	mL	-					50	480	250
Volume in Bucket	mL	-					400	550	100
Volume Sampled	mL	-	1,200	1,000	350	450	450	1030	350

Notes

NES - Not enough to sample

Cells shaded yellow are below the laboratory limit of reporting

Sample Origin									
Sample Name		1838750 30-Dec-2021	1838758 06-Jan-2022	1838825 12-Jan-2022	1838924 20-Jan-2022	1839224 20-Jan-2022	1839307 11-Feb-2022	1839335 15-Feb-2022	1839574 28-Feb-2022
Sample Date and Time		30-Dec-21	6-Jan-22	12-Jan-22	20-Jan-22	3-Feb-22	11-Feb-22	15-Feb-22	28-Feb-22
Laboratory Reference		2815489.3	2823026.2	2825714.2	2836064.2	2854592.2	2867192.2	2873486.2	2900847.1
Field Parameters									
FLS Electrical Conductivity	mS/m		514.9	626	642	719.6	898.8	982.2	
FLS pH	pH Units		2.76	2.49	2.6	2.4	2.35	1.92	
FLS Temperature	°C		25.1	26.8	21.9	21.4	23.1	24	
Acidity and Alkalinity									
Acidity (pH 3.7)	m^3 as CaC(		1,110	1,030	2,100	3,900	6,900	5100	4400
Alkalinity - Total	m^3 as CaC(		1.0	1	1.0	1.0	1.0	1.0	1.0
Dissolved Heavy Metals and Trace Elemen									
Aluminium-Dissolved	g/m^3		230		360	390		440	
Antimony-Dissolved	g/m^3		0.002		0.004	0.005		0.013	
Arsenic-Dissolved	g/m^3	1.20	6.60	8.90	6.30	30.00	117.00	83.00	51.00
Barium-Dissolved	g/m^3		0.05		0.012	0.005		0.005	
Cadmium-Dissolved	g/m^3	0.055	0.047	0.032	0.033	0.033	0.038	0.026	0.0164
Calcium-Dissolved	g/m^3		480		480	470		350	
Chromium-Dissolved	g/m^3	0.078	0.21	0.6	0.6	0.69	0.8	0.59	0.33
Cobalt-Dissolved	g/m^3		2.2		1.64	1.79		1.52	
Copper-Dissolved	g/m^3	7.2	6.1	5.6	5	5.1	4.8	3.5	2.3
Iron-Dissolved	g/m^3		187		570	750		1990	
Lead-Dissolved	g/m^3	0.0083	0.0153	0.0011	0.001	0.0005	0.0013	0.001	0.0005
Magnesium-Dissolved	g/m^3		139		105	121		144	
Manganese-Dissolved	g/m^3		44		54	57		60	
Mercury-Dissolved	g/m^3	0.00008	0.00008	0.00008	0.00015	0.00015	0.00015	0.0003	0.00015
Molybdenum-Dissolved	g/m^3		0.002	-	0.002	0.0053		0.016	
Nickel-Dissolved	g/m^3	1.02	0.81	0.58	0.57	0.62	0.61	0.53	0.37
Potassium-Dissolved	g/m^3		167		39	6.2		0.5	
Selenium-Dissolved	g/m^3		0.031		0.015	0.013		0.02	
Silver-Dissolved	g/m^3		0.001		0.0019	0.001		0.0035	
Sodium-Dissolved	g/m^3		25		8.3	8		2.1	
Strontium-Dissolved	g/m^3		1.39		0.65	0.5		0.156	
Sulphate	g/m^3		5,600	5,300	5,500	7,500	11,500	9,500	8,100
Uranium-Dissolved	g/m^3		0.172		0.164	0.178		0.095	
Vanadium-Dissolved	g/m^3		0.025		0.32	0.159		0.73	
Zinc-Dissolved	g/m^3	31	26	24	23	25	39	31	21
Laboratory Field Parameters									
pH(pH units)	pH units		2.4	2.4	2.5	2.2	2	2.1	2.1
Electrical Conductivity	(mS/m)		594	591	570	785	1018	844	709
Leachate									
Volume in Tubing	mL	60	260	1,170	1,160	1,310	1,170	1,140	1,110
Volume in Bucket	mL	110	0	0	0	70	110	170	190
Volume Sampled	mL	170	260	1,170	1,160	1,380	1,280	1,310	1,300

Notes

NES - Not enough to sample

Cells shaded yellow are below the laboratory

Sample Origin									
Sample Name		1839845 07-Mar-2022	1839989 10-Mar-2022	1840316 18-Mar-2022	1840621 25-Mar-2022				
Sample Date and Time		7-Mar-22	10-Mar-22	18-Mar-22	25-Mar-22	31-Mar-22	7-Apr-22	13-Apr-22	21-Apr-22
Laboratory Reference		2909016.2	2914098.2	2925270.2	2934532.2				
Field Parameters									
FLS Electrical Conductivity	mS/m	736.4	971.4	949.4	795.3				
FLS pH	pH Units	1.94	1.8	1.86	1.89				
FLS Temperature	°C	29.1	22.5	23.1	20.2				
Acidity and Alkalinity									
Acidity (pH 3.7)	m^3 as CaC(	5,400	7,800	9,200	5,800				
Alkalinity - Total	m^3 as CaC(	1.0	1.0	1.0	6				
Dissolved Heavy Metals and Trace Elemen									
Aluminium-Dissolved	g/m^3	320		400					
Antimony-Dissolved	g/m^3	0.0104		0.02					
Arsenic-Dissolved	g/m^3	77.00	114.00	125.00	47.00				
Barium-Dissolved	g/m^3	0.005		0.005					
Cadmium-Dissolved	g/m^3	0.0157	0.0152	0.0147	0.0077				
Calcium-Dissolved	g/m^3	220		240					
Chromium-Dissolved	g/m^3	0.34	0.39	0.37	0.182				
Cobalt-Dissolved	g/m^3	1		1.11					
Copper-Dissolved	g/m^3	2.5	2.4	2.3	1.44				
Iron-Dissolved	g/m^3	1740		3000					
Lead-Dissolved	g/m^3	0.0006	0.0011	0.0013	0.0005				
Magnesium-Dissolved	g/m^3	106		125					
Manganese-Dissolved	g/m^3	36		35					
Mercury-Dissolved	g/m^3	0.00015	0.00015	0.00015	0.00015				
Molybdenum-Dissolved	g/m^3	0.0161		0.032					
Nickel-Dissolved	g/m^3	0.53	0.43	0.43	0.28				
Potassium-Dissolved	g/m^3	0.6		0.3					
Selenium-Dissolved	g/m^3	0.021		0.045					
Silver-Dissolved	g/m^3	0.0028		0.0013					
Sodium-Dissolved	g/m^3	1.08		1.01					
Strontium-Dissolved	g/m^3	0.113		0.043					
Sulphate	g/m^3	8,000	13,900	11,500	7,000				
Uranium-Dissolved	g/m^3	0.056		0.075					
Vanadium-Dissolved	g/m^3	0.25		0.41					
Zinc-Dissolved	g/m^3	22	19.6	17	9.3				
Laboratory Field Parameters									
pH(pH units)	pH units	2.1	2	2	2				
Electrical Conductivity	(mS/m)	784	977	987	754				
Leachate									
Volume in Tubing	mL	770	1100	2,000	2,600		680	780	6,710
Volume in Bucket	mL	0	0	0	-		0	0	90
Volume Sampled	mL	770	1100	2,000	2,600	2,100	680	780	6,800

Notes

NES - Not enough to sample

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Sample Origin												
Sample Name		1841581 28-Apr-2022	1843236 26-May-2022				1843666 23-Jun-2022				1844014 21-Jul-2022	1844071 28-Jul-2022
Sample Date and Time		28-Apr-22	26-May-22	2-Jun-22	10-Jun-22	16-Jun-22	23-Jun-22	30-Jun-22	7-Jul-22	14-Jul-22	21-Jul-22	28-Jul-22
Laboratory Reference		2972202.2	2999688.2				3020815.2				3039091.2	3043493.1
Field Parameters												
FLS Electrical Conductivity	mS/m											
FLS pH	pH Units											
FLS Temperature	°C											
Acidity and Alkalinity												
Acidity (pH 3.7)	m^3 as CaC	2,900	3,900				2,100				630	550
Alkalinity - Total	m^3 as CaC	1.0	1.0				1.0				1.0	1.0
Dissolved Heavy Metals and Trace Elemen												
Aluminium-Dissolved	g/m^3	104	136				65				13.3	10.1
Antimony-Dissolved	g/m^3	0.005	0.0068				0.003				0.0024	0.0025
Arsenic-Dissolved	g/m^3	16.90	35				10.5				0.62	0.5
Barium-Dissolved	g/m^3	0.005	0.005				0.005				0.005	0.005
Cadmium-Dissolved	g/m^3	0.0025	0.0021				0.0008				0.0003	0.00015
Calcium-Dissolved	g/m^3	74	89				40				45	32
Chromium-Dissolved	g/m^3	0.059	0.077				0.033				0.006	0.0042
Cobalt-Dissolved	g/m^3	0.4	0.48				0.21				0.06	0.047
Copper-Dissolved	g/m^3	0.7	0.71				0.39				0.092	0.078
Iron-Dissolved	g/m^3	830	1,330				650				153	133
Lead-Dissolved	g/m^3	0.0005	0.0005				0.0005				0.0005	0.0001
Magnesium-Dissolved	g/m^3	40	45				17.2				5.4	3.6
Manganese-Dissolved	g/m^3	8.7	9.6				4				1.32	0.9
Mercury-Dissolved	g/m^3	0.00008	0.00015				0.00008				0.00008	0.00008
Molybdenum-Dissolved	g/m^3	0.0077	0.0125				0.0045				0.001	0.0008
Nickel-Dissolved	g/m^3	0.16	0.189				0.084				0.024	0.02
Potassium-Dissolved	g/m^3	0.3	0.3				0.3				0.3	0.08
Selenium-Dissolved	g/m^3	0.013	0.023				0.009				0.005	0.0017
Silver-Dissolved	g/m^3	0.0011	0.0007				0.0005				0.0005	0.00035
Sodium-Dissolved	g/m^3	1.15	1.97				1.98				1.32	1.8
Strontium-Dissolved	g/m^3	0.017	0.019				0.017				0.022	0.015
Sulphate	g/m^3	3,800	5,800				2,600				730	750
Uranium-Dissolved	g/m^3	0.0137	0.0171				0.0069				0.0053	0.0029
Vanadium-Dissolved	g/m^3	0.096	0.127				0.056				0.022	0.024
Zinc-Dissolved	g/m^3	2.9	2.5				1.1				0.22	0.164
Laboratory Field Parameters												
pH(pH units)	pH units	2.1	2.1				2.2				2.5	2.6
Electrical Conductivity	(mS/m)	2900	634				426				201	196
Leachate												
Volume in Tubing	mL	1,560	1350	9,700	4,700	2,350	1,000	4,200	2,100	6,500	7,120	4,800
Volume in Bucket	mL	0	0	1,100	0	0	0	0	0	9,800	110	1,000
Volume Sampled	mL	1,560	1350	10,800	4,700	2,350	1,000	4,200	2,100	16,300	7,230	5,800

Notes

NES - Not enough to sample

Cells shaded yellow are below the laboratory

4. Column Decommissioning

Representative sub-samples of the column material upon decommissioning were assessed using multi-element and acid base accounting (ABA) accounting. The collated data is summarised in Table 4.1 and the laboratory data is provided in Appendix D.

Table 4.1 Whole Rock Geochemistry – Column Decommissioning

Sample Origin		**T-Stream**	**EG-North**	**EG-South**
Sample Name		**T-Stream**	**EG-North**	**EG-South**
Date and Time		**16/02/2023**	**16/02/2023**	**16/02/2023**
Laboratory Reference	**Unit**	**ME-MS61**	**ME-MS61**	**ME-MS61**
Total Sulphur (S)	%	0.60	0.46	0.59
Total Carbon (C)	%	0.02	0.01	0.01
Acid Neutralising Capacity (ANC)	kg H_2SO_4/T	-1	1	4
Acid Neutralising Capacity (ANC)	% $CaCO_3$ equiv.	-0.1	0.1	0.1
Total Acid Producing (TAP)	kg H_2SO_4/T	18.0	14.0	18.0
Total Acid Producing (TAP)	kg $CaCO_3$/T	18.4	14.3	18.4
Acid Producing	kg H_2SO_4/T	18.36	14.08	18.05
Acid Producing	% $CaCO_3$ equiv.	1.87	1.44	1.84
Acid Neutralising Capacity / Total Acid Producing (ANC/PA Ratio)		-0.05	0.07	0.05
Net Acid Producing Potential (NAPP)	kg H_2SO_4/T	18.0	13.0	14.0
Net Acid Generation pH (NAG pH)	pH unit	3.7	3.7	3.7
Net Acid Generation (NAG)	kg H_2SO_4/T	17.0	11.0	12.0
NP	kg H2SO4/T	1.67	0.83	0.83
NNP	kg $CaCO_3$/T	-16.70	-13.45	-17.53
NPR Ratio	%	0.09	0.06	0.05
Sulphide Sulphate (S-)	%	0.47	0.32	0.42
S	%	0.63	0.47	0.63
Major Elements				
Al	%	8.15	5.6	6.16
Fe	%	1.04	0.92	1.33
Ca	%	0.03	0.05	0.09
Mg	%	0.09	0.04	0.16
Na	%	0.09	0.18	0.16
K	%	3.36	5.83	5.45
Trace Elements				
Sb	ppm	7.97	11.75	9.41
As	ppm	74	131	174
Ba	ppm	400	630	670
Cd	ppm	<0.02	<0.02	<0.02
Co	ppm	0.6	0.4	1.4
Cr	ppm	5	6	6
Cu	ppm	5.2	2.6	4.6
Pb	ppm	16.8	12.7	11.4
Hg	ppm	0.489	0.098	0.067
Mn	ppm	53	53	158
Mo	ppm	1.43	1.26	1.19
Ni	ppm	0.8	0.6	2.4
Se	ppm	<1	1	1
V	ppm	35	11	17
Zn	ppm	6	4	12

5. Limitations

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The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described throughout this report and in the appendices. GHD disclaims liability arising from any of the assumptions being incorrect.

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The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

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Regards

Tim Mulliner
Technical Lead - Environment

This Technical Memorandum is provided as an interim output under our agreement with Oceana Gold NZ Ltd. It is provided to foster discussion in relation to technical matters associated with the project and should not be relied upon in any way.

Appendices

Appendix A

Column Set Up Methodology

Memorandum

16 June 2021

To	Mark Burroughs, Oceana Gold NZ Ltd.		
Copy to	Thomas Gardner, Oceana Gold NZ Ltd.; Ian Jenkins, AECOM NZ Ltd.		
From	Carlos Hillman, Tim Mulliner	Tel	+64 3 378 0900
Subject	WKP Waste Rock Field Column Testing Set-up	Project no.	12552081

Introduction and Background

GHD Limited (GHD) has been engaged by Oceana Gold New Zealand Ltd (Oceana Gold) to undertake Geochemical characterisation of the WKP tunnel and mine spoil. This memorandum outlines specifications, set up and operational procedures for the field column tests to aid the geochemical characterisation and assessment.

The purpose of the column tests is to investigate the onset of acid producing leachate and leachate water quality from the waste rock material associated with the WKP Ore Body. Data gathered will enable geochemical characterisation of waste material and its similarity or dissimilarity to waste material currently handled at the existing and proposed Waihi operations. This will then aid methodology for the development of backfill placement and estimating WKP tunnel inflow water quality.

The methodology outlined here is an adaptation of the methodology as outlined in AECOM, 2017[1]

Column Setup and Specification

The existing columns on site (dimensions approximately 800 mm high, 300 mm diameter equalling a total volume of approximately 0.057 m^3 each) will be utilised. The existing columns should be prepared for use by emptying and cleaning, replacing all tubing and buckets (with sealed lids) with food grade plastic and setting up the columns as outlined in Figure 1. Any new or pre-existing equipment should be thoroughly flushed with an acid wash to remove any existing contaminants. It is recommended that if possible, the column cylinders be replaced.

K1 gravel material is recommended at the base of the columns and placed at a thickness that will allow free drainage of leachate to occur (approximately 100 mm). Tubing should be sealed to the base of the columns to collect drainage and avoid any leakage. The length of the tubing should be sufficient so that it can be connected to the collection buckets beneath the columns and long enough so the outlet of the piping can be attached to the side of the column at a height above the maximum level of the waste rock within the column (introducing a head pressure gradient to enable the column to become fully saturated). Tubing should be secured in place (at side of column and top of bucket) in a way that it can easily be released (when sampling) and repositioned when required. Where the tubing connects at the top of the leachate buckets it should be ‘sealed’ in a manner that avoids water other than leachate entering the buckets and enables the removal of the tubing for sampling during the column operation. An approximate tubing length of 1000 – 2000 mm is therefore recommended.

[1] Standard Operating Procedure for PYE Field Columns, Waihi – Set up and sample collection. AECOM, (2017).

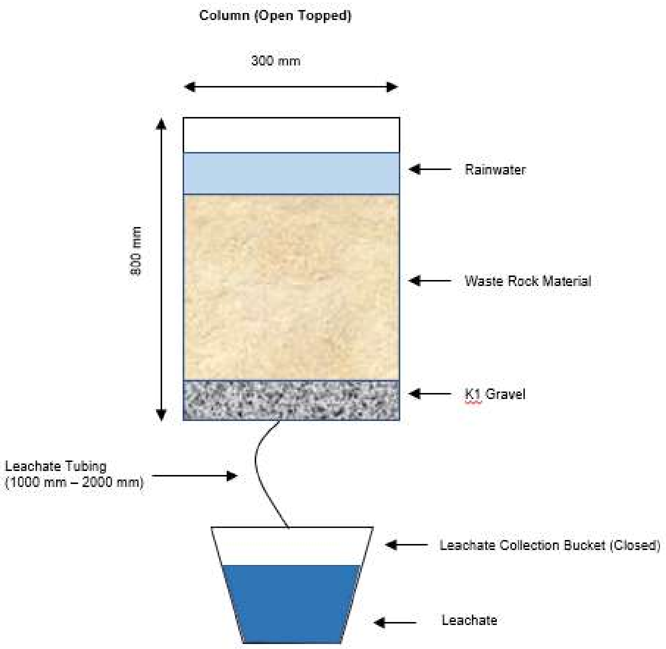

Figure 1 Column Set-up and Specifications

Figure 2 Historical On-site Column Setup (2019)

Waste Rock Selection and Preparation

Three separate columns will be set-up using core material representative of waste spoil and/or tunnel/stope lining material from the WKP Ore body. One column will consist of material surrounding the T-Stream Vein (Drill Site 2) and two columns will exist of material associated with the EG Vein (Drill Site 4 (Northern area) and Drill Site 1 (Southern area)). Each column will contain approximately 60 kg of waste rock representative of the Rhyolitic waste material. Waste rock should be sourced from core material as identified by GHD in the provided spreadsheets (to be provided separately). Appropriate material is selected based on core logs, assay data and photos previously provided to GHD from Oceana Gold.

Once the selected material for each individual column is selected, the material should be fully mixed prior to being crushed (crushing was previously undertaken by the local SGS lab). This will ensure the maximum particle size is not greater than 60 mm or 20% of the column diameter.

Representative samples from each column should be sent for analysis for the parameters detailed in Table 1

The balance of the material should then be placed directly on top of the K1 gravel within the columns. This material should be weighed prior to placing in the column so that total mass of waste within each column is known. A minimum of 150 mm should be maintained between the top of the sample and the top of the column.

Table 1 Recommended Analytical Suite for Column Waste Rock

Required Analytes
PSD (Particle Size Distribution)
NAG pH
Total Sulphur (%)
Total Carbon (%)
ANC (kg $CaCO_3$/tonne)
Aluminium
Iron
Calcium
Magnesium
Sodium
Potassium
Antimony
Arsenic
Barium
Cadmium
Cobalt
Chromium
Copper
Lead
Mercury
Manganese
Molybdenum
Nickel
Selenium
Vanadium
Zinc
Titanium
Tin
Silver
Thallium
Fluoride
Uranium

Column Operation and Sample Procedure

The columns should be left exposed to atmospheric conditions for a minimum of 10 weeks. This initial phase is to ensure that oxidation of the waste rock takes place and becomes acid producing. During this initial phase, leachate generated should be monitored weekly. Depending on the results, the monitoring frequency may be extended with time.

Samples can be obtained by carefully removing the leachate tubing from the bucket and collecting leachate directly from the tubing into laboratory supplied containers suitable for the analysis of the parameters detailed in Table 2 and Table 3.

The expanded and reduced analytical suite should be undertaken on alternate weeks. It is recommended that the expanded suite is utilised for the first flush sample (the first leachate collection event).

Field parameters should be collected utilising a calibrated multi-parameter (or similar individual meters) and the following field parameters recorded:

- pH
- Conductivity
- Temperature

It is recommended that calibration of pH and conductivity is undertaken using appropriate calibration solutions that cover the likely range of measured parameters.

The remaining leachate should be left to drain into the bucket until the tubing runs dry. The volume of leachate within the bucket should be recorded and sampled before reconnecting the tubing to the empty bucket.

If insufficient leachate drains from the tubing and base of column to enable the collection of water samples and/or accurate measurement of field parameters, static water within the bucket should be utilised.

If no leachate water (or insufficient leachate water) is available, a measured volume of 500 mL of de-ionised water should be poured into the column at the top, and the leachate should be collected as described above. Where this is required, it should be recorded on the sampling sheet. In the event that there is frequently not enough leachate to sample within the tubing, a measured volume of deionised water should be added to the top of the column several days before sampling to ensure sufficient water is available. The water level of the columns and buckets should be monitoring during and after heavy rainfall events in order to prevent overflow. If leachate buckets need emptying in between the weekly sample cycle, it is recommended that field parameters (as above) be recorded prior to the disposal of the leachate water.

The water level of the columns and buckets should be monitoring during and after heavy rainfall events in order to prevent overflow. If leachate buckets need emptying in between the weekly sample cycle, it is recommended that field parameters (as above) be recorded prior to the disposal of the leachate water.

Table 2 Recommended Analytical Suite for the Leachate Sample Collection – Expanded Suite

Required Analytes
pH
Conductivity
Acidity (mg $CaCO_3$/L)
Alkalinity (mg $CaCO_3$/L)
Sulphate
Dissolved Aluminium
Dissolved Iron
Dissolved Calcium
Dissolved Magnesium
Dissolved Sodium
Dissolved Potassium
Dissolved Antimony
Dissolved Arsenic
Dissolved Barium
Dissolved Cadmium
Dissolved Cobalt
Dissolved Chromium
Dissolved Copper
Dissolved Lead
Dissolved Mercury
Dissolved Manganese
Dissolved Molybdenum
Dissolved Nickel
Dissolved Selenium
Dissolved Vanadium
Dissolved Zinc
Dissolved Titanium
Dissolved Tin
Dissolved Silver
Dissolved Thallium
Dissolved Fluoride
Dissolved Uranium

*It is recommended that samples are field filtered and are analysed at trace level.

*Table 3 Recommended Analytical Suite for the Leachate Sample Collection – Reduced Suite_*

Required Analytes
pH
Conductivity
Acidity (mg $CaCO_3$/L)
Alkalinity (mg $CaCO_3$/L)
Sulphate
Dissolved Arsenic
Dissolved Cadmium
Dissolved Chromium
Dissolved Copper
Dissolved Lead
Dissolved Nickel
Dissolved Zinc

*It is recommended that samples are field filtered and are analysed at trace level.

Results should be forwarded to GHD upon receipt and will be reviewed in terms of the acid generating. Once the columns are verified as being acid producing (generally based on a measured pH <3 and elevated sulphate) GHD will review and advise on requirements for ongoing monitoring.

Regards

Carlos Hillman

Geochemist

Appendix B

Whole Rock Laboratory Data

ANALYSIS REPORT
WP21-09045

Client: Oceana Gold (New Zealand) Ltd
PO Box 190

Waihi 3641 NEW ZEALAND
Attention: Mark Burroughs

Received: 24-Nov-2021
Completed: 23/12/2021
Job Number: WP21-09045
Report Number: 0000019912
Order Reference: 70057883

Sample ID	ESO_CSA06V S % LOR 0.01	ESO_CSA06V C % LOR 0.01	ESO_CLA48V ANC H2SO4 KGH2SO4/T LOR -1,000.00	ESO_CLA48V ANC CaCO3 % LOR -100.00	ESO_CLA48V TAP KGH2SO4/T LOR 0.15
T-Stream (B1-SS3)	1.05	0.028	2	0.2	32
EG North (B2-SS3)	0.770	0.020	2	0.2	24
EG south (B3-SS3)	0.938	0.019	5	0.5	29

ANALYSIS REPORT
WP21-09045

Client:	Oceana Gold (New Zealand) Ltd PO Box 190 Waihi 3641 NEW ZEALAND Attention: Mark Burroughs	**Received:** **Completed:** **Job Number:** **Report Number:** **Order Reference:**	24-Nov-2021 23/12/2021 WP21-09045 0000019912 70057883

Sample ID	ESO_CLA48V NAPP KGH2SO4/T LOR -1,000.00	ESO_CLA49V NAG pH pH unit LOR 2.00	ESO_CLA49V NAG KGH2SO4/T	ESO_CSA08V Sulphide S % LOR 0.01
T-Stream (B1-SS3)	31	3.1	30	0.834
EG North (B2-SS3)	21	3.3	21	0.624
EG south (B3-SS3)	24	3.2	25	0.777

Date Start/End Analysis (7/12/2021 - 23/12/2021)

* - Denotes non accredited tests

REMARKS:
Note that general geochem carbon analysis is not performed routinely, and has been done at request using the Leco CHN analyser used for coal ultimate analysis. Calibration curve set up using geo sulphur CRMs which had certified carbon values.
NAG pH for blank was 5.4.

APPLIED METHODS:

ESO_CSA06V: Total sulphur/carbon, LECO Method: SGS Global method

ESO_CLA48V: Determination of ANC, TAP and NAPP of Soils/Rocks: SGS inhouse method

ESO_CLA49V: Net Acid Generation Test: SGS Global method

ANALYSIS REPORT

WP21-09045

Client:	Oceana Gold (New Zealand) Ltd PO Box 190 Waihi 3641 NEW ZEALAND Attention: Mark Burroughs	**Received:** **Completed:** **Job Number:** **Report Number:** **Order Reference:**	24-Nov-2021 23/12/2021 WP21-09045 0000019912 70057883

Signed and dated on 23-Dec-2021

Nick LEES
Operations Manager

Australian Laboratory Services Pty. Ltd.

32 Shand Street
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Brisbane QLD 4053
Phone: +61 7 3243 7222 Fax: +61 7 3243 7218
www.alsglobal.com/geochemistry

ALS Brisbane is a NATA Accredited Testing Laboratory. Corporate Accreditation No: 825, Corporate Site No: 818.

To: OCEANA GOLD (NZ) LTD
PO BOX 5442
DUNEDIN 9058
NEW ZEALAND

Finalized Date: 12-FEB-2022
Account: OCEGOL

CERTIFICATE BR21332922

Project: WNP

This report is for 3 samples of Crushed Core submitted to our lab in Brisbane, QLD, Australia on 2-NOV-2021.

The following have access to data associated with this certificate:

CASSIE CRAIG	THOMAS GARDNER	REBECCA HILLYARD

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
LEV-01	Waste Disposal Levy
QAR-01	Quarantine Treatment Charge
LOG-22	Sample login - Rcd w/o BarCode
PUL-23	Pulv Sample - Split/Retain
BAG-01	Bulk Master for Storage
PUL-QC	Pulverizing QC Test
TRA-21	Transfer sample

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
F-ELE81a	F by Specific Ion Electrode	TITRATOR
ME-MS61	48 element four acid ICP-MS	
Hg-MS42	Trace Hg by ICPMS	ICP-MS

This is the Final Report and supersedes any preliminary report with this certificate number.Results apply to samples as submitted.All pages of this report have been checked and approved for release.
***** See Appendix Page for comments regarding this certificate *****

Signature:

Shaun Kenny, Brisbane Laboratory Manager

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DUNEDIN 9058
NEW ZEALAND

Finalized Date: 12-FEB-2022
Account: OCEGOL

Project: WNP

CERTIFICATE OF ANALYSIS BR21332922

Sample Description	Method Analyte Units LOD	WEI-21 Recvd Wt. kg 0.02	PUL-QC Pass75um % 0.01	F-ELE81a F ppm 20	ME-MS61 Ag ppm 0.01	ME-MS61 Al % 0.01	ME-MS61 As ppm 0.2	ME-MS61 Ba ppm 10	ME-MS61 Be ppm 0.05	ME-MS61 Bi ppm 0.01	ME-MS61 Ca % 0.01	ME-MS61 Cd ppm 0.02	ME-MS61 Ce ppm 0.01	ME-MS61 Co ppm 0.1	ME-MS61 Cr ppm 1	ME-MS61 Cs ppm 0.05
B1- SS1		1.17	99.1	60	0.61	7.37	134.5	390	0.72	0.04	0.46	0.02	25.0	2.5	9	8.52
B2- SS1		1.98	99.1	30	0.87	5.18	201	600	0.79	0.03	0.18	0.02	31.6	1.3	7	7.46
B3- SS1		2.16	99.2	80	1.05	5.71	228	630	0.98	0.07	0.40	0.03	32.8	2.8	10	8.68

***** See Appendix Page for comments regarding this certificate *****

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NEW ZEALAND

Finalized Date: 12-FEB-2022
Account: OCEGOL

Project: WNP

CERTIFICATE OF ANALYSIS BR21332922

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	Hg-MS42	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb
	Units	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm
	LOD	0.2	0.01	0.05	0.05	0.1	0.005	0.005	0.01	0.5	0.2	0.01	5	0.05	0.01	0.1
B1- SS1		12.9	1.33	13.60	0.06	2.5	0.550	0.037	3.10	14.2	102.5	0.12	79	2.00	0.07	6.8
B2- SS1		6.2	1.32	9.00	0.08	1.6	0.076	0.016	4.19	15.6	42.9	0.04	90	1.41	0.15	5.9
B3- SS1		6.5	1.64	10.25	0.08	1.6	0.064	0.014	3.39	16.1	35.6	0.15	216	1.65	0.13	5.4

***** See Appendix Page for comments regarding this certificate *****

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NEW ZEALAND

Finalized Date: 12-FEB-2022
Account: OCEGOL

Project: WNP

CERTIFICATE OF ANALYSIS BR21332922

Sample Description	Method / Analyte / Units / LOD	ME-MS61 Ni ppm 0.2	ME-MS61 P ppm 10	ME-MS61 Pb ppm 0.5	ME-MS61 Rb ppm 0.1	ME-MS61 Re ppm 0.002	ME-MS61 S % 0.01	ME-MS61 Sb ppm 0.05	ME-MS61 Sc ppm 0.1	ME-MS61 Se ppm 1	ME-MS61 Sn ppm 0.2	ME-MS61 Sr ppm 0.2	ME-MS61 Ta ppm 0.05	ME-MS61 Te ppm 0.05	ME-MS61 Th ppm 0.01	ME-MS61 Ti % 0.005
B1- SS1		3.1	90	15.8	185.5	<0.002	1.06	7.60	4.1	<1	3.7	38.0	0.62	<0.05	12.15	0.086
B2- SS1		1.6	50	11.4	250	<0.002	0.75	11.50	3.0	<1	1.7	50.8	0.49	<0.05	10.10	0.065
B3- SS1		2.6	350	10.7	226	<0.002	0.95	9.23	3.9	<1	1.9	60.8	0.47	<0.05	9.50	0.099

***** See Appendix Page for comments regarding this certificate *****

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NEW ZEALAND

Finalized Date: 12-FEB-2022
Account: OCEGOL

Project: WNP

CERTIFICATE OF ANALYSIS BR21332922

Sample Description	Method Analyte Units LOD	ME-MS61 Tl ppm 0.02	ME-MS61 U ppm 0.1	ME-MS61 V ppm 1	ME-MS61 W ppm 0.1	ME-MS61 Y ppm 0.1	ME-MS61 Zn ppm 2	ME-MS61 Zr ppm 0.5
B1- SS1		2.04	2.9	38	1.7	10.7	13	67.5
B2- SS1		3.47	1.9	10	1.2	11.1	19	44.5
B3- SS1		3.73	1.8	16	1.5	11.3	32	44.5

***** See Appendix Page for comments regarding this certificate *****

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DUNEDIN 9058
NEW ZEALAND

Finalized Date: 12-FEB-2022
Account: OCEGOL

Project: WNP

CERTIFICATE OF ANALYSIS BR21332922

CERTIFICATE COMMENTS

ANALYTICAL COMMENTS

REEs may not be totally soluble in this method.

Applies to Method: ME-MS61

ACCREDITATION COMMENTS

NATA Accreditation covers the performance of this service but does not cover the performance of ALS Brisbane Sample Preparation. Corporate Accreditation No: 825, Corporate Site No: 818. The Technical Signatory is David Jones,ICPMS Supervising Chemist

Applies to Method: ME-MS61

LABORATORY ADDRESSES

Processed at ALS Brisbane located at 32 Shand Street, Stafford, Brisbane, QLD, Australia. Processed at ALS Brisbane Sample Preparation at 23 Pineapple Street, Zillmere, QLD, 4034, Australia

Applies to Method:

BAG-01	F-ELE81a	Hg-MS42	LEV-01
LOG-22	ME-MS61	PUL-23	PUL-QC
QAR-01	TRA-21	WEI-21	

Appendix C

Particle Size Distribution Analysis

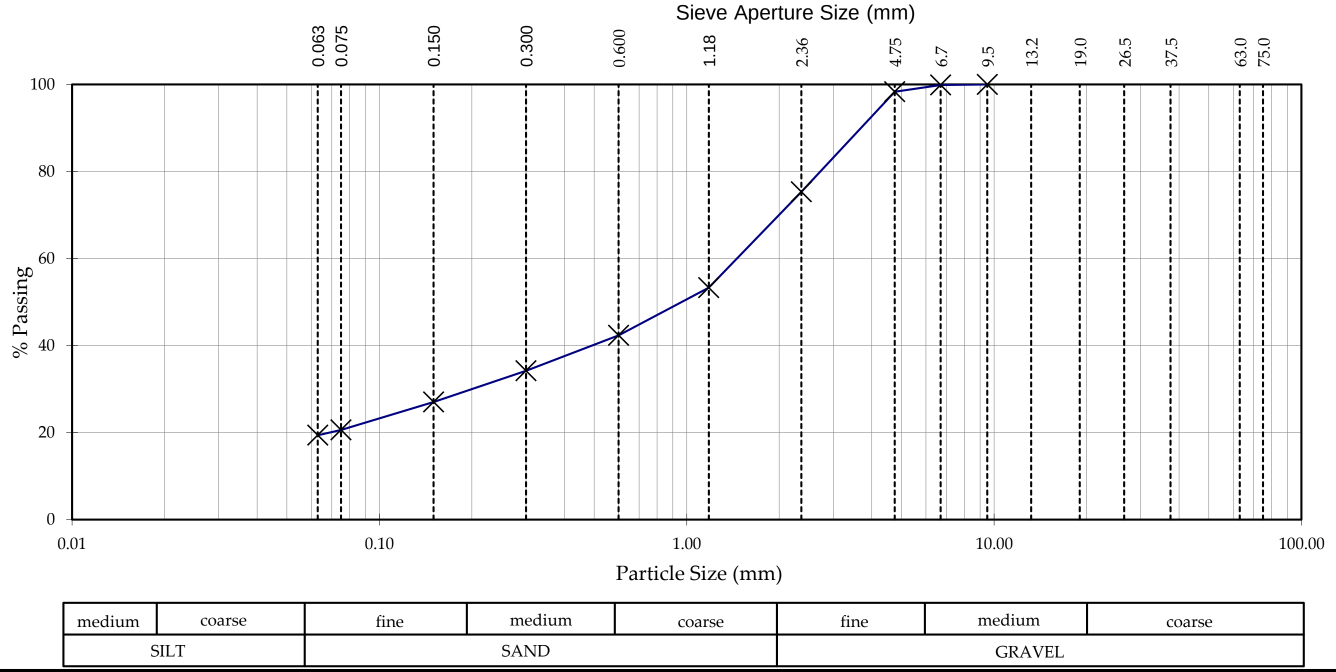
WET SIEVE ANALYSIS
TEST REPORT

Project :	Leach Column WUG
Location :	43, Moresby Avenue, Waihi 2610
Client :	OceanaGold
Contractor :	Rebecca Hillyard
Sampled by :	Rebecca Hillyard
Date sampled :	17/09/2021
Sampling method :	Drill core
Sample description :	Core samples
Sample condition	Crushed
Source	Waihi, T- Stream (B1)
Depth (m) :	n/a

Project No :	5-24G21.67
Lab Ref No :	OR1378A
Client Ref No :	B1-SS2

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	-	19.00	-	4.75	98	0.300	34
63.00	-	13.20	-	2.36	75	0.150	27
37.50	-	9.50	100	1.18	53	0.075	21
26.50	-	6.70	100	0.600	42	0.063	19



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: As received Fraction tested: Whole Dispersant Used: Sodium hexametaphosphate w/ Sodium carbonate All information supplied by Client Sample size is less than specified in NZS4407:2015.

Date tested : 02 - 04/11/2021
Date reported : 09/11/2021

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full

IANZ Approved Signatory

Designation : *Laboratory Technician (Z. Francis)*
Date : 09/11/2021

ACCREDITED IANZ TESTING LABORATORY

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

WSP New Zealand Limited
WSP Research & Innovation Centre
Quality Management Systems Certified to ISO 9001

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New Zealand

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Facsimile +64 4 587 0604
Website www.wsp.com/en-NZ

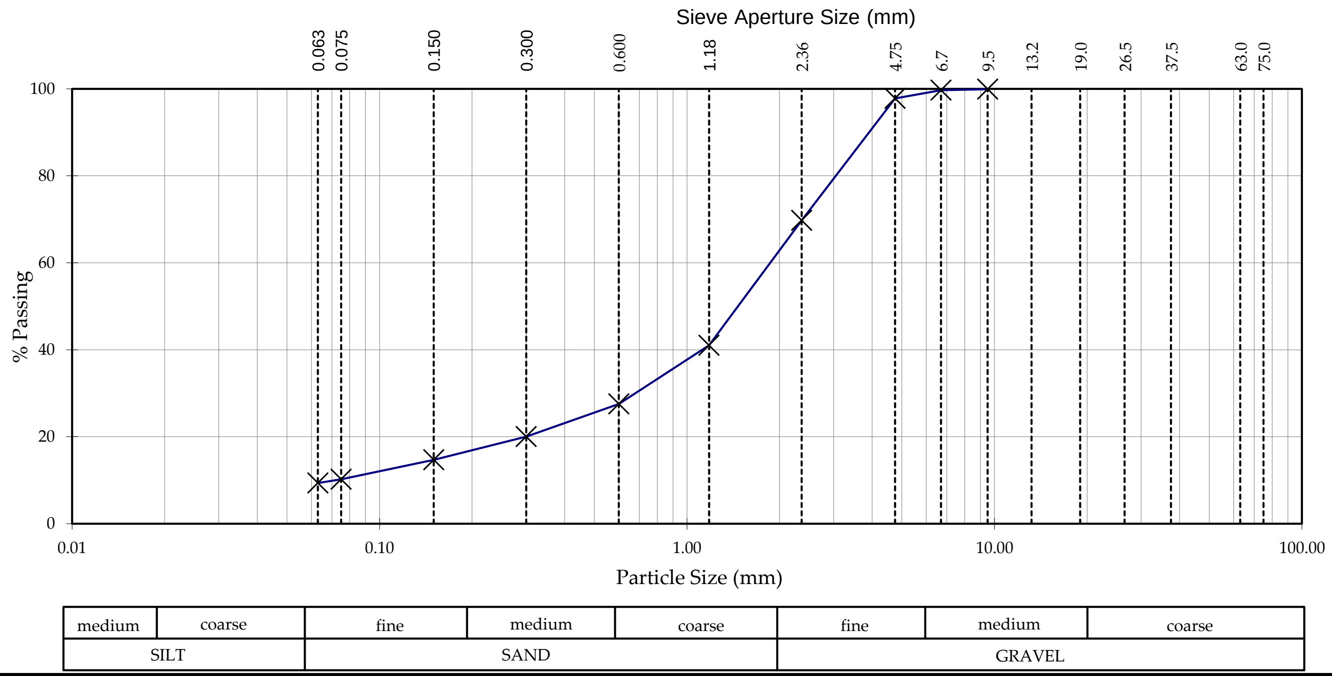
WET SIEVE ANALYSIS
TEST REPORT

Project :	Leach Column WUG
Location :	43, Moresby Avenue, Waihi 2610
Client :	OceanaGold
Contractor :	Rebecca Hillyard
Sampled by :	Rebecca Hillyard
Date sampled :	17/09/2021
Sampling method :	Drill core
Sample description :	Core samples
Sample condition	Crushed
Source	Waihi, EG North (B2)
Depth (m) :	n/a

Project No :	5-24G21.67
Lab Ref No :	OR1378B
Client Ref No :	B2-SS2

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	-	19.00	-	4.75	98	0.300	20
63.00	-	13.20	-	2.36	70	0.150	15
37.50	-	9.50	100	1.18	41	0.075	10
26.50	-	6.70	100	0.600	28	0.063	9



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: As received Fraction tested: Whole Dispersant Used: Sodium hexametaphosphate w/ Sodium carbonate All information supplied by Client Sample size is less than specified in NZS4407:2015.

Date tested : 02 - 04/11/2021
Date reported : 09/11/2021

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
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IANZ Approved Signatory

Designation : *Laboratory Technician (Z. Francis)*
Date : 09/11/2021

ACCREDITED IANZ TESTING LABORATORY

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

PF-LAB-099 (11/07/2020)

WSP New Zealand Limited
WSP Research & Innovation Centre
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Website www.wsp.com/en-NZ

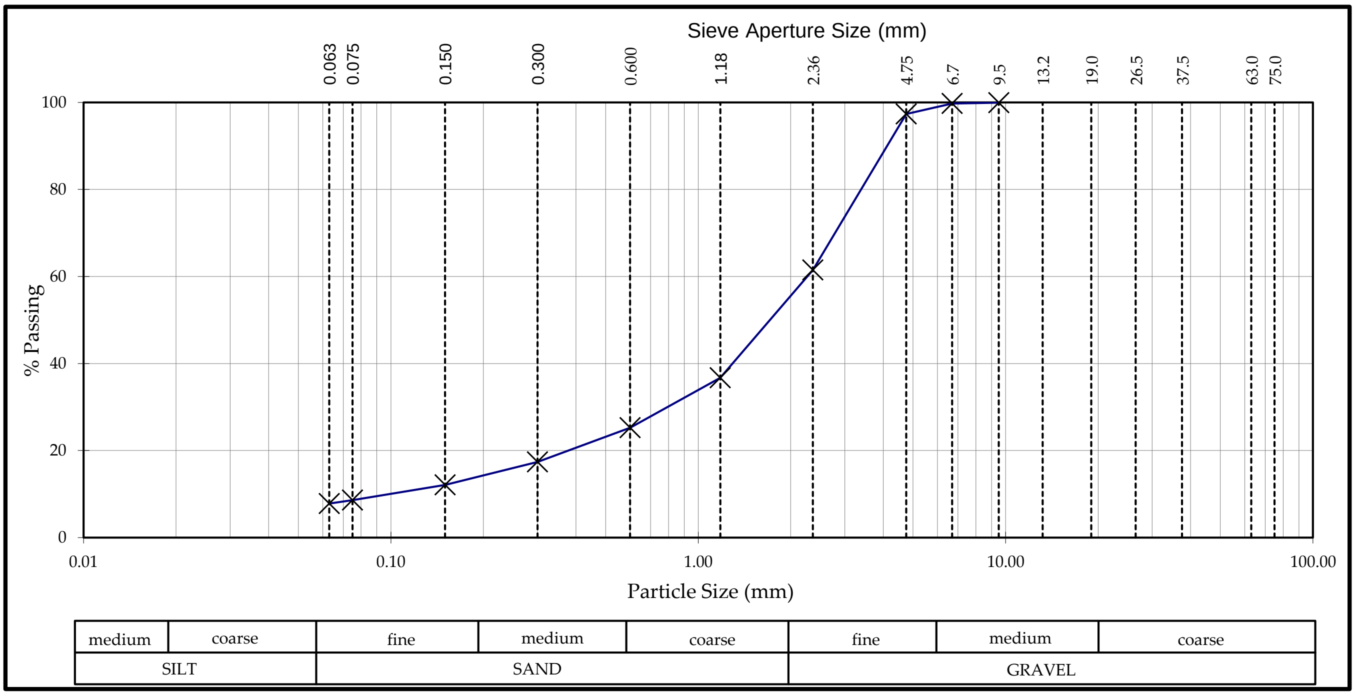
WET SIEVE ANALYSIS
TEST REPORT

Project :	Leach Column WUG
Location :	43, Moresby Avenue, Waihi 2610
Client :	OceanaGold
Contractor :	Rebecca Hillyard
Sampled by :	Rebecca Hillyard
Date sampled :	17/09/2021
Sampling method :	Drill core
Sample description :	Core samples
Sample condition	Crushed
Source	Waihi, EG South (B3)
Depth (m) :	n/a

Project No :	5-24G21.67
Lab Ref No :	OR1378C
Client Ref No :	B3-SS2

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	-	19.00	-	4.75	97	0.300	17
63.00	-	13.20	-	2.36	61	0.150	12
37.50	-	9.50	100	1.18	37	0.075	9
26.50	-	6.70	100	0.600	25	0.063	8



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: As received Fraction tested: Whole Dispersant Used: Sodium hexametaphosphate w/ Sodium carbonate All information supplied by Client Sample size is less than specified in NZS4407:2015.

Date tested : 02 - 04/11/2021
Date reported : 09/11/2021

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full

IANZ Approved Signatory

Designation : *Laboratory Technician (Z. Francis)*
Date : 09/11/2021

ACCREDITED IANZ TESTING LABORATORY

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

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Appendix D

Whole Rock Laboratory Data - Decommissioning

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ALS Brisbane is a NATA Accredited Testing Laboratory. Corporate Accreditation No: 825, Corporate Site No: 818.

To: **OCEANA GOLD (NZ) LTD**
PO BOX 5442
DUNEDIN 9058
NEW ZEALAND

Finalized Date: 16-FEB-2023
Account: OCEGOL

CERTIFICATE BR23024242

Project: WNP
P.O. No.: 70058128
This report is for 3 samples of Other submitted to our lab in Brisbane, QLD, Australia on 30-JAN-2023.
The following have access to data associated with this certificate:

CASSIE MCARTHUR	TIM MULLINER	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
LOG-22	Sample login - Rcd w/o BarCode
LEV-01	Waste Disposal Levy
TRA-21	Transfer sample
PUL-32	Pulverize 1000g to 85% < 75 um
PUL-QC	Pulverizing QC Test
BAG-01	Bulk Master for Storage

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
F-ELE81a	F by Specific Ion Electrode	TITRATOR
ME-MS61	48 element four acid ICP-MS	
Hg-MS42	Trace Hg by ICPMS	ICP-MS

This is the Final Report and supersedes any preliminary report with this certificate number.Results apply to samples as submitted.All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature:

Shaun Kenny, Brisbane Laboratory Manager

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PO BOX 5442
DUNEDIN 9058
NEW ZEALAND

Finalized Date: 16-FEB-2023
Account: OCEGOL

Project: WNP

CERTIFICATE OF ANALYSIS BR23024242

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga
	Units	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm
	LOD	0.01	0.01	0.2	10	0.05	0.01	0.01	0.02	0.01	0.1	1	0.05	0.2	0.01	0.05
EG North		3.37	5.60	131.0	630	0.83	0.04	0.05	<0.02	35.4	0.4	6	9.24	2.6	0.92	10.75
EG South		0.92	6.16	174.0	670	0.91	0.07	0.09	<0.02	35.2	1.4	6	9.62	4.6	1.33	11.35
T Stream		0.72	8.15	74.0	400	0.69	0.06	0.03	<0.02	26.8	0.6	5	9.50	5.2	1.04	15.55

***** See Appendix Page for comments regarding this certificate *****

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DUNEDIN 9058
NEW ZEALAND

Finalized Date: 16-FEB-2023
Account: OCEGOL

Project: WNP

CERTIFICATE OF ANALYSIS BR23024242

Sample Description	Method	ME-MS61	ME-MS61	Hg-MS42	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb
	Units	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm
	LOD	0.05	0.1	0.005	0.005	0.01	0.5	0.2	0.01	5	0.05	0.01	0.1	0.2	10	0.5
EG North		0.05	1.8	0.098	0.009	5.83	18.1	42.2	0.04	53	1.26	0.18	5.5	0.6	50	12.7
EG South		0.05	1.7	0.067	0.012	5.45	18.0	33.8	0.16	158	1.19	0.16	5.1	2.4	340	11.4
T Stream		<0.05	2.8	0.489	0.030	3.36	15.2	115.0	0.09	53	1.43	0.09	7.0	0.8	70	16.8

***** See Appendix Page for comments regarding this certificate *****

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NEW ZEALAND

Project: WNP

Finalized Date: 16-FEB-2023
Account: OCEGOL

CERTIFICATE OF ANALYSIS BR23024242

Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
Analyte	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V
Units	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
Sample Description / LOD	0.1	0.002	0.01	0.05	0.1	1	0.2	0.2	0.05	0.05	0.01	0.005	0.02	0.1	1
EG North	296	<0.002	0.47	11.75	3.5	1	1.8	49.0	0.54	<0.05	11.25	0.069	3.99	2.1	11
EG South	292	<0.002	0.63	9.41	4.1	1	1.9	60.5	0.50	<0.05	9.97	0.106	4.20	1.9	17
T Stream	188.0	<0.002	0.63	7.97	4.5	<1	4.2	34.0	0.68	<0.05	13.00	0.093	2.27	3.1	35

***** See Appendix Page for comments regarding this certificate *****

Australian Laboratory Services Pty. Ltd.
32 Shand Street
Stafford
Brisbane QLD 4053
Phone: +61 7 3243 7222 Fax: +61 7 3243 7218
www.alsglobal.com/geochemistry

ALS Brisbane is a NATA Accredited Testing Laboratory. Corporate Accreditation No: 825, Corporate Site No: 818.

To: **OCEANA GOLD (NZ) LTD**
PO BOX 5442
DUNEDIN 9058
NEW ZEALAND

Finalized Date: 16-FEB-2023
Account: OCEGOL

Project: WNP

CERTIFICATE OF ANALYSIS BR23024242

Sample Description	Method / Analyte / Units / LOD	ME-MS61 W ppm 0.1	ME-MS61 Y ppm 0.1	ME-MS61 Zn ppm 2	ME-MS61 Zr ppm 0.5	WEI-21 Recvd Wt. kg 0.02	PUL-QC Pass75um % 0.01	F-ELE81a F ppm 20
EG North		1.5	11.8	4	49.2	0.34	99.1	30
EG South		2.6	12.0	12	48.5	0.34	99.1	90
T Stream		2.0	11.2	6	76.8	0.23		60

***** See Appendix Page for comments regarding this certificate *****

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CERTIFICATE OF ANALYSIS BR23024242

CERTIFICATE COMMENTS

ANALYTICAL COMMENTS

REEs may not be totally soluble in this method.

Applies to Method: ME-MS61

ACCREDITATION COMMENTS

NATA Accreditation covers the performance of this service but does not cover the performance of ALS Brisbane Sample Preparation. Corporate Accreditation No: 825, Corporate Site No: 818. The Technical Signatory is David Jones,ICPMS Supervising Chemist

Applies to Method: ME-MS61

LABORATORY ADDRESSES

Processed at ALS Brisbane located at 32 Shand Street, Stafford, Brisbane, QLD, Australia. Processed at ALS Brisbane Sample Preparation at 23 Pineapple Street, Zillmere, QLD, 4034, Australia

Applies to Method:

BAG-01	F-ELE81a	Hg-MS42	LEV-01
LOG-22	ME-MS61	PUL-32	PUL-QC
TRA-21	WEI-21		

ANALYSIS REPORT

WP22-11176

Client: Oceana Gold (New Zealand) Ltd
PO Box 190

Waihi 3641 NEW ZEALAND
Attention:

Received: 20-Oct-2022
Completed: 01/11/2022
Job Number: WP22-11176
Report Number: 0000023587
Order Reference: 70057883

Sampled By:

Sample ID	Laboratory ID	ESO_CSA06V S % LOR 0.01	ESO_CSA06V C % LOR 0.01	ESO_CLA48V ANC H2SO4 KGH2SO4/T LOR -1,000.00	ESO_CLA48V ANC CaCO3 % LOR -100.00
T-Stream	WP22-11176.001	0.60	0.02	-1	-0.1
EG North	WP22-11176.002	0.46	0.01	1	0.1
EG south	WP22-11176.003	0.59	0.01	4	0.4

SGS

ANALYSIS REPORT

WP22-11176

Client: Oceana Gold (New Zealand) Ltd
PO Box 190

Waihi 3641 NEW ZEALAND
Attention:

Received: 20-Oct-2022
Completed: 01/11/2022
Job Number: WP22-11176
Report Number: 0000023587
Order Reference: 70057883

Sampled By:

Sample ID	**Laboratory ID**	ESO_CLA48V TAP KGH2SO4/T LOR 0.15	ESO_CLA48V NAPP KGH2SO4/T LOR -1,000.00	ESO_CLA49V NAG pH pH unit LOR 2.00	ESO_CLA49V NAG KGH2SO4/T
T-Stream	WP22-11176.001	18	18	3.7	17
EG North	WP22-11176.002	14	13	3.7	11
EG south	WP22-11176.003	18	14	3.7	12

SGS

ANALYSIS REPORT
WP22-11176

Client: Oceana Gold (New Zealand) Ltd
PO Box 190

Waihi 3641 NEW ZEALAND
Attention:

Received: 20-Oct-2022
Completed: 01/11/2022
Job Number: WP22-11176
Report Number: 0000023587
Order Reference: 70057883

Sampled By:

Sample ID	Laboratory ID	ESO_CSA08V Sulphide S % LOR 0.01
T-Stream	WP22-11176.001	0.47
EG North	WP22-11176.002	0.32
EG south	WP22-11176.003	0.42

Date Start/End Analysis (25/10/2022 - 1/11/2022)

* - Denotes non accredited tests

REMARKS:
Note that general geochem carbon analysis is not performed routinely, and has been done at request using the Leco CHN analyser used for coal ultimate analysis. Calibration curve set up using geo sulphur CRMs which had certified carbon values.

NAG pH for blank was 4.7.

APPLIED METHODS:

ESO_CSA06V: Total sulphur/carbon, LECO Method: SGS Global method

ESO_CLA48V: Determination of ANC, TAP and NAPP of Soils/Rocks: SGS inhouse method

ESO_CLA49V: Net Acid Generation Test: SGS Global method

SGS

ANALYSIS REPORT

WP22-11176

Client:	Oceana Gold (New Zealand) Ltd	**Received:**	20-Oct-2022
	PO Box 190	**Completed:**	01/11/2022
		Job Number:	WP22-11176
	Waihi 3641 NEW ZEALAND	**Report Number:**	0000023587
	Attention:	**Order Reference:**	70057883

Signed and dated on 02-Nov-2022

Nick LEES
Operations Manager