



The mine closure specialists



ATLAS PROJECT ACID SULFATE SOILS INVESTIGATION AND MANAGEMENT PLAN

March 2023

MINE EARTH



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EXECUTIVE SUMMARY

Mine Earth was commissioned by Image Resources to complete an acid sulfate soil (ASS) assessment for the Atlas Project (the Project). The Project is located approximately 18 kilometres (km) east of Cervantes in the Shire of Dandaragan, Western Australia (WA).

The ASS assessment comprised the following:

- Analysis of the Project drilling database to identify the presence and location of soils typically associated with ASS.
- A dedicated sampling and analysis program to quantify the presence and location of potentially acid sulphate soils (PASS). The sampling and analysis program comprised:
 - Sonic drilling to a depth of 1m below the proposed disturbance at 26 locations, with collection and analysis of 245 samples.
 - Analysis of all samples for ASS Suite 1 parameters (pH_F and pH_{FOX}).
 - Analysis of 72 samples for ASS Suite 2 parameters, including Cr reducible S (S_{Cr}), acid neutralising capacity and acid base accounting.
 - Analysis of total and leachable metals on selected samples of overburden and tailings material.
- Assessment of relevant groundwater analysis data.
- Assessment of risks and associated management protocols for ASS.

The review of the drilling database for the Project identified the presence of PASS (i.e. dark soil colours with high clay contents) at variable depths within the soil profiles. There appeared to be little consistent spatial correlation of clay content and soil colour, either with position in the landscape and/or depth within the soil profiles.

The Suite 1 ASS laboratory analysis program for the 245 collected samples indicated the following:

- pH_F values ranged from 3.8 to 9.5 and did not appear to have any correlation with sample depth.
- Majority of soils recorded a pH_F > 5.
- 1 sample recorded pH_F ≤ 4, indicating actual acid soil.
- 5 samples recorded pH_F > 4 but ≤ 5, indicating a strong potential for ASS.
- pH_{FOX} values ranged from 1.9 to 9.2 with no apparent correlation with depth or position within the landscape, i.e. samples were distributed throughout the soil profile from near surface to the base of sampling, at variable locations across the deposit.
- 34 samples recorded pH_{FOX} ≤ 3 indicating PASS.
- The change in pH (ΔpH) from pH_F to pH_{FOX} ranged from 0 to 6.4 pH units.
- 43 samples recorded ΔpH > 3 pH units.

The Suite 2 ASS laboratory analysis program for the 72 samples indicated the following:

- Nine of the samples tested exceeded the ASS criteria. Samples exceeding the ASS criteria were present within five of the drilling locations, at sample depths ranging from 2 to 10m.
- Eighteen samples recorded a pH_{FOX} < 3 and > 0.01% S_{Cr}, therefore exceeding the recommended ASS action criteria for Bassendean sands.
- The samples identified as triggering one or all of the ASS action criteria were located within 7 drillholes from variable landscape positions across the deposit.
- All samples identified as PASS recorded a clayey sand to sandy clay texture. No sample intervals logged as 'sand' were classified as PASS.
- All samples identified as PASS were logged as 'dark' soil colours (with actual colour classification variable).

- pH (H₂O) result for the processed tailings clay fines and tailings sand fractions were recorded as circum-neutral.
- The total metals results indicated minor elevated concentrations, relative to the average crustal abundance, for Zn (in three overburden samples) and As (six overburden samples and the tailings clay fines sample).
- Leachable metal concentrations of the overburden and tailings samples were mostly below detection limits, except for Ba, B, Mn and Zn for some samples. All concentrations were below trigger values for livestock drinking water.

Unlike other mineral sands mining operations in the region, there does not appear to be a strong correlation between soil profile stratigraphy, soil texture, soil colour and PASS materials. The PASS identified appear to be distributed in relatively isolated, inconsistent depths within the soil profile. All of the samples identified as PASS were classified as having either sandy clay or clayey sand textures, indicating that while the PASS in the deposit are associated with relatively high clay contents, not all samples with high clay contents were classified as PASS.

Similarly, all PASS samples were logged as having 'dark' soil colours, although the colours of the PASS samples were variable. Given that multiple samples with similar 'dark' soil colour classifications did not exceed any of the PASS action criteria, soil colour alone cannot be used as an indicator of PASS within the deposit. It is considered likely that PASS within the soil profiles are generally associated with relatively high clay contents and 'dark' soil colours, although it cannot be assumed that all 'dark', clay rich materials are PASS.

Further assessment of PASS within the deposit will need to be undertaken during operations to further quantify distribution and volumes of PASS material requiring management. Testing of the pH / pH_{FOX} and S_{Cr} of the subsoil / overburden will be undertaken, particularly where dark coloured, clay rich materials are identified during mining. If the tested materials contain pH_{FOX} values <3 and S_{Cr} values >0.01%, they will require treatment and management in accordance with the guidelines for neutralisation, as detailed within this report.

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1 INTRODUCTION

1.1 Project overview

Image Resources (Image) are proposing to develop the Atlas Mineral Sands Mine (the Project), located approximately 18 km east of Cervantes in the Shire of Dandaragan (Figure 1). Image are proposing to develop an open cut mine pit, processing plant, solar drying ponds and supporting infrastructure for the mining and processing of approximately 5.47 Mt of ore. The mine pit will be dewatered, mined and progressively rehabilitated in stages with a total extent of approximately 3 km long, up to 600 m wide and up to 15 m deep (Preston Consulting, 2022).

1.2 Acid sulfate soil background

A targeted acid sulfate soil (ASS) investigation was conducted for the Project, in accordance with the Government of Western Australia guidelines for identification and investigation of acid sulfate soils and acidic landscapes (the guidelines) (DER, 2015a).

ASS often occur beneath the water table in sandy soil profiles of the Swan Coastal Plain and are often associated with mineral sand deposits (DER, 2015a). ASS are naturally occurring soils and sediments that contain iron sulfides, predominantly in the form of pyrite materials. The disturbance of ASS and exposure to oxygen results in sulfuric acid being formed, which can lead to the release of metals, nutrients and acidity into the soil and groundwater system (DER, 2015b).

ASS includes potential acid sulfate soils (PASS) and actual acid sulfate soils (AASS). PASS are soils or sediments which contain iron sulfides or other sulfide minerals that have not been oxidised, and AASS are soils or sediments which contain iron sulfides or other sulfidic materials that have undergone some oxidation (DER, 2015a).

The study area is located outside of the Swan Coastal Plain ASS risk mapping area, however land units that are considered an ASS risk are located in proximity to or within the area i.e. wetlands, creeklines, high groundwater table areas (DER, 2015a). ASS have been encountered at numerous other mineral sands mines on the northern Swan Coastal Plain (e.g. Boonanarring, Cooljarloo), typically at the boundary of geological formations. Within mineral sands deposits, ASS are typically associated with dark coloured soils and those soils with higher clay fines (clay) contents.

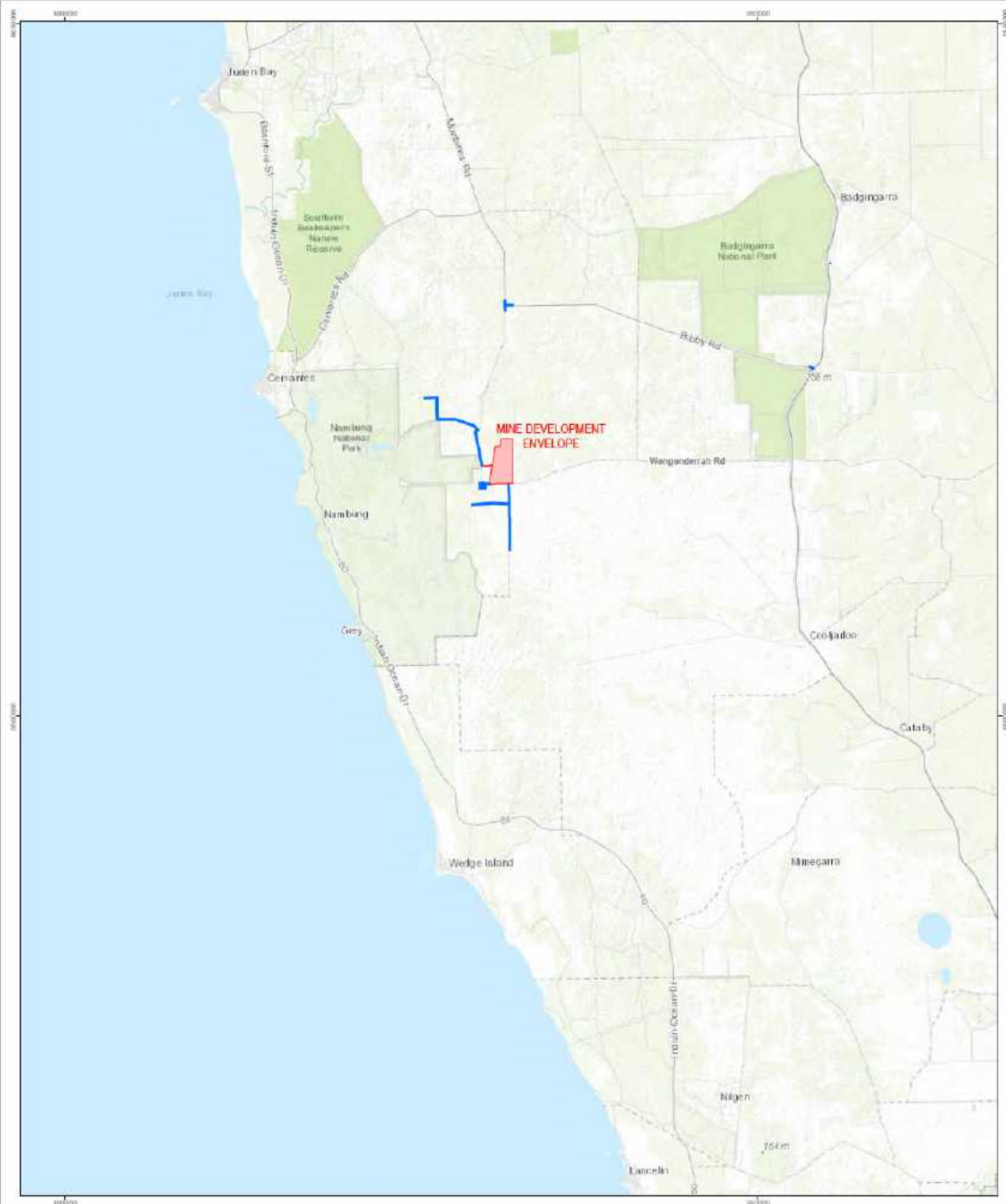
An ASS management plan is required when net acidity as equivalent sulfur (%S) minus acid neutralising capacity is greater than 0.03 %S in soils, in accordance with the guidelines (DER, 2015a). In addition, it has been identified that $\text{pH}_{\text{Fox}} < 3$ and an analytical value of 0.01%S or greater are reliable indicators of ASS and can be used as a basis for managing PASS in Bassendean sands (UWA/DEC, 2011).

1.3 Scope of work

This report presents the results of the ASS investigation and provides details of proposed management measures. It includes the following:

- Existing environmental information relevant to the ASS investigation.
- Review of Project drilling database
- ASS sampling and analysis methodology
- Results of the ASS investigation
- Groundwater assessment
- Interpretation and conceptual model
- Identification of environmental risks
- ASS monitoring and management
- Groundwater monitoring and management

Further detail pertaining to the management of soil, overburden and tailings materials during operations and at closure for the Project is provided within the Atlas Mineral Sands – Soil and Mine Waste Management Plan (Mine Earth, 2022a).





Preston Consulting

CREATED	JOB	DATE	REVISION
ENVIRONMAPS	PC2900270	3/05/2022	0

Image Resources

Figure 1

Regional Location of the Atlas Mineral Sands Project



Legend

- Mine Development Envelope
- External Infrastructure Development Envelope

Source: Open Street Map

2 EXISTING ENVIRONMENT

2.1 Location and land use

The Project is located 18 km east of Cervantes in the Wheatbelt region of WA. The Project sits within an area of remnant vegetation that is surrounded by farmland. Nambung National Park is approximately 1.4 km west of the Project.

2.2 Climate

The climate of the study area is temperate Mediterranean, characterised by cool winters and hot summers. The nearest long term weather station is at Jurien Bay, approximately 33km north. Rainfall averages in the order of 540mm per annum and is predominantly received between April and October. Mean daily temperatures range from around 31°C in February to 20°C in July. Jurien Bay is situated on the coast, which has a moderating effect on climate, with temperature ranges at the Atlas project therefore expected to exceed those experienced at Jurien Bay.

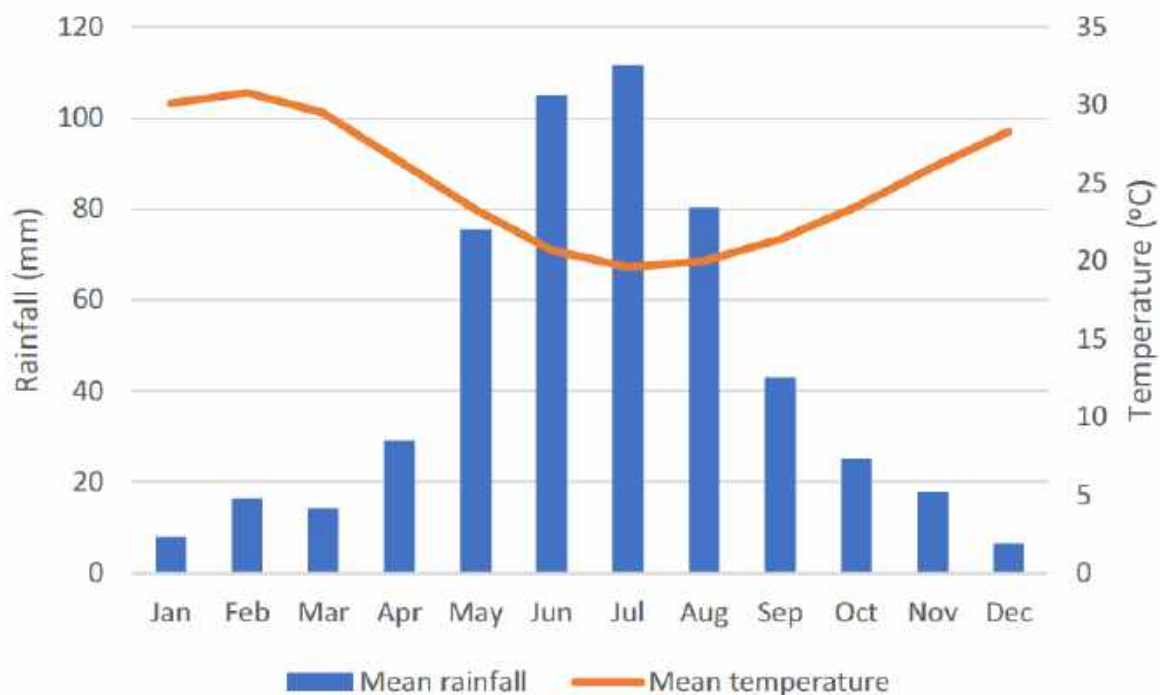


Figure 2 Mean monthly rainfall and mean monthly temperature for the Jurien Bay weather station, 1969 to 2021 (BOM, 2021).

2.3 Topography

The Atlas site is situated on the Swan Coastal Plain geomorphic unit. Topography of the study area is subdued and undulating. The land slopes marginally to the west and ranges in elevation from 37m AHD to 48m AHD (Image Resources, 2017).

2.4 Geology and stratigraphy

The Project is located within the northern Swan Coastal Plain (SCP), west of the Gingin Scarp on flat-lying to gently west sloping and westerly draining terrain. The Atlas deposit is formed in surficial marine sediments eroded into Cretaceous basal sediments during the Pleistocene marine transgressions. The Atlas deposit is predominantly comprised of pale deep Bassendean sands with areas of yellow deep sand, gravelly sands, sandy duplexes and wet soils (Image Resources, 2017).

Several stratigraphic layers have been identified as present within the deposit as follows (MWES, 2022a):

- Clean dune sands with almost no clay fines content form the topmost layer across much of the deposit, sometimes as subdued ridges and often as thin sheet deposits less than 2 m thick. The sands are generally absent where drainage channels cross the deposit but thicken in the larger dunes in the south of the deposit.
- The dune sands overly a relatively high clay fines layer described as a clayey sand with thickness up to 8 m and depths ranging from 1 to 8 m. The clay fines concentrations range from 10 to 20% in the central part of the deposit and 20 to 25% at the ends of the deposit. Most of this sediment is sand so is still considered part of the Bassendean Sand stratigraphic unit. Thin bands of cemented ferruginous material (“coffee rock”) with interstitial clay is common near the top of this layer.
- The clay fines concentration decreases with depth and transitions to a layer with clay fines concentrations mainly less than 10% and often less than 5%. These form at the base of the Bassendean Sand unit.

Analysis of drill log information indicates that the stratigraphy of the soil profiles across the deposit is highly variable, with substantial, but inconsistent variation in soil colour and soil texture present both vertically and laterally. This is attributable to the complex historical cycles of erosion and deposition that have occurred, particularly in the northern areas of the deposit, where surface drainage channels intersect the Project area.

Mineralisation has been classified as $\geq 2\%$ heavy mineral (HM) content. This mineralisation often starts at the surface but can be up to 16 m deep. The deposit is oxidised to the base of the mineralisation. However, where there is a thick clay base, the underlying grey to black coloured sediments are often less oxidised to reducing. Two zones of iron oxide induration are present in the stratigraphy. The first is located on the contact with the basal Cretaceous sediments (basement) and the second occurs as a layer above the mineralisation, where it is covered by later sands. The formation of iron cementation at two levels in the deposit suggests that water table and redox conditions have varied throughout the sequence. The basement units are predominantly very fine to granular or pebbly, poorly sorted sands and clayey sands. Occasional silt and clay units are also intersected on the edges of the deposit, most likely reflective of facies changes in the underlying Yarragadee Formation and other Jurassic units. (Image Resources, 2017).

2.5 Surface water

The Study area is within the catchment of the Nambung River, which feeds into the Nambung National Park. Mount Jetty Creek and Bibby Creeks are ephemeral watercourses that flow to the north of the Project and into the Nambung River to the west of the study area. The Nambung River flows into a karstic system before discharging into the Indian Ocean. There are four sub-catchments of the Nambung River within the vicinity of the Project. Runoff rates are very low and local runoff is mostly retained in seasonal swales and ponds. The high water table gives rise to numerous wetlands and damplands within the area. These geomorphic wetlands have been mapped but not allocated to a wetland evaluation category. Groundwater and surface water interactions are considered important to the local flow regime (Preston Consulting, 2020).

2.6 Groundwater

The water table across the Project area occurs between 2m and 8m below ground level. The groundwater formations within the Project area include the Superficial Aquifer and the Yarragadee Aquifer, both of which are unconfined (Preston Consulting, 2020). Downgradient of the Project area is the Tamala Limestone, which sits beneath the Nambung National Park. The hydraulic connection between the Superficial aquifer, Yarragadee and Tamala Limestone is considered high (Image Resources, 2017). Seasonal groundwater levels within the Project area vary by an average of 0.49m in shallow bores and 0.39m in deep bores from the start to the end of the rainy season (MWES, 2022b). Groundwater quality is described in Section 5.

The Project will require dewatering prior to mining. The groundwater management strategy is described in Section 9.

3 DRILLING DATABASE REVIEW

3.1 Analysis of Project drilling database

The Project drilling database was interrogated to identify the presence and location of soils typically associated with ASS (i.e. dark coloured, clay-rich soils). Figures relating to interrogation of the drilling database are included in Appendix A.

Drill logs from a total of 2,664 drill holes (comprising 30,204 individual drill logs) from across the Project area were interrogated via the following process:

1. Leap Frog software was used to plot the entire drilling database (Figure A1).
2. Given that ASS are typically associated with darker coloured soils in other mineral sands deposits, the drilling database was interrogated to identify areas / profile depths where 'dark coloured' soils were logged. This included the following logged soil colours: black, black-grey, dark grey, dark grey-brown, dark brown-grey, dark green, grey-green, green and olive. These logged soil colours were labelled as potential ASS (PASS). A total of 385 individual logs of 'dark coloured' soils were identified in the drilling database.
3. ASS are also typically associated with soils with higher clay fines (clay) contents. These are also referred to as slimes in mineral sands mining. Therefore, the drilling database was also interrogated to identify areas where clay fines (slimes) contents were >30%. Each datapoint was then labelled as high slimes (HSL) (high clay fines) or low slimes (LSL) (low clay fines).
4. Leap Frog software was used to plot the locations of the drillholes where a combination of dark soil colours and >30% clay fines were logged (PASS + HSL) (Figure A2)
5. Cross-sections were then taken through those areas where drill logs showed PASS and HSL. The locations of these cross-sections are shown on Figure A3. Each of the drill log cross-sections are shown in Figures A4 to A16. The depth intervals coloured red in each cross-section indicate soil intervals logged as having a combination of PASS (dark soil colour) and HSL.

Based upon the information detailed within the drilling database, it was identified that PASS soils (i.e. dark soil colours with HSL) were present at variable depths within the soil profiles. There appeared to be little spatial correlation of PASS soils, either with position in the landscape and/or depth within the soil profiles (Figure A4 to Figure A16).

Due to the identification of PASS soils (i.e. dark coloured soils with high clay contents) within the drilling database, a dedicated sampling and analysis program was undertaken to further quantify the presence of ASS within the deposit.

4 ACID SULFATE SOIL INVESTIGATION

4.1 Selection of sampling locations

Where there is an identified risk of ASS occurring within the Project disturbance area, a site-based ASS investigation requires sampling and analysis of soils to a depth of 1m below the proposed disturbance and/or maximum groundwater drawdown level. Sampling locations were selected as described in the following sections.

4.1.1 Sampling locations

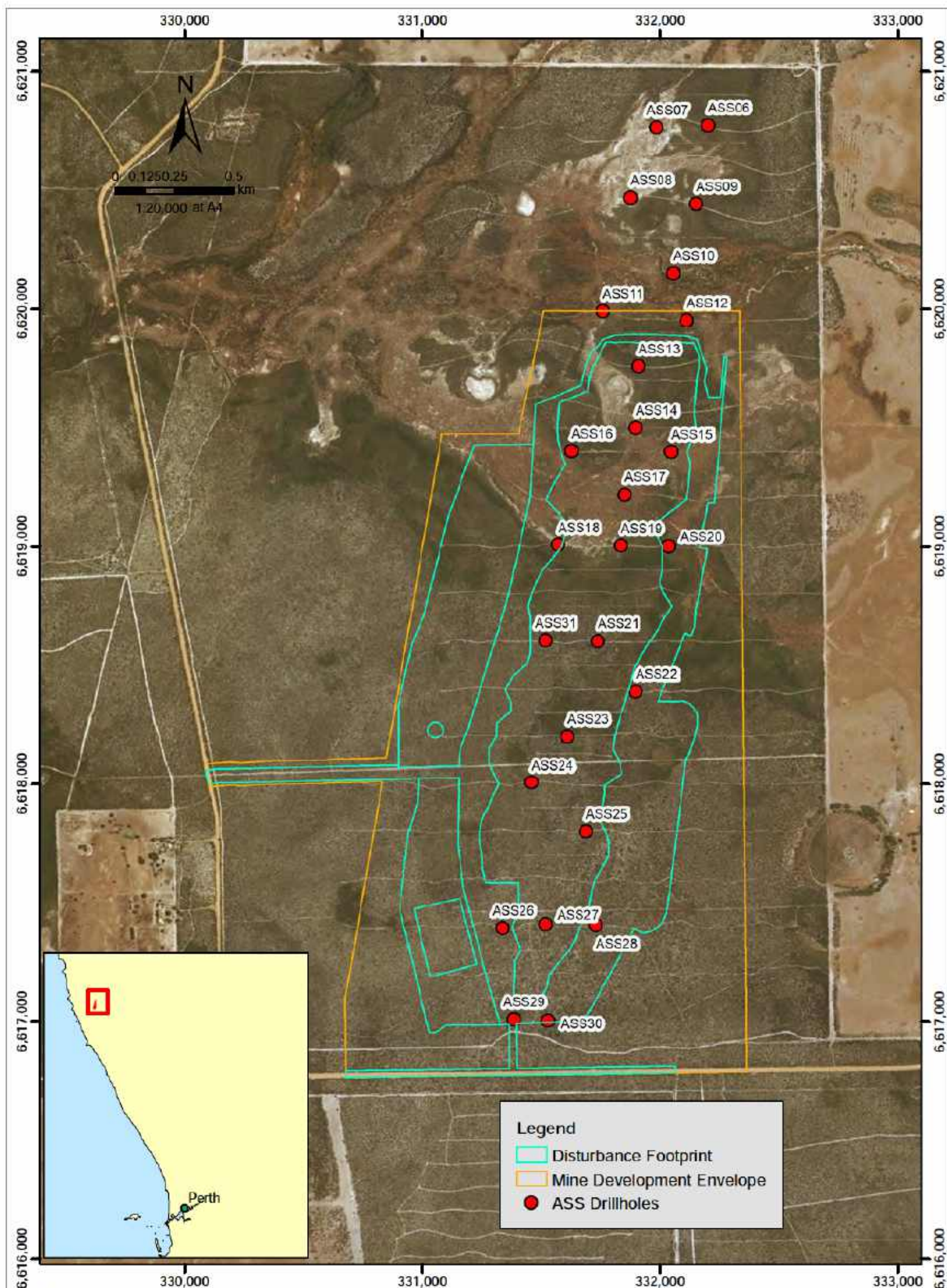
Selection of ASS sampling locations involved a review of existing environmental features of the site, plus information derived from the Project drilling database. Drilling / sampling locations were selected based on:

- proximity to soils identified as PASS (i.e. dark coloured soils with high clay fines content) within the drilling database
- Distribution across the deposit to ensure that the locations selected are spatially representative of the geological units and topography across the site
- Sampling to 1m below the proposed depth of mining disturbance
- Site access for drilling activities.

The drilling locations are detailed in (Figure 3). The sampling depths for each drillhole, based on the maximum depth of disturbance at each location, are provided in Table 1. Sites ASS06 to ASS12 are outside the pit and will not be directly disturbed.

Table 1 Drillhole locations and sampling depths for the ASS assessment.

Site #	MGA_East	MGA_North	Sampling depth (m) (1m below proposed pit floor)
ASS06	332209	6620761	7
ASS07	331988	6620740	7
ASS08	331877	6620468	9
ASS09	332153	6620438	8
ASS10	332048	6620159	7
ASS11	331762	6619984	9
ASS12	332113	6619949	9
ASS13	331914	6619754	8
ASS14	331898	6619498	9
ASS15	331629	6619399	8
ASS16	332045	6619399	7
ASS17	331853	6619214	7
ASS18	331575	6619003	9
ASS19	331832	6619003	10
ASS20	332040	6618997	10
ASS21	331738	6618600	12
ASS22	331900	6618387	10
ASS23	331614	6618199	11
ASS24	331468	6618006	13
ASS25	331692	6617802	10
ASS26	331340	6617388	14
ASS27	331524	6617404	13
ASS28	331733	6617400	8
ASS29	331390	6617003	11
ASS30	331530	6616927	9
ASS31	331532	6618601	12



4.2 ASS sampling procedure

The drillholes were logged and sampled using the following steps:

1. The following information was recorded for each drill hole:
 - a. soil texture, grain size, roundness, sorting and hardness;
 - b. soil colour using a Munsell colour chart; and
 - c. presence of mottling, organic matter, moisture content, water table level and other diagnostic features (e.g. jarosite, shell).
2. Photographs were taken of soils from each 1m sampling interval.
3. Any significant changes with depth through the soil profile (e.g. colour, texture, moisture content) were described.
4. A 500g sample was taken, bulked over each 1m sampling interval and placed into a snap lock bag marked with drill hole number and sample depth.
5. Any visible shell or carbonate nodules were removed.
6. Air was immediately excluded, the plastic bag was sealed and placed into the portable freezer unit.

Once all samples were collected, the portable freezer unit was transported directly to the designated laboratory for sample analysis.

The drill log summary and photos of the 1m sample intervals for all holes is included in Appendix B.

4.3 Laboratory analysis

4.3.1 Suite 1 – screening analysis

A total of 245 samples from 26 drillholes were submitted for analysis of field pH (pH_F) and oxidised pH (pH_{FOX}). The pH_F test measures the existing acidity of a soil-water paste and is used to help identify if ASS are present. If $pH_F \leq 4$, oxidation of sulfides has probably occurred in the past, indicating the presence of AASS. Highly organic soils may also return a pH_F close to 4 (DER, 2015b). The pH_{FOX} test is used to indicate the presence of iron sulfides or PASS, or whether there is another compound contributing to acidity (DER, 2015b). If $pH_{FOX} \leq 3$, then this is a strong indicator that PASS may be present, and further investigation is warranted. The pH_{FOX} is also considered in combination with the strength of the reaction with peroxide, and the change in pH units from pH_F to pH_{FOX} , when determining if further analysis is required (DER, 2015b).

The full results of the pH_F and pH_{FOX} analysis are included in Appendix C and are summarised as follows:

- pH_F values ranged from 3.8 to 9.5 and did not appear to have any correlation with depth (Figure 4)
- Majority of soils had a $pH_F > 5$
- 1 sample recorded $pH_F \leq 4$, indicating actual acid soil (Drill hole 23, 2 to 3m depth)
- 5 samples recorded $pH_F > 4$ but ≤ 5 , indicating a strong potential for ASS
- pH_{FOX} values ranged from 1.9 to 9.2 with no apparent correlation with depth (Figure 5)
- 34 samples recorded $pH_{FOX} \leq 3$
- The change in pH (ΔpH) from pH_F to pH_{FOX} ranged from 0 to 6.4 pH units
- 43 samples recorded $\Delta pH > 3$ pH units

- Samples recording low pH_{FOX} values were distributed throughout the soil profile from near surface to the base of sampling (Figure 5) Figure 5 pH_{FOX} results with depth for all samples (red line indicates $pH_{FOX} < 3$)
- The variable distribution of samples recording low pH_{FOX} values is further demonstrated in Figure 6 to Figure 14, which show pH and pH_{FOX} with depth for all drillholes / sample intervals

The initial screening test results indicated that PASS may be present across the deposit. Based on the Suite 1 analysis results, a total of 72 samples were selected for the second analysis suite (Suite 2) WA - Chromium Suite for Acid Sulfate Soils to further quantify the acid forming potential of the samples.

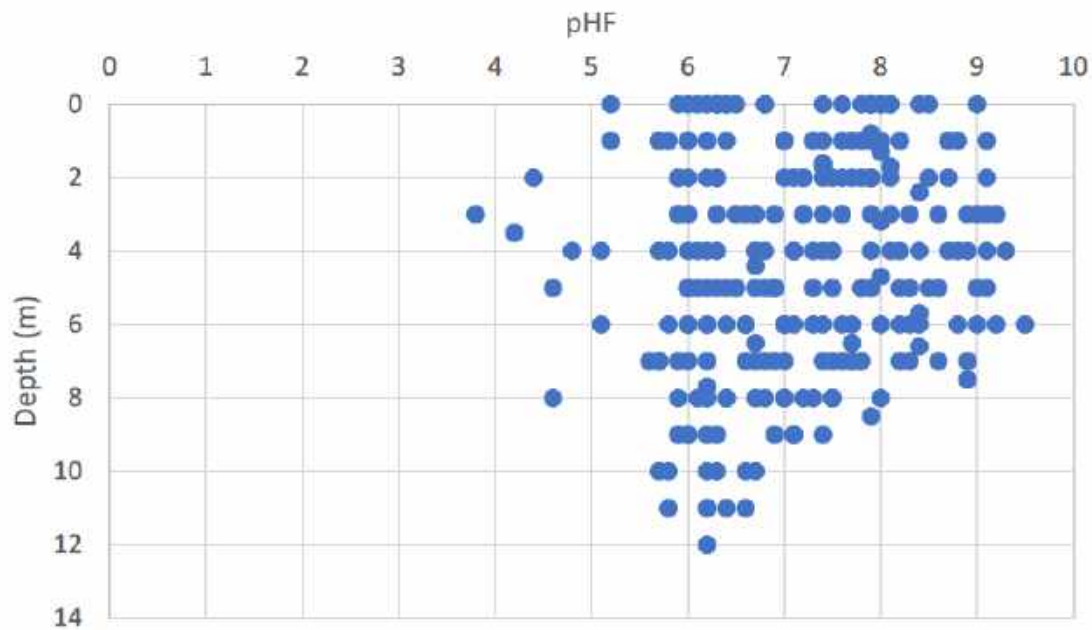


Figure 4 pH_F results with sample depth for all samples

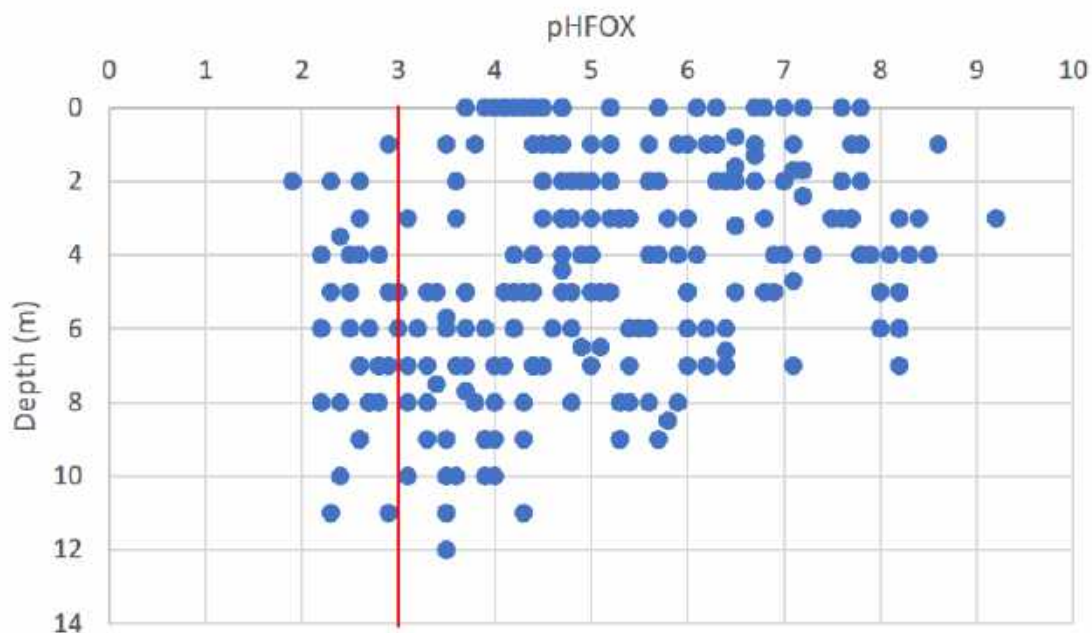


Figure 5 pH_{FOX} results with depth for all samples (red line indicates $pH_{FOX} < 3$)

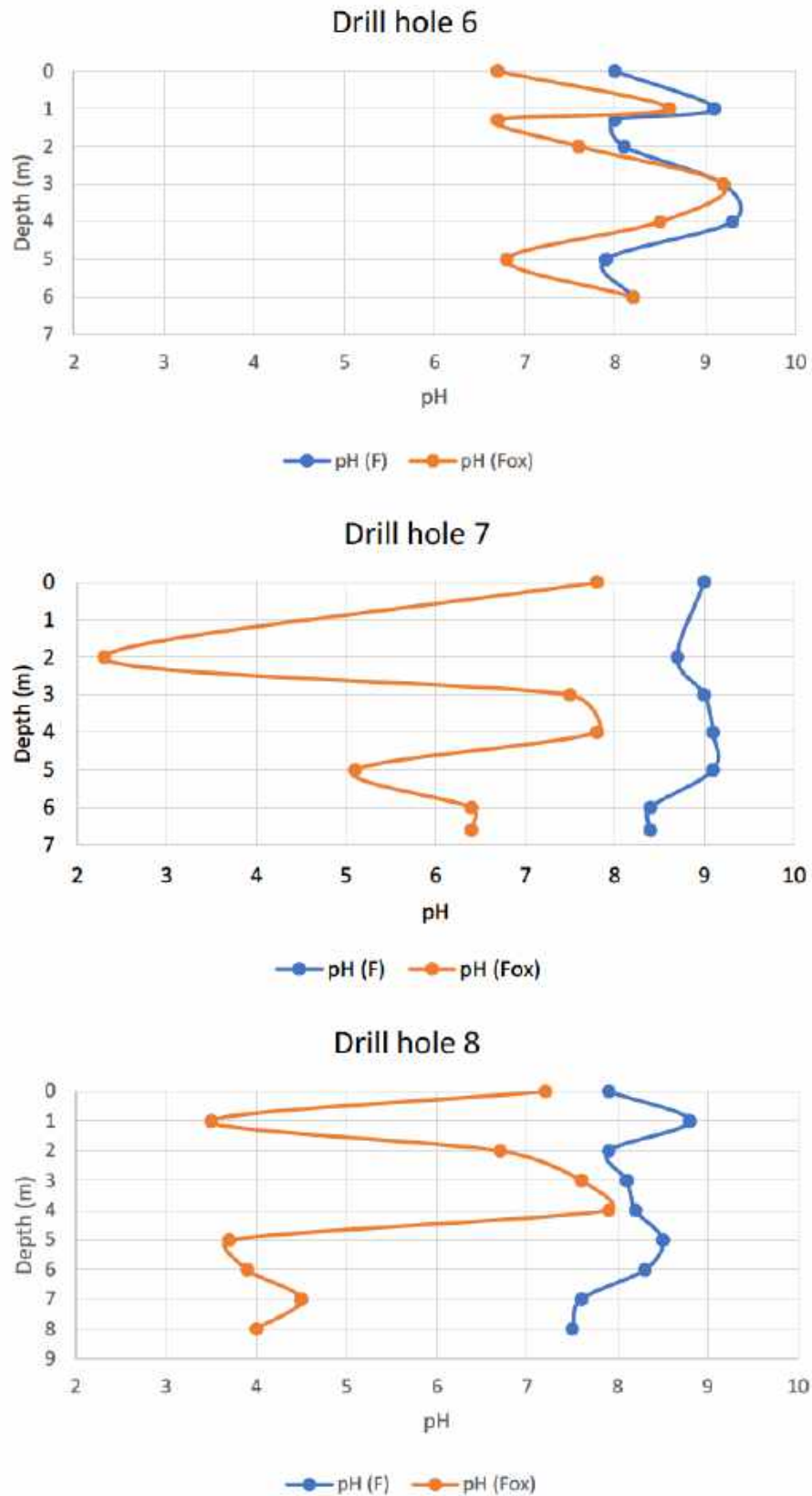


Figure 6 pH_F and pH_{FOX} results with sample depth (m) for drillholes ASS6, 7 and 8

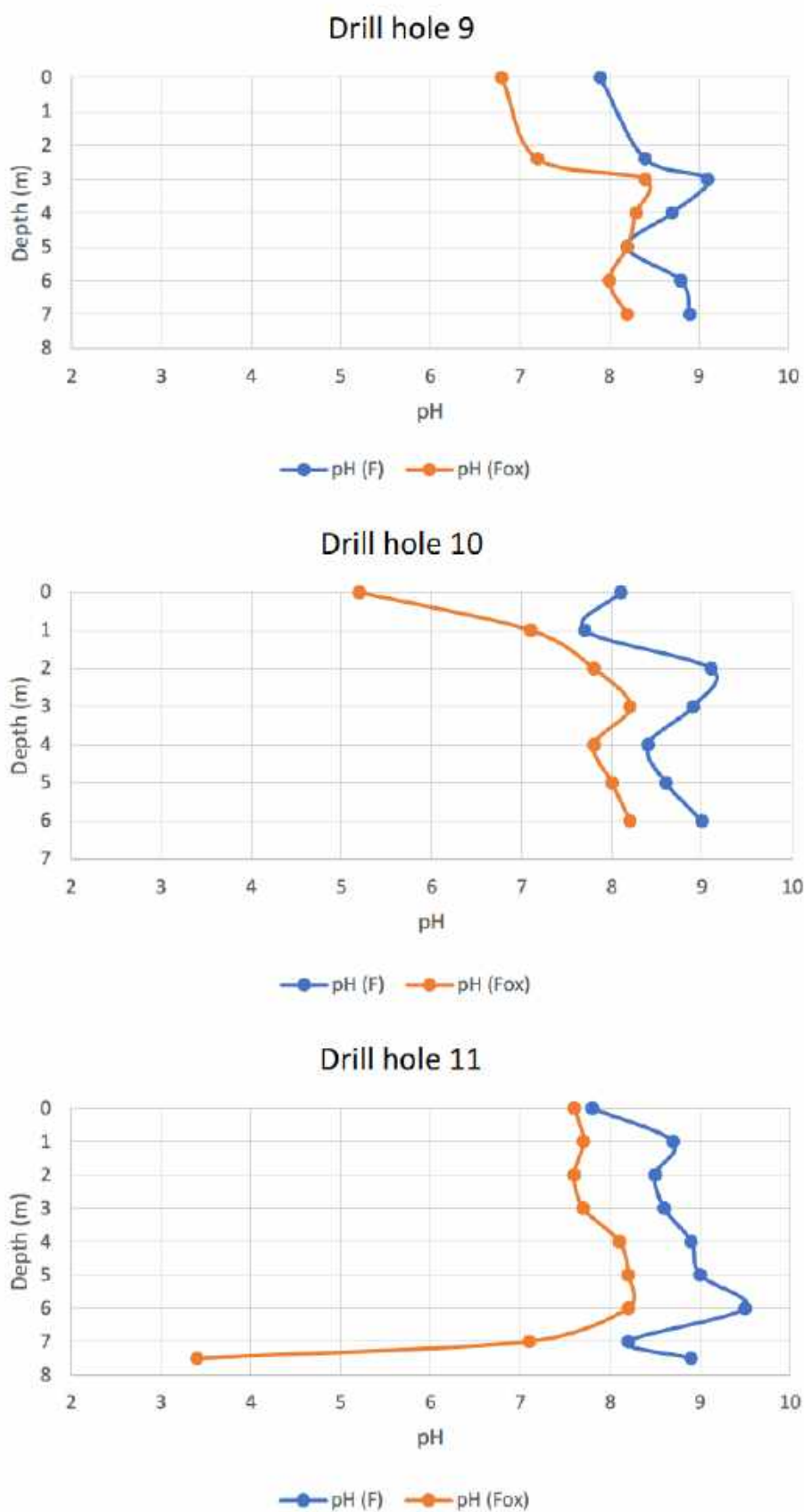


Figure 7 pH_F and pH_{FOX} results with sample depth (m) for drillholes ASS9,10 and 11

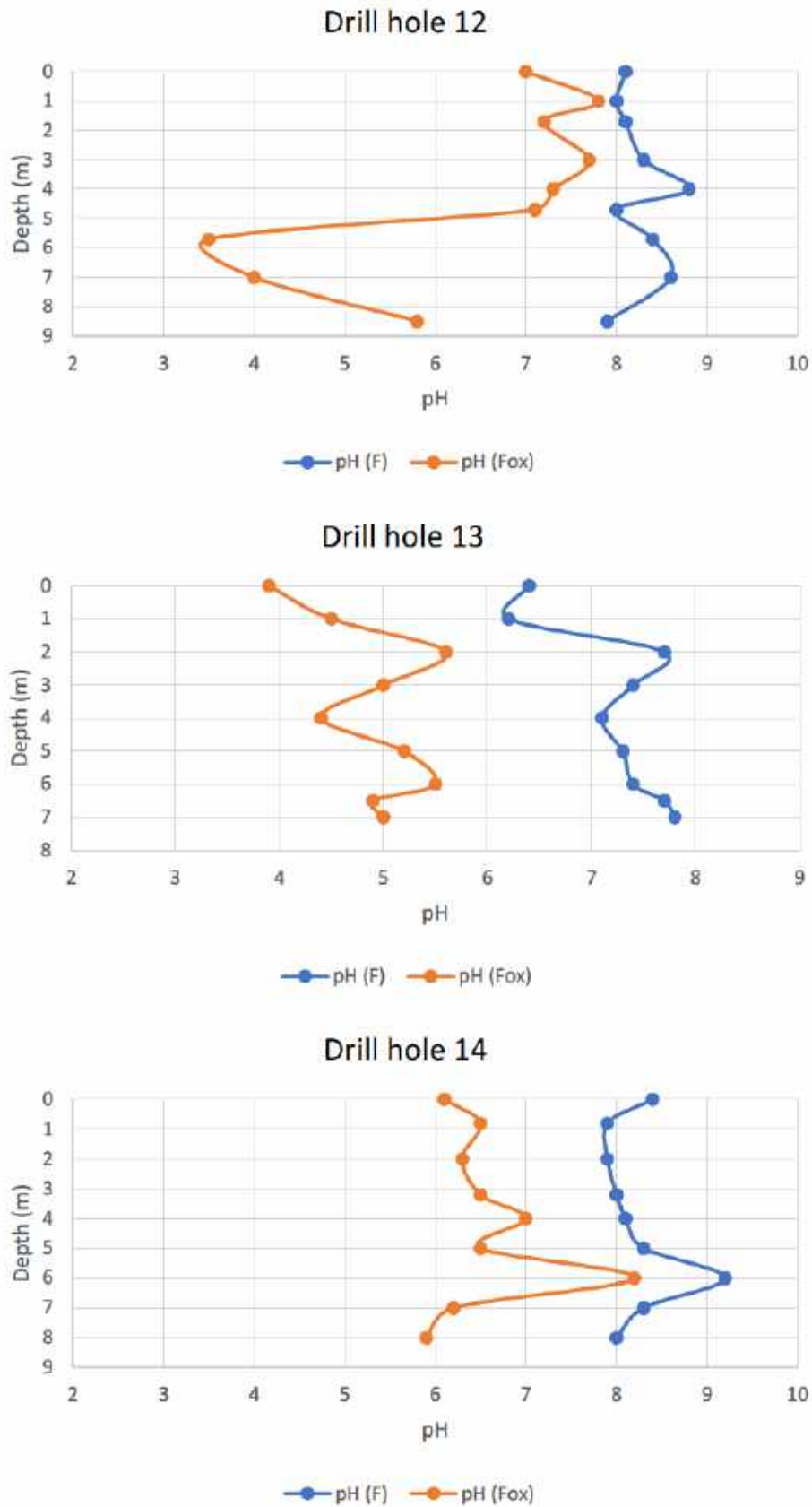


Figure 8 pH_F and pH_{Fox} results with sample depth (m) for drillholes ASS12, 13 and 14

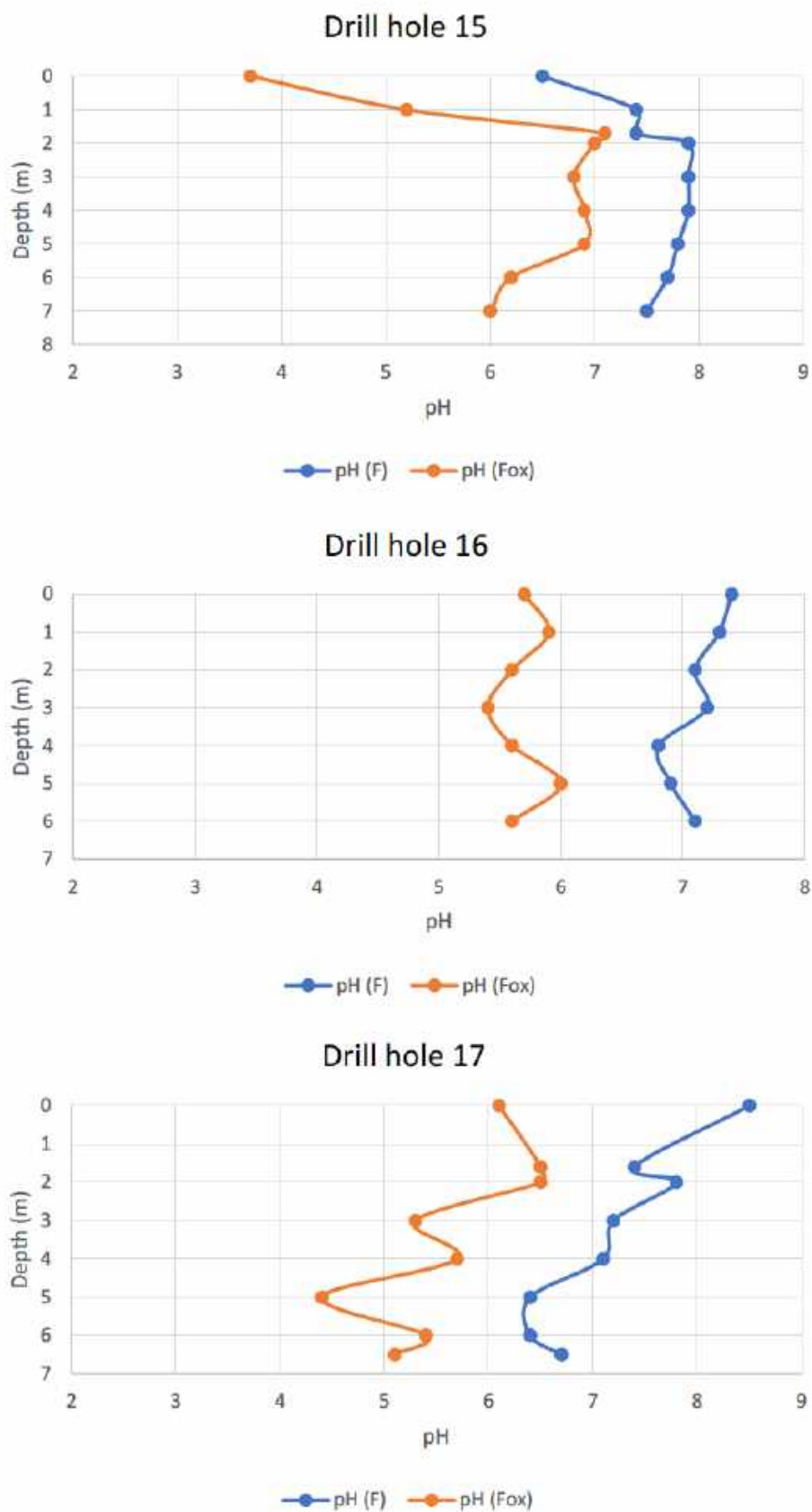


Figure 9 pH_F and pH_{Fox} results with sample depth (m) for drillholes ASS15, 16 and 17

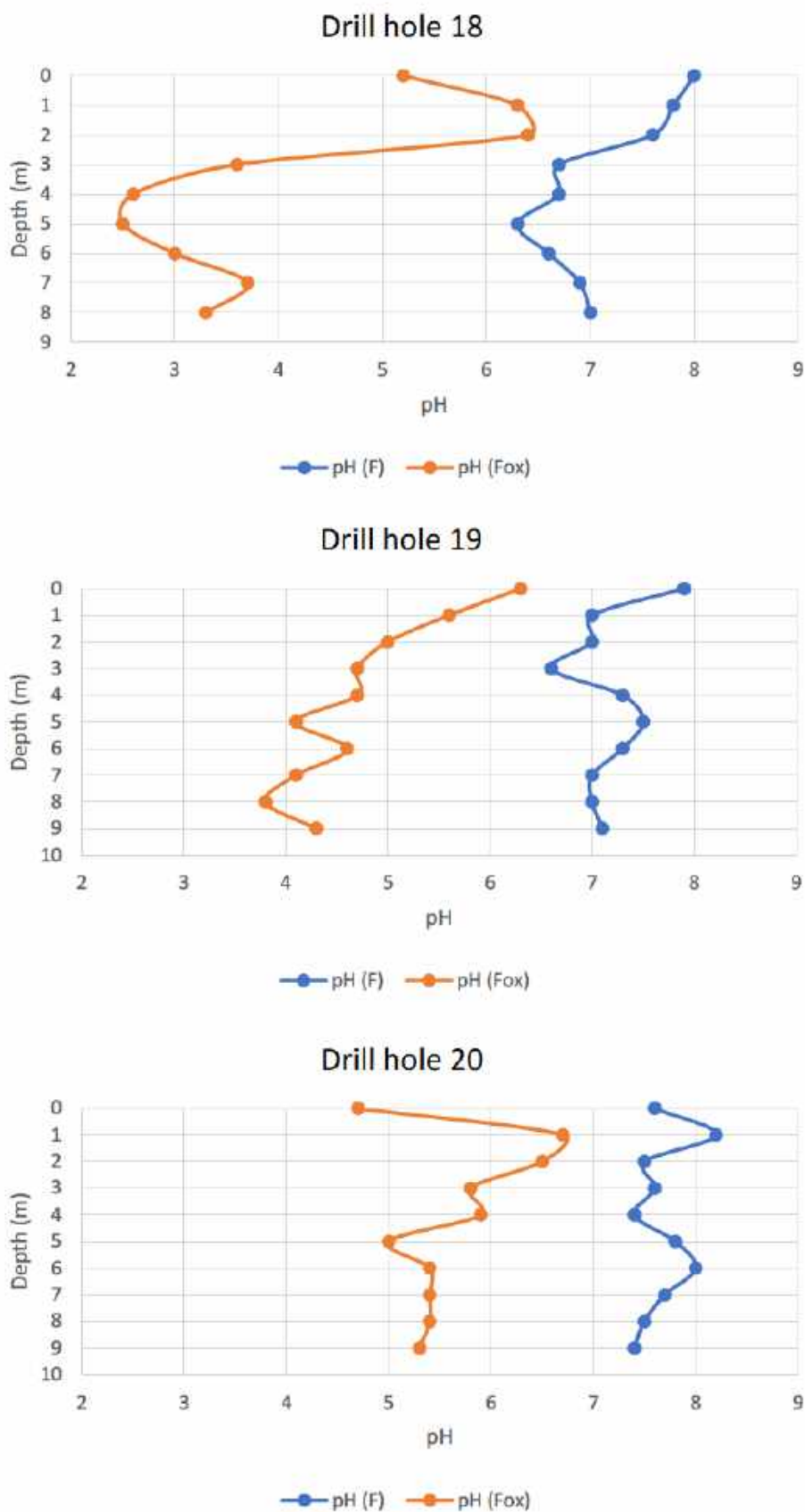


Figure 10 pH_F and pH_{FOX} results with sample depth (m) for drillholes ASS18, 19 and 20

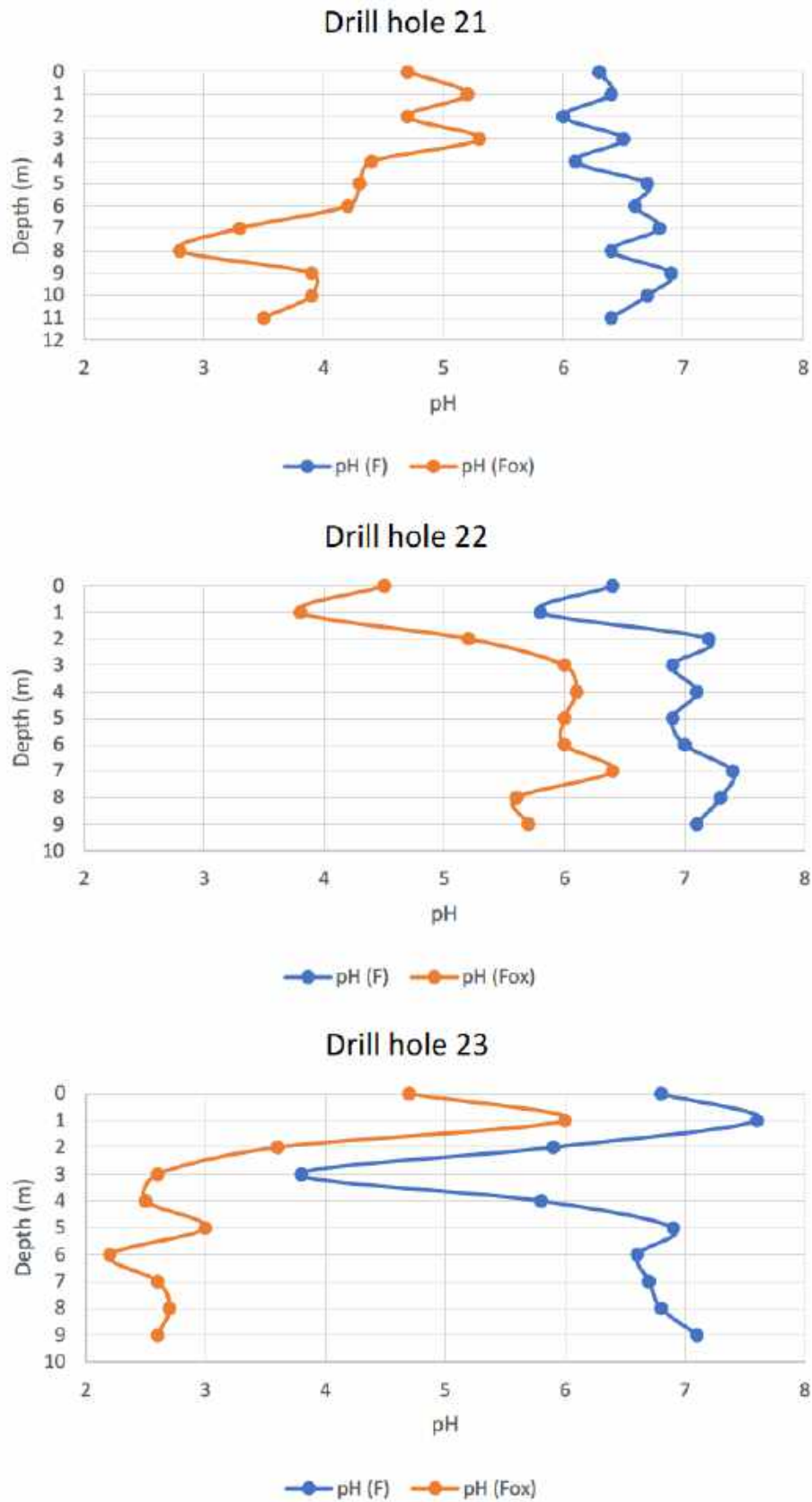


Figure 11 pH_F and pH_{FOX} results with sample depth (m) for drillholes ASS21, 22 and 23

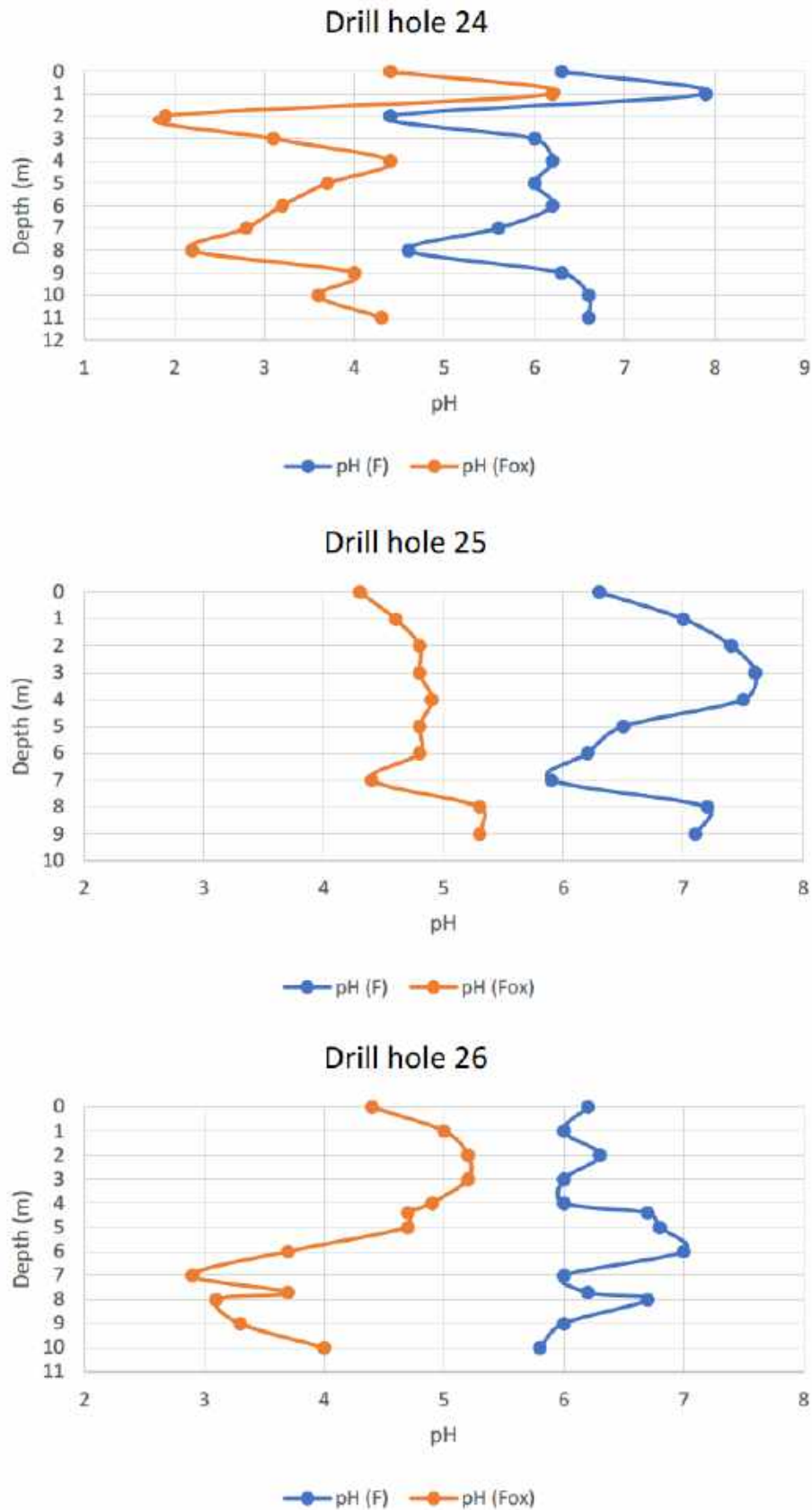


Figure 12 pH_F and pH_{FOX} results with sample depth (m) for drillholes ASS24, 25 and 26

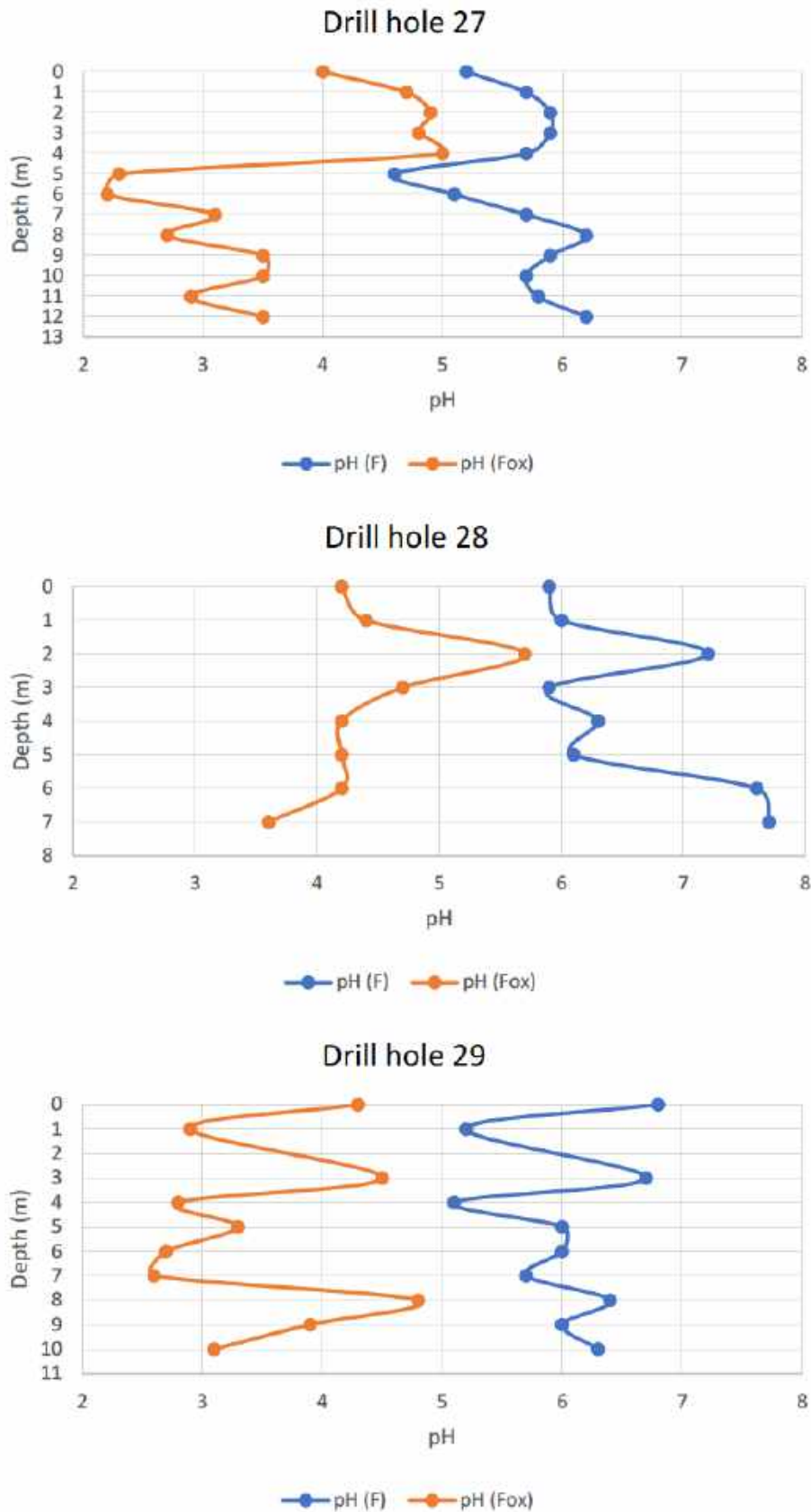


Figure 13 pH_F and pH_{FOX} results with sample depth (m) for drillholes ASS27, 28 and 29

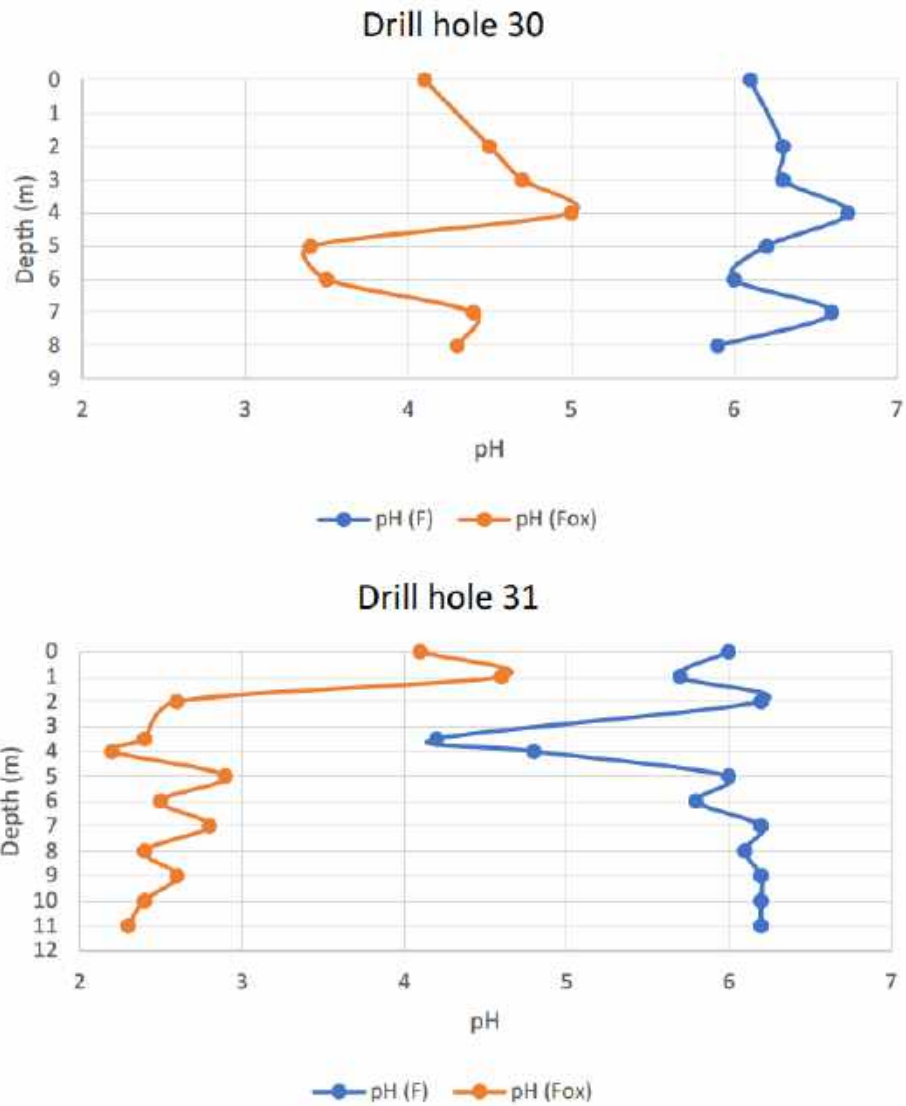


Figure 14 pH_F and pH_{FOX} results with sample depth (m) for drillholes ASS30 and 31

4.3.2 Suite 2 – CRS analysis

Based on the results from the Suite 1 analysis, 72 samples were selected for analysis using the Chromium Reducible Sulfur (CRS) Suite (Suite 2). This analysis suite includes a variety of parameters and identifies actual acidity, potential acidity, acid neutralising capacity and acid base accounting. The CRS suite is not subject to significant interferences from sulfur in organic matter or sulfate materials (DER, 2015b).

The guidelines stipulate 'ASS action criteria' based on net acidity. If the ASS action criteria are exceeded by any sample result, an acid sulfate soil management plan (ASSMP) will need to be developed and implemented for disturbance of ASS (DER, 2015b). The ASS action criteria are defined as follows:

- Net acidity as equivalent sulfur (%S) – acid neutralising capacity = 0.03 %S
- Net acidity as equivalent acidity (mol H⁺/tonne) – acid neutralising capacity = 18 mol H⁺/tonne

Nine of the 72 samples tested exceeded the ASS action criteria (Table 2). Samples exceeding the ASS action criteria were present within five of the drilling locations, at sample depths ranging from 2 to 10m.

Bassendean sands contain single crystal and framboidal aggregates of sub-micron-sized pyrites. They generally have less than one per cent clay and therefore, extremely poor acid-buffering capacity (DER, 2015b). The guidelines state that for Bassendean sands, where a chromium reducible sulfur (S_{Cr}) value is less than 0.03% and $pH_{Fox} < 3$, the soil should be treated by neutralisation with alkaline materials as if it had an inorganic sulfur content of 0.03% (DER, 2015b).

In addition, research into the properties of Bassendean sands has determined that a combination of $pH_{Fox} < 3$ and an analytical value of 0.01% S_{Cr} or greater are reliable indicators of ASS and can be used as a basis for identifying and managing PASS in Bassendean sands (UWA/DEC, 2011). Eighteen samples recorded a $pH_{Fox} < 3$ and $> 0.01\%$ S_{Cr} , and therefore exceed the ASS action criteria for Bassendean sands (Table 2).

The samples identified as triggering all of the ASS action criteria were located within drillholes 7, 18, 23, 24, 27, 29 and 31 (Figure 15), indicating an inconsistent spread across the deposit. Full laboratory results of the Suite 2 analysis are included in Appendix C.

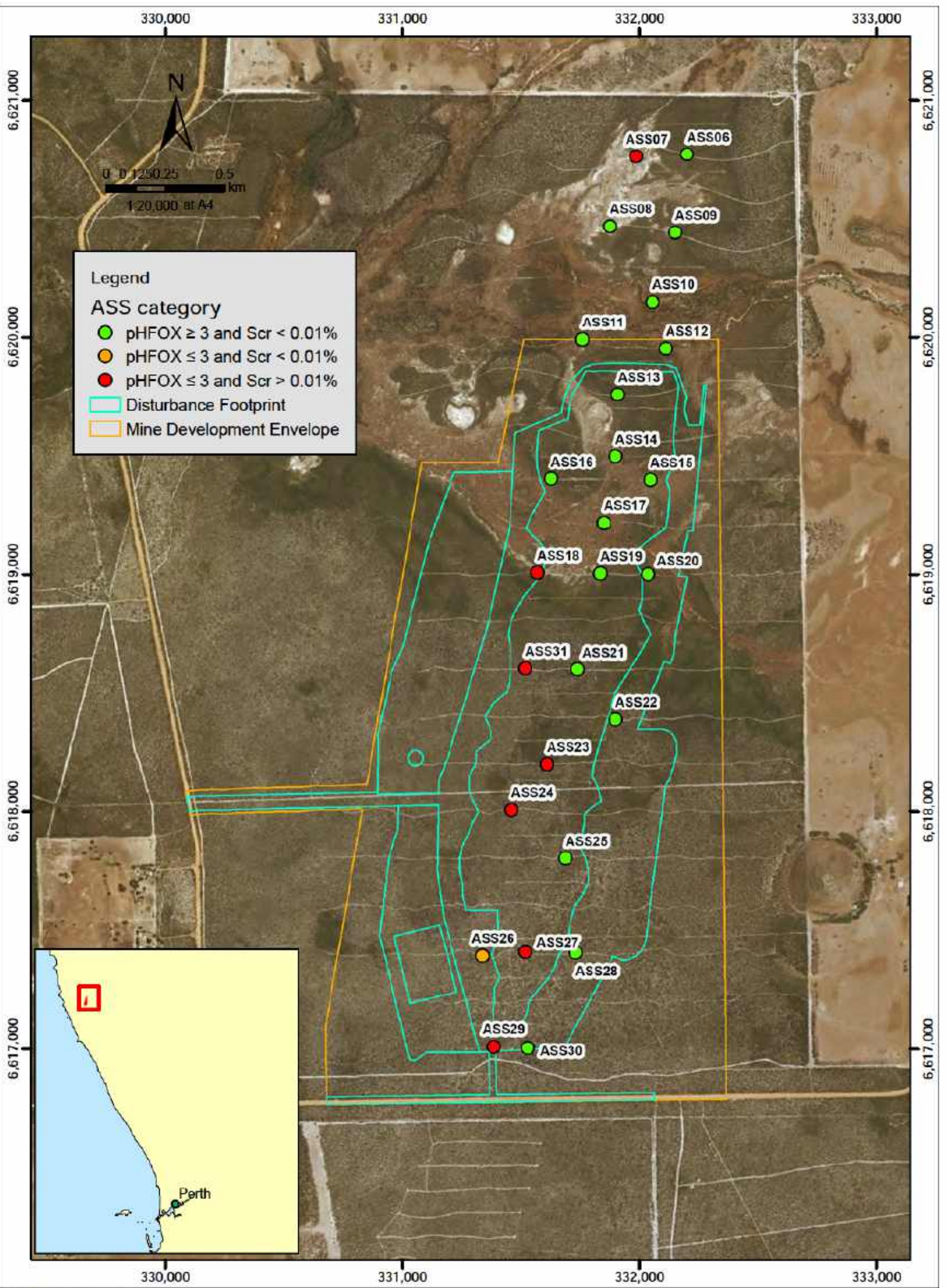
Table 2 Suite 2 ASS analysis results. Individual sample intervals exceeding the individual ASS action criteria are highlighted in yellow, drillholes highlighted red exceed all criteria

Hole ID	Depth from	Depth to	Colour	Soil texture ¹	pH _r	pH _{Fox}	Reaction rate	Change in pH	Chromium Reducible Sulfur (%)	Net Acidity excluding ANC (sulfur %)	Net Acidity excluding ANC (acidity units)
ASS07	1	2	Orange	SC	9	7.8	Extreme	1.2	0.022	0.02	14
ASS07	2	3	Orange	SC	8.7	2.3	Extreme	6.4	0.204	0.21	129
ASS08	1.2	1.7	Green	SC	8.8	3.5	Strong	5.3	0.006	<0.02	<10
ASS08	4	5	Green	CS	8.5	3.7	Strong	4.8	0.011	<0.02	<10
ASS08	8	9	Grey	CS	7.5	4	Strong	3.5	0.017	0.02	10
ASS09	3	4	Green	SC	9.1	8.4	Strong	0.7	0.005	<0.02	<10
ASS10	1.8	3	Yellow	SC	9.1	7.8	Strong	1.3	0.008	<0.02	<10
ASS11	5	6	Green/Grey	CS	9	8.2	Strong	0.8	0.006	<0.02	<10

Hole ID	Depth from	Depth to	Colour	Soil texture ¹	pH _f	pH _{FOX}	Reaction rate	Change in pH	Chromium Reducible Sulfur (%)	Net Acidity excluding ANC (sulfur %)	Net Acidity excluding ANC (acidity units)
ASS11	7.5	8	Grey	SC	8.9	3.4	Slight	5.5	0.006	<0.02	<10
ASS12	5.7	6.5	Grey	CS	8.4	3.5	Moderate	4.9	0.014	<0.02	<10
ASS12	6.5	8	Grey	CS	8.6	4	Slight	4.6	0.010	<0.02	<10
ASS13	0	1	Grey	S	6.4	3.9	Moderate	2.5	<0.005	<0.02	<10
ASS13	4	5	Pink	CS	7.1	4.4	Moderate	2.7	<0.005	<0.02	<10
ASS13	6.5	7	Grey	SC	7.7	4.9	Moderate	2.8	0.008	<0.02	<10
ASS15	0	1	Grey	CS	6.5	3.7	Moderate	2.8	<0.005	<0.02	<10
ASS16	2	3	Grey	SC	7.1	5.6	Slight	1.5	<0.005	<0.02	<10
ASS16	6	7	Yellow	SC	7.1	5.6	Strong	1.5	<0.005	<0.02	<10
ASS17	5	6	Orange	SC	6.4	4.4	Moderate	2	0.006	<0.02	<10
ASS18	3	4	Grey	SC	6.7	3.6	Moderate	3.1	0.014	0.02	11
ASS18	5	6	Grey	SC	6.3	2.5	Strong	3.8	0.014	0.02	10
ASS18	7	8	Grey	SC	6.9	3.7	Slight	3.2	0.007	<0.02	<10
ASS18	8	9	Grey	S	7	3.3	Slight	3.7	0.006	<0.02	<10
ASS19	4.2	5.5	Grey	SC	7.5	4.1	Moderate	3.4	0.006	<0.02	<10
ASS19	6	8	Grey	CS	7	4.1	Slight	2.9	<0.005	<0.02	<10
ASS19	8	10	Grey	SC	7	3.8	Slight	3.2	0.009	<0.02	<10
ASS20	5	6	Grey	SC	7.8	5	Moderate	2.8	0.007	<0.02	<10
ASS21	4	5	Grey	SC	6.1	4.4	Slight	1.7	0.006	<0.02	<10
ASS21	7	8	Brown	SC	6.8	3.3	Moderate	3.5	0.009	<0.02	<10
ASS21	9	10	Orange	SC	6.9	3.9	Slight	3	<0.005	<0.02	<10
ASS21	11	12	Grey	SC	6.4	3.5	Slight	2.9	0.009	<0.02	<10
ASS22	1	2	Yellow	S	5.8	3.8	Slight	2	<0.005	<0.02	<10
ASS23	2	3	Yellow	S	5.9	3.6	Moderate	2.3	<0.005	<0.02	<10
ASS23	3	4	Grey	SC	3.8	2.6	Slight	1.2	<0.005	<0.02	<10
ASS23	5	6	Green	SC	6.9	3	Strong	3.9	0.014	<0.02	<10
ASS23	7	8	Green	SC	6.7	2.6	Strong	4.1	0.093	0.10	61
ASS23	9	11	Green	CS	7.1	2.6	Moderate	4.5	0.008	<0.02	<10
ASS24	2	3	Orange	CS	4.4	1.9	Moderate	2.5	0.009	<0.02	<10
ASS24	3	4	Green	SC	6	3.1	Moderate	2.9	0.007	0.02	13
ASS24	5	6	Blue/green	SC	6	3.7	Strong	2.3	0.006	<0.02	<10
ASS24	7	8	Green	SC	5.6	2.8	Strong	2.8	0.014	0.02	10
ASS24	8	10	Green	CS	4.6	2.2	Strong	2.4	0.019	0.02	12
ASS24	10	11	Green	CS	6.6	3.6	Strong	3	0.009	<0.02	<10
ASS25	3	4	Grey	S	7.6	4.8	Moderate	2.8	<0.005	<0.02	<10
ASS25	7	8	Orange	SC	5.9	4.4	Strong	1.5	<0.005	<0.02	<10

Hole ID	Depth from	Depth to	Colour	Soil texture ¹	pH _F	pH _{FOX}	Reaction rate	Change in pH	Chromium Reducible Sulfur (%)	Net Acidity excluding ANC (sulfur %)	Net Acidity excluding ANC (acidity units)
ASS26	6.5	7	Grey	S	7	3.7	Moderate	3.3	<0.005	<0.02	<10
ASS26	7	7.7	Grey/brown	CS	6	2.9	Moderate	3.1	<0.005	<0.02	<10
ASS26	8	9	Green	SC	6.7	3.1	Strong	3.6	0.005	<0.02	<10
ASS26	10	11	Green	SC	5.8	4	Strong	1.8	<0.005	<0.02	<10
ASS27	0	1	Grey	S	5.2	4	Moderate	1.2	<0.005	<0.02	<10
ASS27	5	6	Brown	CS	4.6	2.3	Moderate	2.3	<0.005	<0.02	<10
ASS27	6	7	Brown	SC	5.1	2.2	Slight	2.9	0.025	0.04	22
ASS27	8	9	Yellow	SC	6.2	2.7	Strong	3.5	0.015	0.02	11
ASS27	9	10	Yellow	SC	5.9	3.5	Strong	2.4	<0.005	<0.02	<10
ASS27	11	12	Grey	SC	5.8	2.9	Moderate	2.9	<0.005	<0.02	<10
ASS27	12	13	Grey	SC	6.2	3.5	Strong	2.7	0.006	<0.02	<10
ASS28	4	5	Grey	SC	6.3	4.2	Strong	2.1	<0.005	<0.02	<10
ASS28	6	7	Grey	SC	7.6	4.2	Strong	3.4	0.007	<0.02	<10
ASS28	7	8	Grey	SC	7.7	3.6	Strong	4.1	0.009	<0.02	<10
ASS29	2	3	Brown	CS	5.2	2.9	Extreme	2.3	0.016	0.02	15
ASS29	4	5	Brown	CS	5.1	2.8	Strong	2.3	0.018	0.04	24
ASS29	6	7	Grey	CS	6	2.7	Strong	3.3	0.005	<0.02	<10
ASS29	7	8	Yellow	SC	5.7	2.6	Strong	3.1	0.035	0.04	22
ASS29	9	10	Yellow	SC	6	3.9	Strong	2.1	<0.005	<0.02	<10
ASS29	10	11	Yellow	SC	6.3	3.1	Strong	3.2	0.019	0.02	14
ASS30	5	6	Yellow	CS	6.2	3.4	Slight	2.8	0.011	<0.02	<10
ASS30	6	7	Yellow	SC	6	3.5	Slight	2.5	0.006	<0.02	<10
ASS31	2	3.5	Green	SC	6.2	2.6	Strong	3.6	0.051	0.06	36
ASS31	4	5	Grey	CS	4.8	2.2	Strong	2.6	<0.005	<0.02	<10
ASS31	6	7	Green	SC	5.8	2.5	Strong	3.3	0.035	0.04	23
ASS31	7	8	Green	SC	6.2	2.8	Strong	3.4	0.036	0.04	25
ASS31	9	10	Green	CS	6.2	2.6	Strong	3.6	0.029	0.03	19
ASS31	11	12	Green	CS	6.2	2.3	Strong	3.9	0.011	<0.02	<10

¹S = sand, CS = clayey sand, SC = sandy clay



4.3.4 Tailings pH

The pH of the tailings clay fines and tailings sand fraction was assessed on representative samples supplied by Image Resources (Mine Earth, 2022a). The pH (H₂O) of the tailings clay fines and sand fractions were recorded as pH 7.9 and pH 6.9 respectively. Given the exposure of the ore / tailings samples to oxidation and the circum neutral pH values recorded, it is reasonable to assume that the tailings materials, as received / tested, are unlikely to acidify as a result of ASS oxidation.

4.3.5 Total and leachable metals

Total metals were analysed for selected samples from the ASS investigation (Table 3). The samples selected comprised material representative of the overburden waste above the ore zone from across the deposit. Samples of the tailings clay fines and tailings sand fractions from metallurgical testing (as supplied by Image) were also assessed. The results indicated minor elevated concentrations, relative to the average crustal abundance (Reinmann & de Caritat, 1998), for Zn (in three overburden samples) and As (six overburden samples and the tailings clay fines sample).

An assessment of leachable metals was undertaken via an acetic acid leach of the selected samples and analysis by ICPAES (Table 4 and Appendix C). Leachable metal concentrations were mostly below detection limits, except for Ba, B, Mn and Zn for some samples. The majority of metal concentrations were below trigger values for 95% protection of aquatic ecosystems (ANZG, 2018), except for Zn in some samples. These results indicate that leachate from the soils / overburden materials under acidic (pH2.8) conditions is unlikely to contain large concentrations of metals and metalloids that will potentially impact the surrounding environment.

Table 3 Total metals concentrations for selected drill samples. Sample IDs in bold denote samples identified as PASS. Individual values above the Average Crustal Abundance (Reimann and de Caritat, 1998) are highlighted in yellow.

Sample ID	Depth	Total concentration (mg/kg)														
		As	Ba	Be	B	Cd	Cr	Co	Cu	Hg	Pb	Mn	Ni	Se	V	Zn
ASS06	1-2m	7	20	<1	<50	<1	8	2	<5	<0.1	<5	5	2	<5	9	<5
ASS07	2-3m	18	90	<1	<50	<1	15	<2	<5	<0.1	6	74	<2	<5	21	7
ASS10	1-2m	<5	<10	<1	<50	<1	4	<2	<5	<0.1	<5	246	<2	<5	<5	<5
ASS14	2-3m	5	20	<1	<50	<1	19	<2	<5	<0.1	<5	9	<2	<5	36	11
ASS14	3-4m	<5	20	<1	<50	<1	12	<2	<0.1	<5	<5	6	<2	<5	18	<5
ASS23	4-5m	5	20	<1	<50	<1	19	<2	<5	<0.1	<5	9	<2	<5	36	11
ASS24	2-3m	<5	<10	<1	<50	<1	<2	<2	<0.1	<5	<5	<5	<2	<5	<5	78
ASS25	1-2m	<5	<10	<1	<50	<1	4	<2	<5	<0.1	<5	14	3	<5	<5	372
ASS25	2-3m	<5	<10	<1	<50	<1	5	<2	<5	<0.1	<5	14	<2	<5	<5	360
ASS26	2-3m	<5	<10	<1	<50	<1	<2	<2	<5	<0.1	<5	<5	<2	<5	<5	<5
ASS27	1-2m	<5	<10	<1	<50	<1	<2	<2	<5	<0.1	<5	<5	<2	<5	<5	<5
ASS27	3-4m	<5	<10	<1	<50	<1	<2	<2	<0.1	<5	<5	<5	<2	<5	<5	<5
ASS29	2-3m	9	100	<1	<50	<1	10	<2	<5	<0.1	6	9	<2	<5	14	<5
ASS30	2-3m	<5	<10	<1	<50	<1	<2	<2	<5	<0.1	<5	<5	<2	<5	<5	14
ASS31	1-2m	<5	<10	<1	<50	<1	<2	<2	<5	<0.1	<5	<5	<2	<5	<5	<5
ASS31	2-3m	13	20	<1	<50	<1	12	<2	<5	<0.1	6	<5	<2	<5	25	<5
ASS31	4-5m	<5	<10	<1	<50	<1	<2	<2	<0.1	<5	<5	<5	<2	<5	<5	<5
Tailings clay fines	-	16	80	<1	<50	<1	51	3	<5	0.2	9	59	5	<5	89	16
Tailings sand	-	<5	<10	<1	<50	<1	3	<2	<5	<0.1	<5	<5	3	<5	<5	<5
Average crustal abundance		1.7	500	2.4	10	0.1	100	20	50	0.05	14	950	80	0.05	160	75

Table 4 Leachable metals from selected drill samples. Sample IDs in bold denote samples identified as PASS.

Sample ID	Depth	Total concentration (mg/L)														
		As	Ba	Be	B	Cd	Cr	Co	Cu	Pb	Mn	Ni	Se	V	Zn	Hg
Guideline value ¹		0.5	-	-	5	0.01	1	1	0.4	0.1	-	1	0.02	-	0.02	0.002
Guideline value ²		0.024	-	-	0.94	0.0002	0.0033	0.0014	0.0014	0.0034	1.9	0.011	0.011	0.006	0.008	
ASS06	1-2	<0.1	0.2	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.001
ASS07	2-3	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	0.6	<0.1	<0.05	<0.1	0.2	<0.001
ASS10	1-2	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	0.6	<0.1	<0.05	<0.1	<0.1	<0.001
ASS14	2-3	<0.1	0.2	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	0.2	<0.001
ASS14	3-4	<0.1	0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	0.1	<0.001
ASS23	4-5	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	0.2	<0.001
ASS24	2-3	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	3.8	<0.001
ASS25	1-2	<0.1	0.2	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.05	<0.1	17.3	<0.001
ASS25	2-3	<0.1	0.2	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.05	<0.1	15.0	<0.001
ASS26	2-3	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.001
ASS27	1-2	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	0.1	<0.001
ASS27	3-4	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.001
ASS29	2-3	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.05	<0.1	<0.1	<0.001
ASS30	2-3	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	1.0	<0.001
ASS31	1-2	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.001
ASS31	2-3	<0.1	0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.001
ASS31	4-5	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	0.1	<0.001
Tailings clay fines	-	<0.1	0.5	<0.05	0.2	<0.05	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	<0.05	<0.1	<0.1	<0.001
Tailings sand	-	<0.1	0.3	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.001

¹ Water quality trigger values for livestock drinking water (ANZECC/ARMCANZ, 2000)

² Water quality trigger values for 95% protection of aquatic ecosystems (ANZG, 2018)

5 GROUNDWATER ASSESSMENT

Groundwater samples were collected from monitoring bores surrounding the Project area in December 2021. Locations of bores are shown in Figure 16. It should be noted that some of these bores are located a considerable distance from the deposit, and as such do not all represent the quality of the groundwater immediately surrounding the deposit. Groundwater from these bores was analysed and the results were interpreted in a report by MWES Hydrological Services (MWES, 2022a) (Table 5). High dissolved concentrations of Fe, Mn, As and Ni are common in superficial aquifers across the Perth Basin and particularly in the Bassendean Sands (Davidson, 1995 cited in MWES, 2022). High iron concentrations are present within some shallow bores and levels decrease significantly with depth. High Mn concentrations observed in some bores are associated with saline groundwater. Other elements such as As and Ni have moderately low concentrations and are patchy in distribution (MWES, 2022a). Elevated sulfate concentrations were present in some samples.

Chemical indicators within groundwater can be used to indicate whether groundwater has been affected by the oxidation of sulfides in ASS as follows:

- An alkalinity:sulfate ratio of less than 5
- A pH of less than 5
- A soluble aluminium concentration greater than 1 mg/L (DER, 2015b)

The alkalinity:sulfate ratio of the majority of the groundwater samples was less than 5 (Table 5), indicating that the groundwater may have been affected by the oxidation of sulfides. However, none of the samples had a pH less than 5 and only one of the samples had a soluble aluminium concentration greater than 1 mg/L (highlighted in yellow in Table 5). This bore is located outside the mining tenement (Figure 16)

The alkalinity of the groundwater is a measure of the natural buffering capacity of the groundwater, such that the lower the total alkalinity and the higher the total acidity, the more vulnerable groundwater is to acidification (**DER, 2015b**). Several samples had alkalinity levels that were inadequate to maintain stable acceptable pH levels (Table 5). Total acidity of the groundwater was not measured. It is recommended that total acidity be measured in newly established bores prior to Project construction so that baseline values are recorded (Section 9.2).

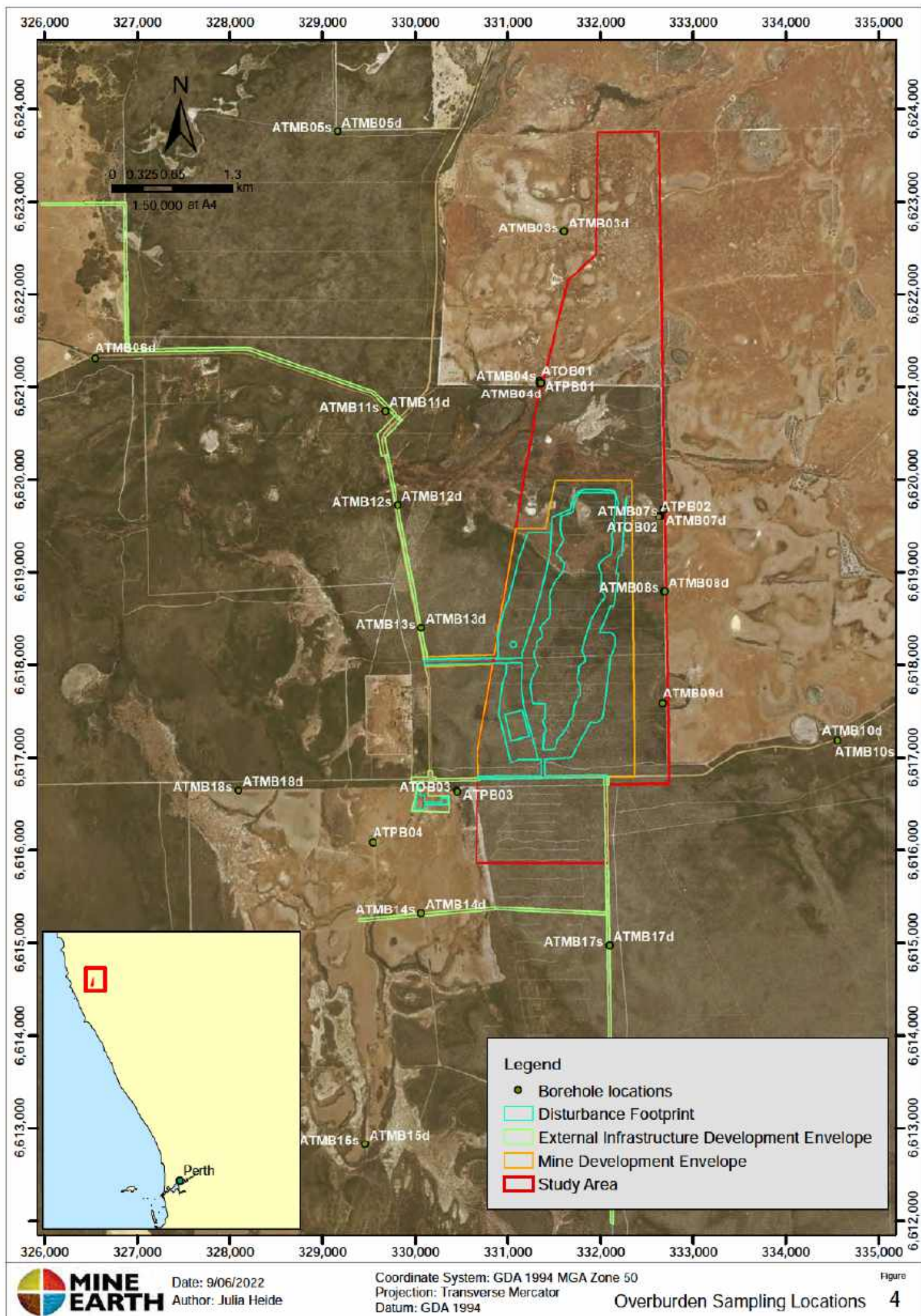


Table 5 Groundwater chemistry from bores surrounding the Atlas Project compared to Australian Drinking Water Guidelines (MWES, 2022a)

Bore ID	pH	EC	TDS	TSS	Ca	K	Mg	Na	HCO ₃ (CaCO ₃)	CO ₃ (CaCO ₃)	OH (CaCO ₃)	Alkalinity (CaCO ₃)	Cl	SO ₄	Ionic Balance	Hardness (CaCO ₃)	P	S	Al	As	B	Cd	Co	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Zn	Alkalinity- SO ₄ Ratio
	pH Units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
Health limit (mg/L)																				0.01	4	0.002			2		0.5	0.5	0.02	0.01		
Health half limit trigger																				0.005	2	0.001			1		0.25	0.025	0.01	0.005		
Aesthetic limit (mg/L)	<6.5 or >8.5		600		NL	NL	NL	180	NL	NL	NL	NL	250	250	NL	200	NL	NL	0.2				NL		1	0.3	0.1				3	
ATMB01S	7.2	28000	15000	29000	240	73	640	6300	190	<5	<5	190	6800	1300	21	3200	<0.05	400	<0.01	0.002	0.25	<0.0001	<0.001	<0.001	<0.001	0.02	0.03	0.002	0.002	<0.001	0.002	0.15
ATMB01D	6.5	130	190	260	2.9	2.3	2.4	17	18	<5	<5	18	26	1	0.043	17	0.12	0.8	0.22	0.002	<0.02	<0.0001	0.005	0.001	0.003	0.66	0.014	<0.001	0.006	<0.001	0.01	18.00
ATMB02S	7.8	32000	22000	65000	370	50	770	7700	700	<5	<5	700	10000	1100	13	4100	0.21	340	0.02	0.006	0.38	<0.0001	0.001	<0.001	<0.001	0.03	1.9	<0.001	0.002	<0.001	0.005	0.64
ATMB02D	7.6	40000	29000	80	480	59	1100	9900	240	<5	<5	240	13000	2100	15	5700	<0.05	770	<0.01	<0.001	0.42	<0.0001	0.002	<0.001	<0.001	<0.001	0.59	<0.001	0.002	<0.001	0.003	0.11
ATMB04S	7	1500	1000	13000	8.2	20	19	240	73	<5	<5	73	300	46	9.1	97	<0.05	16	<0.01	<0.001	0.05	<0.0001	<0.001	<0.001	<0.001	<0.01	0.18	<0.001	<0.001	<0.001	<0.001	1.59
ATMB04D	7.1	1500	750	110	8.2	19	18	230	79	<5	<5	79	290	39	8.4	94	<0.05	12	<0.01	<0.001	0.05	<0.0001	<0.001	<0.001	<0.001	<0.01	0.03	<0.001	<0.001	<0.001	0.013	2.03
ATMB05D	7.5	3000	1800	19	89	12	68	410	190	<5	<5	190	540	270	6.4	500	<0.05	87	0.01	0.003	<0.02	<0.0001	<0.001	<0.001	<0.001	0.12	0.11	0.002	0.001	<0.001	0.002	0.70
ATMB06D	7.1	1100	620	45	23	6	27	140	120	<5	<5	120	240	24	0.09	170	<0.05	7.2	<0.01	0.002	0.03	<0.0001	0.001	<0.001	<0.001	0.02	0.56	<0.001	<0.001	<0.001	<0.001	5.00
ATMB07S	7.7	19000	12000	2100	320	52	450	3500	260	<5	<5	260	5200	820	10	2800	<0.05	290	<0.01	0.001	0.1	0.0001	0.002	<0.001	<0.001	0.01	0.37	<0.001	0.003	<0.001	0.002	0.32
ATMB07D	7.6	37000	27000	63	730	83	1100	8400	200	<5	<5	200	11000	1900	15	6500	<0.05	700	0.01	<0.001	0.3	0.0001	<0.001	<0.001	<0.001	<0.01	0.95	<0.001	0.01	<0.001	0.054	0.11
ATMB08S	7	1800	1200	5700	14	5.4	20	280	140	<5	<5	140	320	30	8.1	120	<0.05	12	0.02	<0.001	0.04	<0.0001	<0.001	<0.001	0.001	0.11	0.091	<0.001	0.007	<0.001	0.003	4.67
ATMB08D	7.2	3100	1900	82	59	14	42	470	190	<5	<5	190	640	<2	11	320	<0.05	1.5	0.04	0.002	0.08	<0.0001	0.006	0.002	<0.001	10	0.37	0.003	0.007	<0.001	0.014	380.00
ATMB09D	7.4	1700	970	94	31	8.6	28	250	170	<5	<5	170	310	2	9.7	190	<0.05	1.5	0.03	0.018	0.05	<0.0001	<0.001	0.003	<0.001	0.92	0.011	0.001	0.001	0.001	0.004	85.00
ATMB010S	8	27000	16000	11000	170	54	450	6700	510	<5	<5	510	6900	770	21	2300	<0.05	230	<0.01	0.017	0.6	0.0001	0.002	<0.001	0.002	0.01	0.09	0.002	0.009	<0.001	0.002	0.06
ATMB010D	7.5	8900	5700	240	120	40	120	1600	300	<5	<5	300	2300	41	8.8	810	<0.05	16	0.02	0.001	0.52	<0.0001	<0.001	<0.001	<0.001	0.19	0.076	<0.001	<0.001	<0.001	0.004	7.32
ATMB11S	5.7	4300	3000	8200	290	12	98	500	22	<5	<5	22	710	1300	4	1100	<0.05	400	0.34	0.072	0.05	<0.0001	0.009	<0.001	<0.001	58	0.099	<0.001	0.025	0.001	0.019	0.02
ATMB11D	6.9	2700	1500	99	24	14	51	420	170	<5	<5	170	580	5	9.4	270	<0.05	1.6	<0.01	<0.001	0.08	<0.0001	<0.001	<0.001	<0.001	0.29	0.21	<0.001	<0.001	<0.001	<0.001	34.00
ATMB12S	6	18000	14000	4000	870	26	790	2600	44	<5	<5	44	4500	3100	6.9	5400	<0.05	1100	0.2	0.007	0.08	0.0006	0.01	<0.001	<0.001	51	0.55	<0.001	0.023	0.002	0.1	0.01
ATMB12D	6.8	1900	1600	15	25	8	37	270	160	<5	<5	160	360	<1	10	210	<0.05	1.3	0.01	0.004	0.04	<0.0001	0.001	0.001	<0.001	6.6	0.11	<0.001	0.001	<0.001	0.001	320.00
ATMB13S	6.2	8200	6900	7600	780	19	310	950	78	<5	<5	78	1400	3000	0.28	3200	<0.05	1000	0.12	<0.001	<0.02	<0.0001	<0.001	<0.001	<0.001	88	0.71	<0.001	0.001	<0.001	0.026	0.03
ATMB13D	7.4	1900	1000	39	40	14	21	300	240	<5	<5	240	420	44	1.2	190	<0.05	7.6	0.06	<0.001	0.35	<0.0001	<0.001	<0.001	<0.001	0.03	0.091	0.001	0.001	<0.001	0.007	5.45
ATMB14S	7.7	1500	790	16000	26	1.7	11	300	360	<5	<5	360	190	84	3.6	110	<0.05	26	<0.01	<0.001	0.06	<0.0001	<0.001	<0.001	<0.001	<0.01	0.12	0.002	0.001	<0.001	0.001	4.29
ATMB14D	7.4	3400	1800	86	89	8.8	47	580	340	<5	<5	340	770	100	3.3	420	<0.05	35	0.01	<0.001	<0.02	<0.0001	<0.001	<0.001	<0.001	<0.01	<0.005	0.002	<0.001	<0.001	0.015	3.80
ATMB15S	7.4	690	380	33000	30	5.6	8.8	97	230	<5	<5	230	76	17	3.1	110	<0.05	8.9	<0.01	<0.001	0.03	<0.0001	<0.001	<0.001	<0.001	0.03	0.023	0.001	<0.001	<0.001	<0.001	13.53
ATMB15D	7.6	820	420	33	43	5.9	8.4	110	270	<5	<5	270	110	5	3.6	140	<0.05	2	0.03	0.007	0.03	<0.0001	<0.001	<0.001	<0.001	<0.01	0.044	<0.001	<0.001	<0.001	0.002	54.00
ATMB16S	6.2	4400	2700	300	150	10	130	630	29	<5	<5	29	820	980	1.6	900	<0.05	330	0.01	0.002	0.03	0.0002	0.014	<0.001	0.001	1.6	0.89	<0.001	0.027	<0.001	0.098	0.03
ATMB16D	7.1	2500	1400	250	40	8.1	46	390	170	<5	<5	170	550	5	9.9	290	<0.05	2.6	<0.01	0.002	0.05	<0.0001	0.047	<0.001	<0.001	0.02	0.08	<0.001	0.04	<0.001	0.007	34.00
ATMB17S	5.7	1700	1200	4200	31	8.3	34	240	42	<5	<5	42	320	130	8.8	220	<0.05	39	1.4	0.003	<0.02	<0.0001	0.002	0.003	0.002	5.3	0.027	0.002	0.004	0.004	0.099	0.32
ATMB17D	5.6	1300	890	53	8.8	6.5	18	190	28	<5	<5	28	280	<1	9.4	97	<0.05	2.4	0.52	0.01	<0.02	<0.0001	<0.001	0.024	0.002	15	0.043	<0.001	0.002	0.005	0.057	56.00
ATMB18S	7.5	490	270	180	24	4.4	14	52	120	<5	<5	120	44	28	5.2	120	<0.05	8.8	<0.01	<0.001	0.04	<0.0001	<0.001	<0.001	<0.001	<0.01	<0.005	<0.001	<0.001	<0.001	0.004	4.29
ATMB18D	7.7	600	320	12	11	4.6	8.2	98	190	<5	<5	190	61	24	2.9	61	<0.05	7.8	0.02	0.002	0.04	<0.0001	<0.001	<0.001	<0.001	<0.01	0.005	<0.001	0.001	<0.001	0.004	7.92
ATOB01	6.8	1400	680	260	6.4	18	17	220	74	<5	<5	74	290	42	6	85	<0.05	13	<0.01	<0.001	0.05	<0.0001	<0.001	<0.001	<0.001	<0.01	0.18	<0.001	<0.001	<0.001	<0.001	1.76
ATOB02	7.5	23000	16000	110	400	65	590	4400	230	<5	<5	230	6100	1000	14	3400	<0.05	310	<0.01	0.001	0.2	<0.0001	0.001	<0.001	<0.001	0.14	0.66	<0.001	0.001	<0.001	0.012	0.23
ATOB03	5.9	1600	980	160	25	6.8	34	220	43	<5	<5	43	310	110	7.2	200	<0.05	32	0.04	0.003	0.02	<0.0001	0.002	0.001	<0.001	18	0.12	<0.001	0.001	<0.001	0.027	0.39
ATOB04	6.2	1300	850	15	18	6.6	17	190	56	<5	<5	56	280	3	7.9	110	<0.05	2.5	0.15	0.011	<0.02	<0.0001	0.004	0.029	<0.001	29	0.36	0.001	0.003	<0.001	0.018	18.67
ATOB05	6.3	1300	830	34	20	8.2	16	190	84	<5	<5	84	270	3	7.7	120	<0.05	2.3	0.2	0.005	<0.02	<0.0001	0.003	0.017	<0.001	26						

6 INTERPRETATION AND CONCEPTUAL MODEL

The pH_F values for all samples indicated that there are only minor occurrences (one sample) of actual acidity present in the soil profile (Table 2). The pH_{FOX} values indicated significant reduction in pH following oxidation (Table 2), and that PASS are inconsistently distributed through the profile of the deposit.

The CRS analysis indicated relatively minor occurrences of PASS present in the samples analysed, illustrated by only nine of the 72 samples analysed for the Suite 2 exceeding the standard ASS action criteria (Table 2). However, numerous samples exhibited pH_{FOX} values <3 with S_{Cr} values $>0.01\%$, which is used as a conservative indicator for PASS in Bassendean sands (UWA/DEC, 2011).

Given that PASS has been detected in some samples through CRS analysis, and exceeded the ASS action criteria for Bassendean sands (Table 2), a management plan is required for disturbance of the soil profile during mining operations.

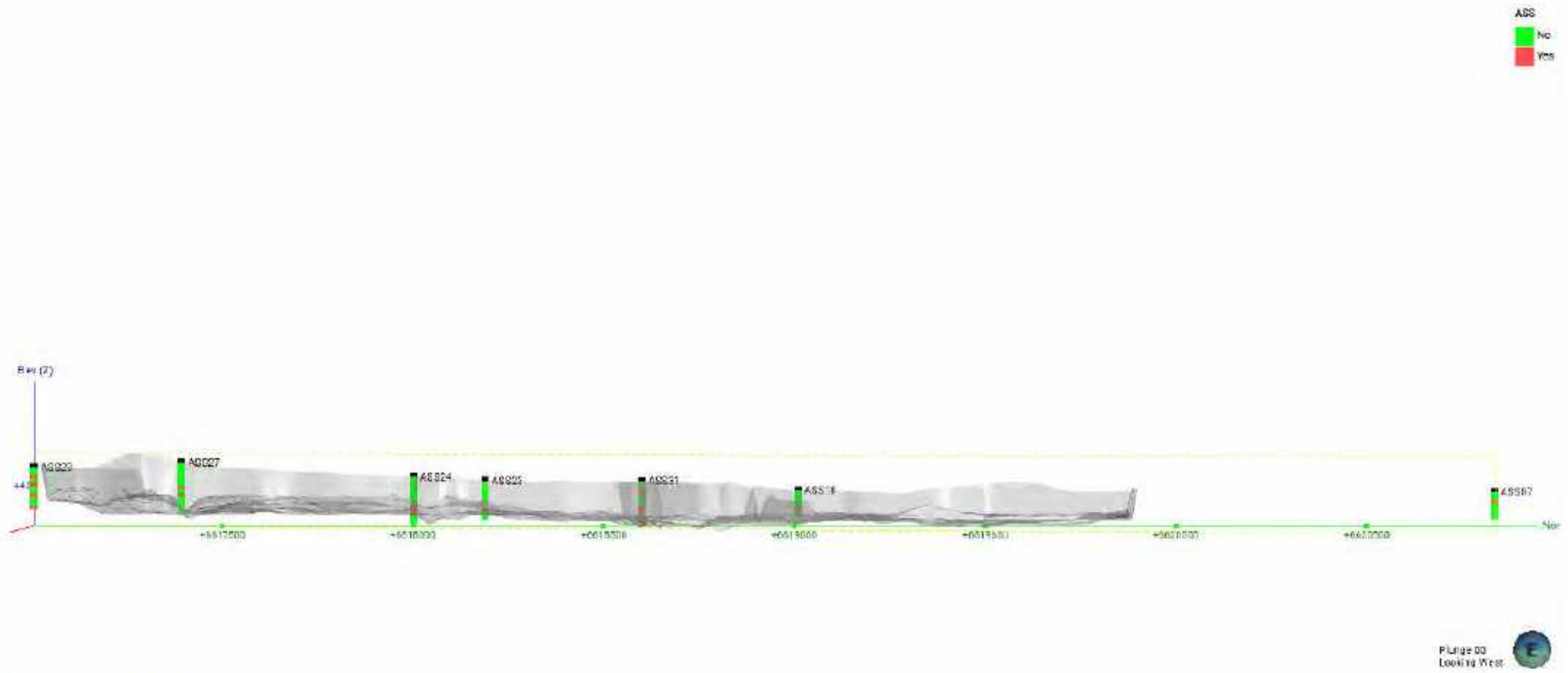
The distribution of PASS appears variable, both laterally and with depth, and does not appear to be correlated with any particular stratigraphy / zones of the orebody (Figure 17). This is likely reflective of the highly dissected / heterogeneous nature of the soil profile, which has been influenced by complex cycles of deposition and erosion, particularly where surface drainage channels have historically intersected, or currently intersect the study area.

Unlike other mineral sands mining operations in the region (e.g. Boonanarring), there does not appear to be a strong correlation between soil profile stratigraphy, soil texture, soil colour and PASS materials. The PASS appears to be distributed in relatively isolated, inconsistent depths within the soil profile. All of the samples identified as PASS were classified as having either sandy clay or clayey sand textures (Table 2), indicating that the PASS is associated with soils with relatively high clay contents, however, not all samples with high clay contents were classified as PASS. None of the samples classified as having a sand texture exceeded any of the PASS action criteria.

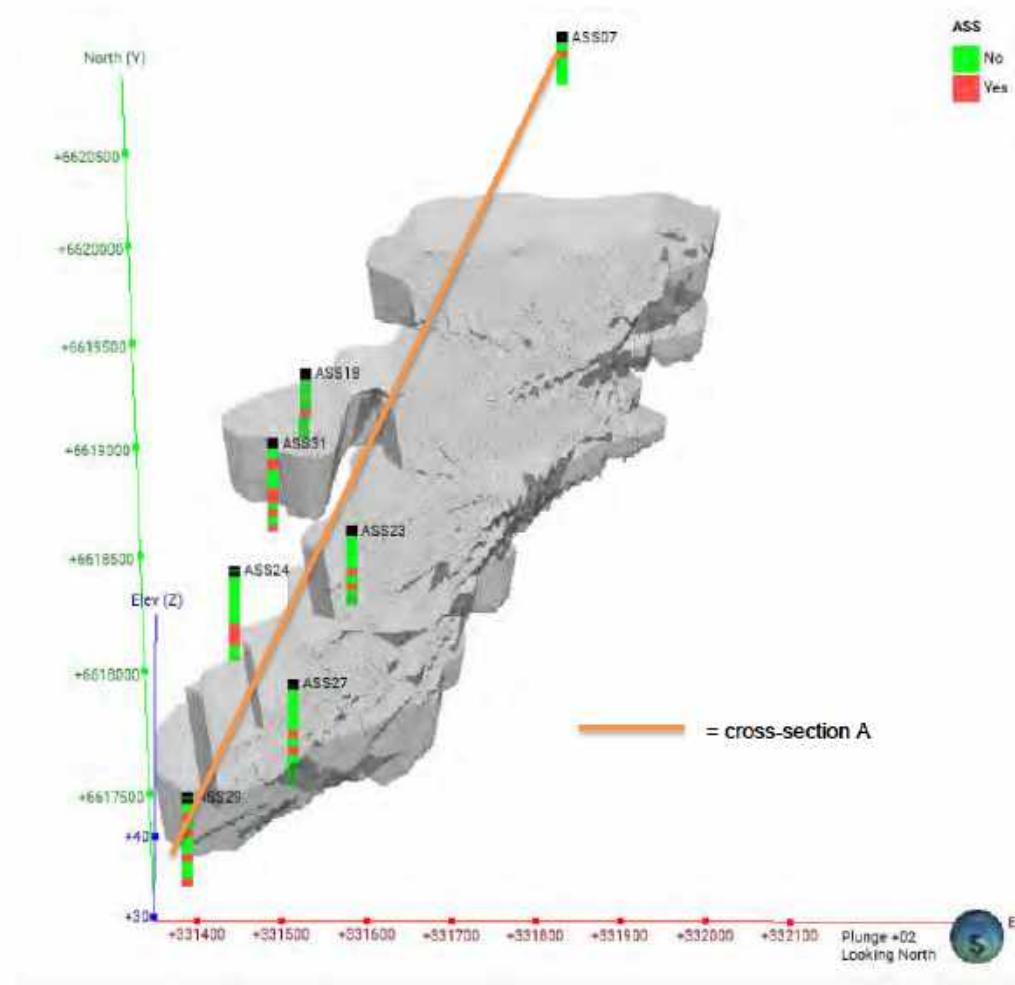
Similarly, all PASS samples were logged as having 'dark' soil colours, although the colours of the PASS samples were variable. Photos of drill samples that exceeded the standard ASS action criteria (Net acidity as equivalent sulfur (%S) – acid neutralising capacity = 0.03 %S) are provided in Figure 18. Given that multiple samples with similar 'dark' soil colour classifications did not exceed any of the PASS action criteria, soil colour alone cannot be used as an indicator of PASS within the deposit.

It is considered likely that PASS within the soil profiles are generally associated with relatively high clay contents and 'dark' colours, although it cannot be assumed that all 'dark', clay rich materials are PASS.

Further quantification of PASS within the deposit will need to be undertaken during operations to further quantify distribution and volumes of PASS material requiring management.



Cross-section A through the proposed pit



View looking north through the proposed pit

Figure 17 Location of PASS materials within the Atlas deposit



ASS07 2-3m



ASS23 6-8m



ASS27 6-7m



ASS29 7-8m



ASS31 7-8m

Figure 18 Examples of sample intervals which exceeded the ASS action criteria

7 ENVIRONMENTAL RISKS

PASS materials identified within the deposit have the potential to impact the surrounding environment through direct disturbance of the soil and through lowering of the groundwater table. Both processes result in exposure of PASS to oxygen with subsequent potential oxidation of the PASS materials and generation of acidity. The source and pathways for potential acidification of the surrounding environment are shown in Figure 19.

Additional analysis of soil / overburden materials throughout the proposed mining operations will facilitate further delineation of the distribution of likely PASS and volumes of material requiring management, to minimise the risks associated with the PASS. Identification, management and treatment of PASS during each mining phase is detailed in Section 8.

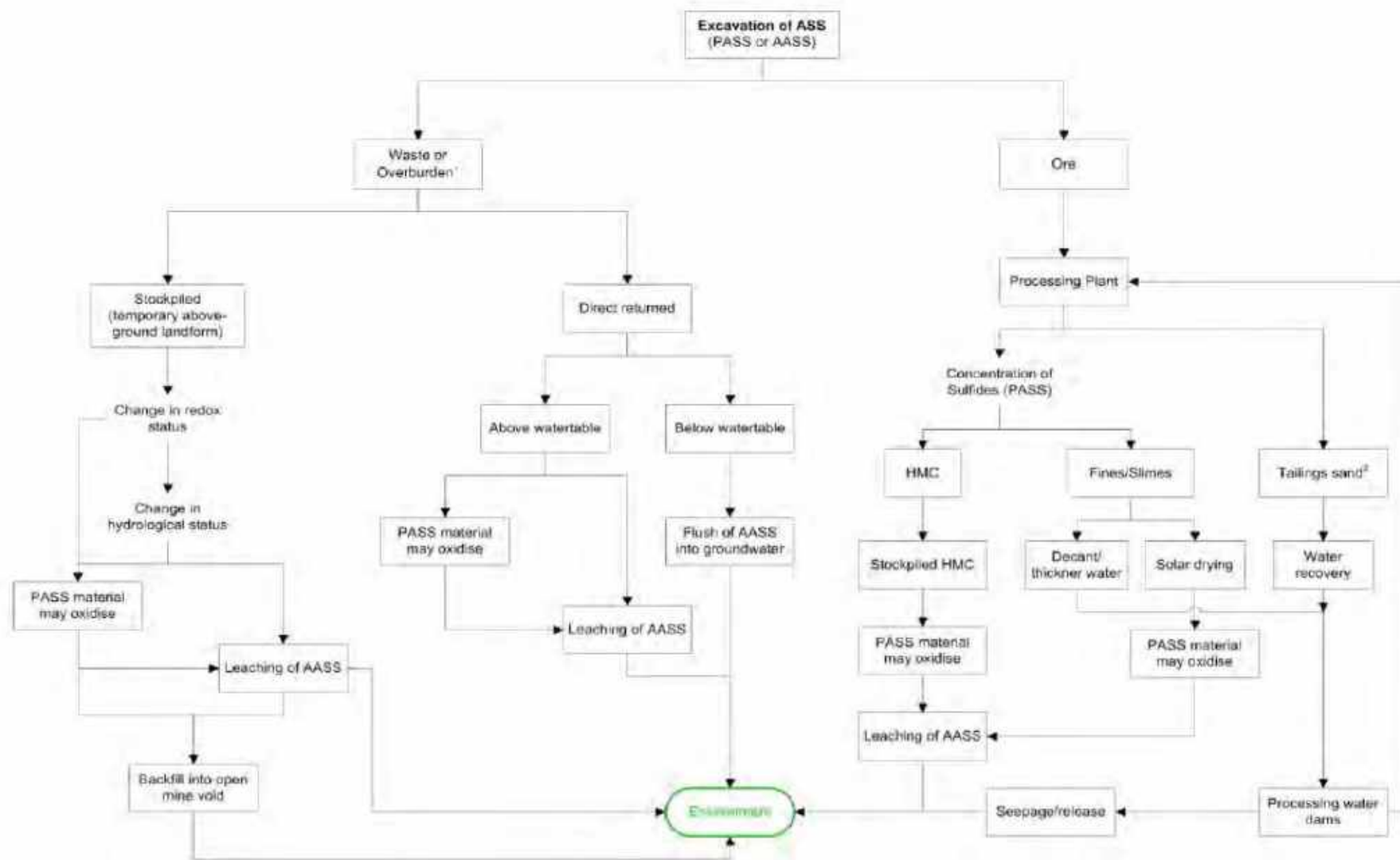


Figure 19 Source and pathways for potential acidification of the environment (SWC, 2017)

8 ACID SULFATE SOIL MANAGEMENT

The results of the ASS investigation indicate that soils / overburden / ore within the deposit may contain PASS. Therefore, the mined materials will require management throughout construction and operation of the mine. The general sequence of mining, processing and soil profile reconstruction will be as follows:

1. Removal and stockpiling of topsoil and stockpiling
2. Removal of subsoil / overburden, with regular additional testing for PASS
3. Excavation of ore, which will be stockpiled on a run-of-mine (ROM) pad until loaded into a feed preparation plant, then slurried and pumped to the wet concentrator plant for processing.
4. Processing of the ore via gravity separation to produce three process streams; heavy minerals concentrate (HMC), tailings sand and tailings clay fines:
 - a. The HMC will be stockpiled on site prior to transport off-site
 - b. The tailings sand will be returned to the pit void after cycloning to dewater the material
 - c. The tailings fines will either be pumped to solar drying ponds before being placed back into the pit void, or co-disposed with the tailings sand fraction within the pit void.
5. Return of overburden to the pit void
6. Return of topsoil and vegetation debris

Management of PASS during each of these mining phases is described below.

8.1 Topsoil management

Topsoil will be stripped to a depth of 0.2 m from all disturbance areas and will be stockpiled as a surface rehabilitation resource, in accordance with the Soil and Waste Management Plan ((Mine Earth, 2022a). Topsoil and subsoil do not require neutralisation if the pH is greater than 4 (DER, 2015b). The baseline soil investigation ((Mine Earth, 2022b) indicated that all soils sampled to a depth of 1m from across the study area had a pH >5. Therefore, topsoil (and subsoil) materials are unlikely to require any treatment for PASS.

8.2 Subsoil / overburden management

The depth of subsoil / overburden within the proposed pit ranges from 0.2 m to 1.5 m. Subsoil / overburden will be removed and initially stockpiled external to the pit until sufficient areas of the pit are available to allow progressive backfill and surface soil profile construction / rehabilitation.

Testing of the pH / pH_{FOX} and S_{Cr} of the subsoil / overburden will be undertaken during mining operations, particularly where dark coloured, clay rich materials are identified to further quantify the presence, distribution and volumes of likely PASS material present. If the tested materials contain pH_{FOX} values <3 and S_{Cr} values >0.01%, they will require treatment in accordance with the guidelines for neutralisation (DER, 2015b), as detailed in Section 8.6.

Overburden that is identified as PASS will be removed and immediately transported to an open pit void and backfilled with the required amount of alkaline material for neutralisation of the acidity (Section 8.6). The neutralising material will be mixed with the overburden as far as practical. A guard layer of alkaline material will initially be added to the base and walls (where practical) of the mine void to limit the potential for acidification.

Overburden identified as PASS that cannot be immediately backfilled into an open pit void will be temporarily stored on a layer of alkaline material for less than 70 hours, prior to being backfilled and mixed with alkaline material for neutralisation. This is in accordance with DWER's short-term stockpiling

timeframe (DER, 2015b). This timeframe is also dependent on lab turn-around times for assessment of PASS and is unlikely to be achievable in situations where the material has already been excavated.

Overburden identified as PASS that is unable to be backfilled into an open pit void within 70 hours will be stockpiled on a treatment pad (Section 8.5), treated with a suitable alkaline material at an appropriate rate (Section 8.6), verified and then backfilled within 21 days (i.e. in accordance with DWER's medium-term stockpiling timeframe).

8.3 Ore management

Further testing of the ore is required to determine the volumes of likely PASS material present and provide more certainty with regards to the distribution. Excavated ore will initially be stockpiled and tested for PASS. Ore that has pH_{FOX} values <3 and S_{Cr} values $>0.01\%$ and is identified as PASS will be processed through the wet concentrator plant as soon as possible.

Any ore material that is not processed immediately upon excavation will be placed on a guard layer of alkaline material and stockpiled for a period of no more than 70 hours (i.e. short-term stockpiling timeframes). Ore that cannot be processed within 70 hours will be stockpiled on a treatment pad (Section 8.6) and will be processed or neutralised and verified within 21 days (i.e. medium-term stockpiling timeframe).

8.4 Processed materials management

8.4.1 HMC

HMC will be stockpiled temporarily on site, prior to transport off site. Any drainage from the HMC stockpiles will be collected and directed back to process water ponds.

8.4.2 Tailings sand

Tailings sand derived from ore processing will be returned to the pit void as a single waste stream and/or co-disposed with tailings clay fines into pit voids.

Sand tails will be regularly assayed to ensure S_{Cr} concentrations are below $0.01\%S$ and pH_{FOX} values are >3 . If necessary, additional lime sand will be incorporated during disposal.

Process water will be derived from the tailings sands and will be routinely field monitored for pH in order to ensure the pH of the water is above 5.5.

8.4.3 Clay fines

Tailings clay fines will be pumped to solar drying ponds, where they will be regularly tested to ensure S_{Cr} concentrations are below $0.01\%S$ and pH_{FOX} values are >3 . If S_{Cr} concentrations are above $0.01\%S$ and pH_{FOX} values are <3 , tailings clay fines will be treated with alkaline material at rates discussed in Section 8.6 prior to disposal within the pit.

8.5 Treatment pad

Treatment pads will be constructed for storage of materials prior to backfill or transport offsite, and treatment of PASS materials. Treatment pads will be constructed of a minimum 300mm layer of compacted crushed limestone (with sufficiently low permeability to prevent infiltration of leachate). All sides will be bunded with compacted crushed limestone to a minimum height of approximately 150mm

above the surface of the pad, to prevent surface water run-off from the pad, and external run-off onto the pad.

8.6 Neutralisation plan

8.6.1 Soil neutralisation rates

Any materials that contain pH_{FOX} values <3 and S_{Cr} values $>0.01\%$ will require treatment with lime. Calculations for determining the appropriate amount of lime required should be undertaken in accordance with the guidelines (DER, 2015b) and as follows:

Lime required (kg CaCO_3/m^3 soil) = Soil bulk density (tonne/ m^3) x net acidity (%S x 30.59) x 1.02 x safety factor (1.5) x 100/ENV

Where:

- Soil bulk density = average bulk density of the soil
- Net acidity = average net acidity of the materials (from S_{Cr} testing)
- ENV = effective neutralising value of the neutralising agent, (supplied with the product)

An indication of the approximate rates of lime likely to be required for neutralisation (kg CaCO_3/t) is detailed within the Acid Base Accounting (ABA) information conducted as part of the Suite 2 ASS analysis (Appendix C). Examples of rates required for selected samples are provided in Table 6. The indicative rates can be converted to kg CaCO_3/m^3 soil by using the measured soil bulk density. The actual rate required will need to be determined using measured net acidity, bulk density and ENV for specific materials.

Table 6 ABA data including indicative liming rates required for neutralisation of selected samples

Hole ID	Depth from	Depth to	Chromium Reducible Sulfur (%)	Net Acidity excluding ANC (sulfur %)	Net Acidity excluding ANC (acidity units)	Indicative liming rate (kg CaCO_3/t) ¹
ASS07	2	3	0.204	0.21	129	10
ASS18	5	6	0.014	0.02	10	1
ASS23	7	8	0.093	0.1	61	5
ASS24	7	8	0.014	0.02	10	1
ASS24	8	10	0.019	0.02	12	1
ASS27	6	7	0.025	0.04	22	2
ASS29	2	3	0.016	0.02	15	1
ASS29	4	5	0.018	0.04	24	2
ASS31	2	3	0.051	0.06	36	3
ASS31	6	7	0.035	0.04	23	2
ASS31	7	8	0.036	0.04	25	2
ASS31	9	10	0.029	0.03	19	1

1. Indicative liming rates included in ABA data for all samples analyses for Suite 2 analysis (Appendix C) calculated using by laboratory using an assumed bulk density and ENV

8.6.2 Soil validation sampling

Validation sampling will be undertaken using field testing (pH_F and pH_{FOX}) and the CRS suite with the inclusion of a measurement of total potential acidity (TPA) from the SPOCAS suite. Soils will initially be sampled at a density consistent with the *Landfill Waste Classification and Waste Definitions 1996 (As Amended 2018)*, however sampling density will be refined based on the amount of soil that has been neutralised.

Materials will be considered effectively neutralised if they meet the following criteria (DER, 2015b):

- The neutralising material appears well-blended with the soil.
- Samples have a pH_F of between 6.0 and 8.5.
- Samples have a pH_{FOX} of at least 5, to indicate that there is neutralising capacity greater than the existing plus potential acidity of the soil.
- The TPA of the soil is less than the limits of reporting.

8.6.3 Process water neutralisation

Routine monitoring of process water quality from process water dams will be undertaken.

If the pH of the water drops below 4, sodium bicarbonate (NaHCO_3) will be used to increase the pH. The quantity of NaHCO_3 used will be determined by laboratory assessment of the total acidity of water by titration, in accordance with the guidelines (DER, 2015b). Any accumulated sediments within treatments systems will be disposed of appropriately to prevent increases in sodicity and salinity of the surrounding environment.

9 GROUNDWATER MANAGEMENT

9.1 Management strategy

Groundwater drawdown mitigation is planned at the Project to minimise impacts on groundwater dependent vegetation and acid sulfate soils. A drawdown mitigation system (DMS) is proposed which works by recharging water into a series of relatively small infiltration ponds, significantly reducing the extent of the drawdown and impacts on surrounding vegetation (MWES, 2022b). Clean water, with compatible quality to the local groundwater is recirculated to the ponds by connecting pipelines and allowed to infiltrate to the top of the groundwater table. Infiltration water quality will be similar or better quality than the local groundwater as measured at the water table. The ponds will be constructed along a line that forms a barrier between the pit and sensitive vegetation and will be constructed on both sides of the pit, extending from the southern end to the area of cleared vegetation at the northern end of the deposit. The pit and associated dewatering activities are progressed in a northerly direction followed by backfilling. Once ore has been removed, ponds each side of the pit will continue to be recharged until the groundwater within the pit area returns to pre-mining levels (MWES, 2022b). An alternative option of using injection wells was also considered for the DMS. This may be necessary to use if pond infiltration rates are too low. (MWES, 2023)

Modelling is currently being undertaken to predict the extent of drawdown using this mitigation method. The modelled extent of drawdown for the infiltration ponds and the injection wells is shown in Figure 20.

If the groundwater table level has declined more than the limits as defined on the groundwater licence, the flow rate into the infiltration ponds, the number of infiltration ponds or the size of the infiltration ponds can be increased (MWES, 2022b).

9.2 Groundwater monitoring program

Groundwater will be monitored as per the groundwater operating strategy (GOS) (MWES, 2022b) and groundwater licence.

Piezometers will be installed near the network of infiltration ponds prior to mining, to establish the natural groundwater table level and record baseline water quality adjacent to the deposit. These bores will be monitored for groundwater levels in accordance with the GOS. Groundwater quality will be assessed for pH, EC, TDS and the parameters outlined in Table 7 (MWES, 2022b).

Validation of additional water treatment before recharge and down gradient of attenuation zone will occur. Field and laboratory analysis of native and recharged groundwater associated with the infiltration ponds will occur regularly, in accordance with the GOS (MWES, 2022b).

Table 7 Groundwater parameters to be assessed

Non-metals	Metals	
Total alkalinity	Arsenic	Magnesium (Mg)
Total acidity	Barium (Ba)	Mercury (Hg)
Carbonate (CO ₃)	Cadmium (Cd)	Nickel (Ni)
Bicarbonate (HCO ₃)	Calcium (Ca)	Potassium (K)

Chloride (Cl)	Chromium (Cr)	Selenium (Se)
Nitrate (NO ₃)	Copper (Cu)	Sodium (Na)
Sulfate (SO ₄)	Iron (total)	Titanium (Ti)
Hydroxide (OH)	Lead (Pb)	Zinc (Zn)

9.3 Groundwater trigger criteria

Once the new bores have been constructed surrounding the deposit, a site-specific baseline of groundwater quality will be determined. This will be used to establish site-specific groundwater trigger criteria for the measured criteria.

9.4 Groundwater treatment

If any of the criteria are triggered, the following initial actions will be taken to determine if the result requires re-sampling and analysis, immediate further action or no response:

- All water data will be reviewed to determine if there are any trends or possible causal factors.
- Review sampling and analysis methods to ensure appropriate methods were used.
- If considered necessary, re-sample affected bores to confirm the exceedance.
- Increase frequency of monitoring of the affected bore.

Secondary responses will include the following:

- If pH and titratable acidity trigger criteria are exceeded in successive sampling events, increase sampling frequency to fortnightly
- If it is confirmed that any groundwater parameter exceeds background based trigger levels, a contingency action plan will be prepared, suited to the level of risk to groundwater users and environmental receptors.

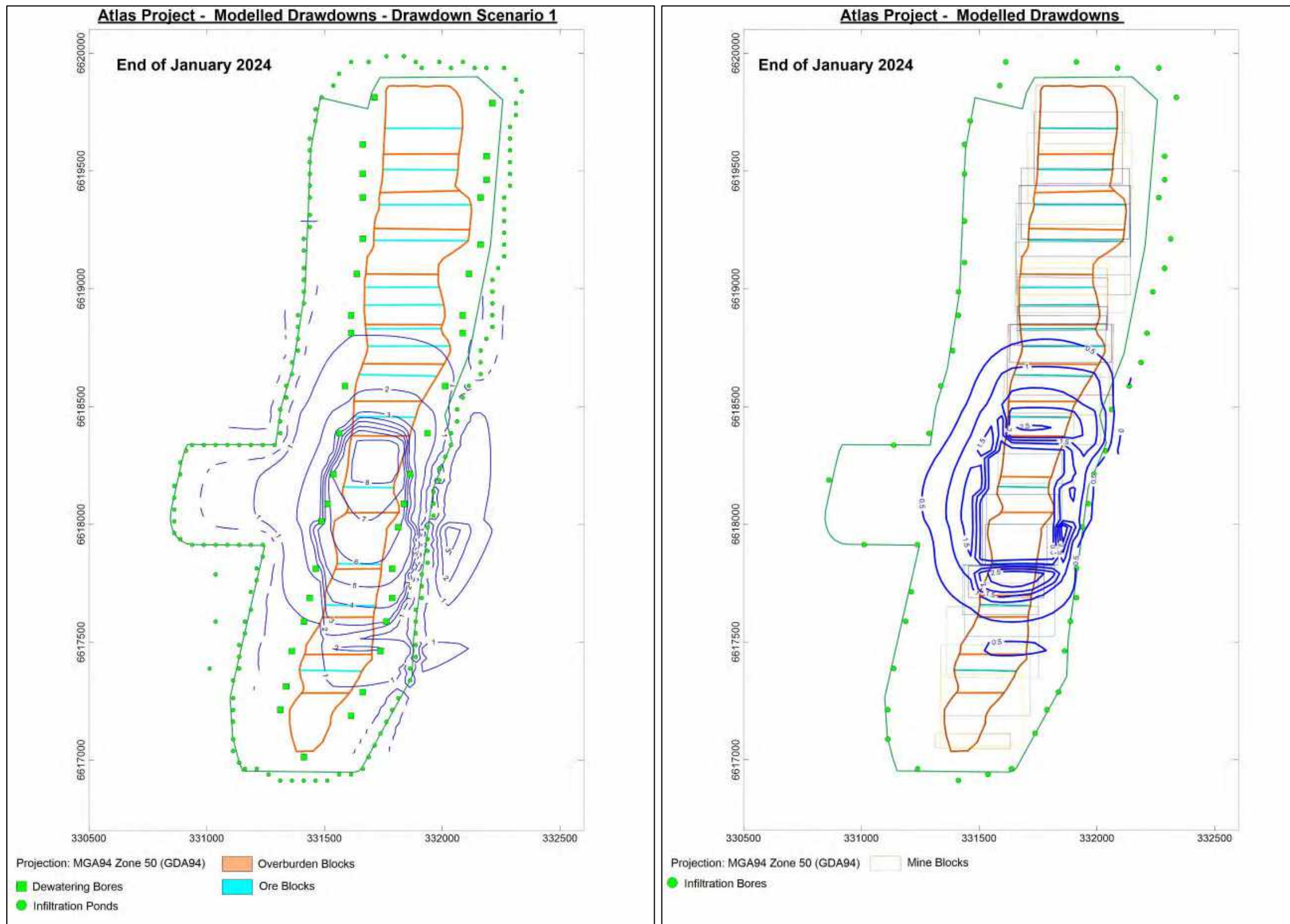


Figure 20 Modelled drawdowns using the infiltration ponds (scenario 1) and injection wells (scenario 2) recharge method (MWES, 2023)

10 CLOSURE REPORTING

An initial closure report will be completed after completion of site works. The closure report will be prepared in accordance with the guidelines (DER, 2015b) and will be submitted to DWER for approval.

Groundwater monitoring will continue after completion of dewatering. A post-dewatering monitoring closure report will be submitted to DWER after completion of the groundwater monitoring program. The report will be prepared in accordance with the guidelines (DER, 2015b).

11 REFERENCES

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Appendix A

Drilling database review

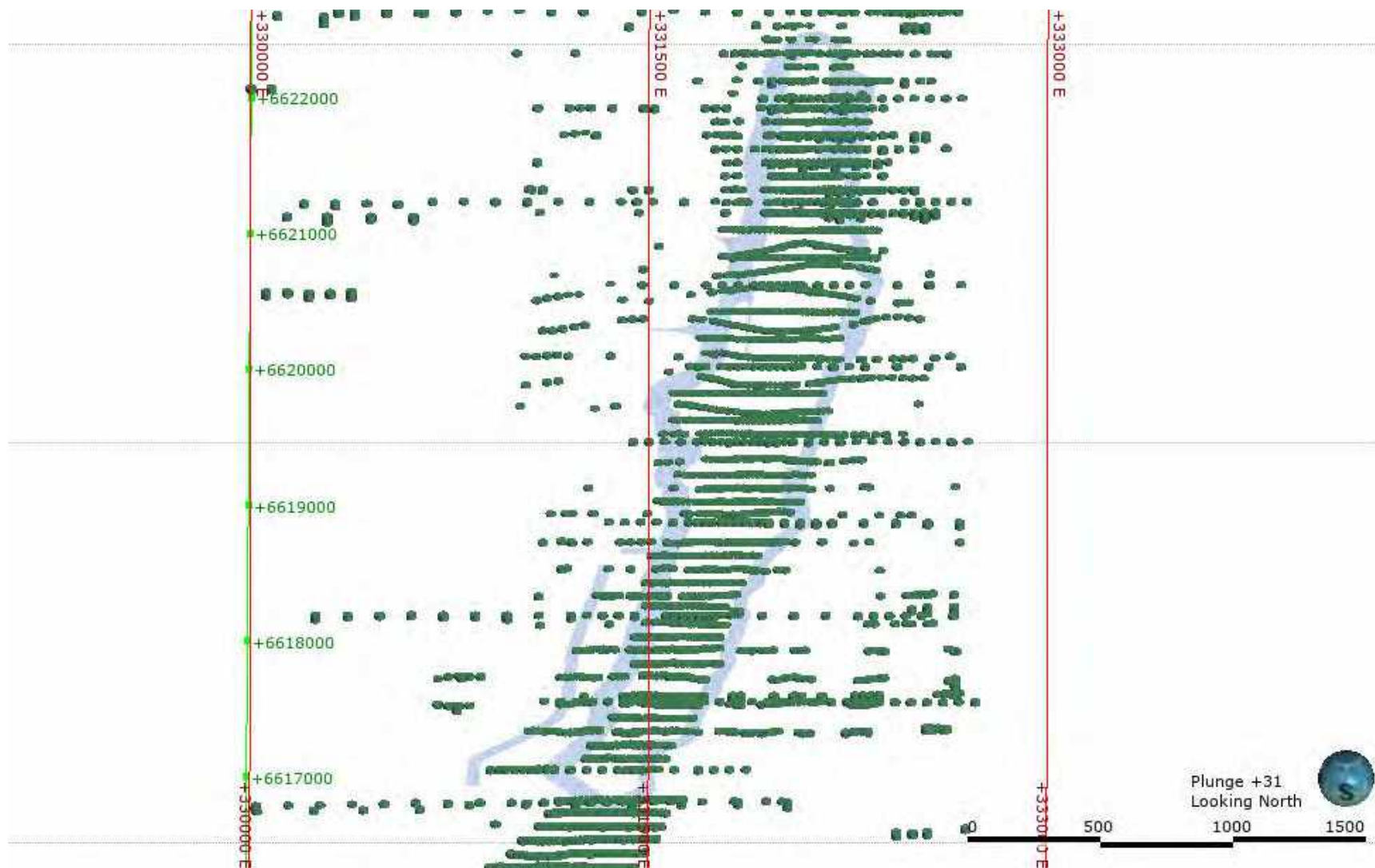


Figure A1 Entire drilling database (proposed pit disturbance at the time of database review delineated by blue polygon)



Figure A2 Drillholes logged with a combination of PASS (based on dark soil colour) and high clay fines content (HSL)

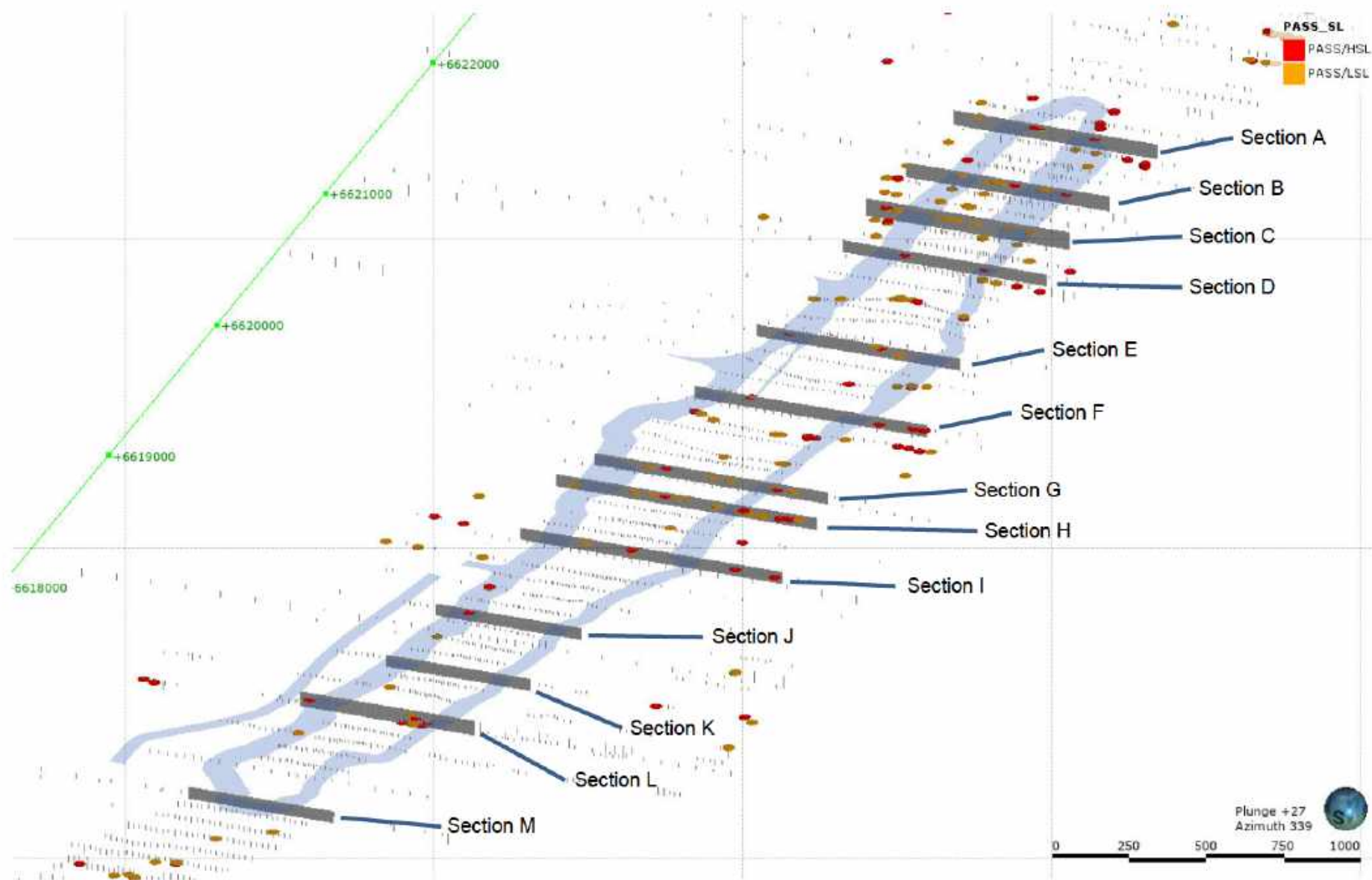
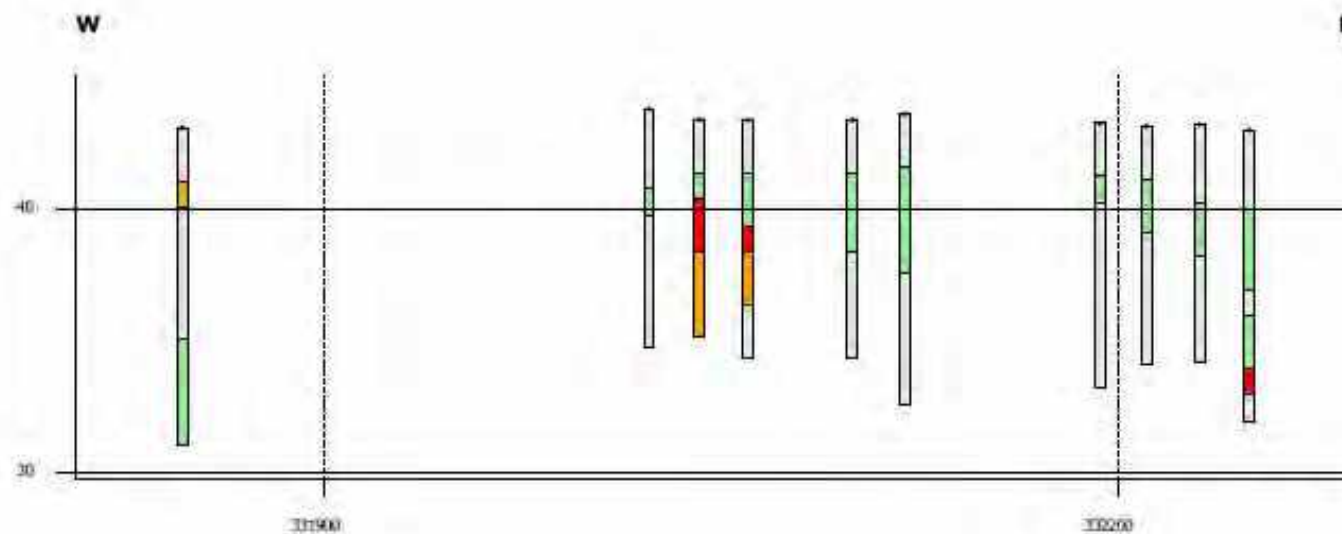
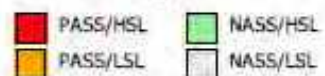


Figure A3 Locations of drilling database cross-sections (proposed pit disturbance at the time of database review delineated by blue polygon)

Section A



Legend



Location

E: 331806, 6622101
W: 332290, 6622101

Scale: 1:2,300

Vertical exaggeration: 10x



Figure A4 Cross-section A

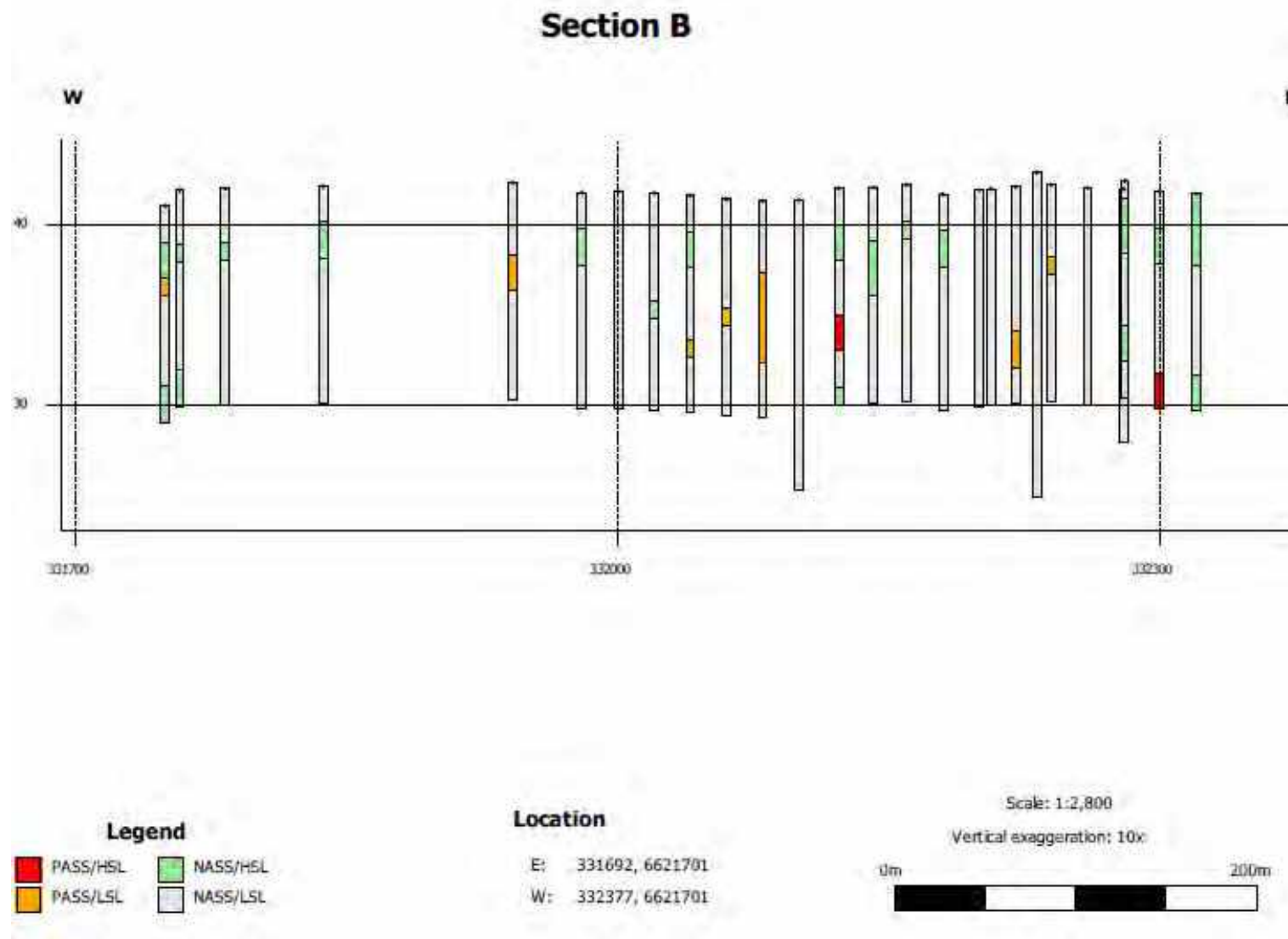


Figure A5 Cross-section B

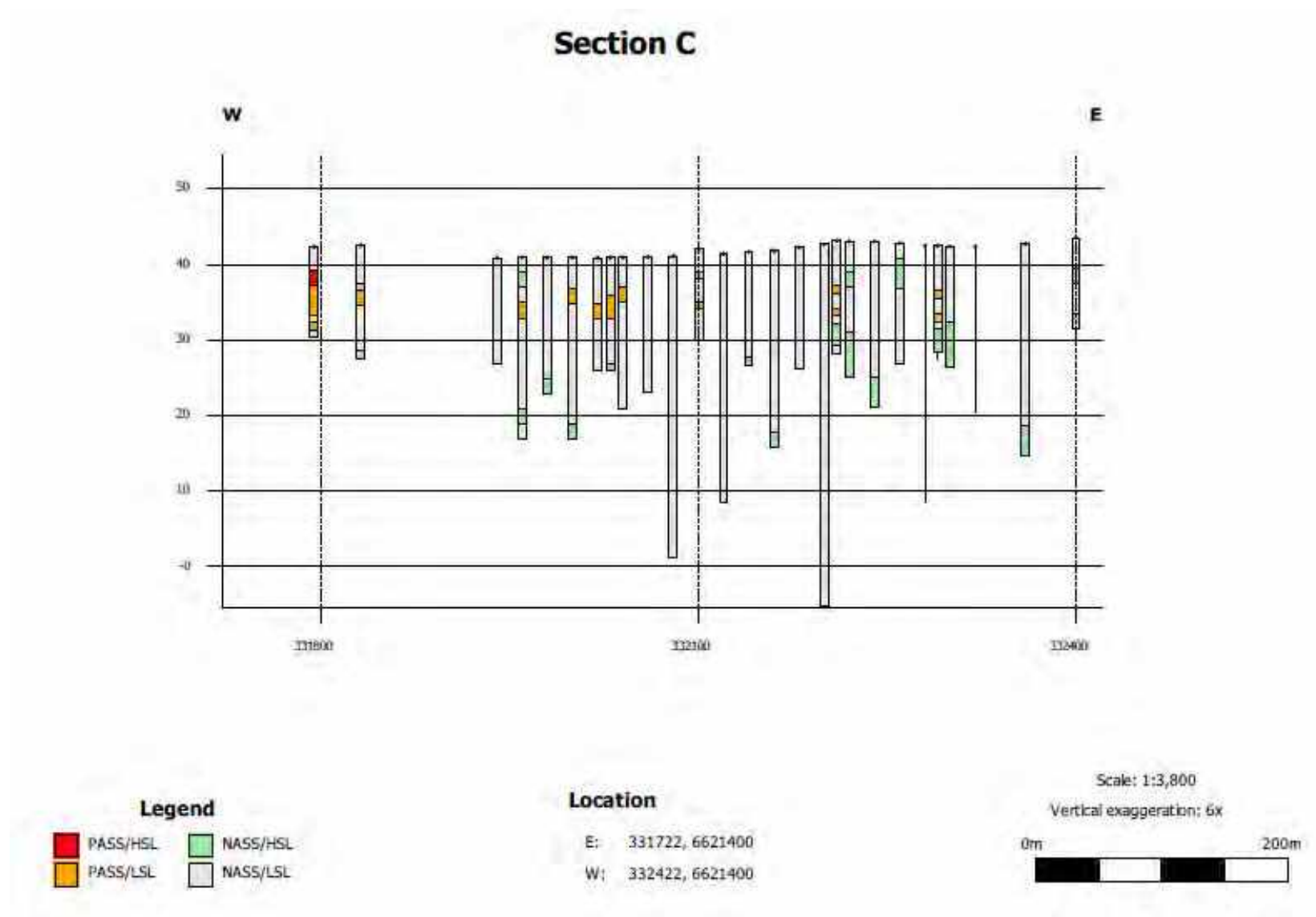


Figure A6 Cross-section C

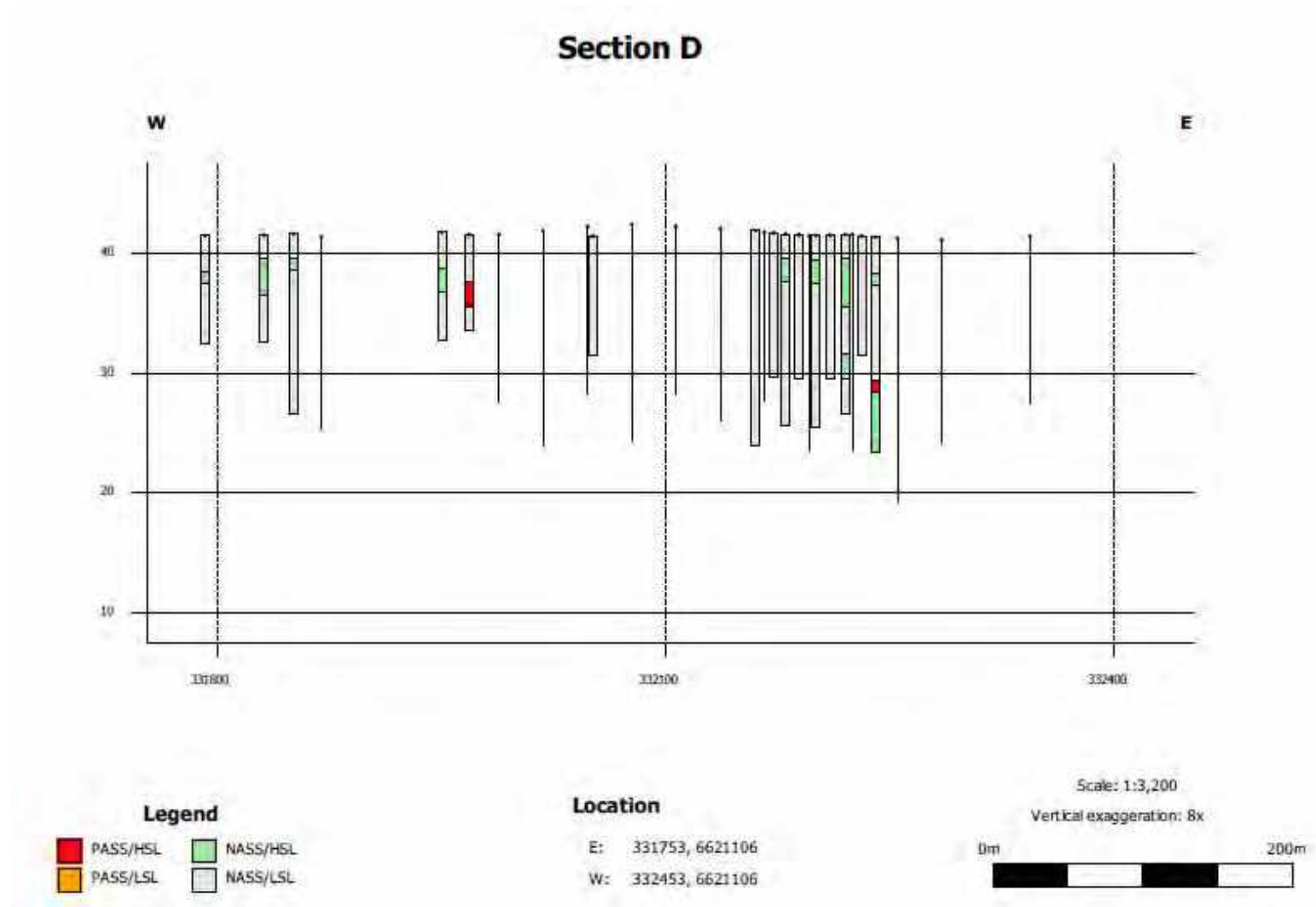


Figure A7 Cross-section D

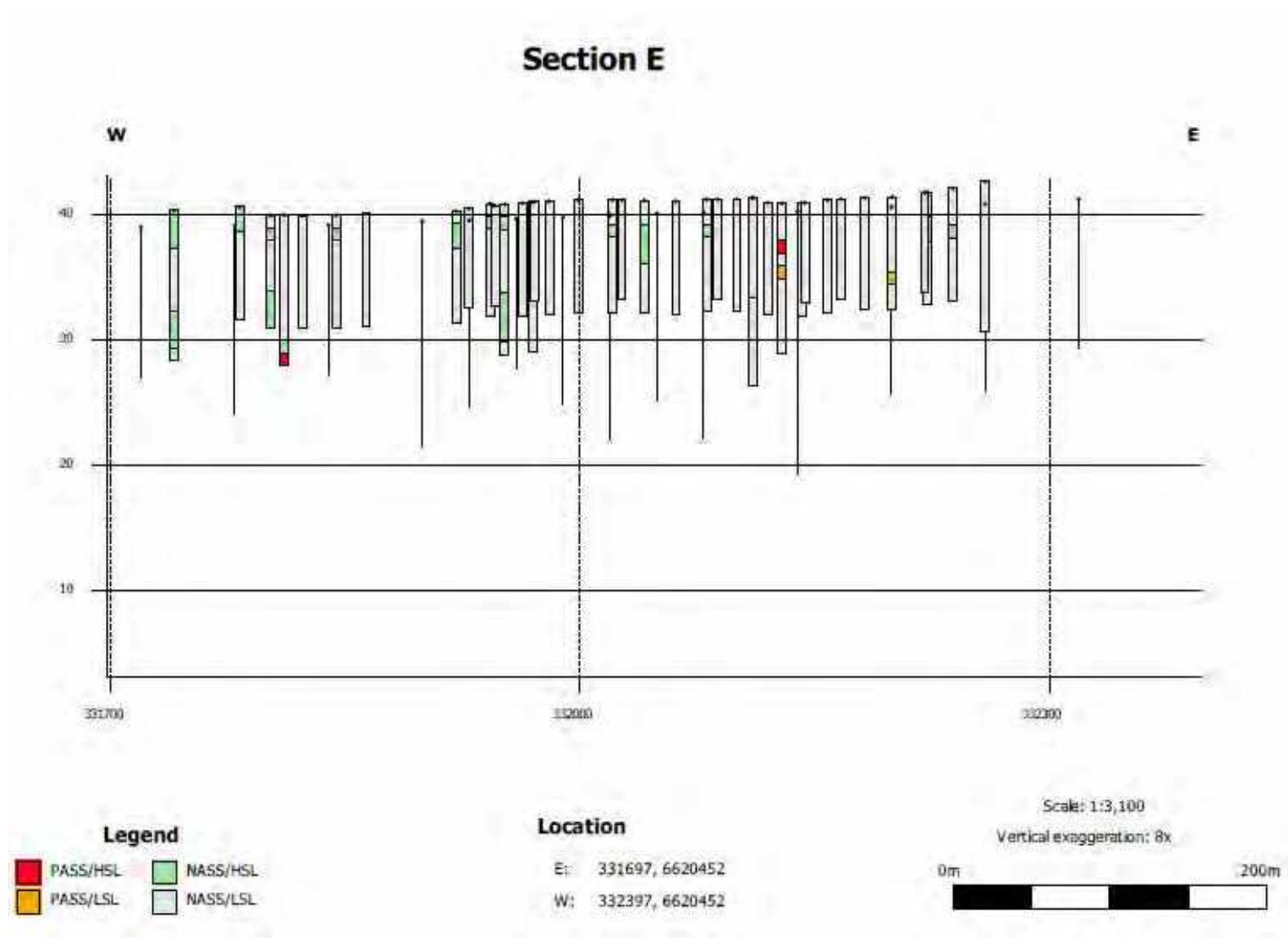


Figure A8 Cross-section E

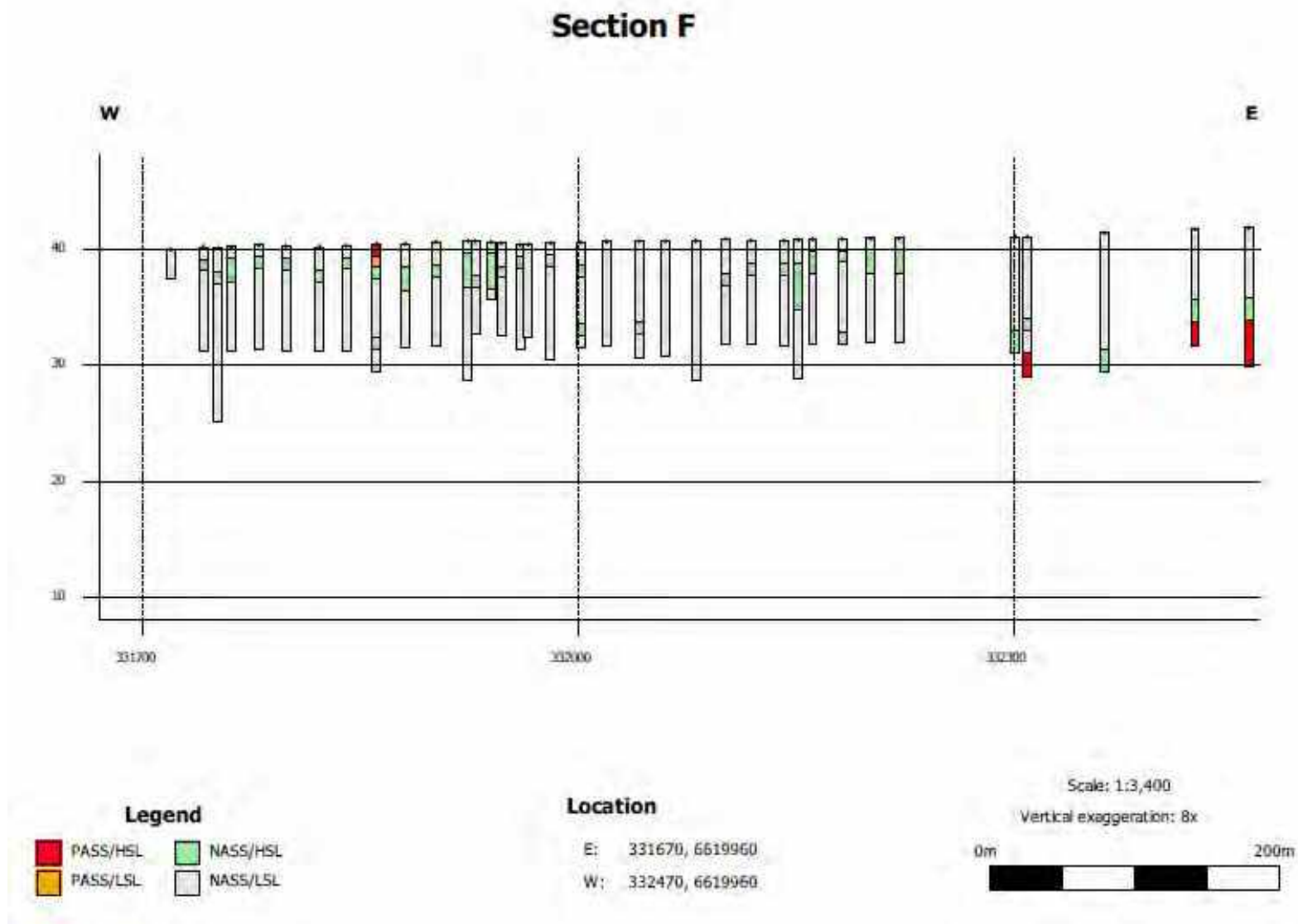


Figure A9 Cross-section F

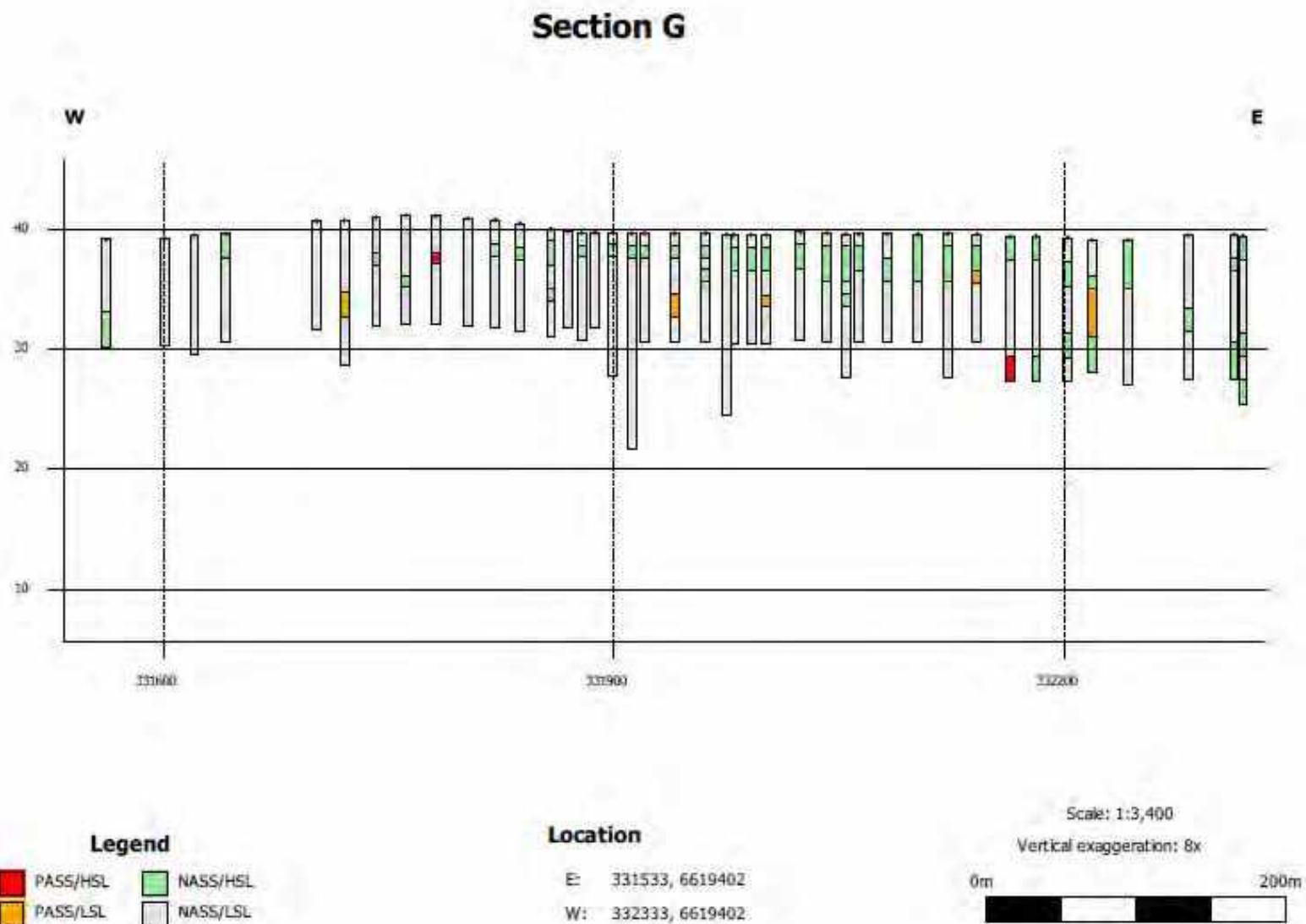


Figure A10 Cross-section G

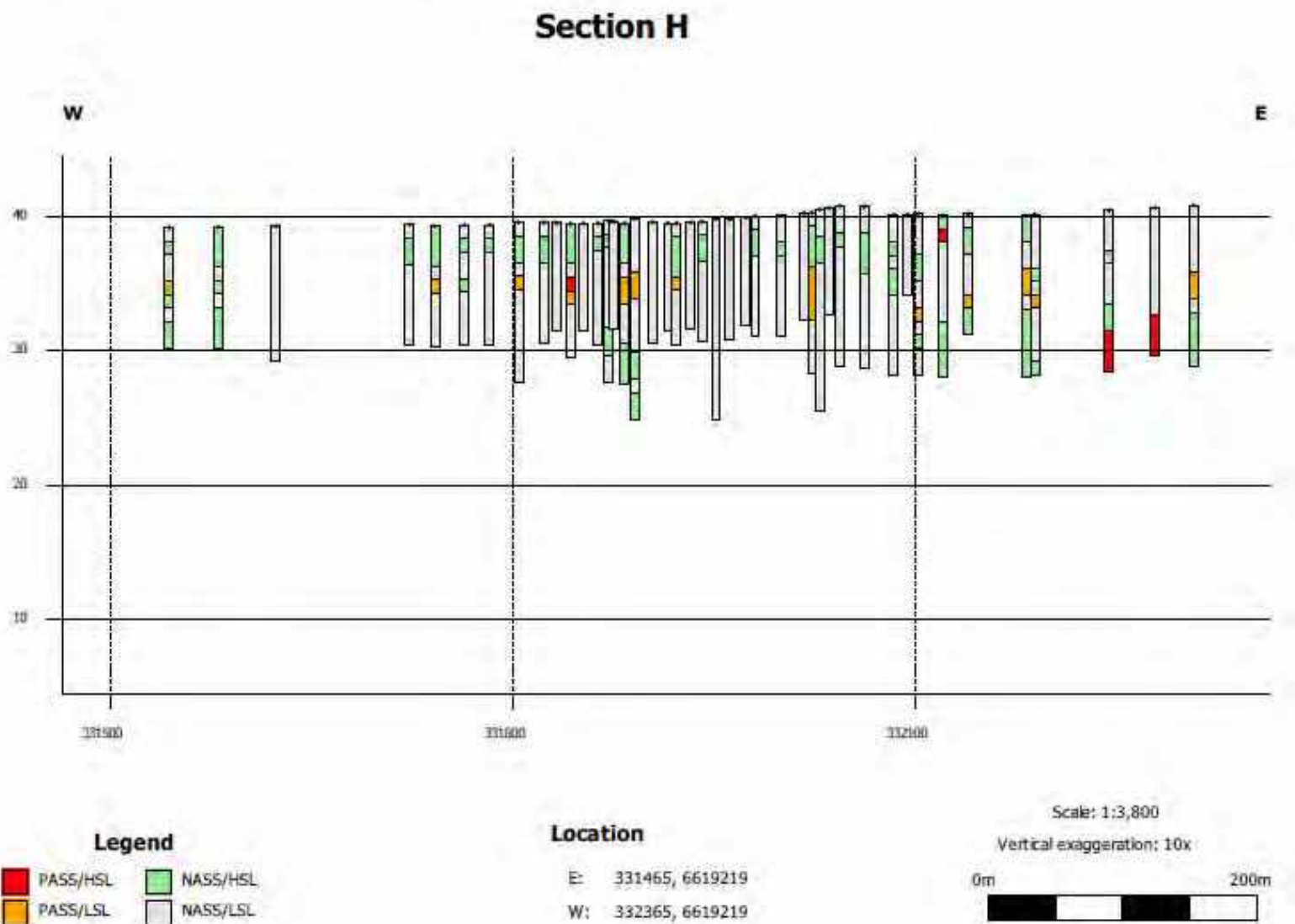


Figure A11 Cross-section H

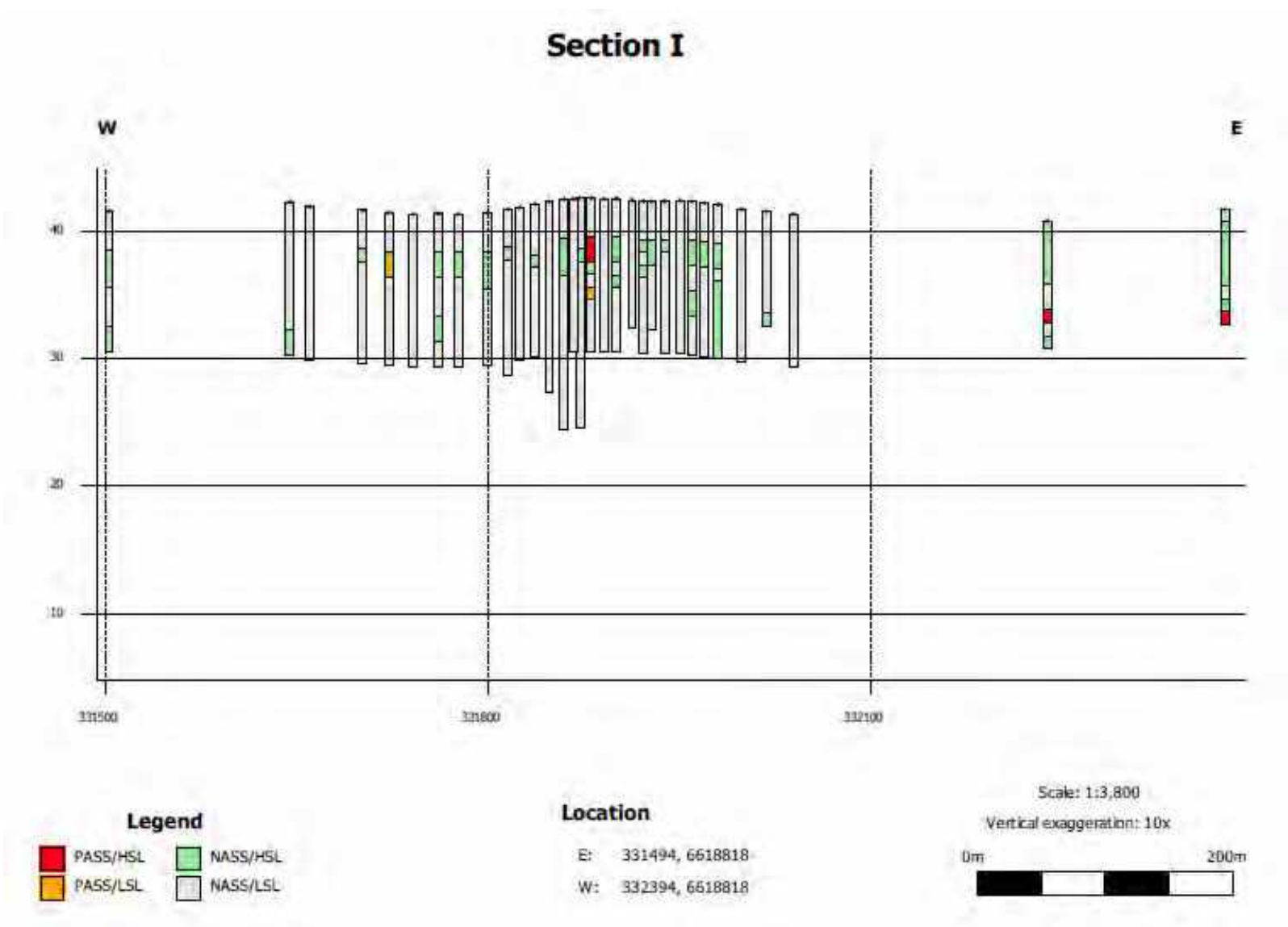


Figure A12 Cross-section I

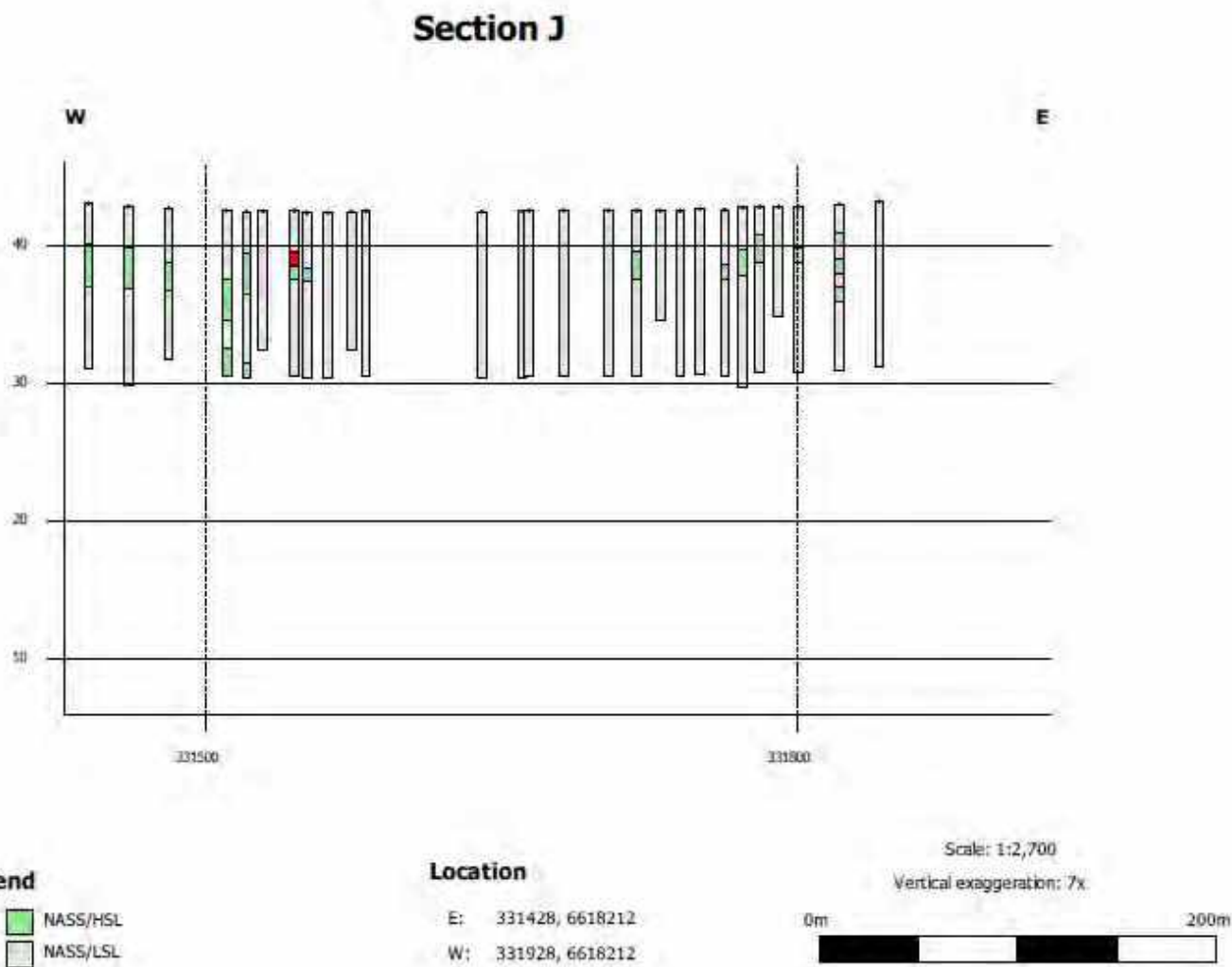


Figure A13 Cross-section J

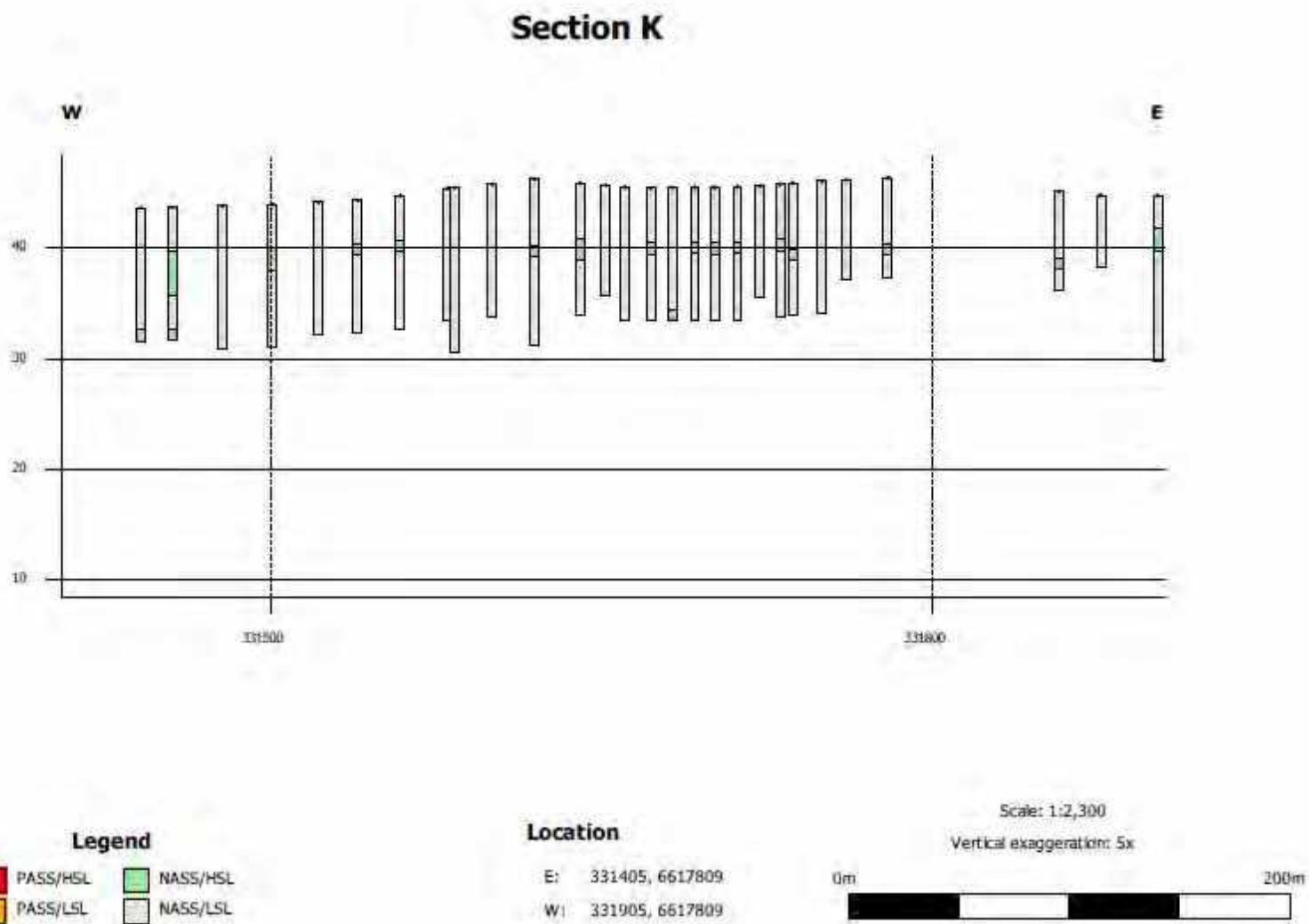


Figure A14 Cross-section K

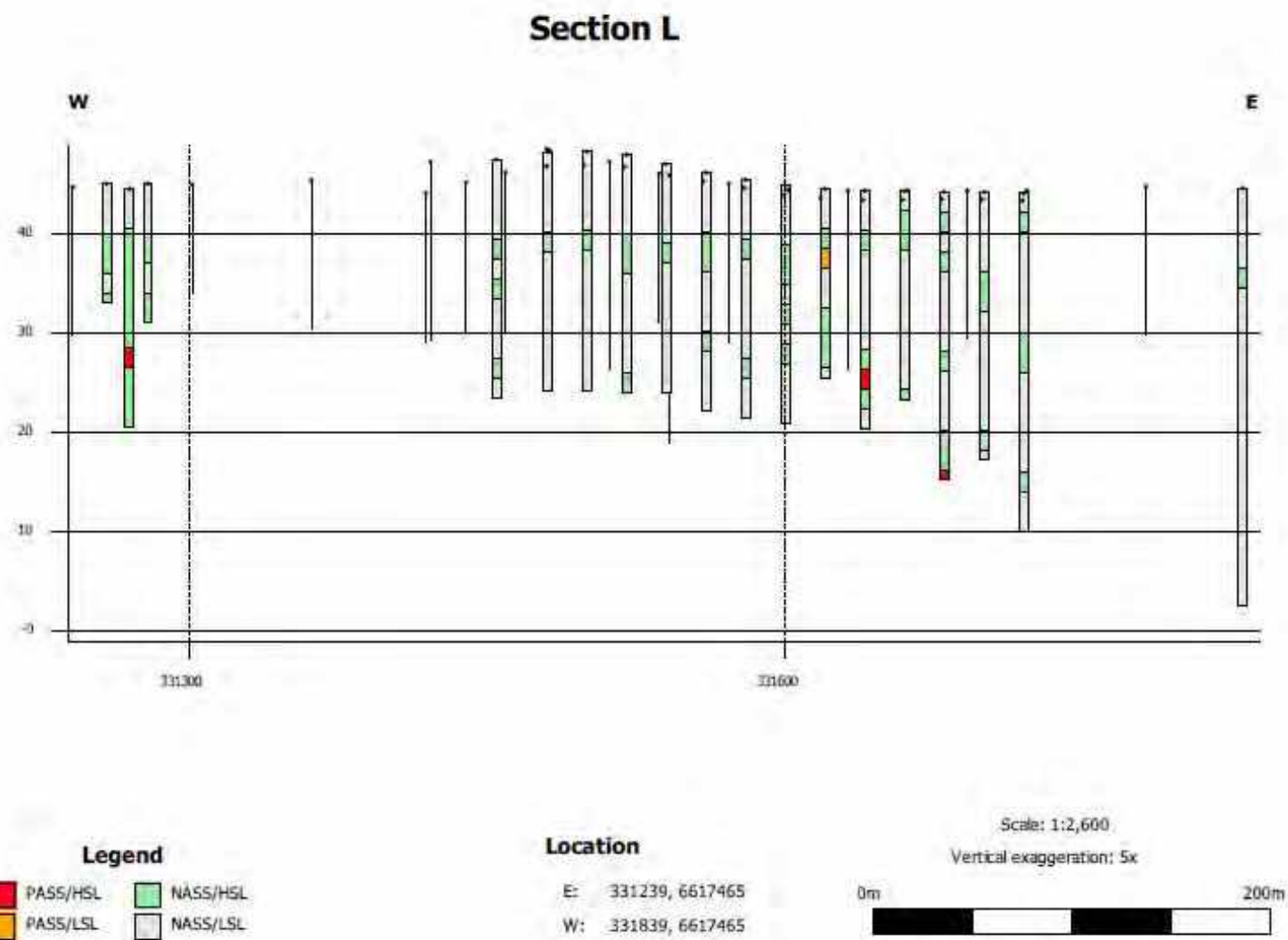


Figure A15 Cross-section L

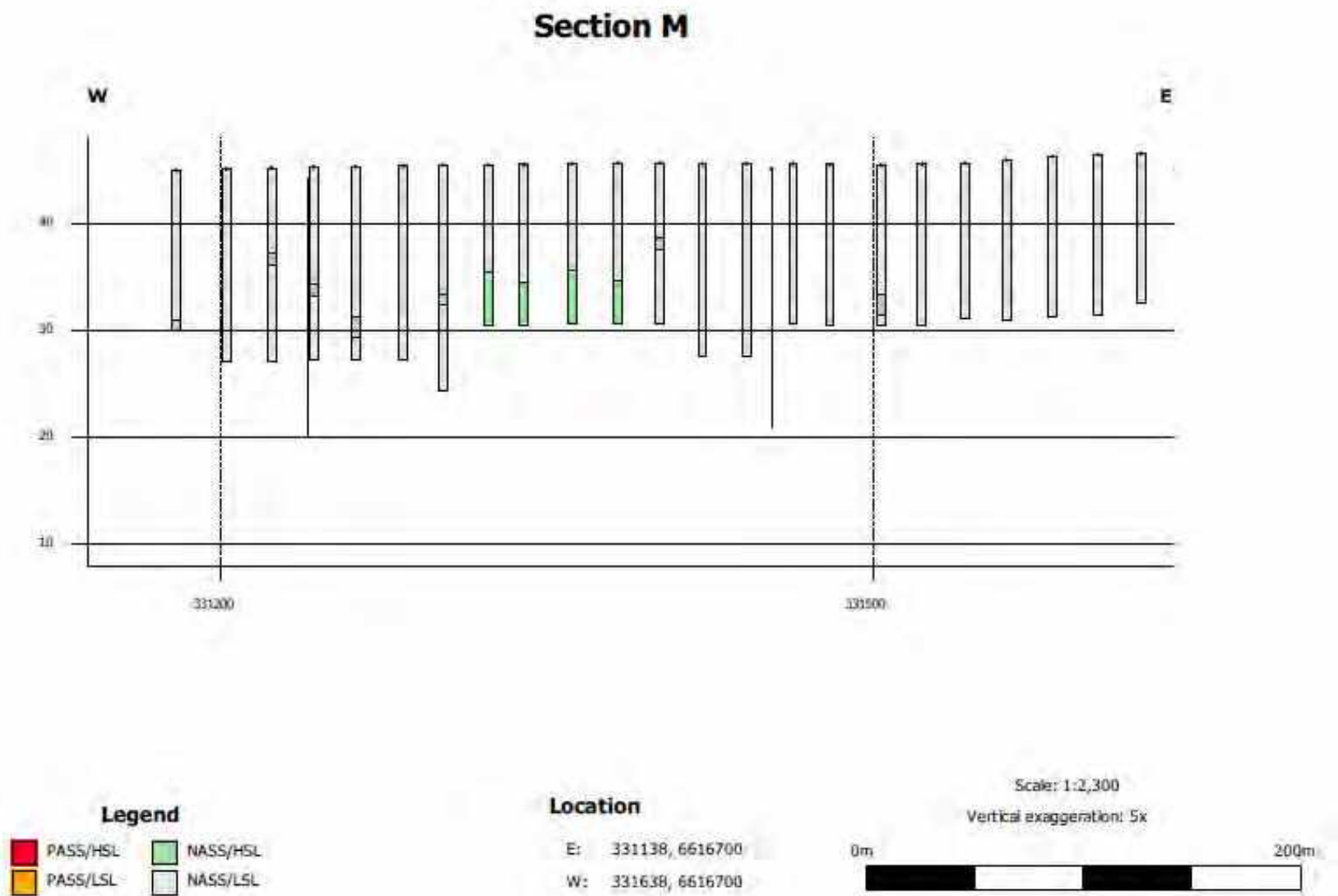













Figure A16 Cross-section M

Appendix B

ASS Drill logs


Hole ID:	Coordinates (GDA94_51)		Collar RL (m):		Depth of hole (m):		Depth to groundwater(m):				
ASS06	Easting	332204	41.1		7		0.5				
	Northing	6620773									
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	0.7	N 7/0	L	Grey	-	Sand	SR	M	Soft	N	
0.7	1.0	5YR 8/3	L	Orange	Grey	Clayey sand	SR	M	Stiff	N	
1.0	1.3	10G 7/1	M	Green	Grey	Sandy clay	SR	P	Stiff	Y	
1.3	2.0	7.5YR 8/3	L	Orange	Grey	Clayey sand	SR	G	Soft	Y	
2.0	3.3	7.5YR 8/3	L	Orange	Grey	Clayey sand	SR	M	Soft	N	
3.3	5.0	7.5YR 8/8	L	Orange	Green	Sandy clay	SR	P	Stiff	N	 
5	6.6	7.5YR 8/4	L	Yellow	Grey	Sand	SR	P	Soft	N	

6.6	7.0	7.5YR 8/3	L	Orange	Grey	Sandy clay	SR	G	Soft	N	
-----	-----	-----------	---	--------	------	------------	----	---	------	---	---

Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS07		Easting	331988	39.9	7		0.5				
		Northing	6620764								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	No sample									
1	2	7.5YR 8/8		Orange	Green	Sandy clay	SR	W	Stiff	N	
2	3	7.5YR 8/8		Orange	Green	Sandy clay	SR	M	Stiff	N	
3	4	7.5YR 8/8		Orange	Green	Sandy clay	SR	M	Stiff	N	
4	5	5YR 8/3	L	Orange	Brown	Sandy clay	SR	M	Stiff	Y	
5	6	7.5YR 8/3	L	Orange	Grey	Clayey sand	SR	G	Soft	N	
6	6.6	10YR 7/4	L	Orange		Sand	SR	M	Soft	N	


6.6	7			Orange		Sand	SR	M	Soft	N	
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Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS08		Easting	331877	39.5	9		0.5				
		Northing	6620469								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1.2	N 7/0	L	Grey	-	Sand	SR	G	Soft	N	
1.2	1.7	10G 7/1		Green	Grey	Sandy clay	SR	M	Stiff	Y	
1.7	2	N 7/0	L	Grey	Orange	Clayey sand	SR	M	Soft	N	
2	3	2.5YR 7/6	M	Yellow	Brown	Sandy clay	SR	M	Firm	Y	
3	4	5YR 8/4	L	Yellow	Grey	Clayey sand	SR	G	Soft	N	
4	5	5G 7/1	L	Green	Grey	Clayey sand	SR	M	Firm	N	
5	6	5G 7/1	L	Green	Grey	Clayey sand	SR	M	Soft	N	





6	8	N 7/0	L	Grey	-	Clayey sand	SR	M	Soft	N	
8	9	N 7/0	L	Grey	-	Clayey sand	SR	M	Soft	N	







Hole ID:		Coordinates (GDA94_51)		Collar RL (m):		Depth of hole (m):		Depth to groundwater(m):			
ASS09		Easting	332153	40.764		8		0.5			
		Northing	6620442								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	2.4	5Y 8/4		Yellow	Grey	Sand	SR	G	Soft	N	
2.4	4	5G 7/1	L	Green	Grey	Sandy clay	SR	M	Stiff	N	
4	5	5G 7/1		Green	Grey	Sand	SR	G	Stiff	N	
5	6	5YR 8/4	L	Yellow	Grey	Sand	SR	M	Soft	N	
6	7	5G 7/1	L	Green	Grey	Clayey sand	SR	P	Firm	N	
7	8	5G 7/1	L	Green	Grey	Clayey sand	SR	G	Firm	N	



Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS10		Easting	332057	40.3	7		0				
		Northing	6620151								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	N 7/0	L	Grey		Clayey sand	SR	G	Soft	N	
1	1.8	N 6/0	L	Grey	Green	Sandy clay	SR	M	Soft	N	
1.8	3	5GY 8/1	M	Yellow	Green	Sandy clay	SR	M	Stiff	N	
3	4	5GY 8/1	M	Yellow	Green	Sandy clay	SR	M	Stiff	N	
4	5	5YR 8/4	M	Yellow	Grey	Sandy clay	SA	M	Firm	N	
5	6	2.5GY 7/1	L	Grey		Clayey sand	SR	G	Soft	N	
6	7	2.5GY 7/1	L	Grey		Clayey sand	SR	G	Soft	N	

Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS11		Easting	331762	39.5	8		5				
		Northing	6619992								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	2.5Y 8/2	L	Yellow	Brown	Sand	SR	G	Soft	N	
1	2	10Y 7/1	L	Green	Grey	Clayey sand	SA	P	Stiff	N	
2	4	5Y 8/4		Yellow	Grey	Sandy clay	SA	P	Stiff	N	
4	5	7.5Y 6/3	M	Green	Grey	Sandy clay	SR	P	Stiff	N	
5	7.5	7.5Y 6/3; 5G 7/1	L	Green	Grey	Clayey sand	SR	M	Soft	N	
7.5	8	N 8/0	L	Grey	-	Sandy clay	SR	G	Soft	N	







Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS12		Easting	332113	40.3	9		0				
		Northing	6619954								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1.7	5Y 8/4	L	Yellow	Grey	Clayey sand	SR	M	Soft	N	
1.7	2.2	7.5YR 8/3	L	Orange	Grey	Sandy clay	SA	P	Stiff	Y	
2.2	3	7.5YR 8/8	L	Orange	Green	Sandy clay	SA	P	Stiff	Y	
3	4	7.5GY 7/1	L	Grey	-	Sandy clay	SR	M	Firm	N	
4	4.6	N 7/0	L	Grey	-	Sandy clay	SR	G	Firm	N	
4.6	5	5YR 8/3	L	Orange	Brown	Sandy clay	SR	M	Firm	N	
5	5.7	5YR 8/4	L	Yellow	Grey	Clayey sand	SR	M	Soft	N	
5.7	6.5	N 7/0	L	Grey	-	Clayey sand	SR	M	Soft	N	
6.5	8	N 7/0	L	Grey	-	Clayey sand	SR	M	Soft	N	
8	8.5	N 7/0	L	Grey	-	Clayey sand	SR	M	Soft	N	
8.5	9	N/A		White	-	Clayey sand	SR	M	Soft	N	






Hole ID:		Coordinates (GDA94_51)		Collar RL (m):		Depth of hole (m):		Depth to groundwater(m):			
ASS13		Easting	331911	40.6		8		1			
		Northing	6619761								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	N 7/10	L	Grey	-	Sand	SR	G	Soft	N	
1	1.7	5Y 8/4	L	Yellow	Grey	Clayey sand	SR	G	Soft	N	
1.7	2	5YR 7/6; N 8/0	L	Orange	Grey	Clayey sand / Laterite	SA	P	Hard	Y	
2	4	2.5YR 7/2	L	Pink	Orange	Clayey sand	SR	G	Soft	Y	
4	6	2.5YR 7/2	L	Pink	Orange	Clayey sand	SR	G	Soft	Y	
6	6.5	2.5YR 7/2	L	Pink	Orange	Clayey sand	SR	M	Soft	Y	
6.5	8	N 6/0	D	Grey	-	Sandy clay	SR	M	Soft	N	

Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS14		Easting	331900	39.6	9		5				
		Northing	6619500								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	0.8	N 8/0; 7.5YR 8/3	L	Grey	Orange	Clayey sand	SR	M	Soft	N	
0.8	2	2.5GY 8/1	L	Green	Grey	Sandy clay	SR	M	Firm	Y	
2	3.2	5YR 8/3	L	Orange	Brown	Sandy clay	SR	M	Stiff	N	
3.2	4	N 7/0	L	Grey	Orange	Sandy clay	SR	M	Stiff	Y	
4	5	5Y 8/4	L	Yellow	Brown	Sandy clay	SR	M	Stiff	N	
5	6	N 7/0	L	Grey	-	SW	SR	G	Firm	Y	

6	8	5G 7/1	L	Green	Grey	Clayey sand	SR	G	Firm	N	
8	9	5Y 8/4	M	Yellow	Grey	Clayey sand	SR	M	Soft	N	

Hole ID:		Coordinates (GDA94_51)		Collar RL (m):		Depth of hole (m):		Depth to groundwater(m):			
ASS15		Easting	332049	39.8		8		5			
		Northing	6619399								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	N 8/0; 7.5YR 8/3	L	Grey	Orange	Clayey sand	SR	M	Soft	Y	
1	1.7	5YR 8/1	L	Brown	-	Clayey sand	SA	M	Stiff	N	
1.7	2	7.5YR 7/6	L	Orange	Grey	Sandy clay	SA	M	Stiff	Y	
2	3	7.5YR 8/3	L	Orange	Grey	Sandy clay	SR	M	Stiff	Y	
3	4	N 7/0	L	Grey	-	Sandy clay	SR	M	Firm	N	
4	4.3	N 7/0	L	Grey	-	Sandy clay	SA	M	Stiff	Y	
4.3	5	N 7/0	L	Grey	-	Sandy clay	SA	M	Firm	N	
5	6	7.5YR 8/3	L	Orange	Grey	Sandy clay	SR	M	Firm	Y	
6	7	N 8/0; 5YR 8/3	L	Grey	Orange	Sandy clay	SR	M	Firm	Y	
7	8	N 7/0	L	Grey	-	Clayey sand	SR	M	Firm	N	








Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS16		Easting	331629	39.3	7		4				
		Northing	6619403								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	5YR 8/1	L	Grey	Brown	Clayey sand	SR	M	Soft	N	
1	2	2.5GY 8/1	L	Green	Grey	Sandy clay	SR	M	Stiff	Y	
2	3	N 7/0	L	Grey	Orange	Sandy clay	SA	M	Stiff	Y	
3	4	N 7/0	L	Orange	Grey	Sandy clay	SA	M	Hard	Y	
4	6	5YR 7/6	M	Orange	Brown	Sandy clay	SA	M	Hard	Y	
6	7	5YR 8/3	L	Yellow	Brown	Sandy clay	SA	M	Hard	Y	

Hole ID:		Coordinates (GDA94_51)		Collar RL (m):		Depth of hole (m):		Depth to groundwater(m):			
ASS17		Easting	331852	39.4		7		5			
		Northing	6619218								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1.6	N 8/0	L	Grey	-	Clayey sand	SR	M	Soft	N	
1.6	3.2	5YR 7/6	M	Orange	Brown	Sandy clay	SA	M	Firm	Y	
3.2	4	N 7/0	L	Grey	-	Sandy clay	SA	M	Firm	N	
4	5	N 8/0; 5YR 8/3	L	Grey	Orange	Sandy clay	SA	M	Firm	Y	
5	6	7.5YR 7/4	M	Orange	Grey	Sandy clay	SA	M	Soft	Y	



6	6.5	7.5YR 7/4	M	Brown	Orange	Sandy clay	SA	M	Soft	Y
6.5	7	N 7/0	L	Grey	-	Sandy clay	SR	M	Soft	N











Hole ID:		Coordinates (GDA94_51)		Collar RL (m):		Depth of hole (m):		Depth to groundwater(m):			
ASS18		Easting	331572	39.5		9		4			
		Northing	6619007								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	2	5YR 7/1; 7.5YR 8/3	M	Grey	Brown	Clayey sand	SR	M	Soft	N	
2	3	7.5YR 8/3	L	Orange	Grey	Sandy clay	SA	M	Hard	Y	
3	4	N 8/0	L	Grey	Orange	Sandy clay	SR	G	Firm	N	
4	6	N 7/0	M	Grey	-	Sandy clay	SR	G	Soft	N	
6	8	N 8/0	L	Grey	-	SW	SR	G	Soft	N	
8	9	N 8/0	L	Grey	-	Gravelly sand	SR	M	Soft	N	

Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS19		Easting	331838	39.6	10		4				
		Northing	6619004								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	2	N 8/0	L	Grey	Orange	Sand / clayey sand	SR	M	Soft	Y	
2	3	N 8/0; 5YR 8/4	L	Grey	Yellow	Sand / clayey sand	SR	M	Firm	Y	
3	4	N 8/0; 5YR 8/4	L	Grey	Orange	Sandy clay	SA	M	Firm	Y	
4	4.2	N 8/0; 5YR 8/4	L	Grey	-	Sandy clay	SA	M	Firm	Y	
4.2	5.5	N 7/0	L	Grey	-	Sandy clay	SR	M	Soft	N	
5.5	6	N 8/0	L	Grey	-	Clayey sand	SR	M	Soft	N	
6	8	N 8/0; 5G 7/1	L	Grey	Green	Clayey sand	SR	M	Soft	N	
8	10	N 8/0; 52.5GY 8/1	L	Grey	-	Sandy clay	SR	M	Soft	N	


Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS20		Easting	332039	39.9	10		4				
		Northing	6619001								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	N 8/0	L	Grey	-	Sand	SR	M	Soft	N	
1	2	7.5YR 8/3	L	Grey	Orange	Sandy clay	SA	P	Firm	Y	
2	3	7.5 YR 8/3	L	Grey	Orange	Sandy clay	SA	P	Firm	Y	
3	4	N 8/0 5G 7/1	L	Grey	Green	Sandy clay	SA	M	Firm	N	
4	5	N 8/0 5YR 8/3	L	Grey	Orange	Sandy clay	SA	M	Firm	Y	
5	6	N 8/0	L	Grey	-	Sandy clay	SA	M	Firm	N	
6	8	N 7/0	L	Grey	-	Sandy clay	SA	M	Firm	N	

8	9	N 8/0	L	Grey	-	Sandy clay	SA	M	Soft	N	
9	10	N 8/0	L	Grey	-	Clayey sand	SR	M	Soft	N	




Hole ID:		Coordinates (GDA94_51)		Collar RL (m):		Depth of hole (m):		Depth to groundwater(m):			
ASS21		Easting	331741	42.3		12		5			
		Northing	6618602								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	2	N 8/0	L	Grey	-	Sand	SR	M	Soft	N	
2	4	5YR 8/1 N 6/0	L	Grey	Brown	Clayey sand	SA	M	Soft	N	
4	5	5YR 8/1	L	Grey	Brown	Sandy clay	SA	M	Firm	Y	
5	6	5Y 8/4	L	Yellow	Grey	Sandy clay	SR	M	Soft	Y	
6	7	N 7/0	L	Grey	-	Sandy clay	SR	M	Firm	N	
7	8	5YR 7/1; 7.5YR 8/3	M	Brown	Grey	Sandy clay	SR	M	Firm	Y	











8	10	7.5 YR 8/3	L	Orange	Grey	Sandy clay	SR	M	Soft	Y	
10	12	N 7/0	L	Grey	-	Sandy clay	SR	M	Soft	N	










Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS22		Easting	331900	42.5	10						
		Northing	6618391								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	N 8/0	L	Grey	-	Sand	SR	M	Soft	N	
1	2	5Y 8/4	L	Yellow	Grey	Sand	SA	G	Soft	N	
2	3	5YR 7/6	L	Yellow	Grey	Laterite	SA	P	Hard	Y	
3	5	N 7/0	L	Grey	Orange	Sandy clay	SA	P	Stiff	Y	
5	7	N 8/0	L	Grey	Green	Sandy clay	SA	P	Stiff	Y	
7	8	N 8/0	L	Grey	Green	Sandy clay	SA	G	Firm	Y	


8	10	5YR 8/3	L	Orange	Brown	Sandy clay	SA	P	Firm	Y	
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Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS23		Easting	331613	41.9	11		6				
		Northing	6618201								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	N 8/0		Grey	-	Clayey sand	SR	M	Soft	N	
1	2	5Y 8/4	L	Yellow	Grey	Sandy clay	SA	M	Soft	Y	
2	3	5YR 8/1	L	Grey	Brown	Clayey sand	SA	M	Soft	N	
3	5	5YR 8/1	L	Grey	Brown	Sandy clay	SA	M	Stiff	Y	
5	6	2.5GY 8/1	L	Green	Grey	Sandy clay	SR	M	Firm	N	
6	8	2.5GY 8/1	L	Green	Grey	Clayey sand	SR	M	Soft	N	




8	10	5G 7/1	L	Green	Grey	Clayey sand	SR	M	Firm	N	
10	11	5G 7/1	L	Green	Grey	Clayey sand	SR	P	Soft	N	
											






Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS24		Easting	331461	42.5	12		8				
		Northing	6618007								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	N 6/0	L	Grey	-	Sand	SR	M	Soft	N	
1	2	7.5YR 8/3	L	Orange	Grey	Clayey sand / Sandy clay	SA	M	Firm	N	
2	3	7.5YR 7/6		Orange	Grey	Clayey sand	SR	M	Soft	Y	
3	5	5G 7/1	L	Green	Brown	Sandy clay	SA	M	Stiff	Y	
5	6	10BG 6/1	M	Blue	Green	Sandy clay	SA	M	Stiff	Y	
6	7	5G 7/1	M	Green	Grey	Sandy clay	SA	M	Stiff	N	
7	8	2.5GY 8/1	L	Green	Grey	Sandy clay	SA	M	Stiff	N	
8	10	5G 7/1	L	Green	Grey	Clayey sand	SR	M	Soft	Y	
10	11	5G 7/1	L	Green	Grey	Clayey sand	-	-	Soft	N	
11	12	5G 7/1	L	Green	Grey	Sandy clay	-	-	Soft	N	

Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS25		Easting	331690	45.1	10		8				
		Northing	6617802								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	N 6/0	M	Grey	-	Sand	SR	M	Soft	N	
1	2	5YR 8/1	L	Grey	Brown	Sand	SA	M	Soft	N	
2	3	N 6/0	M	Grey	-	Sand	SA	M	Soft	N	
3	4	N 8/0	L	Grey	-	Sand	SA	M	Soft	N	
4	5	5Y 8/4	L	Yellow	Grey	Clayey sand	SA	M	Soft	Y	
5	6	5YR 8/3		Orange	Brown	Sandy clay	SA	M	Stiff	Y	
6	7	5YR 8/3		Orange	Brown	Sandy clay	SA	M	Stiff	Y	
7	8	5YR 8/3		Orange	Brown	Sandy clay	SA	M	Stiff	Y	
8	9	7.5Y 8/3	L	Yellow	Brown	Clayey sand / Sandy clay	SA	M	Firm	N	

9	10	7.5Y 8/3	L	Yellow	Brown	Clayey sand / Sandy clay	SA	M	Soft	N	
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Hole ID:		Coordinates (GDA94_51)		Collar RL (m):		Depth of hole (m):		Depth to groundwater(m):			
ASS26		Easting	331340	45.2		11		8			
		Northing	6617392								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	N 6/0	M	Grey	-	Sand	SR	M	Soft	N	
1	4.4	N 8/0	L	Grey	-	Sand	SR	M	Soft	N	  
4.4	5	N 5/0	D	Grey	-	Sand	SR	M	Soft	N	
5	6.5	N 5/0	L	Grey	Brown	Sand	SR	M	Soft	Y	
6.5	7.7	5YR 7/1	L	Grey	Brown	Sand	SR	M	Stiff	N	





7.7	8	5YR 7/1	M	Yellow	Green	Sandy clay	SA	M	Stiff	Y	
8	10	2.5GY 8/1	L	Green	Grey	Sandy clay	SA	P	Firm	N	
10	11	2.5GY 8/1	L	Green	Grey	Sandy clay	SR	M	Soft	N	

Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS27		Easting	331520	46.4	13		10				
		Northing	6617409								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	N 6/0	D	Grey	-	Sand	SR	M	Soft	N	
1	5	N 8/0	L	Grey	-	Sand	SR	M	Soft	N	
5	6	N 8/0	L	Brown	-	Clayey sand	SA	M	Soft	N	
6	7	5YR 8/1	L	Brown	Grey	Sandy clay	SA	M	Stiff	Y	
7	9	5YR 8/1	L	Yellow	Grey	Sandy clay	SA	M	Stiff	Y	


											
9	10	7.5YR 8/3	L	Yellow	Orange	Sandy clay	SR	P	Hard	Y	
10	11	7.5YR 7/6	M	Yellow	Orange	Sandy clay	SR	P	Firm	Y	
11	12	N 7/0	D	Grey	-	Sandy clay	SR	P	Soft	N	
12	13	N 6/0	L	Grey	-	Sandy clay	SR	P	Firm	Y	




Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS28		Easting	331732	44.3	8		7.5				
		Northing	6617405								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1.5	N 6/0	D	Grey	-	Sand		M	Soft	Y	
1.5	2	5YR 8/1	L	Grey	Brown	Sand		M	Soft	N	
2	3	5Y 8/3		Yellow	Brown	Sandy clay		P	Stiff	Y	
3	4	5Y 8/4	L	Yellow	Grey	Sandy clay		P	Stiff	Y	
4	6	5YR 8/1	L	Grey	Brown	Sandy clay		M	Stiff	N	
6	8	2.5GY 8/1	L	Grey	Green	Sandy clay		M	Firm	N	


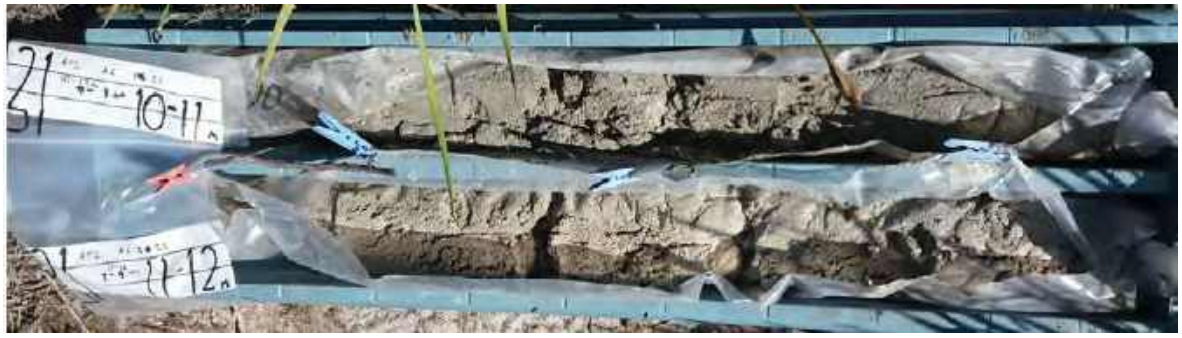
Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS29		Easting	331387	44.8	11		10				
		Northing	6617009								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	10YR 8/1	L	Grey	-	SW	SR	M	Soft	N	
1	2	No sample									
2	3	2.5YR 4/4	D	Brown	-	Clayey sand	SA	M	Soft	Y	
3	4	10Y 8/1	L	Grey	-	Sand	SA	M	Soft	N	
4	5	2.5YR 4/4	D	Brown	Green	Clayey sand	SA	M	Stiff	Y	
5	6	5Y 7/3	D	Yellow	Green	Sandy clay	SA	M	Stiff	Y	
6	7	5YR 7/2	D	Grey	Brown	Clayey sand	SA	M	Soft	N	

7	8	5Y 7/3	D	Yellow	Green	Sandy clay	SA	M	Soft	Y	
8	9	5Y 7/3	D	Yellow	Green	Sandy clay	SA	M	Stiff	Y	
9	10	5Y 7/3	D	Yellow	Green	Sandy clay	SA	M	Stiff	Y	
10	11	5Y 8/3	D	Yellow	Grey	Sandy clay	SA	M	Soft	N	

Hole ID:		Coordinates (GDA94_51)		Collar RL (m):	Depth of hole (m):		Depth to groundwater(m):				
ASS30		Easting	331531	45.2	9						
		Northing	6617004								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	2	N 7/0	-	Grey	-	Sand	SR	M	Loose	N	
2	3.5	N 7/0	-	Grey	White	Sand	SR	M	Loose	N	
3.5	4	5YR 8/1	-	Grey	Brown	Clayey sand	SR	M	Loose	Y	
4	6	5YR 8/3	-	Yellow	Brown	Clayey sand / Laterite	SA	P	Hard	N	
6	7	5YR 8/3	-	Yellow	Brown	Sandy clay	SA	-	Firm	Y	
7	8	5YR 8/4	-	Yellow	Grey	Sandy clay	SR	-	Soft	Y	

8	9	5YR 8/4	-	Yellow	Grey	Sandy clay	-	-	Stiff	Y	
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Hole ID:		Coordinates (GDA94_51)		Collar RL (m):		Depth of hole (m):		Depth to groundwater(m):			
ASS31		Easting	331521	41.5		12		3.5			
		Northing	6618604								
Depth		Colour	Hue	Colour 1	Colour 2	Soil texture	Roundness	Sorting	Hardness	Mottling (Y/N)	Interval Photo
From (m)	To (m)										
0	1	N 7/0	M	Grey	-	Sand	SR	M	Soft	N	
1	2	5YR 8/1		Grey	White	Sand	SR	M	Soft	N	
2	3.5	5G 7/1	M	Green	Grey	Sandy clay	SA	P	Stiff	Y	
3.5	5	5YR 8/1	L	Grey	Brown	Clayey sand	SR	G	Soft	N	
5	8	2.5GY 8/1	L	Green	Grey	Sandy clay	SA	M	Stiff	Y	

8	10	5G 7/1	M	Green	Grey	Clayey sand	SR	M	Soft	N	
10	12	5G 7/1	M	Green	Grey	Clayey sand	SR	M	Soft	N	

Appendix C

Laboratory Analyses



Environmental

CERTIFICATE OF ANALYSIS

Work Order : EP2114243
Client : The Trustee for Mine Earth Unit Trust
Contact : [REDACTED]
Address : [REDACTED]

Telephone : [REDACTED]
Project : ATS-2104 Atlas Project ASS
Order number : ----
C-O-C number : ----
Sampler : Image Resources
Site : ----
Quote number : EP/378/21
No. of samples received : 76
No. of samples analysed : 76

Page : 1 of 18
Laboratory : Environmental Division Perth

Date Samples Received : 22-Nov-2021 11:10
Date Analysis Commenced : 24-Nov-2021
Issue Date : 26-Nov-2021 17:08

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
-------------	----------	------------------------



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

~ = Indicates an estimated value.

- ASS: EA037 (Rapid Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- EA037 ASS Field Screening: NATA accreditation does not cover performance of this service.



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS16 0 1	ASS16 1 2	ASS16 2 3	ASS16 3 4	ASS16 4 5
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-001	EP2114243-002	EP2114243-003	EP2114243-004	EP2114243-005
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.4	7.3	7.1	7.2	6.8
pH (Fox)	----	0.1	pH Unit	5.7	5.9	5.6	5.4	5.6
Reaction Rate	----	1	-	Slight	Slight	Slight	Moderate	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS16 5 6	ASS16 6 7	ASS17 0 1.6	ASS17 1.6 2	ASS17 2 3
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-006	EP2114243-007	EP2114243-008	EP2114243-009	EP2114243-010
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.9	7.1	8.5	7.4	7.8
pH (Fox)	----	0.1	pH Unit	6.0	5.6	6.1	6.5	6.5
Reaction Rate	----	1	-	Strong	Strong	Slight	Moderate	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS17 3 4	ASS17 4 5	ASS17 5 6	ASS17 6 6.5	ASS17 6.5 7
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-011	EP2114243-012	EP2114243-013	EP2114243-014	EP2114243-015
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.2	7.1	6.4	6.4	6.7
pH (Fox)	----	0.1	pH Unit	5.3	5.7	4.4	5.4	5.1
Reaction Rate	----	1	-	Moderate	Moderate	Moderate	Strong	Slight



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS18 0 1	ASS18 1 2	ASS18 2 3	ASS18 3 4	ASS18 4 5
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-016	EP2114243-017	EP2114243-018	EP2114243-019	EP2114243-020
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.0	7.8	7.6	6.7	6.7
pH (Fox)	----	0.1	pH Unit	5.2	6.3	6.4	3.6	2.6
Reaction Rate	----	1	-	Strong	Slight	Moderate	Moderate	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS18 5 6	ASS18 6 7	ASS18 7 8	ASS18 8 9	ASS19 0 1
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-021	EP2114243-022	EP2114243-023	EP2114243-024	EP2114243-025
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.3	6.6	6.9	7.0	7.9
pH (Fox)	----	0.1	pH Unit	2.5	3.0	3.7	3.3	6.3
Reaction Rate	----	1	-	Strong	Slight	Slight	Slight	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS19 1 2	ASS19 2 3	ASS19 3 4	ASS19 4 5	ASS19 5 6
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-026	EP2114243-027	EP2114243-028	EP2114243-029	EP2114243-030
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.0	7.0	6.6	7.3	7.5
pH (Fox)	----	0.1	pH Unit	5.6	5.0	4.7	4.7	4.1
Reaction Rate	----	1	-	Slight	Moderate	Moderate	Moderate	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS19 6 7	ASS19 7 8	ASS19 8 9	ASS19 9 10	ASS20 0 1
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-031	EP2114243-032	EP2114243-033	EP2114243-034	EP2114243-035
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.3	7.0	7.0	7.1	7.6
pH (Fox)	----	0.1	pH Unit	4.6	4.1	3.8	4.3	4.7
Reaction Rate	----	1	-	Slight	Slight	Slight	Moderate	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS20 1 2	ASS20 2 3	ASS20 3 4	ASS20 4 5	ASS20 5 6
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-036	EP2114243-037	EP2114243-038	EP2114243-039	EP2114243-040
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.2	7.5	7.6	7.4	7.8
pH (Fox)	----	0.1	pH Unit	6.7	6.5	5.8	5.9	5.0
Reaction Rate	----	1	-	Moderate	Moderate	Moderate	Moderate	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS20 6 7	ASS20 7 8	ASS20 8 9	ASS20 9 10	ASS21 0 1
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-041	EP2114243-042	EP2114243-043	EP2114243-044	EP2114243-045
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.0	7.7	7.5	7.4	6.3
pH (Fox)	----	0.1	pH Unit	5.4	5.4	5.4	5.3	4.7
Reaction Rate	----	1	-	Slight	Moderate	Slight	Slight	Slight



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS21 1 2	ASS21 2 3	ASS21 3 4	ASS21 4 5	ASS21 5 6
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-046	EP2114243-047	EP2114243-048	EP2114243-049	EP2114243-050
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.4	6.0	6.5	6.1	6.7
pH (Fox)	----	0.1	pH Unit	5.2	4.7	5.3	4.4	4.3
Reaction Rate	----	1	-	Slight	Slight	Slight	Slight	Moderate



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS21 6 7	ASS21 7 8	ASS21 8 9	ASS21 9 10	ASS21 10 11
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-051	EP2114243-052	EP2114243-053	EP2114243-054	EP2114243-055
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.6	6.8	6.4	6.9	6.7
pH (Fox)	----	0.1	pH Unit	4.2	3.3	2.8	3.9	3.9
Reaction Rate	----	1	-	Moderate	Moderate	Slight	Slight	Slight



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS21 11 12	ASS22 0 1	ASS22 1 2	ASS22 2 3	ASS22 3 4
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-056	EP2114243-057	EP2114243-058	EP2114243-059	EP2114243-060
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.4	6.4	5.8	7.2	6.9
pH (Fox)	----	0.1	pH Unit	3.5	4.5	3.8	5.2	6.0
Reaction Rate	----	1	-	Slight	Slight	Slight	Moderate	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS22 4 5	ASS22 5 6	ASS22 6 7	ASS22 7 8	ASS22 8 9
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-061	EP2114243-062	EP2114243-063	EP2114243-064	EP2114243-065
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.1	6.9	7.0	7.4	7.3
pH (Fox)	----	0.1	pH Unit	6.1	6.0	6.0	6.4	5.6
Reaction Rate	----	1	-	Slight	Slight	Slight	Slight	Slight



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS22 9 10	ASS23 0 1	ASS23 1 2	ASS23 2 3	ASS23 3 4
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-066	EP2114243-067	EP2114243-068	EP2114243-069	EP2114243-070
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.1	6.8	7.6	5.9	3.8
pH (Fox)	----	0.1	pH Unit	5.7	4.7	6.0	3.6	2.6
Reaction Rate	----	1	-	Moderate	Moderate	Slight	Moderate	Slight



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS23 4 5	ASS23 5 6	ASS23 6 7	ASS23 7 8	ASS23 8 9
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114243-071	EP2114243-072	EP2114243-073	EP2114243-074	EP2114243-075
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	5.8	6.9	6.6	6.7	6.8
pH (Fox)	----	0.1	pH Unit	2.5	3.0	2.2	2.6	2.7
Reaction Rate	----	1	-	Strong	Strong	Strong	Strong	Moderate

Page : 18 of 18
 Work Order : EP2114243
 Client : The Trustee for Mine Earth Unit Trust
 Project : ATS-2104 Atlas Project ASS



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ASS23 9 10	----	----	----	----
				Sampling date / time	[17-Nov-2021]	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2114243-076	-----	-----	-----	-----
				Result		----	----	----	----
EA037: Ass Field Screening Analysis									
pH (F)	----	0.1	pH Unit		7.1	----	----	----	----
pH (Fox)	----	0.1	pH Unit		2.6	----	----	----	----
Reaction Rate	----	1	-		Moderate	----	----	----	----



Environmental

QUALITY CONTROL REPORT

Work Order : EP2114243

Page : 1 of 3

Client : The Trustee for Mine Earth Unit Trust

Laboratory : Environmental Division Perth

Contact

Address

Telephone

: ----

Project : ATS-2104 Atlas Project ASS

Order number : ----

C-O-C number : ----

Sampler : Image Resources

Site : ----

Quote number : EP/378/21

No. of samples received : 76

No. of samples analysed : 76

Date Samples Received : 22-Nov-2021

Date Analysis Commenced : 24-Nov-2021

Issue Date : 26-Nov-2021

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories

Position

Accreditation Category



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA037: Ass Field Screening Analysis (QC Lot: 4040902)									
EP2114243-001	ASS16 0 1	EA037: pH (F)	----	0.1	pH Unit	7.4	7.3	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	5.7	5.7	0.0	0% - 20%
EP2114243-010	ASS17 2 3	EA037: pH (F)	----	0.1	pH Unit	7.8	7.8	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	6.5	6.6	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4040903)									
EP2114243-021	ASS18 5 6	EA037: pH (F)	----	0.1	pH Unit	6.3	6.3	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.5	2.5	0.0	0% - 20%
EP2114243-030	ASS19 5 6	EA037: pH (F)	----	0.1	pH Unit	7.5	7.4	1.8	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	4.1	4.2	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4040904)									
EP2114243-041	ASS20 6 7	EA037: pH (F)	----	0.1	pH Unit	8.0	7.8	1.3	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	5.4	5.5	0.0	0% - 20%
EP2114243-050	ASS21 5 6	EA037: pH (F)	----	0.1	pH Unit	6.7	6.8	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	4.3	4.3	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4040905)									
EP2114243-061	ASS22 4 5	EA037: pH (F)	----	0.1	pH Unit	7.1	7.1	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	6.1	6.1	0.0	0% - 20%
EP2114243-070	ASS23 3 4	EA037: pH (F)	----	0.1	pH Unit	3.8	3.9	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.6	2.7	0.0	0% - 20%



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

- **No Method Blank (MB) or Laboratory Control Spike (LCS) Results are required to be reported.**

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**
-

QA/QC Compliance Assessment to assist with Quality Review

Work Order : EP2114243

Page : 1 of 5

Client : The Trustee for Mine Earth Unit Trust

Laboratory : Environmental Division Perth

Contact

Project : ect ASS

Site : ----

Sampler : Image Resources

Order number : ----

Date Samples Received : 22-Nov-2021

Issue Date : 26-Nov-2021

No. of samples received : 76

No. of samples analysed : 76

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA037: Ass Field Screening Analysis							
Snap Lock Bag - frozen (EA037)							



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA037: Ass Field Screening Analysis - Continued								
ASS16 0 1, ASS16 2 3, ASS16 4 5, ASS16 6 7, ASS17 1.6 2, ASS17 3 4, ASS17 5 6, ASS17 6.5 7, ASS18 1 2, ASS18 3 4, ASS18 5 6, ASS18 7 8, ASS19 0 1, ASS19 2 3, ASS19 4 5, ASS19 6 7, ASS19 8 9, ASS20 0 1, ASS20 2 3, ASS20 4 5, ASS20 6 7, ASS20 8 9, ASS21 0 1, ASS21 2 3, ASS21 4 5, ASS21 6 7, ASS21 8 9, ASS21 10 11, ASS22 0 1, ASS22 2 3, ASS22 4 5, ASS22 6 7, ASS22 8 9, ASS23 0 1, ASS23 2 3, ASS23 4 5, ASS23 6 7, ASS23 8 9,	ASS16 1 2, ASS16 3 4, ASS16 5 6, ASS17 0 1.6, ASS17 2 3, ASS17 4 5, ASS17 6 6.5, ASS18 0 1, ASS18 2 3, ASS18 4 5, ASS18 6 7, ASS18 8 9, ASS19 1 2, ASS19 3 4, ASS19 5 6, ASS19 7 8, ASS19 9 10, ASS20 1 2, ASS20 3 4, ASS20 5 6, ASS20 7 8, ASS20 9 10, ASS21 1 2, ASS21 3 4, ASS21 5 6, ASS21 7 8, ASS21 9 10, ASS21 11 12, ASS22 1 2, ASS22 3 4, ASS22 5 6, ASS22 7 8, ASS22 9 10, ASS23 1 2, ASS23 3 4, ASS23 5 6, ASS23 7 8, ASS23 9 10	17-Nov-2021	24-Nov-2021	16-May-2022	✓	24-Nov-2021	16-May-2022	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification	
Analytical Methods	Method	QC	Regular	Actual	Expected		Evaluation
Laboratory Duplicates (DUP)							
ASS Field Screening Analysis	EA037	8	76	10.53	10.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
ASS Field Screening Analysis	EA037	SOIL	In house: Referenced to Acid Sulfate Soils Laboratory Methods Guidelines. As received samples are tested for pH field and pH fox and assessed for a reaction rating.

Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house



CHAIN OF CUSTODY

ALS Laboratory:
please tick →

ADLAIDE 21 Burna Road Pteraka SA 5095
Ph: 08 8359 0590 E: adelaide@alsglobal.com

BRISBANE 32 Shand Street Stafford QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

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MACKAY 76 Harbour Road Mackay QLD 4740
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Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com


WOLLONGONG 95 Kenny Street Wollongong NSW 2500
Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: Mine Earth		TURNAROUND REQUIREMENTS: <input checked="" type="checkbox"/> Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)	
OFFICE: Unit 1/94 Forsyth St, O'Connor, WA		(Standard TAT may be longer for some tests e.g., Ultra Trace Organics)		Custom Seal Intact? Yes No	
PROJECT: ATS-2104 Atlas Project ASS		ALS QUOTE NO.: EP/378/21		Frozen & frozen ice blocks present upon receipt? Yes No	
ORDER NUMBER:		COC SEQUENCE NUMBER (Circle)		Random Sample Temperature on receipt: °C	
PROJECT MANAGER: Matt Brainbridge		CONTACT PH: 0407 086 443		Other comment: -6.8	
SAMPLER: Image Resources		SAMPLER MOBILE:		RECEIVED BY:	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):		DATE/TIME:	
Email Reports to (will default to PM if no other addresses are listed): matt@mineearth.com.au		RELINQUISHED BY:		DATE/TIME:	
Email Invoice to (will default to PM if no other addresses are listed): matt@mineearth.com.au		DATE/TIME:		DATE/TIME:	

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:
All Samples to remain frozen until Suite 1 ASS Field Screening.
All remaining sample to be kept frozen for subsequent Suite 2 analysis.
Samples for Suite 2 analysis to be identified following Suite 1 analysis.
All remaining samples to be returned to Mine Earth following Suite 2 analysis

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)		CONTAINER INFORMATION			ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).										Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <i>to codes below</i>	<i>(refer</i>	TOTAL CONTAINERS	Suite 1 Drying (EN0200)	Suite 1 ASS Field Screening (EA037)									Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	ASS06 0 1		S	ASS - frozen		1	x	x									
	ASS06 1 1.3		S	ASS - frozen		1	x	x									
	ASS06 1.3 2		S	ASS - frozen		1	x	x									
	ASS06 2 3		S	ASS - frozen		1	x	x									
	ASS06 3 4		S	ASS - frozen		1	x	x									
	ASS06 5 6		S	ASS - frozen		1	x	x									
	ASS06 6 7		S	ASS - frozen		1	x	x									
	ASS07 0 2		S	ASS - frozen		1	x	x									
	ASS07 2 3		S	ASS - frozen		1	x	x									
	ASS07 3 4		S	ASS - frozen		1	x	x									
	ASS07 4 5		S	ASS - frozen		1	x	x									
	ASS07 5 6		S	ASS - frozen		1	x	x									
	ASS07 6 6.6		S	ASS - frozen		1	x	x									

Environmental Division
Perth
Work Order Reference
EP2114243



Telephone : -- 61-8-9406 1301

Environmental Division
Perth
Work Order Reference
EP2114243



Telephone : -- 81-8-9406 1301

ASS07 6.6 7		S	ASS - frozen	1	x	x								
ASS08 0 1		S	ASS - frozen	1	x	x								
ASS08 1 2		S	ASS - frozen	1	x	x								
ASS08 2 3		S	ASS - frozen	1	x	x								
ASS08 3 4		S	ASS - frozen	1	x	x								
ASS08 4 5		S	ASS - frozen	1	x	x								
ASS08 5 6		S	ASS - frozen	1	x	x								
ASS08 6 7		S	ASS - frozen	1	x	x								
ASS08 7 8		S	ASS - frozen	1	x	x								
ASS08 8 9		S	ASS - frozen	1	x	x								
ASS09 0 2.4		S	ASS - frozen	1	x	x								
ASS09 2.4 3		S	ASS - frozen	1	x	x								
ASS09 3 4		S	ASS - frozen	1	x	x								
ASS09 4 5		S	ASS - frozen	1	x	x								
ASS09 5 6		S	ASS - frozen	1	x	x								
ASS09 6 7		S	ASS - frozen	1	x	x								
ASS09 7 8		S	ASS - frozen	1	x	x								

ASS10 0 1		S	ASS - frozen	1	x	x							
ASS10 1 2		S	ASS - frozen	1	x	x							
ASS10 2 3		S	ASS - frozen	1	x	x							
ASS10 3 4		S	ASS - frozen	1	x	x							
ASS10 4 5		S	ASS - frozen	1	x	x							
ASS10 5 6		S	ASS - frozen	1	x	x							
ASS10 6 7		S	ASS - frozen	1	x	x							
ASS11 0 1		S	ASS - frozen	1	x	x							
ASS11 1 2		S	ASS - frozen	1	x	x							
ASS11 2 3		S	ASS - frozen	1	x	x							
ASS11 3 4		S	ASS - frozen	1	x	x							
ASS11 4 5		S	ASS - frozen	1	x	x							
ASS11 5 6		S	ASS - frozen	1	x	x							
ASS11 6 7		S	ASS - frozen	1	x	x							
ASS11 7 7.5		S	ASS - frozen	1	x	x							
ASS11 7.5 8		S	ASS - frozen	1	x	x							
ASS12 0 1		S	ASS - frozen	1	x	x							
ASS12 1 1.7		S	ASS - frozen	1	x	x							
ASS12 1.7 3		S	ASS - frozen	1	x	x							
ASS12 3 4		S	ASS - frozen	1	x	x							
ASS12 4 4.7		S	ASS - frozen	1	x	x							
ASS12 4.7 5.7		S	ASS - frozen	1	x	x							
ASS12 5.7 7		S	ASS - frozen	1	x	x							
ASS12 7 8.5		S	ASS - frozen	1	x	x							
ASS12 8.5 9		S	ASS - frozen	1	x	x							
ASS13 0 1		S	ASS - frozen	1	x	x							
ASS13 1 2		S	ASS - frozen	1	x	x							
ASS13 2 3		S	ASS - frozen	1	x	x							
ASS13 3 4		S	ASS - frozen	1	x	x							
ASS13 4 5		S	ASS - frozen	1	x	x							

ASS13 5 6		S	ASS - frozen	1	x	x							
ASS13 6 6.5		S	ASS - frozen	1	x	x							
ASS13 6.5 7		S	ASS - frozen	1	x	x							
ASS13 7 8		S	ASS - frozen	1	x	x							

	ASS14 0 0.8		S	ASS - frozen	1	x	x							
	ASS14 0.8 2		S	ASS - frozen	1	x	x							
	ASS14 2 3.2		S	ASS - frozen	1	x	x							
	ASS14 3.2 4		S	ASS - frozen	1	x	x							
	ASS14 4 5		S	ASS - frozen	1	x	x							
	ASS14 5 6		S	ASS - frozen	1	x	x							
	ASS14 6 7		S	ASS - frozen	1	x	x							
	ASS14 7 8		S	ASS - frozen	1	x	x							
	ASS14 8 9		S	ASS - frozen	1	x	x							
	ASS15 0 1		S	ASS - frozen	1	x	x							
	ASS15 1 1.7		S	ASS - frozen	1	x	x							
	ASS15 1.7 2		S	ASS - frozen	1	x	x							
	ASS15 2 3		S	ASS - frozen	1	x	x							
	ASS15 3 4		S	ASS - frozen	1	x	x							
	ASS15 4 5		S	ASS - frozen	1	x	x							
	ASS15 5 6		S	ASS - frozen	1	x	x							
	ASS15 6 7		S	ASS - frozen	1	x	x							
	ASS15 7 8		S	ASS - frozen	1	x	x							
1	ASS16 0 1		S	ASS - frozen	1	x	x							
2	ASS16 1 2		S	ASS - frozen	1	x	x							
3	ASS16 2 3		S	ASS - frozen	1	x	x							
4	ASS16 3 4		S	ASS - frozen	1	x	x							
5	ASS16 4 5		S	ASS - frozen	1	x	x							
6	ASS16 5 6		S	ASS - frozen	1	x	x							
7	ASS16 6 7		S	ASS - frozen	1	x	x							
8	ASS17 0 1.6		S	ASS - frozen	1	x	x							
9	ASS17 1.6 2		S	ASS - frozen	1	x	x							
10	ASS17 2 3		S	ASS - frozen	1	x	x							
11	ASS17 3 4		S	ASS - frozen	1	x	x							
12	ASS17 4 5		S	ASS - frozen	1	x	x							

13	ASS17 6 6		S	ASS - frozen	1	x	x							
14	ASS17 6 6.5		S	ASS - frozen	1	x	x							
15	ASS17 6.5 7		S	ASS - frozen	1	x	x							

16	ASS18 0 1		S	ASS - frozen	1	x	x							
17	ASS18 1 2		S	ASS - frozen	1	x	x							
18	ASS18 2 3		S	ASS - frozen	1	x	x							
19	ASS18 3 4		S	ASS - frozen	1	x	x							
20	ASS18 4 5		S	ASS - frozen	1	x	x							
21	ASS18 5 6		S	ASS - frozen	1	x	x							
22	ASS18 6 7		S	ASS - frozen	1	x	x							
23	ASS18 7 8		S	ASS - frozen	1	x	x							
24	ASS18 8 9		S	ASS - frozen	1	x	x							
25	ASS19 0 1		S	ASS - frozen	1	x	x							
26	ASS19 1 2		S	ASS - frozen	1	x	x							
27	ASS19 2 3		S	ASS - frozen	1	x	x							
28	ASS19 3 4		S	ASS - frozen	1	x	x							
29	ASS19 4 5		S	ASS - frozen	1	x	x							
30	ASS19 5 6		S	ASS - frozen	1	x	x							
31	ASS19 6 7		S	ASS - frozen	1	x	x							
32	ASS19 7 8		S	ASS - frozen	1	x	x							
33	ASS19 8 9		S	ASS - frozen	1	x	x							
34	ASS19 9 10		S	ASS - frozen	1	x	x							
35	ASS20 0 1		S	ASS - frozen	1	x	x							
36	ASS20 1 2		S	ASS - frozen	1	x	x							
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39	ASS20 4 5		S	ASS - frozen	1	x	x							
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41	ASS20 6 7		S	ASS - frozen	1	x	x							
42	ASS20 7 8		S	ASS - frozen	1	x	x							
43	ASS20 8 9		S	ASS - frozen	1	x	x							
44	ASS20 9 10		S	ASS - frozen	1	x	x							
45	ASS21 0 1		S	ASS - frozen	1	x	x							

46	ASS21 1 2		S	ASS - frozen	1	x	x							
47	ASS21 2 3		S	ASS - frozen	1	x	x							
48	ASS21 3 4		S	ASS - frozen	1	x	x							
49	ASS21 4 5		S	ASS - frozen	1	x	x							
50	ASS21 5 6		S	ASS - frozen	1	x	x							
51	ASS21 6 7		S	ASS - frozen	1	x	x							
52	ASS21 7 8		S	ASS - frozen	1	x	x							
53	ASS21 8 9		S	ASS - frozen	1	x	x							
54	ASS21 9 10		S	ASS - frozen	1	x	x							
55	ASS21 10 11		S	ASS - frozen	1	x	x							
56	ASS21 11 12		S	ASS - frozen	1	x	x							
57	ASS22 0 1		S	ASS - frozen	1	x	x							
58	ASS22 1 2		S	ASS - frozen	1	x	x							
59	ASS22 2 3		S	ASS - frozen	1	x	x							
60	ASS22 3 4		S	ASS - frozen	1	x	x							
61	ASS22 4 5		S	ASS - frozen	1	x	x							
62	ASS22 5 6		S	ASS - frozen	1	x	x							
63	ASS22 6 7		S	ASS - frozen	1	x	x							
64	ASS22 7 8		S	ASS - frozen	1	x	x							
65	ASS22 8 9		S	ASS - frozen	1	x	x							
66	ASS22 9 10		S	ASS - frozen	1	x	x							
67	ASS23 0 1		S	ASS - frozen	1	x	x							
68	ASS23 1 2		S	ASS - frozen	1	x	x							
69	ASS23 2 3		S	ASS - frozen	1	x	x							
70	ASS23 3 4		S	ASS - frozen	1	x	x							
71	ASS23 4 5		S	ASS - frozen	1	x	x							
72	ASS23 5 6		S	ASS - frozen	1	x	x							
73	ASS23 6 7		S	ASS - frozen	1	x	x							
74	ASS23 7 8		S	ASS - frozen	1	x	x							
75	ASS23 8 9		S	ASS - frozen	1	x	x							

76	ASS23 9 10		S	ASS - frozen	1	x	x							
----	------------	--	---	--------------	---	---	---	--	--	--	--	--	--	--

ASS24 0 1		S	ASS - frozen	1	x	x							
ASS24 1 2		S	ASS - frozen	1	x	x							
ASS24 2 3		S	ASS - frozen	1	x	x							
ASS24 3 4		S	ASS - frozen	1	x	x							
ASS24 4 5		S	ASS - frozen	1	x	x							
ASS24 5 6		S	ASS - frozen	1	x	x							
ASS24 6 7		S	ASS - frozen	1	x	x							
ASS24 7 8		S	ASS - frozen	1	x	x							
ASS24 8 9		S	ASS - frozen	1	x	x							
ASS24 9 10		S	ASS - frozen	1	x	x							
ASS24 10 11		S	ASS - frozen	1	x	x							
ASS24 11 12		S	ASS - frozen	1	x	x							
ASS25 0 1		S	ASS - frozen	1	x	x							
ASS25 1 2		S	ASS - frozen	1	x	x							
ASS25 2 3		S	ASS - frozen	1	x	x							
ASS25 3 4		S	ASS - frozen	1	x	x							
ASS25 4 5		S	ASS - frozen	1	x	x							
ASS25 5 6		S	ASS - frozen	1	x	x							
ASS25 6 7		S	ASS - frozen	1	x	x							
ASS25 7 8		S	ASS - frozen	1	x	x							
ASS25 8 9		S	ASS - frozen	1	x	x							
ASS25 9 10		S	ASS - frozen	1	x	x							
ASS26 0 1		S	ASS - frozen	1	x	x							
ASS26 1 2		S	ASS - frozen	1	x	x							
ASS26 2 3		S	ASS - frozen	1	x	x							
ASS26 3 4		S	ASS - frozen	1	x	x							
ASS26 4 4.4		S	ASS - frozen	1	x	x							
ASS26 4.4 5		S	ASS - frozen	1	x	x							
ASS26 5 6		S	ASS - frozen	1	x	x							
ASS26 6 7		S	ASS - frozen	1	x	x							

ASS26 7 7.7		S	ASS - frozen	1	x	x							
ASS26 7.7 8		S	ASS - frozen	1	x	x							
ASS26 8 9		S	ASS - frozen	1	x	x							
ASS26 9 10		S	ASS - frozen	1	x	x							
ASS26 10 11		S	ASS - frozen	1	x	x							
ASS27 0 1		S	ASS - frozen	1	x	x							
ASS27 1 2		S	ASS - frozen	1	x	x							
ASS27 2 3		S	ASS - frozen	1	x	x							
ASS27 3 4		S	ASS - frozen	1	x	x							
ASS27 4 5		S	ASS - frozen	1	x	x							
ASS27 5 6		S	ASS - frozen	1	x	x							
ASS27 6 7		S	ASS - frozen	1	x	x							
ASS27 7 8		S	ASS - frozen	1	x	x							
ASS27 8 9		S	ASS - frozen	1	x	x							
ASS27 9 10		S	ASS - frozen	1	x	x							
ASS27 10 11		S	ASS - frozen	1	x	x							
ASS27 11 12		S	ASS - frozen	1	x	x							
ASS27 12 13		S	ASS - frozen	1	x	x							
ASS28 0 1		S	ASS - frozen	1	x	x							
ASS28 1 2		S	ASS - frozen	1	x	x							
ASS28 2 3		S	ASS - frozen	1	x	x							
ASS28 3 4		S	ASS - frozen	1	x	x							
ASS28 4 5		S	ASS - frozen	1	x	x							
ASS28 5 6		S	ASS - frozen	1	x	x							
ASS28 6 7		S	ASS - frozen	1	x	x							
ASS28 7 8		S	ASS - frozen	1	x	x							


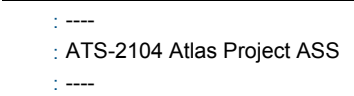
ASS29 0 1		S	ASS - frozen	1	x	x								
ASS29 1 2		S	ASS - frozen	1	x	x								
ASS29 2 3		S	ASS - frozen	1	x	x								
ASS29 3 4		S	ASS - frozen	1	x	x								
ASS29 4 5		S	ASS - frozen	1	x	x								
ASS29 5 6		S	ASS - frozen	1	x	x								
ASS29 6 7		S	ASS - frozen	1	x	x								
ASS29 7 8		S	ASS - frozen	1	x	x								
ASS29 8 9		S	ASS - frozen	1	x	x								
ASS29 9 10		S	ASS - frozen	1	x	x								
ASS29 10 11		S	ASS - frozen	1	x	x								
ASS30 0 2		S	ASS - frozen	1	x	x								
ASS30 2 3		S	ASS - frozen	1	x	x								
ASS30 3 4		S	ASS - frozen	1	x	x								
ASS30 4 5		S	ASS - frozen	1	x	x								
ASS30 5 6		S	ASS - frozen	1	x	x								
ASS30 6 7		S	ASS - frozen	1	x	x								
ASS30 7 8		S	ASS - frozen	1	x	x								
ASS30 8 9		S	ASS - frozen	1	x	x								
ASS31 0 1		S	ASS - frozen	1	x	x								
ASS31 1 2		S	ASS - frozen	1	x	x								
ASS31 2 3.5		S	ASS - frozen	1	x	x								
ASS31 3.5 4		S	ASS - frozen	1	x	x								
ASS31 4 5		S	ASS - frozen	1	x	x								
ASS31 5 6		S	ASS - frozen	1	x	x								
ASS31 6 7		S	ASS - frozen	1	x	x								
ASS31 7 8		S	ASS - frozen	1	x	x								
ASS31 8 9		S	ASS - frozen	1	x	x								
ASS31 9 10		S	ASS - frozen	1	x	x								
ASS31 10 11		S	ASS - frozen	1	x	x								

[illegible]



Environmental

CERTIFICATE OF ANALYSIS

Work Order : **EP2114246**
Client : **The Trustee for Mine Earth Unit Trust**
Contact : 
Address : 
Telephone : ----
Project : **ATS-2104 Atlas Project ASS**
Order number : ----
C-O-C number : ----
Sampler : **Image Resources**
Site : ----
Quote number : **EP/378/21**
No. of samples received : **83**
No. of samples analysed : **83**

Page : 1 of 19

Laboratory : 

Date Samples Received : 22-Nov-2021 11:10

Date Analysis Commenced : 25-Nov-2021

Issue Date : 26-Nov-2021 17:19

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

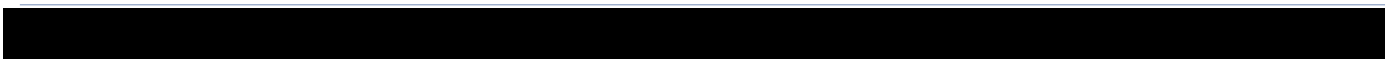
Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories

Position

Accreditation Category





General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

~ = Indicates an estimated value.

- ASS: EA037 (Rapid Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- EA037 ASS Field Screening: NATA accreditation does not cover performance of this service.



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS06 0 1	ASS06 1 1.3	ASS06 1.3 2	ASS06 2 3	ASS06 3 4
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-001	EP2114246-002	EP2114246-003	EP2114246-004	EP2114246-005
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.0	9.1	8.0	8.1	9.2
pH (Fox)	----	0.1	pH Unit	6.7	8.6	6.7	7.6	9.2
Reaction Rate	----	1	-	Slight	Strong	Slight	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS06 4 5	ASS06 5 6	ASS06 6 7	ASS07 0 2	ASS07 2 3
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-006	EP2114246-007	EP2114246-008	EP2114246-009	EP2114246-010
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	9.3	7.9	8.2	9.0	8.7
pH (Fox)	----	0.1	pH Unit	8.5	6.8	8.2	7.8	2.3
Reaction Rate	----	1	-	Strong	Strong	Strong	Extreme	Extreme



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS07 3 4	ASS07 4 5	ASS07 5 6	ASS07 6 6.6	ASS07 6.6 7
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-011	EP2114246-012	EP2114246-013	EP2114246-014	EP2114246-015
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	9.0	9.1	9.1	8.4	8.4
pH (Fox)	----	0.1	pH Unit	7.5	7.8	5.1	6.4	6.4
Reaction Rate	----	1	-	Strong	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS08 0 1	ASS08 1 2	ASS08 2 3	ASS08 3 4	ASS08 4 5
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-016	EP2114246-017	EP2114246-018	EP2114246-019	EP2114246-020
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.9	8.8	7.9	8.1	8.2
pH (Fox)	----	0.1	pH Unit	7.2	3.5	6.7	7.6	7.9
Reaction Rate	----	1	-	Strong	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS08 5 6	ASS08 6 7	ASS08 7 8	ASS08 8 9	ASS09 0 2.4
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-021	EP2114246-022	EP2114246-023	EP2114246-024	EP2114246-025
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.5	8.3	7.6	7.5	7.9
pH (Fox)	----	0.1	pH Unit	3.7	3.9	4.5	4.0	6.8
Reaction Rate	----	1	-	Strong	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS09 2.4 3	ASS09 3 4	ASS09 4 5	ASS09 5 6	ASS09 6 7
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-026	EP2114246-027	EP2114246-028	EP2114246-029	EP2114246-030
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.4	9.1	8.7	8.2	8.8
pH (Fox)	----	0.1	pH Unit	7.2	8.4	8.3	8.2	8.0
Reaction Rate	----	1	-	Strong	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS09 7 8	ASS10 0 1	ASS10 1 2	ASS10 2 3	ASS10 3 4
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-031	EP2114246-032	EP2114246-033	EP2114246-034	EP2114246-035
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.9	8.1	7.7	9.1	8.9
pH (Fox)	----	0.1	pH Unit	8.2	5.2	7.1	7.8	8.2
Reaction Rate	----	1	-	Strong	Moderate	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS10 4 5	ASS10 5 6	ASS10 6 7	ASS11 0 1	ASS11 1 2
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-036	EP2114246-037	EP2114246-038	EP2114246-039	EP2114246-040
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.4	8.6	9.0	7.8	8.7
pH (Fox)	----	0.1	pH Unit	7.8	8.0	8.2	7.6	7.7
Reaction Rate	----	1	-	Strong	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS11 2 3	ASS11 3 4	ASS11 4 5	ASS11 5 6	ASS11 6 7
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-041	EP2114246-042	EP2114246-043	EP2114246-044	EP2114246-045
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.5	8.6	8.9	9.0	9.5
pH (Fox)	----	0.1	pH Unit	7.6	7.7	8.1	8.2	8.2
Reaction Rate	----	1	-	Strong	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS11 7 7.5	ASS11 7.5 8	ASS12 0 1	ASS12 1 1.7	ASS12 1.7 3
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-046	EP2114246-047	EP2114246-048	EP2114246-049	EP2114246-050
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.2	8.9	8.1	8.0	8.1
pH (Fox)	----	0.1	pH Unit	7.1	3.4	7.0	7.8	7.2
Reaction Rate	----	1	-	Strong	Slight	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS12 3 4	ASS12 4 4.7	ASS12 4.7 5.7	ASS12 5.7 7	ASS12 7 8.5
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-051	EP2114246-052	EP2114246-053	EP2114246-054	EP2114246-055
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.3	8.8	8.0	8.4	8.6
pH (Fox)	----	0.1	pH Unit	7.7	7.3	7.1	3.5	4.0
Reaction Rate	----	1	-	Strong	Strong	Strong	Moderate	Slight



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS12 8.5 9	ASS13 0 1	ASS13 1 2	ASS13 2 3	ASS13 3 4
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-056	EP2114246-057	EP2114246-058	EP2114246-059	EP2114246-060
Result				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.9	6.4	6.2	7.7	7.4
pH (Fox)	----	0.1	pH Unit	5.8	3.9	4.5	5.6	5.0
Reaction Rate	----	1	-	Moderate	Moderate	Moderate	Slight	Slight



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS13 4 5	ASS13 5 6	ASS13 6 6.5	ASS13 6.5 7	ASS13 7 8
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-061	EP2114246-062	EP2114246-063	EP2114246-064	EP2114246-065
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.1	7.3	7.4	7.7	7.8
pH (Fox)	----	0.1	pH Unit	4.4	5.2	5.5	4.9	5.0
Reaction Rate	----	1	-	Moderate	Moderate	Moderate	Moderate	Moderate



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS14 0 0.8	ASS14 0.8 2	ASS14 2 3.2	ASS14 3.2 4	ASS14 4 5
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-066	EP2114246-067	EP2114246-068	EP2114246-069	EP2114246-070
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.4	7.9	7.9	8.0	8.1
pH (Fox)	----	0.1	pH Unit	6.1	6.5	6.3	6.5	7.0
Reaction Rate	----	1	-	Slight	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS14 5 6	ASS14 6 7	ASS14 7 8	ASS14 8 9	ASS15 0 1
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-071	EP2114246-072	EP2114246-073	EP2114246-074	EP2114246-075
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	8.3	9.2	8.3	8.0	6.5
pH (Fox)	----	0.1	pH Unit	6.5	8.2	6.2	5.9	3.7
Reaction Rate	----	1	-	Strong	Strong	Strong	Strong	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS15 1 1.7	ASS15 1.7 2	ASS15 2 3	ASS15 3 4	ASS15 4 5
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114246-076	EP2114246-077	EP2114246-078	EP2114246-079	EP2114246-080
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.4	7.4	7.9	7.9	7.9
pH (Fox)	----	0.1	pH Unit	5.2	7.1	7.0	6.8	6.9
Reaction Rate	----	1	-	Moderate	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ASS15 5 6	ASS15 6 7	ASS15 7 8	----	----
Sampling date / time					[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	----	----
Compound	CAS Number	LOR	Unit		EP2114246-081	EP2114246-082	EP2114246-083	-----	-----
Result					Result	Result	Result	----	----
EA037: Ass Field Screening Analysis									
pH (F)	----	0.1	pH Unit		7.8	7.7	7.5	----	----
pH (Fox)	----	0.1	pH Unit		6.9	6.2	6.0	----	----
Reaction Rate	----	1	-		Strong	Strong	Strong	----	----



Environmental

QUALITY CONTROL REPORT

Work Order : EP2114246

Page : 1 of 3

Client : The Trustee for Mine Earth Unit Trust

Contact

Address

Laboratory : Environmental Division Perth

Telephone : ----

Project : ATS-2104 Atlas Project ASS

Order number : ----

C-O-C number : ----

Sampler : Image Resources

Site : ----

Quote number : EP/378/21

No. of samples received : 83

No. of samples analysed : 83

Date Samples Received : 22-Nov-2021

Date Analysis Commenced : 25-Nov-2021

Issue Date : 26-Nov-2021

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories

Position

Accreditation Category



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA037: Ass Field Screening Analysis (QC Lot: 4040906)									
EP2114246-001	ASS06 0 1	EA037: pH (F)	----	0.1	pH Unit	8.0	8.0	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	6.7	6.7	0.0	0% - 20%
EP2114246-010	ASS07 2 3	EA037: pH (F)	----	0.1	pH Unit	8.7	8.6	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.3	2.3	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4040907)									
EP2114246-021	ASS08 5 6	EA037: pH (F)	----	0.1	pH Unit	8.5	8.6	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	3.7	3.6	0.0	0% - 20%
EP2114246-030	ASS09 6 7	EA037: pH (F)	----	0.1	pH Unit	8.8	8.9	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	8.0	8.0	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4040908)									
EP2114246-041	ASS11 2 3	EA037: pH (F)	----	0.1	pH Unit	8.5	8.5	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	7.6	7.6	0.0	0% - 20%
EP2114246-050	ASS12 1.7 3	EA037: pH (F)	----	0.1	pH Unit	8.1	8.1	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	7.2	7.2	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4040909)									
EP2114246-061	ASS13 4 5	EA037: pH (F)	----	0.1	pH Unit	7.1	7.1	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	4.4	4.4	0.0	0% - 20%
EP2114246-070	ASS14 4 5	EA037: pH (F)	----	0.1	pH Unit	8.1	8.0	0.0	0% - 20%
		EA037 pH (Fox)	----	0.1	pH Unit	7.0	7.1	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4040910)									
EP2114246-081	ASS15 5 6	EA037: pH (F)	----	0.1	pH Unit	7.8	7.8	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	6.9	7.0	0.0	0% - 20%



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

- **No Method Blank (MB) or Laboratory Control Spike (LCS) Results are required to be reported.**

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**
-

QA/QC Compliance Assessment to assist with Quality Review

Work Order : EP2114246

Page : 1 of 6

Client : The Trustee for Mine Earth Unit Trust

Laboratory : Environmental Division Perth

Contact

Project : ATS-2104 Atlas Project ASS

Date Samples Received : 22-Nov-2021

Site : ----

Issue Date : 26-Nov-2021

Sampler : Image Resources

No. of samples received : 83

Order number : ----

No. of samples analysed : 83

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA037: Ass Field Screening Analysis							
Snap Lock Bag - frozen (EA037)							

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA037: Ass Field Screening Analysis - Continued								
ASS06 0 1, ASS06 1.3 2, ASS06 3 4, ASS06 5 6, ASS07 0 2, ASS07 3 4, ASS07 5 6, ASS07 6.6 7, ASS08 1 2, ASS08 3 4, ASS08 5 6, ASS08 7 8, ASS09 0 2.4, ASS09 3 4, ASS09 5 6, ASS09 7 8, ASS10 1 2, ASS10 3 4, ASS10 5 6, ASS11 0 1, ASS11 2 3, ASS11 4 5, ASS11 6 7, ASS11 7.5 8, ASS12 1 1.7, ASS12 3 4, ASS12 4.7 5.7, ASS12 7 8.5, ASS13 0 1, ASS13 2 3, ASS13 4 5, ASS13 6 6.5, ASS13 7 8, ASS14 0.8 2, ASS14 3.2 4, ASS14 5 6, ASS14 7 8, ASS15 0 1, ASS15 1.7 2, ASS15 3 4, ASS15 5 6,	ASS06 1 1.3, ASS06 2 3, ASS06 4 5, ASS06 6 7, ASS07 2 3, ASS07 4 5, ASS07 6 6.6, ASS08 0 1, ASS08 2 3, ASS08 4 5, ASS08 6 7, ASS08 8 9, ASS09 2.4 3, ASS09 4 5, ASS09 6 7, ASS10 0 1, ASS10 2 3, ASS10 4 5, ASS10 6 7, ASS11 1 2, ASS11 3 4, ASS11 5 6, ASS11 7 7.5, ASS12 0 1, ASS12 1.7 3, ASS12 4 4.7, ASS12 5.7 7, ASS12 8.5 9, ASS13 1 2, ASS13 3 4, ASS13 5 6, ASS13 6.5 7, ASS14 0 0.8, ASS14 2 3.2, ASS14 4 5, ASS14 6 7, ASS14 8 9, ASS15 1 1.7, ASS15 2 3, ASS15 4 5, ASS15 6 7,	17-Nov-2021	25-Nov-2021	16-May-2022	✓	25-Nov-2021	16-May-2022	✓



Matrix: SOIL

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA037: Ass Field Screening Analysis - Continued							
ASS15 7 8							



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL** Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification	
Analytical Methods	Method	QC	Regular	Actual	Expected		Evaluation
Laboratory Duplicates (DUP)							
ASS Field Screening Analysis	EA037	9	83	10.84	10.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
ASS Field Screening Analysis	EA037	SOIL	In house: Referenced to Acid Sulfate Soils Laboratory Methods Guidelines. As received samples are tested for pH field and pH fox and assessed for a reaction rating.

Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house



CHAIN OF CUSTODY

ALS Laboratory:
please tick →

LABS: 1111 Bunn Road, Adelaide SA 5095
Ph: 08 8369 0600 E: adelaide@alsglobal.com

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GLADSTONE 44 Callenderdon Drive, Clinton QLD 4650
Ph: 07 7471 5630 E: gladstone@alsglobal.com

DMACRA 13 Harbord Road, Mackay QLD 4740
Ph: 07 4944 6177 E: mackay@alsglobal.com

JIMEL SCURNE 744 Vines Road, Springvale VIC 3171
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Ph: 07 4796 0800 E: bunde@alsglobal.com

DMACRA 69 Kenny Street, Wollongong NSW 2520
Ph: 02 4225 3125 E: ports@alsglobal.com

CLIENT: Mine Earth

OFFICE:

PROJECT: ATS-2104 Atlas Project ASS

ORDER NUMBER:

PROJECT MANAGER: Matt Braimbridge

SAMPLER: Image Resources

COC emailed to ALS? (YES / NO)

Email Reports to (will default to PM if no other addresses are listed): matt@mineearth.com.au

Email Invoice to (will default to PM if no other addresses are listed): matt@mineearth.com.au

TURNAROUND REQUIREMENTS :

(Standard TAT may be longer for some tests
e.g. Ultra Trace Organics)

ALS QUOTE NO.:

EP/378/21

☒ Standard TAT (List due date):

☐ Non Standard or urgent TAT (List due date):

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OP: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)

Quality Seal Intact: Yes No N/A

Freeze / Frozen for subsequent analysis: Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

CONTACT PH: 0407 086 443

SAMPLER MOBILE:

EDD FORMAT (or default):

RELINQUISHED BY:

↑

DATE/TIME:

RECEIVED BY:

ND 22.11.21

DATE/TIME:

11:10

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY:

DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

All Samples to remain frozen until Suite 1 ASS Field Screening.

All remaining sample to be kept frozen for subsequent Suite 2 analysis.

Samples for Suite 2 analysis to be identified following Suite 1 analysis.

All remaining samples to be returned to Mine Earth following Suite 2 analysis

ALS USE		SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)		CONTAINER INFORMATION			ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).										Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE to codes below	(refer	TOTAL CONTAINERS	Suite 1 Drying (EN020D)	Suite 1 ASS Field Screening (EA037)									Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.	
1	ASS06 0 1		S	ASS - frozen		1	x	x										
2	ASS06 1 1.3		S	ASS - frozen		1	x	x										
3	ASS06 1.3 2		S	ASS - frozen		1	x	x										
4	ASS06 2 3		S	ASS - frozen		1	x	x										
5	ASS06 3 4		S	ASS - frozen		1	x	x										
7	ASS06 5 6		S	ASS - frozen		1	x	x										
8	ASS06 6 7		S	ASS - frozen		1	x	x										
9	ASS07 0 2		S	ASS - frozen		1	x	x										
10	ASS07 2 3		S	ASS - frozen		1	x	x										
11	ASS07 3 4		S	ASS - frozen		1	x	x										
12	ASS07 4 5		S	ASS - frozen		1	x	x										
13	ASS07 5 6		S	ASS - frozen		1	x	x										
14	ASS07 6 6.6		S	ASS - frozen		1	x	x										

Environmental Division
Perth

Work Order Reference

EP2114246



Telephone : -- 61-8-9406 1301

15	ASS07 6.6 7		S	ASS - frozen	1	x	x										
16	ASS08 0 1		S	ASS - frozen	1	x	x										
17	ASS08 1 2		S	ASS - frozen	1	x	x										
18	ASS08 2 3		S	ASS - frozen	1	x	x										
19	ASS08 3 4		S	ASS - frozen	1	x	x										
20	ASS08 4 5		S	ASS - frozen	1	x	x										
21	ASS08 5 6		S	ASS - frozen	1	x	x										
22	ASS08 6 7		S	ASS - frozen	1	x	x										
23	ASS08 7 8		S	ASS - frozen	1	x	x										
24	ASS08 8 9		S	ASS - frozen	1	x	x										
25	ASS09 0 2.4		S	ASS - frozen	1	x	x										
26	ASS09 2.4 3		S	ASS - frozen	1	x	x										
27	ASS09 3 4		S	ASS - frozen	1	x	x										
28	ASS09 4 5		S	ASS - frozen	1	x	x										
29	ASS09 5 6		S	ASS - frozen	1	x	x										
30	ASS09 6 7		S	ASS - frozen	1	x	x										
31	ASS09 7 8		S	ASS - frozen	1	x	x										

6 ASS06 4 5

5

ASS-frozen

32	ASS10 0 1		S	ASS - frozen	1	x	x								
33	ASS10 1 2		S	ASS - frozen	1	x	x								
34	ASS10 2 3		S	ASS - frozen	1	x	x								
35	ASS10 3 4		S	ASS - frozen	1	x	x								
36	ASS10 4 5		S	ASS - frozen	1	x	x								
37	ASS10 5 6		S	ASS - frozen	1	x	x								
38	ASS10 6 7		S	ASS - frozen	1	x	x								
39	ASS11 0 1		S	ASS - frozen	1	x	x								
40	ASS11 1 2		S	ASS - frozen	1	x	x								
41	ASS11 2 3		S	ASS - frozen	1	x	x								
42	ASS11 3 4		S	ASS - frozen	1	x	x								
43	ASS11 4 5		S	ASS - frozen	1	x	x								
44	ASS11 5 6		S	ASS - frozen	1	x	x								
45	ASS11 6 7		S	ASS - frozen	1	x	x								
46	ASS11 7 7.5		S	ASS - frozen	1	x	x								
47	ASS11 7.5 8		S	ASS - frozen	1	x	x								
48	ASS12 0 1		S	ASS - frozen	1	x	x								
49	ASS12 1 1.7		S	ASS - frozen	1	x	x								
50	ASS12 1.7 3		S	ASS - frozen	1	x	x								
51	ASS12 3 4		S	ASS - frozen	1	x	x								
52	ASS12 4 4.7		S	ASS - frozen	1	x	x								
53	ASS12 4.7 5.7		S	ASS - frozen	1	x	x								
54	ASS12 5.7 7		S	ASS - frozen	1	x	x								
55	ASS12 7 8.5		S	ASS - frozen	1	x	x								
56	ASS12 8.5 9		S	ASS - frozen	1	x	x								
57	ASS13 0 1		S	ASS - frozen	1	x	x								
58	ASS13 1 2		S	ASS - frozen	1	x	x								
59	ASS13 2 3		S	ASS - frozen	1	x	x								
60	ASS13 3 4		S	ASS - frozen	1	x	x								
61	ASS13 4 5		S	ASS - frozen	1	x	x								

62	ASS13 5 6		S	ASS - frozen	1	x	x							
63	ASS13 6 6.5		S	ASS - frozen	1	x	x							
64	ASS13 6.5 7		S	ASS - frozen	1	x	x							
65	ASS13 7 8		S	ASS - frozen	1	x	x							

66	ASS14 0 0.8		S	ASS - frozen	1	x	x								
67	ASS14 0.8 2		S	ASS - frozen	1	x	x								
68	ASS14 2 3.2		S	ASS - frozen	1	x	x								
69	ASS14 3.2 4		S	ASS - frozen	1	x	x								
70	ASS14 4 5		S	ASS - frozen	1	x	x								
71	ASS14 5 6		S	ASS - frozen	1	x	x								
72	ASS14 6 7		S	ASS - frozen	1	x	x								
73	ASS14 7 8		S	ASS - frozen	1	x	x								
74	ASS14 8 9		S	ASS - frozen	1	x	x								
75	ASS15 0 1		S	ASS - frozen	1	x	x								
76	ASS15 1 1.7		S	ASS - frozen	1	x	x								
77	ASS15 1.7 2		S	ASS - frozen	1	x	x								
78	ASS15 2 3		S	ASS - frozen	1	x	x								
79	ASS15 3 4		S	ASS - frozen	1	x	x								
80	ASS15 4 5		S	ASS - frozen	1	x	x								
81	ASS15 5 6		S	ASS - frozen	1	x	x								
82	ASS15 6 7		S	ASS - frozen	1	x	x								
83	ASS15 7 8		S	ASS - frozen	1	x	x								
	ASS16 0 1		S	ASS - frozen	1	x	x								
	ASS16 1 2		S	ASS - frozen	1	x	x								
	ASS16 2 3		S	ASS - frozen	1	x	x								
	ASS16 3 4		S	ASS - frozen	1	x	x								
	ASS16 4 5		S	ASS - frozen	1	x	x								
	ASS16 5 6		S	ASS - frozen	1	x	x								
	ASS16 6 7		S	ASS - frozen	1	x	x								
	ASS17 0 1.6		S	ASS - frozen	1	x	x								
	ASS17 1.6 2		S	ASS - frozen	1	x	x								
	ASS17 2 3		S	ASS - frozen	1	x	x								
	ASS17 3 4		S	ASS - frozen	1	x	x								
	ASS17 4 5		S	ASS - frozen	1	x	x								

ASS1756		S	ASS - frozen	1	x	x							
ASS1766.5		S	ASS - frozen	1	x	x							
ASS176.57		S	ASS - frozen	1	x	x							

ASS18 0 1		S	ASS - frozen	1	x	x							
ASS18 1 2		S	ASS - frozen	1	x	x							
ASS18 2 3		S	ASS - frozen	1	x	x							
ASS18 3 4		S	ASS - frozen	1	x	x							
ASS18 4 5		S	ASS - frozen	1	x	x							
ASS18 5 6		S	ASS - frozen	1	x	x							
ASS18 6 7		S	ASS - frozen	1	x	x							
ASS18 7 8		S	ASS - frozen	1	x	x							
ASS18 8 9		S	ASS - frozen	1	x	x							
ASS19 0 1		S	ASS - frozen	1	x	x							
ASS19 1 2		S	ASS - frozen	1	x	x							
ASS19 2 3		S	ASS - frozen	1	x	x							
ASS19 3 4		S	ASS - frozen	1	x	x							
ASS19 4 5		S	ASS - frozen	1	x	x							
ASS19 5 6		S	ASS - frozen	1	x	x							
ASS19 6 7		S	ASS - frozen	1	x	x							
ASS19 7 8		S	ASS - frozen	1	x	x							
ASS19 8 9		S	ASS - frozen	1	x	x							
ASS19 9 10		S	ASS - frozen	1	x	x							
ASS20 0 1		S	ASS - frozen	1	x	x							
ASS20 1 2		S	ASS - frozen	1	x	x							
ASS20 2 3		S	ASS - frozen	1	x	x							
ASS20 3 4		S	ASS - frozen	1	x	x							
ASS20 4 5		S	ASS - frozen	1	x	x							
ASS20 5 6		S	ASS - frozen	1	x	x							
ASS20 6 7		S	ASS - frozen	1	x	x							
ASS20 7 8		S	ASS - frozen	1	x	x							
ASS20 8 9		S	ASS - frozen	1	x	x							
ASS20 9 10		S	ASS - frozen	1	x	x							
ASS21 0 1		S	ASS - frozen	1	x	x							

ASS21 1 2		S	ASS - frozen	1	x	x							
ASS21 2 3		S	ASS - frozen	1	x	x							
ASS21 3 4		S	ASS - frozen	1	x	x							
ASS21 4 5		S	ASS - frozen	1	x	x							
ASS21 5 6		S	ASS - frozen	1	x	x							
ASS21 6 7		S	ASS - frozen	1	x	x							
ASS21 7 8		S	ASS - frozen	1	x	x							
ASS21 8 9		S	ASS - frozen	1	x	x							
ASS21 9 10		S	ASS - frozen	1	x	x							
ASS21 10 11		S	ASS - frozen	1	x	x							
ASS21 11 12		S	ASS - frozen	1	x	x							
ASS22 0 1		S	ASS - frozen	1	x	x							
ASS22 1 2		S	ASS - frozen	1	x	x							
ASS22 2 3		S	ASS - frozen	1	x	x							
ASS22 3 4		S	ASS - frozen	1	x	x							
ASS22 4 5		S	ASS - frozen	1	x	x							
ASS22 5 6		S	ASS - frozen	1	x	x							
ASS22 6 7		S	ASS - frozen	1	x	x							
ASS22 7 8		S	ASS - frozen	1	x	x							
ASS22 8 9		S	ASS - frozen	1	x	x							
ASS22 9 10		S	ASS - frozen	1	x	x							
ASS23 0 1		S	ASS - frozen	1	x	x							
ASS23 1 2		S	ASS - frozen	1	x	x							
ASS23 2 3		S	ASS - frozen	1	x	x							
ASS23 3 4		S	ASS - frozen	1	x	x							
ASS23 4 5		S	ASS - frozen	1	x	x							
ASS23 5 6		S	ASS - frozen	1	x	x							
ASS23 6 7		S	ASS - frozen	1	x	x							
ASS23 7 8		S	ASS - frozen	1	x	x							
ASS23 8 9		S	ASS - frozen	1	x	x							

ASS23 9 10		S	ASS - frozen	1	x	x							
------------	--	---	--------------	---	---	---	--	--	--	--	--	--	--

ASS24 0 1		S	ASS - frozen	1	x	x								
ASS24 1 2		S	ASS - frozen	1	x	x								
ASS24 2 3		S	ASS - frozen	1	x	x								
ASS24 3 4		S	ASS - frozen	1	x	x								
ASS24 4 5		S	ASS - frozen	1	x	x								
ASS24 5 6		S	ASS - frozen	1	x	x								
ASS24 6 7		S	ASS - frozen	1	x	x								
ASS24 7 8		S	ASS - frozen	1	x	x								
ASS24 8 9		S	ASS - frozen	1	x	x								
ASS24 9 10		S	ASS - frozen	1	x	x								
ASS24 10 11		S	ASS - frozen	1	x	x								
ASS24 11 12		S	ASS - frozen	1	x	x								
ASS25 0 1		S	ASS - frozen	1	x	x								
ASS25 1 2		S	ASS - frozen	1	x	x								
ASS25 2 3		S	ASS - frozen	1	x	x								
ASS25 3 4		S	ASS - frozen	1	x	x								
ASS25 4 5		S	ASS - frozen	1	x	x								
ASS25 5 6		S	ASS - frozen	1	x	x								
ASS25 6 7		S	ASS - frozen	1	x	x								
ASS25 7 8		S	ASS - frozen	1	x	x								
ASS25 8 9		S	ASS - frozen	1	x	x								
ASS25 9 10		S	ASS - frozen	1	x	x								
ASS26 0 1		S	ASS - frozen	1	x	x								
ASS26 1 2		S	ASS - frozen	1	x	x								
ASS26 2 3		S	ASS - frozen	1	x	x								
ASS26 3 4		S	ASS - frozen	1	x	x								
ASS26 4 4.4		S	ASS - frozen	1	x	x								
ASS26 4.4 5		S	ASS - frozen	1	x	x								
ASS26 5 6		S	ASS - frozen	1	x	x								
ASS26 6 7		S	ASS - frozen	1	x	x								

ASS26 7 7 7		S	ASS - frozen	1	x	x								
ASS26 7 7 8		S	ASS - frozen	1	x	x								
ASS26 8 9		S	ASS - frozen	1	x	x								
ASS26 9 10		S	ASS - frozen	1	x	x								
ASS26 10 11		S	ASS - frozen	1	x	x								
ASS27 0 1		S	ASS - frozen	1	x	x								
ASS27 1 2		S	ASS - frozen	1	x	x								
ASS27 2 3		S	ASS - frozen	1	x	x								
ASS27 3 4		S	ASS - frozen	1	x	x								
ASS27 4 5		S	ASS - frozen	1	x	x								
ASS27 5 6		S	ASS - frozen	1	x	x								
ASS27 6 7		S	ASS - frozen	1	x	x								
ASS27 7 8		S	ASS - frozen	1	x	x								
ASS27 8 9		S	ASS - frozen	1	x	x								
ASS27 9 10		S	ASS - frozen	1	x	x								
ASS27 10 11		S	ASS - frozen	1	x	x								
ASS27 11 12		S	ASS - frozen	1	x	x								
ASS27 12 13		S	ASS - frozen	1	x	x								
ASS28 0 1		S	ASS - frozen	1	x	x								
ASS28 1 2		S	ASS - frozen	1	x	x								
ASS28 2 3		S	ASS - frozen	1	x	x								
ASS28 3 4		S	ASS - frozen	1	x	x								
ASS28 4 5		S	ASS - frozen	1	x	x								
ASS28 5 6		S	ASS - frozen	1	x	x								
ASS28 6 7		S	ASS - frozen	1	x	x								
ASS28 7 8		S	ASS - frozen	1	x	x								

ASS29 0 1		S	ASS - frozen	1	x	x							
ASS29 1 2		S	ASS - frozen	1	x	x							
ASS29 2 3		S	ASS - frozen	1	x	x							
ASS29 3 4		S	ASS - frozen	1	x	x							
ASS29 4 5		S	ASS - frozen	1	x	x							
ASS29 5 6		S	ASS - frozen	1	x	x							
ASS29 6 7		S	ASS - frozen	1	x	x							
ASS29 7 8		S	ASS - frozen	1	x	x							
ASS29 8 9		S	ASS - frozen	1	x	x							
ASS29 9 10		S	ASS - frozen	1	x	x							
ASS29 10 11		S	ASS - frozen	1	x	x							
ASS30 0 2		S	ASS - frozen	1	x	x							
ASS30 2 3		S	ASS - frozen	1	x	x							
ASS30 3 4		S	ASS - frozen	1	x	x							
ASS30 4 5		S	ASS - frozen	1	x	x							
ASS30 5 6		S	ASS - frozen	1	x	x							
ASS30 6 7		S	ASS - frozen	1	x	x							
ASS30 7 8		S	ASS - frozen	1	x	x							
ASS30 8 9		S	ASS - frozen	1	x	x							
ASS31 0 1		S	ASS - frozen	1	x	x							
ASS31 1 2		S	ASS - frozen	1	x	x							
ASS31 2 3.5		S	ASS - frozen	1	x	x							
ASS31 3.5 4		S	ASS - frozen	1	x	x							
ASS31 4 5		S	ASS - frozen	1	x	x							
ASS31 5 6		S	ASS - frozen	1	x	x							
ASS31 6 7		S	ASS - frozen	1	x	x							
ASS31 7 8		S	ASS - frozen	1	x	x							
ASS31 8 9		S	ASS - frozen	1	x	x							
ASS31 9 10		S	ASS - frozen	1	x	x							
ASS31 10 11		S	ASS - frozen	1	x	x							

ASS31 11 12	S	ASS - frozen	1	x	x							
TOTAL			245									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
 V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
 Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CERTIFICATE OF ANALYSIS

Work Order : EP2114249
Client : The Trustee for Mine Earth Unit Trust
Contact : [REDACTED]
Address : [REDACTED]
Telephone : [REDACTED]
Project : ATS-2104 Atlas Project ASS
Order number : ----
C-O-C number : ----
Sampler : Image Resources
Site : ----
Quote number : EP/378/21
No. of samples received : 86
No. of samples analysed : 86

Page : 1 of 20
Laboratory : Environmental Division Perth

Date Samples Received : 22-Nov-2021 11:10
Date Analysis Commenced : 26-Nov-2021
Issue Date : 29-Nov-2021 11:07

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
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General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

~ = Indicates an estimated value.

- ASS: EA037 (Rapid Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- EA037 ASS Field Screening: NATA accreditation does not cover performance of this service.



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS24 0 1	ASS24 1 2	ASS24 2 3	ASS24 3 4	ASS24 4 5
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-001	EP2114249-002	EP2114249-003	EP2114249-004	EP2114249-005
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.3	7.9	4.4	6.0	6.2
pH (Fox)	----	0.1	pH Unit	4.4	6.2	1.9	3.1	4.4
Reaction Rate	----	1	-	Moderate	Slight	Moderate	Moderate	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS24 5 6	ASS24 6 7	ASS24 7 8	ASS24 8 9	ASS24 9 10
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-006	EP2114249-007	EP2114249-008	EP2114249-009	EP2114249-010
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.0	6.2	5.6	4.6	6.3
pH (Fox)	----	0.1	pH Unit	3.7	3.2	2.8	2.2	4.0
Reaction Rate	----	1	-	Strong	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS24 10 11	ASS24 11 12	ASS25 0 1	ASS25 1 2	ASS25 2 3
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-011	EP2114249-012	EP2114249-013	EP2114249-014	EP2114249-015
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.6	6.6	6.3	7.0	7.4
pH (Fox)	----	0.1	pH Unit	3.6	4.3	4.3	4.6	4.8
Reaction Rate	----	1	-	Strong	Strong	Moderate	Moderate	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS25 3 4	ASS25 4 5	ASS25 5 6	ASS25 6 7	ASS25 7 8
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-016	EP2114249-017	EP2114249-018	EP2114249-019	EP2114249-020
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.6	7.5	6.5	6.2	5.9
pH (Fox)	----	0.1	pH Unit	4.8	4.9	4.8	4.8	4.4
Reaction Rate	----	1	-	Moderate	Moderate	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS25 8 9	ASS25 9 10	ASS26 0 1	ASS26 1 2	ASS26 2 3
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-021	EP2114249-022	EP2114249-023	EP2114249-024	EP2114249-025
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.2	7.1	6.2	6.0	6.3
pH (Fox)	----	0.1	pH Unit	5.3	5.3	4.4	5.0	5.2
Reaction Rate	----	1	-	Strong	Strong	Moderate	Slight	Slight



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS26 3 4	ASS26 4 4.4	ASS26 4.4 5	ASS26 5 6	ASS26 6 7
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-026	EP2114249-027	EP2114249-028	EP2114249-029	EP2114249-030
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.0	6.0	6.7	6.8	7.0
pH (Fox)	----	0.1	pH Unit	5.2	4.9	4.7	4.7	3.7
Reaction Rate	----	1	-	Slight	Slight	Slight	Slight	Moderate



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS26 7 7.7	ASS26 7.7 8	ASS26 8 9	ASS26 9 10	ASS26 10 11
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-031	EP2114249-032	EP2114249-033	EP2114249-034	EP2114249-035
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.0	6.2	6.7	6.0	5.8
pH (Fox)	----	0.1	pH Unit	2.9	3.7	3.1	3.3	4.0
Reaction Rate	----	1	-	Moderate	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS27 0 1	ASS27 1 2	ASS27 2 3	ASS27 3 4	ASS27 4 5
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-036	EP2114249-037	EP2114249-038	EP2114249-039	EP2114249-040
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	5.2	5.7	5.9	5.9	5.7
pH (Fox)	----	0.1	pH Unit	4.0	4.7	4.9	4.8	5.0
Reaction Rate	----	1	-	Moderate	Slight	Slight	Slight	Slight



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS27 5 6	ASS27 6 7	ASS27 7 8	ASS27 8 9	ASS27 9 10
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-041	EP2114249-042	EP2114249-043	EP2114249-044	EP2114249-045
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	4.6	5.1	5.7	6.2	5.9
pH (Fox)	----	0.1	pH Unit	2.3	2.2	3.1	2.7	3.5
Reaction Rate	----	1	-	Moderate	Slight	Moderate	Strong	Strong

Page : 12 of 20
 Work Order : EP2114249
 Client : The Trustee for Mine Earth Unit Trust
 Project : ATS-2104 Atlas Project ASS



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS27 10 11	ASS27 11 12	ASS27 12 13	ASS28 0 1	ASS28 1 2
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-046	EP2114249-047	EP2114249-048	EP2114249-049	EP2114249-050
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	5.7	5.8	6.2	5.9	6.0
pH (Fox)	----	0.1	pH Unit	3.5	2.9	3.5	4.2	4.4
Reaction Rate	----	1	-	Strong	Moderate	Strong	Moderate	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS28 2 3	ASS28 3 4	ASS28 4 5	ASS28 5 6	ASS28 6 7
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-051	EP2114249-052	EP2114249-053	EP2114249-054	EP2114249-055
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.2	5.9	6.3	6.1	7.6
pH (Fox)	----	0.1	pH Unit	5.7	4.7	4.2	4.2	4.2
Reaction Rate	----	1	-	Moderate	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS28 7 8	ASS29 0 1	ASS29 2 3	ASS29 3 4	ASS29 4 5
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-056	EP2114249-057	EP2114249-058	EP2114249-059	EP2114249-060
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	7.7	6.8	5.2	6.7	5.1
pH (Fox)	----	0.1	pH Unit	3.6	4.3	2.9	4.5	2.8
Reaction Rate	----	1	-	Strong	Moderate	Extreme	Strong	Strong



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS29 5 6	ASS29 6 7	ASS29 7 8	ASS29 8 9	ASS29 9 10
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-061	EP2114249-062	EP2114249-063	EP2114249-064	EP2114249-065
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.0	6.0	5.7	6.4	6.0
pH (Fox)	----	0.1	pH Unit	3.3	2.7	2.6	4.8	3.9
Reaction Rate	----	1	-	Strong	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS29 10 11	ASS30 0 2	ASS30 2 3	ASS30 3 4	ASS30 4 5
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-066	EP2114249-067	EP2114249-068	EP2114249-069	EP2114249-070
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.3	6.1	6.3	6.3	6.7
pH (Fox)	----	0.1	pH Unit	3.1	4.1	4.5	4.7	5.0
Reaction Rate	----	1	-	Strong	Moderate	Moderate	Moderate	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS30 5 6	ASS30 6 7	ASS30 7 8	ASS30 8 9	ASS31 0 1
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-071	EP2114249-072	EP2114249-073	EP2114249-074	EP2114249-075
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.2	6.0	6.6	5.9	6.0
pH (Fox)	----	0.1	pH Unit	3.4	3.5	4.4	4.3	4.1
Reaction Rate	----	1	-	Slight	Slight	Strong	Strong	Moderate



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS31 1 2	ASS31 2 3.5	ASS31 3.5 4	ASS31 4 5	ASS31 5 6
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-076	EP2114249-077	EP2114249-078	EP2114249-079	EP2114249-080
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	5.7	6.2	4.2	4.8	6.0
pH (Fox)	----	0.1	pH Unit	4.6	2.6	2.4	2.2	2.9
Reaction Rate	----	1	-	Moderate	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS31 6 7	ASS31 7 8	ASS31 8 9	ASS31 9 10	ASS31 10 11
Sampling date / time				[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]	[17-Nov-2021]
Compound	CAS Number	LOR	Unit	EP2114249-081	EP2114249-082	EP2114249-083	EP2114249-084	EP2114249-085
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	5.8	6.2	6.1	6.2	6.2
pH (Fox)	----	0.1	pH Unit	2.5	2.8	2.4	2.6	2.4
Reaction Rate	----	1	-	Strong	Strong	Strong	Strong	Strong



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Sample ID

				ASS31 11 12	----	----	----	----
				[17-Nov-2021]	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2114249-086	-----	-----	-----	-----
				Result	----	----	----	----
EA037: Ass Field Screening Analysis								
pH (F)	----	0.1	pH Unit	6.2	----	----	----	----
pH (Fox)	----	0.1	pH Unit	2.3	----	----	----	----
Reaction Rate	----	1	-	Strong	----	----	----	----



Environmental

QUALITY CONTROL REPORT

Work Order : EP2114249

Page : 1 of 3

Client : The Trustee for Mine Earth Unit Trust

Laboratory : Environmental Division Perth

Contact

Address

Telephone

Project : ATS-2104 Atlas Project ASS

Order number : ----

C-O-C number : ----

Sampler : Image Resources

Site : ----

Quote number : EP/378/21

No. of samples received : 86

No. of samples analysed : 86

Date Samples Received : 22-Nov-2021

Date Analysis Commenced : 26-Nov-2021

Issue Date : 29-Nov-2021

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories

Position

Accreditation Category



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA037: Ass Field Screening Analysis (QC Lot: 4043213)									
EP2114249-001	ASS24 0 1	EA037: pH (F)	----	0.1	pH Unit	6.3	6.3	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	4.4	4.5	0.0	0% - 20%
EP2114249-010	ASS24 9 10	EA037: pH (F)	----	0.1	pH Unit	6.3	6.4	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	4.0	3.9	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4043214)									
EP2114249-021	ASS25 8 9	EA037: pH (F)	----	0.1	pH Unit	7.2	7.2	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	5.3	5.3	0.0	0% - 20%
EP2114249-030	ASS26 6 7	EA037: pH (F)	----	0.1	pH Unit	7.0	6.9	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	3.7	3.7	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4043215)									
EP2114249-041	ASS27 5 6	EA037: pH (F)	----	0.1	pH Unit	4.6	4.7	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.3	2.4	0.0	0% - 20%
EP2114249-050	ASS28 1 2	EA037: pH (F)	----	0.1	pH Unit	6.0	6.0	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	4.4	4.3	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4043216)									
EP2114249-061	ASS29 5 6	EA037: pH (F)	----	0.1	pH Unit	6.0	6.1	1.7	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	3.3	3.3	0.0	0% - 20%
EP2114249-070	ASS30 4 5	EA037: pH (F)	----	0.1	pH Unit	6.7	6.6	0.0	0% - 20%
		EA037 pH (Fox)	----	0.1	pH Unit	5.0	5.0	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4043217)									
EP2114249-081	ASS31 6 7	EA037: pH (F)	----	0.1	pH Unit	5.8	5.8	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.5	2.5	0.0	0% - 20%



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

- **No Method Blank (MB) or Laboratory Control Spike (LCS) Results are required to be reported.**

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**
-

QA/QC Compliance Assessment to assist with Quality Review

Work Order : EP2114249

Page : 1 of 6

Client : Earth Unit Trust

Laboratory : Environmental Division Perth

Contact : [REDACTED]

Project : [REDACTED] ASS

Site : ----

Date Samples Received : 22-Nov-2021

Issue Date : 29-Nov-2021

Sampler : Image Resources

No. of samples received : 86

Order number : ----

No. of samples analysed : 86

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA037: Ass Field Screening Analysis							
Snap Lock Bag - frozen (EA037)							



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA037: Ass Field Screening Analysis - Continued								
ASS24 0 1, ASS24 2 3, ASS24 4 5, ASS24 6 7, ASS24 8 9, ASS24 10 11, ASS25 0 1, ASS25 2 3, ASS25 4 5, ASS25 6 7, ASS25 8 9, ASS26 0 1, ASS26 2 3, ASS26 4 4.4, ASS26 5 6, ASS26 7 7.7, ASS26 8 9, ASS26 10 11, ASS27 1 2, ASS27 3 4, ASS27 5 6, ASS27 7 8, ASS27 9 10, ASS27 11 12, ASS28 0 1, ASS28 2 3, ASS28 4 5, ASS28 6 7, ASS29 0 1, ASS29 3 4, ASS29 5 6, ASS29 7 8, ASS29 9 10, ASS30 0 2, ASS30 3 4, ASS30 5 6, ASS30 7 8, ASS31 0 1, ASS31 2 3.5, ASS31 4 5, ASS31 6 7,	ASS24 1 2, ASS24 3 4, ASS24 5 6, ASS24 7 8, ASS24 9 10, ASS24 11 12, ASS25 1 2, ASS25 3 4, ASS25 5 6, ASS25 7 8, ASS25 9 10, ASS26 1 2, ASS26 3 4, ASS26 4.4 5, ASS26 6 7, ASS26 7.7 8, ASS26 9 10, ASS27 0 1, ASS27 2 3, ASS27 4 5, ASS27 6 7, ASS27 8 9, ASS27 10 11, ASS27 12 13, ASS28 1 2, ASS28 3 4, ASS28 5 6, ASS28 7 8, ASS29 2 3, ASS29 4 5, ASS29 6 7, ASS29 8 9, ASS29 10 11, ASS30 2 3, ASS30 4 5, ASS30 6 7, ASS30 8 9, ASS31 1 2, ASS31 3.5 4, ASS31 5 6, ASS31 7 8,	17-Nov-2021	26-Nov-2021	16-May-2022	✔	26-Nov-2021	16-May-2022	✔



Matrix: SOIL

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA037: Ass Field Screening Analysis - Continued								
ASS31 8 9,	ASS31 9 10,							
ASS31 10 11,	ASS31 11 12							



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL** Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification	
Analytical Methods	Method	QC	Regular	Actual	Expected		Evaluation
Laboratory Duplicates (DUP)							
ASS Field Screening Analysis	EA037	9	86	10.47	10.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
ASS Field Screening Analysis	EA037	SOIL	In house: Referenced to Acid Sulfate Soils Laboratory Methods Guidelines. As received samples are tested for pH field and pH fox and assessed for a reaction rating.

Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house



CHAIN OF CUSTODY

ALS Laboratory:
please tick →

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Ph: 02 4423 2000 E: murrumbidgee@als.com.au
MURUMBidgee 100-1000 Road Murrumbidgee NSW 2571
Ph: 02 4423 2000 E: murrumbidgee@als.com.au

CLIENT: Mine Earth	TURNAROUND REQUIREMENTS: <input checked="" type="checkbox"/> Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	FOR LABORATORY USE ONLY (Circle)	
OFFICE: Perth	<input type="checkbox"/> Non Standard or urgent TAT (List due date):	Custody Seal: Intact? Yes No N/A	
PROJECT: ATS-2104 Atlas Project ASS	ALS QUOTE NO.: EP/378/21	Free ice / frozen ice blocks present upon receipt? Yes No N/A	
ORDER NUMBER:		Random Sample Temperature on Receipt: °C	
PROJECT MANAGER: Matt Braimbridge	CONTACT PH: 0407 086 443	Other comment:	
SAMPLER: Image Resources	SAMPLER MOBILE:	RECEIVED BY: ND	
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	RELINQUISHED BY:	
Email Reports to (will default to PM if no other addresses are listed): matt@mineearth.com.au		RECEIVED BY:	
Email Invoice to (will default to PM if no other addresses are listed): matt@mineearth.com.au		DATE/TIME: 22/11/21 11:10	

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

All Samples to remain frozen until Suite 1 ASS Field Screening.
All remaining sample to be kept frozen for subsequent Suite 2 analysis.
Samples for Suite 2 analysis to be identified following Suite 1 analysis.
All remaining samples to be returned to Mine Earth following Suite 2 analysis

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB, Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).										Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <i>to codes below</i>	(refer	TOTAL CONTAINERS	Suite 1 Drying (EN020D)	Suite 1 ASS Field Screening (EA037)									Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	ASS06 0 1		S	ASS - frozen		1	x	x									<div>Environmental D Perth</div> <div>Work Order Ref EP2114</div> <div></div> <div>Telephone : - 61-8-9406</div>
	ASS06 1 1.3		S	ASS - frozen		1	x	x									
	ASS06 1.3 2		S	ASS - frozen		1	x	x									
	ASS06 2 3		S	ASS - frozen		1	x	x									
	ASS06 3 4		S	ASS - frozen		1	x	x									
	ASS06 5 6		S	ASS - frozen		1	x	x									
	ASS06 6 7		S	ASS - frozen		1	x	x									
	ASS07 0 2		S	ASS - frozen		1	x	x									
	ASS07 2 3		S	ASS - frozen		1	x	x									
	ASS07 3 4		S	ASS - frozen		1	x	x									
	ASS07 4 5		S	ASS - frozen		1	x	x									
	ASS07 5 6		S	ASS - frozen		1	x	x									
	ASS07 6 6.6		S	ASS - frozen		1	x	x									

Environmental Division
Perth
Work Order Reference
EP2114249



Telephone : - 61-8-9406 1301

ASS07 6.6 7		S	ASS - frozen	1	x	x								
ASS08 0 1		S	ASS - frozen	1	x	x								
ASS08 1 2		S	ASS - frozen	1	x	x								
ASS08 2 3		S	ASS - frozen	1	x	x								
ASS08 3 4		S	ASS - frozen	1	x	x								
ASS08 4 5		S	ASS - frozen	1	x	x								
ASS08 5 6		S	ASS - frozen	1	x	x								
ASS08 6 7		S	ASS - frozen	1	x	x								
ASS08 7 8		S	ASS - frozen	1	x	x								
ASS08 8 9		S	ASS - frozen	1	x	x								
ASS09 0 2.4		S	ASS - frozen	1	x	x								
ASS09 2.4 3		S	ASS - frozen	1	x	x								
ASS09 3 4		S	ASS - frozen	1	x	x								
ASS09 4 5		S	ASS - frozen	1	x	x								
ASS09 5 6		S	ASS - frozen	1	x	x								
ASS09 6 7		S	ASS - frozen	1	x	x								
ASS09 7 8		S	ASS - frozen	1	x	x								

ASS10 0 1		S	ASS - frozen	1	x	x								
ASS10 1 2		S	ASS - frozen	1	x	x								
ASS10 2 3		S	ASS - frozen	1	x	x								
ASS10 3 4		S	ASS - frozen	1	x	x								
ASS10 4 5		S	ASS - frozen	1	x	x								
ASS10 5 6		S	ASS - frozen	1	x	x								
ASS10 6 7		S	ASS - frozen	1	x	x								
ASS11 0 1		S	ASS - frozen	1	x	x								
ASS11 1 2		S	ASS - frozen	1	x	x								
ASS11 2 3		S	ASS - frozen	1	x	x								
ASS11 3 4		S	ASS - frozen	1	x	x								
ASS11 4 5		S	ASS - frozen	1	x	x								
ASS11 5 6		S	ASS - frozen	1	x	x								
ASS11 6 7		S	ASS - frozen	1	x	x								
ASS11 7 7.5		S	ASS - frozen	1	x	x								
ASS11 7.5 8		S	ASS - frozen	1	x	x								
ASS12 0 1		S	ASS - frozen	1	x	x								
ASS12 1 1.7		S	ASS - frozen	1	x	x								
ASS12 1.7 3		S	ASS - frozen	1	x	x								
ASS12 3 4		S	ASS - frozen	1	x	x								
ASS12 4 4.7		S	ASS - frozen	1	x	x								
ASS12 4.7 5.7		S	ASS - frozen	1	x	x								
ASS12 5.7 7		S	ASS - frozen	1	x	x								
ASS12 7 8.5		S	ASS - frozen	1	x	x								
ASS12 8.5 9		S	ASS - frozen	1	x	x								
ASS13 0 1		S	ASS - frozen	1	x	x								
ASS13 1 2		S	ASS - frozen	1	x	x								
ASS13 2 3		S	ASS - frozen	1	x	x								
ASS13 3 4		S	ASS - frozen	1	x	x								
ASS13 4 5		S	ASS - frozen	1	x	x								

ASS13 5 6		S	ASS - frozen	1	x	x							
ASS13 6 6.5		S	ASS - frozen	1	x	x							
ASS13 6.5 7		S	ASS - frozen	1	x	x							
ASS13 7 8		S	ASS - frozen	1	x	x							

ASS14 0 0.8		S	ASS - frozen	1	x	x								
ASS14 0.8 2		S	ASS - frozen	1	x	x								
ASS14 2 3.2		S	ASS - frozen	1	x	x								
ASS14 3.2 4		S	ASS - frozen	1	x	x								
ASS14 4 5		S	ASS - frozen	1	x	x								
ASS14 5 6		S	ASS - frozen	1	x	x								
ASS14 6 7		S	ASS - frozen	1	x	x								
ASS14 7 8		S	ASS - frozen	1	x	x								
ASS14 8 9		S	ASS - frozen	1	x	x								
ASS15 0 1		S	ASS - frozen	1	x	x								
ASS15 1 1.7		S	ASS - frozen	1	x	x								
ASS15 1.7 2		S	ASS - frozen	1	x	x								
ASS15 2 3		S	ASS - frozen	1	x	x								
ASS15 3 4		S	ASS - frozen	1	x	x								
ASS15 4 5		S	ASS - frozen	1	x	x								
ASS15 5 6		S	ASS - frozen	1	x	x								
ASS15 6 7		S	ASS - frozen	1	x	x								
ASS15 7 8		S	ASS - frozen	1	x	x								
ASS16 0 1		S	ASS - frozen	1	x	x								
ASS16 1 2		S	ASS - frozen	1	x	x								
ASS16 2 3		S	ASS - frozen	1	x	x								
ASS16 3 4		S	ASS - frozen	1	x	x								
ASS16 4 5		S	ASS - frozen	1	x	x								
ASS16 5 6		S	ASS - frozen	1	x	x								
ASS16 6 7		S	ASS - frozen	1	x	x								
ASS17 0 1.6		S	ASS - frozen	1	x	x								
ASS17 1.6 2		S	ASS - frozen	1	x	x								
ASS17 2 3		S	ASS - frozen	1	x	x								
ASS17 3 4		S	ASS - frozen	1	x	x								
ASS17 4 5		S	ASS - frozen	1	x	x								

ASS17 5 6		S	ASS - frozen	1	x	x								
ASS17 6 6.5		S	ASS - frozen	1	x	x								
ASS17 6.5 7		S	ASS - frozen	1	x	x								

ASS18 0 1		S	ASS - frozen	1	x	x								
ASS18 1 2		S	ASS - frozen	1	x	x								
ASS18 2 3		S	ASS - frozen	1	x	x								
ASS18 3 4		S	ASS - frozen	1	x	x								
ASS18 4 5		S	ASS - frozen	1	x	x								
ASS18 5 6		S	ASS - frozen	1	x	x								
ASS18 6 7		S	ASS - frozen	1	x	x								
ASS18 7 8		S	ASS - frozen	1	x	x								
ASS18 8 9		S	ASS - frozen	1	x	x								
ASS19 0 1		S	ASS - frozen	1	x	x								
ASS19 1 2		S	ASS - frozen	1	x	x								
ASS19 2 3		S	ASS - frozen	1	x	x								
ASS19 3 4		S	ASS - frozen	1	x	x								
ASS19 4 5		S	ASS - frozen	1	x	x								
ASS19 5 6		S	ASS - frozen	1	x	x								
ASS19 6 7		S	ASS - frozen	1	x	x								
ASS19 7 8		S	ASS - frozen	1	x	x								
ASS19 8 9		S	ASS - frozen	1	x	x								
ASS19 9 10		S	ASS - frozen	1	x	x								
ASS20 0 1		S	ASS - frozen	1	x	x								
ASS20 1 2		S	ASS - frozen	1	x	x								
ASS20 2 3		S	ASS - frozen	1	x	x								
ASS20 3 4		S	ASS - frozen	1	x	x								
ASS20 4 5		S	ASS - frozen	1	x	x								
ASS20 5 6		S	ASS - frozen	1	x	x								
ASS20 6 7		S	ASS - frozen	1	x	x								
ASS20 7 8		S	ASS - frozen	1	x	x								
ASS20 8 9		S	ASS - frozen	1	x	x								
ASS20 9 10		S	ASS - frozen	1	x	x								
ASS21 0 1		S	ASS - frozen	1	x	x								

ASS21 1 2		S	ASS - frozen	1	x	x								
ASS21 2 3		S	ASS - frozen	1	x	x								
ASS21 3 4		S	ASS - frozen	1	x	x								
ASS21 4 5		S	ASS - frozen	1	x	x								
ASS21 5 6		S	ASS - frozen	1	x	x								
ASS21 6 7		S	ASS - frozen	1	x	x								
ASS21 7 8		S	ASS - frozen	1	x	x								
ASS21 8 9		S	ASS - frozen	1	x	x								
ASS21 9 10		S	ASS - frozen	1	x	x								
ASS21 10 11		S	ASS - frozen	1	x	x								
ASS21 11 12		S	ASS - frozen	1	x	x								
ASS22 0 1		S	ASS - frozen	1	x	x								
ASS22 1 2		S	ASS - frozen	1	x	x								
ASS22 2 3		S	ASS - frozen	1	x	x								
ASS22 3 4		S	ASS - frozen	1	x	x								
ASS22 4 5		S	ASS - frozen	1	x	x								
ASS22 5 6		S	ASS - frozen	1	x	x								
ASS22 6 7		S	ASS - frozen	1	x	x								
ASS22 7 8		S	ASS - frozen	1	x	x								
ASS22 8 9		S	ASS - frozen	1	x	x								
ASS22 9 10		S	ASS - frozen	1	x	x								
ASS23 0 1		S	ASS - frozen	1	x	x								
ASS23 1 2		S	ASS - frozen	1	x	x								
ASS23 2 3		S	ASS - frozen	1	x	x								
ASS23 3 4		S	ASS - frozen	1	x	x								
ASS23 4 5		S	ASS - frozen	1	x	x								
ASS23 5 6		S	ASS - frozen	1	x	x								
ASS23 6 7		S	ASS - frozen	1	x	x								
ASS23 7 8		S	ASS - frozen	1	x	x								
ASS23 8 9		S	ASS - frozen	1	x	x								

	ASS23 9 10		S	ASS - frozen	1	x	x							
--	------------	--	---	--------------	---	---	---	--	--	--	--	--	--	--

1	ASS24 0 1		S	ASS - frozen	1	x	x								
2	ASS24 1 2		S	ASS - frozen	1	x	x								
3	ASS24 2 3		S	ASS - frozen	1	x	x								
4	ASS24 3 4		S	ASS - frozen	1	x	x								
5	ASS24 4 5		S	ASS - frozen	1	x	x								
6	ASS24 5 6		S	ASS - frozen	1	x	x								
7	ASS24 6 7		S	ASS - frozen	1	x	x								
8	ASS24 7 8		S	ASS - frozen	1	x	x								
9	ASS24 8 9		S	ASS - frozen	1	x	x								
10	ASS24 9 10		S	ASS - frozen	1	x	x								
11	ASS24 10 11		S	ASS - frozen	1	x	x								
12	ASS24 11 12		S	ASS - frozen	1	x	x								
13	ASS25 0 1		S	ASS - frozen	1	x	x								
14	ASS25 1 2		S	ASS - frozen	1	x	x								
15	ASS25 2 3		S	ASS - frozen	1	x	x								
16	ASS25 3 4		S	ASS - frozen	1	x	x								
17	ASS25 4 5		S	ASS - frozen	1	x	x								
18	ASS25 5 6		S	ASS - frozen	1	x	x								
19	ASS25 6 7		S	ASS - frozen	1	x	x								
20	ASS25 7 8		S	ASS - frozen	1	x	x								
21	ASS25 8 9		S	ASS - frozen	1	x	x								
22	ASS25 9 10		S	ASS - frozen	1	x	x								
23	ASS26 0 1		S	ASS - frozen	1	x	x								
24	ASS26 1 2		S	ASS - frozen	1	x	x								
25	ASS26 2 3		S	ASS - frozen	1	x	x								
26	ASS26 3 4		S	ASS - frozen	1	x	x								
27	ASS26 4 4.4		S	ASS - frozen	1	x	x								
28	ASS26 4.4 5		S	ASS - frozen	1	x	x								
29	ASS26 5 6		S	ASS - frozen	1	x	x								
30	ASS26 6 7		S	ASS - frozen	1	x	x								

31	ASS26 7 7.7		S	ASS - frozen	1	x	x							
32	ASS26 7.7 8		S	ASS - frozen	1	x	x							
33	ASS26 8 9		S	ASS - frozen	1	x	x							
34	ASS26 9 10		S	ASS - frozen	1	x	x							
35	ASS26 10 11		S	ASS - frozen	1	x	x							
36	ASS27 0 1		S	ASS - frozen	1	x	x							
37	ASS27 1 2		S	ASS - frozen	1	x	x							
38	ASS27 2 3		S	ASS - frozen	1	x	x							
39	ASS27 3 4		S	ASS - frozen	1	x	x							
40	ASS27 4 5		S	ASS - frozen	1	x	x							
41	ASS27 5 6		S	ASS - frozen	1	x	x							
42	ASS27 6 7		S	ASS - frozen	1	x	x							
43	ASS27 7 8		S	ASS - frozen	1	x	x							
44	ASS27 8 9		S	ASS - frozen	1	x	x							
45	ASS27 9 10		S	ASS - frozen	1	x	x							
46	ASS27 10 11		S	ASS - frozen	1	x	x							
47	ASS27 11 12		S	ASS - frozen	1	x	x							
48	ASS27 12 13		S	ASS - frozen	1	x	x							
49	ASS28 0 1		S	ASS - frozen	1	x	x							
50	ASS28 1 2		S	ASS - frozen	1	x	x							
51	ASS28 2 3		S	ASS - frozen	1	x	x							
52	ASS28 3 4		S	ASS - frozen	1	x	x							
53	ASS28 4 5		S	ASS - frozen	1	x	x							
54	ASS28 5 6		S	ASS - frozen	1	x	x							
55	ASS28 6 7		S	ASS - frozen	1	x	x							
56	ASS28 7 8		S	ASS - frozen	1	x	x							

57	ASS29 0 1		S	ASS - frozen	1	x	x							
SNR	ASS29 1 2		S	ASS - frozen	1	x	x							
58	ASS29 2 3		S	ASS - frozen	1	x	x							
59	ASS29 3 4		S	ASS - frozen	1	x	x							
60	ASS29 4 5		S	ASS - frozen	1	x	x							
61	ASS29 5 6		S	ASS - frozen	1	x	x							
62	ASS29 6 7		S	ASS - frozen	1	x	x							
63	ASS29 7 8		S	ASS - frozen	1	x	x							
64	ASS29 8 9		S	ASS - frozen	1	x	x							
65	ASS29 9 10		S	ASS - frozen	1	x	x							
66	ASS29 10 11		S	ASS - frozen	1	x	x							
67	ASS30 0 2		S	ASS - frozen	1	x	x							
68	ASS30 2 3		S	ASS - frozen	1	x	x							
69	ASS30 3 4		S	ASS - frozen	1	x	x							
70	ASS30 4 5		S	ASS - frozen	1	x	x							
71	ASS30 5 6		S	ASS - frozen	1	x	x							
72	ASS30 6 7		S	ASS - frozen	1	x	x							
73	ASS30 7 8		S	ASS - frozen	1	x	x							
74	ASS30 8 9		S	ASS - frozen	1	x	x							
75	ASS31 0 1		S	ASS - frozen	1	x	x							
76	ASS31 1 2		S	ASS - frozen	1	x	x							
77	ASS31 2 3.5		S	ASS - frozen	1	x	x							
78	ASS31 3.5 4		S	ASS - frozen	1	x	x							
79	ASS31 4 5		S	ASS - frozen	1	x	x							
80	ASS31 5 6		S	ASS - frozen	1	x	x							
81	ASS31 6 7		S	ASS - frozen	1	x	x							
82	ASS31 7 8		S	ASS - frozen	1	x	x							
83	ASS31 8 9		S	ASS - frozen	1	x	x							
84	ASS31 9 10		S	ASS - frozen	1	x	x							
85	ASS31 10 11		S	ASS - frozen	1	x	x							

86	ASS31 11 12		S	ASS - frozen	1	x	x							
TOTAL					245									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CERTIFICATE OF ANALYSIS

Work Order : EP2114643
Client : The Trustee for Mine Earth Unit Trust
Contact : [REDACTED]
Address : [REDACTED]
Telephone : [REDACTED]
Project : ATS-2104 Atlas Project ASS
Order number : —
C-O-C number : —
Sampler : Image Resources
Site : —
Quote number : EP/378/21
No. of samples received : 72
No. of samples analysed : 72

Page : 1 of 17
Laboratory : Environmental Division Perth

Date Samples Received : 22-Nov-2021 11:10
Date Analysis Commenced : 02-Dec-2021
Issue Date : 10-Dec-2021 17:41



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories

Position

Accreditation Category

[REDACTED]

[REDACTED]

[REDACTED]



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- This workorder is a rebatch of EP2114243, EP2114246, and EP2114249.
- ASS: EA033 (CRS Suite): Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): ANC not required for particular samples because pH KCl less than 6.5
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO_3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m³ in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m³'.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ASS07 0 2	ASS07 2 3	ASS08 1 2	ASS08 5 6	ASS08 8 9
Sampling date / time					17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit		EP2114643-001	EP2114643-002	EP2114643-003	EP2114643-004	EP2114643-005
					Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		9.2	6.0	7.2	8.0	5.9
Titrateable Actual Acidity (23F)	----	2	mole H+ / t		<2	2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		0.022	0.204	0.006	0.011	0.017
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		14	127	10	10	10
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)		0.01	% CaCO3		5.07	----	0.10	<0.01	----
acidity - Acid Neutralising Capacity (a-19A2)		10	mole H+ / t		1010	----	20	<10	----
sulfidic - Acid Neutralising Capacity (s-19A2)		0.01	% pyrite S		1.62	----	0.03	<0.01	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S		<0.02	0.21	<0.02	<0.02	0.02
Net Acidity (acidity units)	----	10	mole H+ / t		<10	129	<10	<10	10
Liming Rate	----	1	kg CaCO3/t		<1	10	<1	1	1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		0.02	0.21	<0.02	<0.02	0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		14	129	<10	<10	10
Liming Rate excluding ANC	----	1	kg CaCO3/t		1	10	<1	1	1



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS09 3 4	ASS10 2 3	ASS11 5 6	ASS11 7.5 8	ASS12 5.7 7
Sampling date / time				17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit	EP2114643-006	EP2114643-007	EP2114643-008	EP2114643-009	EP2114643-010
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	8.9	7.4	6.5	6.6	6.2
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.005	0.008	0.006	0.006	0.014
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	10	10	10	10	10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)		0.01	% CaCO3	0.20	0.03	<0.01	0.03	----
acidity - Acid Neutralising Capacity (a-19A2)		10	mole H+ / t	41	<10	<10	<10	----
sulfidic - Acid Neutralising Capacity (s-19A2)		0.01	% pyrite S	0.07	0.01	<0.01	0.01	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	<1	<1	1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ASS12 7 8.5	ASS13 0 1	ASS13 4 5	ASS13 6.5 7	ASS15 0 1
Sampling date / time					17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit		EP2114643-011	EP2114643-012	EP2114643-013	EP2114643-014	EP2114643-015
				Result	Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		6.8	6.0	6.5	6.1	6.4
Titratable Actual Acidity (23F)	----	2	mole H+ / t		<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		0.010	<0.005	<0.005	0.008	<0.005
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		10	10	10	10	10
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3		<0.01	----	<0.01	----	----
acidity - Acid Neutralising Capacity (a-19A2)		10	mole H+ / t		<10	----	<10	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)		0.01	% pyrite S		<0.01	----	<0.01	----	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t		<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	<10	<10	<10	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS16 2 3	ASS16 6 7	ASS17 5 6	ASS18 3 4	ASS18 5 6
Sampling date / time				17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit	EP2114643-016	EP2114643-017	EP2114643-018	EP2114643-019	EP2114643-020
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.9	6.1	5.9	5.9	5.8
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	2	2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	0.006	0.014	0.014
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	10	10	10	10	10
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	0.02	0.02
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	<10	11	10
Liming Rate		1	kg CaCO3/t	<1	<1	<1	1	1
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	0.02	0.02
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	<10	<10	11	10
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	<1	1	1



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS18 7 8	ASS18 8 9	ASS19 5 6	ASS19 7 8	ASS19 8 9
Sampling date / time				17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit	EP2114643-021	EP2114643-022	EP2114643-023	EP2114643-024	EP2114643-025
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	6.3	6.1	5.9	6.0	6.0
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.007	0.006	0.006	<0.005	0.009
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	10	10	10	10	10
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate		1	kg CaCO3/t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ASS20 5 6	ASS21 4 5	ASS21 7 8	ASS21 9 10	ASS21 11 12
Sampling date / time					17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit		EP2114643-026	EP2114643-027	EP2114643-028	EP2114643-029	EP2114643-030
				Result	Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		5.9	6.2	6.1	6.8	6.0
Titrateable Actual Acidity (23F)	----	2	mole H+ / t		<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		0.007	0.006	0.009	<0.005	0.009
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		10	10	10	10	10
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)		0.01	% CaCO3		----	----	----	0.13	----
acidity - Acid Neutralising Capacity (a-19A2)		10	mole H+ / t		----	----	----	25	----
sulfidic - Acid Neutralising Capacity (s-19A2)		0.01	% pyrite S		----	----	----	0.04	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t		<1	<1	1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	<10	<10	<10	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	<1	1	<1	<1



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS22 1 2	ASS23 2 3	ASS23 3 4	ASS23 5 6	ASS23 7 8
Sampling date / time				17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit	EP2114643-031	EP2114643-032	EP2114643-033	EP2114643-034	EP2114643-035
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.9	6.0	5.5	6.2	5.8
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	6	<2	2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	<0.005	0.014	0.093
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	10	10	10	10	58
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	0.10
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	<10	<10	61
Liming Rate		1	kg CaCO3/t	<1	<1	1	1	5
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	0.10
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	<10	<10	<10	61
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	1	1	5



Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Sample ID

				ASS23 9 10	ASS24 2 3	ASS24 3 4	ASS24 5 6	ASS24 7 8
Sampling date / time				17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit	EP2114643-036	EP2114643-037	EP2114643-038	EP2114643-039	EP2114643-040
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	6.0	5.9	5.8	6.2	6.0
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	9	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.008	0.009	0.007	0.006	0.014
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	10	10	10	10	10
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	0.02	<0.02	0.02
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	13	<10	10
Liming Rate		1	kg CaCO3/t	<1	<1	1	<1	1
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	<0.02	0.02	<0.02	0.02
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	<10	13	<10	10
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	1	<1	1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ASS24 8 9	ASS24 10 11	ASS25 3 4	ASS25 7 8	ASS26 6 7
Sampling date / time					17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit		EP2114643-041	EP2114643-042	EP2114643-043	EP2114643-044	EP2114643-045
				Result	Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		6.9	6.1	7.2	6.2	6.1
Titratable Actual Acidity (23F)	----	2	mole H+ / t		<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		0.019	0.009	<0.005	<0.005	<0.005
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		12	10	10	10	10
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)		0.01	% CaCO3		0.46	----	0.78	----	----
acidity - Acid Neutralising Capacity (a-19A2)		10	mole H+ / t		91	----	156	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)		0.01	% pyrite S		0.15	----	0.25	----	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t		<1	1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		12	<10	<10	<10	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t		1	1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ASS26 7 7.7	ASS26 8 9	ASS26 10 11	ASS27 0 1	ASS27 5 6
Sampling date / time					17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit		EP2114643-046	EP2114643-047	EP2114643-048	EP2114643-049	EP2114643-050
				Result	Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		5.8	6.1	6.8	6.8	5.7
Titratable Actual Acidity (23F)	----	2	mole H+ / t		2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		<0.005	0.005	<0.005	<0.005	<0.005
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		10	10	10	10	10
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)		0.01	% CaCO3		----	----	1.19	0.71	----
acidity - Acid Neutralising Capacity (a-19A2)		10	mole H+ / t		----	----	238	142	----
sulfidic - Acid Neutralising Capacity (s-19A2)		0.01	% pyrite S		----	----	0.38	0.23	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t		<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	<10	<10	<10	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ASS27 6 7	ASS27 8 9	ASS27 9 10	ASS27 11 12	ASS27 12 13
Sampling date / time					17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit		EP2114643-051	EP2114643-052	EP2114643-053	EP2114643-054	EP2114643-055
				Result	Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		5.6	5.9	6.2	7.1	5.9
Titratable Actual Acidity (23F)	----	2	mole H+ / t		6	<2	<2	<2	2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		0.025	0.015	<0.005	<0.005	0.006
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		16	10	10	10	10
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)		0.01	% CaCO3		----	----	----	0.74	----
acidity - Acid Neutralising Capacity (a-19A2)		10	mole H+ / t		----	----	----	147	----
sulfidic - Acid Neutralising Capacity (s-19A2)		0.01	% pyrite S		----	----	----	0.24	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S		0.04	0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		22	11	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t		2	1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		0.04	0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		22	11	<10	<10	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t		2	1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS28 4 5	ASS28 6 7	ASS28 7 8	ASS29 2 3	ASS29 4 5
Sampling date / time				17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit	EP2114643-056	EP2114643-057	EP2114643-058	EP2114643-059	EP2114643-060
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.8	6.4	6.1	5.6	5.5
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	2	<2	<2	5	12
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.007	0.009	0.016	0.018
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	10	10	10	10	12
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	0.02	0.04
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	<10	15	24
Liming Rate		1	kg CaCO3/t	<1	<1	<1	1	2
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	0.02	0.04
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	<10	<10	15	24
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	<1	1	2



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ASS29 6 7	ASS29 7 8	ASS29 9 10	ASS29 10 11	ASS30 5 6
Sampling date / time				17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit	EP2114643-061	EP2114643-062	EP2114643-063	EP2114643-064	EP2114643-065
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.9	6.4	6.3	5.8	6.3
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.005	0.035	<0.005	0.019	0.011
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	10	22	10	12	10
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	0.04	<0.02	0.02	<0.02
Net Acidity (acidity units)		10	mole H+ / t	<10	22	<10	14	<10
Liming Rate		1	kg CaCO3/t	<1	2	<1	1	1
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	0.04	<0.02	0.02	<0.02
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	22	<10	14	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	2	<1	1	1



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ASS30 6 7	ASS31 2 3.5	ASS31 4 5	ASS31 6 7	ASS31 7 8
Sampling date / time					17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00	17-Nov-2021 00:00
Compound	CAS Number	LOR	Unit		EP2114643-066	EP2114643-067	EP2114643-068	EP2114643-069	EP2114643-070
					Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		6.7	6.0	5.8	5.9	5.9
Titratable Actual Acidity (23F)	----	2	mole H+ / t		<2	4	<2	<2	2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		0.006	0.051	<0.005	0.035	0.036
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		10	32	10	22	22
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)		0.01	% CaCO3		0.63	----	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)		10	mole H+ / t		126	----	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)		0.01	% pyrite S		0.20	----	----	----	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S		<0.02	0.06	<0.02	0.04	0.04
Net Acidity (acidity units)	----	10	mole H+ / t		<10	36	<10	23	25
Liming Rate	----	1	kg CaCO3/t		<1	3	<1	2	2
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	0.06	<0.02	0.04	0.04
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	36	<10	23	25
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	3	<1	2	2



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	ASS31 9 10	ASS31 11 12	----	----	----
Sampling date / time				17-Nov-2021 00:00	17-Nov-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2114643-071	EP2114643-072	-----	-----	-----
				Result	Result	----	----	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.8	6.0	----	----	----
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	----	----	----
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.029	0.011	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	18	10	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5	-	1.5	1.5	----	----	----
Net Acidity (sulfur units)		0.02	% S	0.03	<0.02	----	----	----
Net Acidity (acidity units)		10	mole H+ / t	19	<10	----	----	----
Liming Rate		1	kg CaCO3/t	1	1	----	----	----
Net Acidity excluding ANC (sulfur units)		0.02	% S	0.03	<0.02	----	----	----
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	19	<10	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	1	1	----	----	----



Environmental

QUALITY CONTROL REPORT

Work Order : EP2114643

Page : 1 of 7

Client : The Trustee for Mine Earth Unit Trust

Laboratory : Environmental Division Perth

Contact

Address

Telephone

: ----

Project : ATS-2104 Atlas Project ASS

Order number

: ----

C-O-C number

: ----

Sampler : Image Resources

Site

: ----

Quote number : EP/378/21

No. of samples received : 72

No. of samples analysed : 72

Date Samples Received : 22-Nov-2021

Date Analysis Commenced : 02-Dec-2021

Issue Date : 10-Dec-2021



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories

Position

Accreditation Category



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA033-A: Actual Acidity (QC Lot: 4057460)									
EP2114643-001	ASS07 0 2	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.2	9.2	0.0	0% - 20%
EP2114643-011	ASS12 7 8.5	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	6.8	6.7	0.0	0% - 20%
EA033-A: Actual Acidity (QC Lot: 4057461)									
EP2114643-021	ASS18 7 8	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	6.3	6.3	0.0	0% - 20%
EP2114643-031	ASS22 1 2	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.9	5.9	0.0	0% - 20%
EA033-A: Actual Acidity (QC Lot: 4057462)									
EP2114643-041	ASS24 8 9	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	6.9	6.8	0.0	0% - 20%
EP2114643-051	ASS27 6 7	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	6	6	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.6	5.6	0.0	0% - 20%
EA033-A: Actual Acidity (QC Lot: 4057465)									
EP2114643-061	ASS29 6 7	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit

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 Work Order : EP2114643
 Client : The Trustee for Mine Earth Unit Trust
 Project : ATS-2104 Atlas Project ASS



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA033-A: Actual Acidity (QC Lot: 4057465) - continued									
EP2114643-061	ASS29 6 7	EA033: pH KCl (23A)	----	0.1	pH Unit	5.9	5.9	0.0	0% - 20%
EP2114643-071	ASS31 9 10	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.8	5.8	0.0	0% - 20%
EA033-B: Potential Acidity (QC Lot: 4057460)									
EP2114643-001	ASS07 0 2	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.022	0.023	4.4	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	14	14	0.0	No Limit
EP2114643-011	ASS12 7 8.5	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.010	0.014	33.3	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EA033-B: Potential Acidity (QC Lot: 4057461)									
EP2114643-021	ASS18 7 8	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.007	0.009	25.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EP2114643-031	ASS22 1 2	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EA033-B: Potential Acidity (QC Lot: 4057462)									
EP2114643-041	ASS24 8 9	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.019	0.018	5.4	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	12	11	9.1	No Limit
EP2114643-051	ASS27 6 7	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.025	0.029	14.8	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	16	18	15.3	No Limit
EA033-B: Potential Acidity (QC Lot: 4057465)									
EP2114643-061	ASS29 6 7	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.005	0.008	46.2	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EP2114643-071	ASS31 9 10	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.029	0.029	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	18	18	0.0	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 4057460)									
EP2114643-001	ASS07 0 2	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	5.07	5.08	0.2	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	1.62	1.63	0.6	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	1010	1010	0.2	0% - 20%
EP2114643-011	ASS12 7 8.5	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	<0.01	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA033-C: Acid Neutralising Capacity (QC Lot: 4057460) - continued									
EP2114643-011	ASS12 7 8.5	EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	<0.01	0.0	No Limit
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 4057462)									
EP2114643-041	ASS24 8 9	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	0.46	0.45	2.2	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.15	0.15	0.0	0% - 50%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	91	90	0.0	No Limit
EA033-E: Acid Base Accounting (QC Lot: 4057460)									
EP2114643-001	ASS07 0 2	EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.02	0.02	0.0	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA033: Liming Rate excluding ANC	----	1	kg CaCO3/t	1	1	0.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
		EA033: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	14	14	0.0	No Limit
EP2114643-011	ASS12 7 8.5	EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	<1	1	0.0	No Limit
		EA033: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	1	0.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
		EA033: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EA033-E: Acid Base Accounting (QC Lot: 4057461)									
EP2114643-021	ASS18 7 8	EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA033: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
		EA033: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EP2114643-031	ASS22 1 2	EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA033: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
		EA033: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EA033-E: Acid Base Accounting (QC Lot: 4057462)									
EP2114643-041	ASS24 8 9	EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.02	0.02	0.0	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.0	No Limit

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 Client : The Trustee for Mine Earth Unit Trust
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Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA033-E: Acid Base Accounting (QC Lot: 4057462) - continued									
EP2114643-041	ASS24 8 9	EA033: Liming Rate excluding ANC	----	1	kg CaCO3/t	1	1	0.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
		EA033: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	12	11	8.7	No Limit
EP2114643-051	ASS27 6 7	EA033: Net Acidity (sulfur units)	----	0.02	% S	0.04	0.04	0.0	No Limit
		EA033: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.04	0.04	0.0	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	2	2	0.0	No Limit
		EA033: Liming Rate excluding ANC	----	1	kg CaCO3/t	2	2	0.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	22	24	8.7	No Limit
		EA033: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	22	24	8.7	No Limit
EA033-E: Acid Base Accounting (QC Lot: 4057465)									
EP2114643-061	ASS29 6 7	EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA033: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
		EA033: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EP2114643-071	ASS31 9 10	EA033: Net Acidity (sulfur units)	----	0.02	% S	0.03	0.03	0.0	No Limit
		EA033: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.03	0.03	0.0	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	1	1	0.0	No Limit
		EA033: Liming Rate excluding ANC	----	1	kg CaCO3/t	1	1	0.0	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	19	20	5.1	No Limit
		EA033: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	19	20	5.1	No Limit



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit		Result	Spike	Spike Recovery (%)	Acceptable Limits (%)
				Concentration		LCS	Low	High
EA033-A: Actual Acidity (QCLot: 4057460)								
EA033: pH KCl (23A)	----	0.1	pH Unit	<0.1	----	----	----	----
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	22.26 mole H+ / t	96.0	79.4	110
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-A: Actual Acidity (QCLot: 4057461)								
EA033: pH KCl (23A)	----	0.1	pH Unit	<0.1	----	----	----	----
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	22.26 mole H+ / t	101	79.4	110
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-A: Actual Acidity (QCLot: 4057462)								
EA033: pH KCl (23A)	----	0.1	pH Unit	<0.1	----	----	----	----
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	22.26 mole H+ / t	95.7	79.4	110
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-A: Actual Acidity (QCLot: 4057465)								
EA033: pH KCl (23A)	----	0.1	pH Unit	<0.1	----	----	----	----
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	22.26 mole H+ / t	107	79.4	110
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 4057460)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.202 % S	91.1	84.6	110
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-B: Potential Acidity (QCLot: 4057461)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.202 % S	91.1	84.6	110
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-B: Potential Acidity (QCLot: 4057462)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.202 % S	101	84.6	110
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-B: Potential Acidity (QCLot: 4057465)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.202 % S	90.6	84.6	110
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 4057460)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	4.9 % CaCO3	102	98.1	108
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----
EA033-E: Acid Base Accounting (QCLot: 4057460)								
EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: <i>Compound</i>	CAS Number	LOR	Unit	Result				
EA033-E: Acid Base Accounting (QCLot: 4057460) - continued								
EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA033: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EA033-E: Acid Base Accounting (QCLot: 4057461)								
EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA033: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EA033-E: Acid Base Accounting (QCLot: 4057462)								
EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA033: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EA033-E: Acid Base Accounting (QCLot: 4057465)								
EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA033: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.

QA/QC Compliance Assessment to assist with Quality Review

Work Order : EP2114643

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Client : The Trustee for Mine Earth Unit Trust

Laboratory : Environmental Division Perth

Contact

Project : ATS-2104 Atlas Project ASS

Date Samples Received : 22-Nov-2021

Site : ----

Issue Date : 10-Dec-2021

Sampler : Image Resources

No. of samples received : 72

Order number : ----

No. of samples analysed : 72

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-A: Actual Acidity							
80* dried soil (EA033)							



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-A: Actual Acidity - Continued								
ASS07 0 2, ASS08 1 2, ASS08 8 9, ASS10 2 3, ASS11 7.5 8, ASS12 7 8.5, ASS13 4 5, ASS15 0 1, ASS16 6 7, ASS18 3 4, ASS18 7 8, ASS19 5 6, ASS19 8 9, ASS21 4 5, ASS21 9 10, ASS22 1 2, ASS23 3 4, ASS23 7 8, ASS24 2 3, ASS24 5 6, ASS24 8 9, ASS25 3 4, ASS26 6 7, ASS26 8 9, ASS27 0 1, ASS27 6 7, ASS27 9 10, ASS27 12 13, ASS28 6 7, ASS29 2 3, ASS29 6 7, ASS29 9 10, ASS30 5 6, ASS31 2 3.5, ASS31 6 7, ASS31 9 10,	ASS07 2 3, ASS08 5 6, ASS09 3 4, ASS11 5 6, ASS12 5.7 7, ASS13 0 1, ASS13 6.5 7, ASS16 2 3, ASS17 5 6, ASS18 5 6, ASS18 8 9, ASS19 7 8, ASS20 5 6, ASS21 7 8, ASS21 11 12, ASS23 2 3, ASS23 5 6, ASS23 9 10, ASS24 3 4, ASS24 7 8, ASS24 10 11, ASS25 7 8, ASS26 7 7.7, ASS26 10 11, ASS27 5 6, ASS27 8 9, ASS27 11 12, ASS28 4 5, ASS28 7 8, ASS29 4 5, ASS29 7 8, ASS29 10 11, ASS30 6 7, ASS31 4 5, ASS31 7 8, ASS31 11 12	17-Nov-2021	02-Dec-2021	17-Nov-2022	✔	06-Dec-2021	02-Mar-2022	✔

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-B: Potential Acidity							
80* dried soil (EA033)	17-Nov-2021	02-Dec-2021	17-Nov-2022	✓	06-Dec-2021	02-Mar-2022	✓
ASS07 0 2,	ASS07 2 3,						
ASS08 1 2,	ASS08 5 6,						
ASS08 8 9,	ASS09 3 4,						
ASS10 2 3,	ASS11 5 6,						
ASS11 7.5 8,	ASS12 5.7 7,						
ASS12 7 8.5,	ASS13 0 1,						
ASS13 4 5,	ASS13 6.5 7,						
ASS15 0 1,	ASS16 2 3,						
ASS16 6 7,	ASS17 5 6,						
ASS18 3 4,	ASS18 5 6,						
ASS18 7 8,	ASS18 8 9,						
ASS19 5 6,	ASS19 7 8,						
ASS19 8 9,	ASS20 5 6,						
ASS21 4 5,	ASS21 7 8,						
ASS21 9 10,	ASS21 11 12,						
ASS22 1 2,	ASS23 2 3,						
ASS23 3 4,	ASS23 5 6,						
ASS23 7 8,	ASS23 9 10,						
ASS24 2 3,	ASS24 3 4,						
ASS24 5 6,	ASS24 7 8,						
ASS24 8 9,	ASS24 10 11,						
ASS25 3 4,	ASS25 7 8,						
ASS26 6 7,	ASS26 7 7.7,						
ASS26 8 9,	ASS26 10 11,						
ASS27 0 1,	ASS27 5 6,						
ASS27 6 7,	ASS27 8 9,						
ASS27 9 10,	ASS27 11 12,						
ASS27 12 13,	ASS28 4 5,						
ASS28 6 7,	ASS28 7 8,						
ASS29 2 3,	ASS29 4 5,						
ASS29 6 7,	ASS29 7 8,						
ASS29 9 10,	ASS29 10 11,						
ASS30 5 6,	ASS30 6 7,						
ASS31 2 3.5,	ASS31 4 5,						
ASS31 6 7,	ASS31 7 8,						
ASS31 9 10,	ASS31 11 12,						



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-C: Acid Neutralising Capacity								
80* dried soil (EA033)		17-Nov-2021	02-Dec-2021	17-Nov-2022	✓	06-Dec-2021	02-Mar-2022	✓
ASS07 0 2,	ASS07 2 3,							
ASS08 1 2,	ASS08 5 6,							
ASS08 8 9,	ASS09 3 4,							
ASS10 2 3,	ASS11 5 6,							
ASS11 7.5 8,	ASS12 5.7 7,							
ASS12 7 8.5,	ASS13 0 1,							
ASS13 4 5,	ASS13 6.5 7,							
ASS15 0 1,	ASS16 2 3,							
ASS16 6 7,	ASS17 5 6,							
ASS18 3 4,	ASS18 5 6,							
ASS18 7 8,	ASS18 8 9,							
ASS19 5 6,	ASS19 7 8,							
ASS19 8 9,	ASS20 5 6,							
ASS21 4 5,	ASS21 7 8,							
ASS21 9 10,	ASS21 11 12,							
ASS22 1 2,	ASS23 2 3,							
ASS23 3 4,	ASS23 5 6,							
ASS23 7 8,	ASS23 9 10,							
ASS24 2 3,	ASS24 3 4,							
ASS24 5 6,	ASS24 7 8,							
ASS24 8 9,	ASS24 10 11,							
ASS25 3 4,	ASS25 7 8,							
ASS26 6 7,	ASS26 7 7.7,							
ASS26 8 9,	ASS26 10 11,							
ASS27 0 1,	ASS27 5 6,							
ASS27 6 7,	ASS27 8 9,							
ASS27 9 10,	ASS27 11 12,							
ASS27 12 13,	ASS28 4 5,							
ASS28 6 7,	ASS28 7 8,							
ASS29 2 3,	ASS29 4 5,							
ASS29 6 7,	ASS29 7 8,							
ASS29 9 10,	ASS29 10 11,							
ASS30 5 6,	ASS30 6 7,							
ASS31 2 3.5,	ASS31 4 5,							
ASS31 6 7,	ASS31 7 8,							
ASS31 9 10,	ASS31 11 12,							

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-D: Retained Acidity							
80* dried soil (EA033)	17-Nov-2021	02-Dec-2021	17-Nov-2022	✓	06-Dec-2021	02-Mar-2022	✓
ASS07 0 2,	ASS07 2 3,						
ASS08 1 2,	ASS08 5 6,						
ASS08 8 9,	ASS09 3 4,						
ASS10 2 3,	ASS11 5 6,						
ASS11 7.5 8,	ASS12 5.7 7,						
ASS12 7 8.5,	ASS13 0 1,						
ASS13 4 5,	ASS13 6.5 7,						
ASS15 0 1,	ASS16 2 3,						
ASS16 6 7,	ASS17 5 6,						
ASS18 3 4,	ASS18 5 6,						
ASS18 7 8,	ASS18 8 9,						
ASS19 5 6,	ASS19 7 8,						
ASS19 8 9,	ASS20 5 6,						
ASS21 4 5,	ASS21 7 8,						
ASS21 9 10,	ASS21 11 12,						
ASS22 1 2,	ASS23 2 3,						
ASS23 3 4,	ASS23 5 6,						
ASS23 7 8,	ASS23 9 10,						
ASS24 2 3,	ASS24 3 4,						
ASS24 5 6,	ASS24 7 8,						
ASS24 8 9,	ASS24 10 11,						
ASS25 3 4,	ASS25 7 8,						
ASS26 6 7,	ASS26 7 7.7,						
ASS26 8 9,	ASS26 10 11,						
ASS27 0 1,	ASS27 5 6,						
ASS27 6 7,	ASS27 8 9,						
ASS27 9 10,	ASS27 11 12,						
ASS27 12 13,	ASS28 4 5,						
ASS28 6 7,	ASS28 7 8,						
ASS29 2 3,	ASS29 4 5,						
ASS29 6 7,	ASS29 7 8,						
ASS29 9 10,	ASS29 10 11,						
ASS30 5 6,	ASS30 6 7,						
ASS31 2 3.5,	ASS31 4 5,						
ASS31 6 7,	ASS31 7 8,						
ASS31 9 10,	ASS31 11 12,						



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-E: Acid Base Accounting								
80* dried soil (EA033)		17-Nov-2021	02-Dec-2021	17-Nov-2022	✓	06-Dec-2021	02-Mar-2022	✓
ASS07 0 2,	ASS07 2 3,							
ASS08 1 2,	ASS08 5 6,							
ASS08 8 9,	ASS09 3 4,							
ASS10 2 3,	ASS11 5 6,							
ASS11 7.5 8,	ASS12 5.7 7,							
ASS12 7 8.5,	ASS13 0 1,							
ASS13 4 5,	ASS13 6.5 7,							
ASS15 0 1,	ASS16 2 3,							
ASS16 6 7,	ASS17 5 6,							
ASS18 3 4,	ASS18 5 6,							
ASS18 7 8,	ASS18 8 9,							
ASS19 5 6,	ASS19 7 8,							
ASS19 8 9,	ASS20 5 6,							
ASS21 4 5,	ASS21 7 8,							
ASS21 9 10,	ASS21 11 12,							
ASS22 1 2,	ASS23 2 3,							
ASS23 3 4,	ASS23 5 6,							
ASS23 7 8,	ASS23 9 10,							
ASS24 2 3,	ASS24 3 4,							
ASS24 5 6,	ASS24 7 8,							
ASS24 8 9,	ASS24 10 11,							
ASS25 3 4,	ASS25 7 8,							
ASS26 6 7,	ASS26 7 7.7,							
ASS26 8 9,	ASS26 10 11,							
ASS27 0 1,	ASS27 5 6,							
ASS27 6 7,	ASS27 8 9,							
ASS27 9 10,	ASS27 11 12,							
ASS27 12 13,	ASS28 4 5,							
ASS28 6 7,	ASS28 7 8,							
ASS29 2 3,	ASS29 4 5,							
ASS29 6 7,	ASS29 7 8,							
ASS29 9 10,	ASS29 10 11,							
ASS30 5 6,	ASS30 6 7,							
ASS31 2 3.5,	ASS31 4 5,							
ASS31 6 7,	ASS31 7 8,							
ASS31 9 10,	ASS31 11 12,							



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	8	72	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	4	72	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	4	72	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

[illegible]



CHAIN OF CUSTODY

ALS Laboratory:
please tick →

ADELAIDE 21 Bunta Road Pteron SA 5095
Ph: 08 8359 0890 E: adelaide@alsglobal.com
BRISBANE 32 Shand Street Stafford QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 48 Callamondah Drive Clinton QLD 4683
Ph: 07 7471 5900 E: gladstone@alsglobal.com

MACKAY 76 Harbour Road Mackay QLD 4740
Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
MUDGEE 27 Sydney Road Mudgee NSW 2850
Ph: 02 6372 6735 E: mudgee.mie@alsglobal.com

NEWCASTLE 5585 Meldand Rd Mayfield West NSW 2304
Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
NOWRA 419 Geary Place North Nowra NSW 2541
Ph: 02 4423 2083 E: nowra@alsglobal.com
PERTH 10 Had Way Malaga WA 6090
Ph: 08 9209 7855 E: samples.perth@alsglobal.com

SYDNEY 277-288 Woodpark Road Smithfield NSW 2184
Ph: 02 8784 3355 E: samples.sydney@alsglobal.com
TOWNSVILLE 14-16 Osama Court Bohle QLD 4818
Ph: 07 4796 0500 E: townsville@alsglobal.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2500
Ph: 02 4225 9126 E: portsonline@alsglobal.com

CLIENT: Mine Earth

OFFICE: Unit 1/94 Forsyth St, O'Connor, WA

PROJECT: ATS-2104 Atlas Project ASS

ORDER NUMBER:

PROJECT MANAGER: Matt Brimbridge

CONTACT PH: 0407 086 443

SAMPLER: Image Resources

SAMPLER MOBILE:

COC emailed to ALS? (YES / NO)

EDD FORMAT (or default):

Email Reports to (will default to PM if no other addresses are listed): matt@mineearth.com.au

Email Invoice to (will default to PM if no other addresses are listed): matt@mineearth.com.au

TURNAROUND REQUIREMENTS: ☒ Standard TAT (List due date):

(Standard TAT may be longer for some tests
e.g. Ultra Trace Organics)

☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: EP/378/21

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OP: 1 2 3 4 5 6 7

RELINQUISHED BY:

RECEIVED BY:

RELINQUISHED BY:

RECEIVED BY:

DATE/TIME:

DATE/TIME:

DATE/TIME:

DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

All Samples to remain frozen until Suite 1 ASS Field Screening.
All remaining sample to be kept frozen for subsequent Suite 2 analysis.
Samples for Suite 2 analysis to be identified following Suite 1 analysis.
All remaining samples to be returned to Mine Earth following Suite 2 analysis

SAMPLE DETAILS						CONTAINER INFORMATION						ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).						Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (to codes below)	(refer	TOTAL CONTAINERS	Suite 1 Drying (EN0200)	Suite 1 ASS Field Screening (EA037)										Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.	
	ASS06 0 1		S	ASS - frozen		1	x	x											
	ASS06 1 1.3		S	ASS - frozen		1	x	x											
	ASS06 1.3 2		S	ASS - frozen		1	x	x											
	ASS06 2 3		S	ASS - frozen		1	x	x											
	ASS06 3 4		S	ASS - frozen		1	x	x											
	ASS06 5 6		S	ASS - frozen		1	x	x											
	ASS06 6 7		S	ASS - frozen		1	x	x											
	ASS07 0 2		S	ASS - frozen		1	x	x											
	ASS07 2 3		S	ASS - frozen		1	x	x											
	ASS07 3 4		S	ASS - frozen		1	x	x											
	ASS07 4 5		S	ASS - frozen		1	x	x											
	ASS07 5 6		S	ASS - frozen		1	x	x											
	ASS07 6 6.8		S	ASS - frozen		1	x	x											

Environmental Division
Perth
Work Order Reference
EP2114243

ASS07 6 6 7		S	ASS - frozen	1	x	x							
ASS08 0 1		S	ASS - frozen	1	x	x							
ASS08 1 2		S	ASS - frozen	1	x	x							
ASS08 2 3		S	ASS - frozen	1	x	x							
ASS08 3 4		S	ASS - frozen	1	x	x							
ASS08 4 5		S	ASS - frozen	1	x	x							
ASS08 5 6		S	ASS - frozen	1	x	x							
ASS08 6 7		S	ASS - frozen	1	x	x							
ASS08 7 8		S	ASS - frozen	1	x	x							
ASS08 8 9		S	ASS - frozen	1	x	x							
ASS09 0 2 4		S	ASS - frozen	1	x	x							
ASS09 2 4 3		S	ASS - frozen	1	x	x							
ASS09 3 4		S	ASS - frozen	1	x	x							
ASS09 4 5		S	ASS - frozen	1	x	x							
ASS09 5 6		S	ASS - frozen	1	x	x							
ASS09 6 7		S	ASS - frozen	1	x	x							
ASS09 7 8		S	ASS - frozen	1	x	x							

ASS10 0 1		S	ASS - frozen	1	x	x							
ASS10 1 2		S	ASS - frozen	1	x	x							
ASS10 2 3		S	ASS - frozen	1	x	x							
ASS10 3 4		S	ASS - frozen	1	x	x							
ASS10 4 5		S	ASS - frozen	1	x	x							
ASS10 5 6		S	ASS - frozen	1	x	x							
ASS10 6 7		S	ASS - frozen	1	x	x							
ASS11 0 1		S	ASS - frozen	1	x	x							
ASS11 1 2		S	ASS - frozen	1	x	x							
ASS11 2 3		S	ASS - frozen	1	x	x							
ASS11 3 4		S	ASS - frozen	1	x	x							
ASS11 4 5		S	ASS - frozen	1	x	x							
ASS11 5 6		S	ASS - frozen	1	x	x							
ASS11 6 7		S	ASS - frozen	1	x	x							
ASS11 7 7.5		S	ASS - frozen	1	x	x							
ASS11 7.5 8		S	ASS - frozen	1	x	x							
ASS12 0 1		S	ASS - frozen	1	x	x							
ASS12 1 1.7		S	ASS - frozen	1	x	x							
ASS12 1.7 3		S	ASS - frozen	1	x	x							
ASS12 3 4		S	ASS - frozen	1	x	x							
ASS12 4 4.7		S	ASS - frozen	1	x	x							
ASS12 4.7 5.7		S	ASS - frozen	1	x	x							
ASS12 5.7 7		S	ASS - frozen	1	x	x							
ASS12 7 8.5		S	ASS - frozen	1	x	x							
ASS12 8.5 9		S	ASS - frozen	1	x	x							
ASS13 0 1		S	ASS - frozen	1	x	x							
ASS13 1 2		S	ASS - frozen	1	x	x							
ASS13 2 3		S	ASS - frozen	1	x	x							
ASS13 3 4		S	ASS - frozen	1	x	x							
ASS13 4 5		S	ASS - frozen	1	x	x							

ASS13 6 6		S	ASS - frozen	1	x	x								
ASS13 6 6.5		S	ASS - frozen	1	x	x								
ASS13 6.5 7		S	ASS - frozen	1	x	x								
ASS13 7 8		S	ASS - frozen	1	x	x								

	ASS14 0 0.8		S	ASS - frozen	1	x	x							
	ASS14 0.8 2		S	ASS - frozen	1	x	x							
	ASS14 2 3.2		S	ASS - frozen	1	x	x							
	ASS14 3.2 4		S	ASS - frozen	1	x	x							
	ASS14 4 5		S	ASS - frozen	1	x	x							
	ASS14 5 6		S	ASS - frozen	1	x	x							
	ASS14 6 7		S	ASS - frozen	1	x	x							
	ASS14 7 8		S	ASS - frozen	1	x	x							
	ASS14 8 9		S	ASS - frozen	1	x	x							
	ASS15 0 1		S	ASS - frozen	1	x	x							
	ASS15 1 1.7		S	ASS - frozen	1	x	x							
	ASS15 1.7 2		S	ASS - frozen	1	x	x							
	ASS15 2 3		S	ASS - frozen	1	x	x							
	ASS15 3 4		S	ASS - frozen	1	x	x							
	ASS15 4 5		S	ASS - frozen	1	x	x							
	ASS15 5 6		S	ASS - frozen	1	x	x							
	ASS15 6 7		S	ASS - frozen	1	x	x							
	ASS15 7 8		S	ASS - frozen	1	x	x							
1	ASS16 0 1		S	ASS - frozen	1	x	x							
2	ASS16 1 2		S	ASS - frozen	1	x	x							
3	ASS16 2 3		S	ASS - frozen	1	x	x							
4	ASS16 3 4		S	ASS - frozen	1	x	x							
5	ASS16 4 5		S	ASS - frozen	1	x	x							
6	ASS16 5 6		S	ASS - frozen	1	x	x							
7	ASS16 6 7		S	ASS - frozen	1	x	x							
8	ASS17 0 1.6		S	ASS - frozen	1	x	x							
9	ASS17 1.6 2		S	ASS - frozen	1	x	x							
10	ASS17 2 3		S	ASS - frozen	1	x	x							
11	ASS17 3 4		S	ASS - frozen	1	x	x							
12	ASS17 4 5		S	ASS - frozen	1	x	x							

13	ASS17 5 6		S	ASS - frozen	1	x	x							
14	ASS17 6 6.5		S	ASS - frozen	1	x	x							
15	ASS17 6.5 7		S	ASS - frozen	1	x	x							

16	ASS18 0 1		S	ASS - frozen	1	x	x							
17	ASS18 1 2		S	ASS - frozen	1	x	x							
18	ASS18 2 3		S	ASS - frozen	1	x	x							
19	ASS18 3 4		S	ASS - frozen	1	x	x							
20	ASS18 4 5		S	ASS - frozen	1	x	x							
21	ASS18 5 6		S	ASS - frozen	1	x	x							
22	ASS18 6 7		S	ASS - frozen	1	x	x							
23	ASS18 7 8		S	ASS - frozen	1	x	x							
24	ASS18 8 9		S	ASS - frozen	1	x	x							
25	ASS19 0 1		S	ASS - frozen	1	x	x							
26	ASS19 1 2		S	ASS - frozen	1	x	x							
27	ASS19 2 3		S	ASS - frozen	1	x	x							
28	ASS19 3 4		S	ASS - frozen	1	x	x							
29	ASS19 4 5		S	ASS - frozen	1	x	x							
30	ASS19 5 6		S	ASS - frozen	1	x	x							
31	ASS19 6 7		S	ASS - frozen	1	x	x							
32	ASS19 7 8		S	ASS - frozen	1	x	x							
33	ASS19 8 9		S	ASS - frozen	1	x	x							
34	ASS19 9 10		S	ASS - frozen	1	x	x							
35	ASS20 0 1		S	ASS - frozen	1	x	x							
36	ASS20 1 2		S	ASS - frozen	1	x	x							
37	ASS20 2 3		S	ASS - frozen	1	x	x							
38	ASS20 3 4		S	ASS - frozen	1	x	x							
39	ASS20 4 5		S	ASS - frozen	1	x	x							
40	ASS20 5 6		S	ASS - frozen	1	x	x							
41	ASS20 6 7		S	ASS - frozen	1	x	x							
42	ASS20 7 8		S	ASS - frozen	1	x	x							
43	ASS20 8 9		S	ASS - frozen	1	x	x							
44	ASS20 9 10		S	ASS - frozen	1	x	x							
45	ASS21 0 1		S	ASS - frozen	1	x	x							

46	ASS21 1 2		S	ASS - frozen	1	x	x								
47	ASS21 2 3		S	ASS - frozen	1	x	x								
48	ASS21 3 4		S	ASS - frozen	1	x	x								
49	ASS21 4 5		S	ASS - frozen	1	x	x								
50	ASS21 5 6		S	ASS - frozen	1	x	x								
51	ASS21 6 7		S	ASS - frozen	1	x	x								
52	ASS21 7 8		S	ASS - frozen	1	x	x								
53	ASS21 8 9		S	ASS - frozen	1	x	x								
54	ASS21 9 10		S	ASS - frozen	1	x	x								
55	ASS21 10 11		S	ASS - frozen	1	x	x								
56	ASS21 11 12		S	ASS - frozen	1	x	x								
57	ASS22 0 1		S	ASS - frozen	1	x	x								
58	ASS22 1 2		S	ASS - frozen	1	x	x								
59	ASS22 2 3		S	ASS - frozen	1	x	x								
60	ASS22 3 4		S	ASS - frozen	1	x	x								
61	ASS22 4 5		S	ASS - frozen	1	x	x								
62	ASS22 5 6		S	ASS - frozen	1	x	x								
63	ASS22 6 7		S	ASS - frozen	1	x	x								
64	ASS22 7 8		S	ASS - frozen	1	x	x								
65	ASS22 8 9		S	ASS - frozen	1	x	x								
66	ASS22 9 10		S	ASS - frozen	1	x	x								
67	ASS23 0 1		S	ASS - frozen	1	x	x								
68	ASS23 1 2		S	ASS - frozen	1	x	x								
69	ASS23 2 3		S	ASS - frozen	1	x	x								
70	ASS23 3 4		S	ASS - frozen	1	x	x								
71	ASS23 4 5		S	ASS - frozen	1	x	x								
72	ASS23 5 6		S	ASS - frozen	1	x	x								
73	ASS23 6 7		S	ASS - frozen	1	x	x								
74	ASS23 7 8		S	ASS - frozen	1	x	x								
75	ASS23 8 9		S	ASS - frozen	1	x	x								

76

ASS23 9 10

	S	ASS - frozen	1	X	X							
--	---	--------------	---	---	---	--	--	--	--	--	--	--

ASS24 0 1		S	ASS - frozen	1	x	x							
ASS24 1 2		S	ASS - frozen	1	x	x							
ASS24 2 3		S	ASS - frozen	1	x	x							
ASS24 3 4		S	ASS - frozen	1	x	x							
ASS24 4 5		S	ASS - frozen	1	x	x							
ASS24 5 6		S	ASS - frozen	1	x	x							
ASS24 6 7		S	ASS - frozen	1	x	x							
ASS24 7 8		S	ASS - frozen	1	x	x							
ASS24 8 9		S	ASS - frozen	1	x	x							
ASS24 9 10		S	ASS - frozen	1	x	x							
ASS24 10 11		S	ASS - frozen	1	x	x							
ASS24 11 12		S	ASS - frozen	1	x	x							
ASS25 0 1		S	ASS - frozen	1	x	x							
ASS25 1 2		S	ASS - frozen	1	x	x							
ASS25 2 3		S	ASS - frozen	1	x	x							
ASS25 3 4		S	ASS - frozen	1	x	x							
ASS25 4 5		S	ASS - frozen	1	x	x							
ASS25 5 6		S	ASS - frozen	1	x	x							
ASS25 6 7		S	ASS - frozen	1	x	x							
ASS25 7 8		S	ASS - frozen	1	x	x							
ASS25 8 9		S	ASS - frozen	1	x	x							
ASS25 9 10		S	ASS - frozen	1	x	x							
ASS26 0 1		S	ASS - frozen	1	x	x							
ASS26 1 2		S	ASS - frozen	1	x	x							
ASS26 2 3		S	ASS - frozen	1	x	x							
ASS26 3 4		S	ASS - frozen	1	x	x							
ASS26 4 4.4		S	ASS - frozen	1	x	x							
ASS26 4.4 5		S	ASS - frozen	1	x	x							
ASS26 5 6		S	ASS - frozen	1	x	x							
ASS26 6 7		S	ASS - frozen	1	x	x							

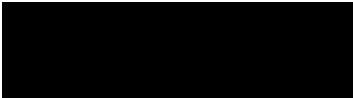


ASS26 7 7.7		S	ASS - frozen	1	x	x								
ASS26 7.7 6		S	ASS - frozen	1	x	x								
ASS26 8 9		S	ASS - frozen	1	x	x								
ASS26 9 10		S	ASS - frozen	1	x	x								
ASS26 10 11		S	ASS - frozen	1	x	x								
ASS27 0 1		S	ASS - frozen	1	x	x								
ASS27 1 2		S	ASS - frozen	1	x	x								
ASS27 2 3		S	ASS - frozen	1	x	x								
ASS27 3 4		S	ASS - frozen	1	x	x								
ASS27 4 5		S	ASS - frozen	1	x	x								
ASS27 5 6		S	ASS - frozen	1	x	x								
ASS27 6 7		S	ASS - frozen	1	x	x								
ASS27 7 8		S	ASS - frozen	1	x	x								
ASS27 8 9		S	ASS - frozen	1	x	x								
ASS27 9 10		S	ASS - frozen	1	x	x								
ASS27 10 11		S	ASS - frozen	1	x	x								
ASS27 11 12		S	ASS - frozen	1	x	x								
ASS27 12 13		S	ASS - frozen	1	x	x								
ASS28 0 1		S	ASS - frozen	1	x	x								
ASS28 1 2		S	ASS - frozen	1	x	x								
ASS28 2 3		S	ASS - frozen	1	x	x								
ASS28 3 4		S	ASS - frozen	1	x	x								
ASS28 4 5		S	ASS - frozen	1	x	x								
ASS28 5 6		S	ASS - frozen	1	x	x								
ASS29 6 7		S	ASS - frozen	1	x	x								
ASS28 7 8		S	ASS - frozen	1	x	x								

ASS29 0 1		S	ASS - frozen	1	x	x								
ASS29 1 2		S	ASS - frozen	1	x	x								
ASS29 2 3		S	ASS - frozen	1	x	x								
ASS29 3 4		S	ASS - frozen	1	x	x								
ASS29 4 5		S	ASS - frozen	1	x	x								
ASS29 5 6		S	ASS - frozen	1	x	x								
ASS29 6 7		S	ASS - frozen	1	x	x								
ASS29 7 8		S	ASS - frozen	1	x	x								
ASS29 8 9		S	ASS - frozen	1	x	x								
ASS29 9 10		S	ASS - frozen	1	x	x								
ASS29 10 11		S	ASS - frozen	1	x	x								
ASS30 0 2		S	ASS - frozen	1	x	x								
ASS30 2 3		S	ASS - frozen	1	x	x								
ASS30 3 4		S	ASS - frozen	1	x	x								
ASS30 4 5		S	ASS - frozen	1	x	x								
ASS30 5 6		S	ASS - frozen	1	x	x								
ASS30 6 7		S	ASS - frozen	1	x	x								
ASS30 7 8		S	ASS - frozen	1	x	x								
ASS30 8 9		S	ASS - frozen	1	x	x								
ASS31 0 1		S	ASS - frozen	1	x	x								
ASS31 1 2		S	ASS - frozen	1	x	x								
ASS31 2 3.5		S	ASS - frozen	1	x	x								
ASS31 3.5 4		S	ASS - frozen	1	x	x								
ASS31 4 5		S	ASS - frozen	1	x	x								
ASS31 5 6		S	ASS - frozen	1	x	x								
ASS31 6 7		S	ASS - frozen	1	x	x								
ASS31 7 8		S	ASS - frozen	1	x	x								
ASS31 8 9		S	ASS - frozen	1	x	x								
ASS31 9 10		S	ASS - frozen	1	x	x								
ASS31 10 11		S	ASS - frozen	1	x	x								

ASS31 11 12		S	ASS - frozen	1	x	x								
TOTAL				245										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CERTIFICATE OF ANALYSIS

Work Order : **EP2205478**
Client : **The Trustee for Mine Earth Unit Trust**
Contact : 
Address : 
Telephone : 
Project : **ATS-2102 Atlas mineral sands**
Order number : **----**
C-O-C number : **----**
Sampler : **Image Resources**
Site : **----**
Quote number : **EP/177/22_V2**
No. of samples received : **19**
No. of samples analysed : **19**

Page : 1 of 10
Laboratory : Environmental Division Perth

Date Analysis Commenced : 09-May-2022
Issue Date : 13-May-2022 12:03



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
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General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG005: Poor matrix spike recovery was obtained for As due to possible sample matrix interference. Results have been confirmed by re-extraction and re-analysis.
- EG035: Positive Hg results for sample EP2205478-001 has been confirmed by re-extraction and re-analysis.



Analytical Results

Sub-Matrix: ACETIC ACID LEACHATE
 (Matrix: WATER)

Sample ID

				ATS - Tailings slimes	ATS - Tailings sand	ATS 06 1-2	ATS 07 2-3	ATS 10 1-2
Sampling date / time				[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]
Compound	CAS Number	LOR	Unit	EP2205478-001	EP2205478-002	EP2205478-003	EP2205478-004	EP2205478-005
				Result	Result	Result	Result	Result
EG005(ED093)C: Leachable Metals by ICPAES								
Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Barium	7440-39-3	0.1	mg/L	0.5	0.3	0.2	<0.1	<0.1
Beryllium	7440-41-7	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	7440-42-8	0.1	mg/L	0.2	<0.1	<0.1	<0.1	<0.1
Cadmium	7440-43-9	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Chromium	7440-47-3	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	7440-50-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	7439-96-5	0.1	mg/L	0.4	<0.1	<0.1	0.6	0.6
Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium	7782-49-2	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Vanadium	7440-62-2	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	7440-66-6	0.1	mg/L	<0.1	<0.1	<0.1	0.2	<0.1
EG035C: Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010



Analytical Results

Sub-Matrix: ACETIC ACID LEACHATE
 (Matrix: WATER)

Sample ID

				ATS 14 2-3	ATS 14 3-4	ATS 23 4-5	ATS 24 2-3	ATS 25 1-2
Sampling date / time				[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]
Compound	CAS Number	LOR	Unit	EP2205478-006	EP2205478-007	EP2205478-008	EP2205478-009	EP2205478-010
				Result	Result	Result	Result	Result
EG005(ED093)C: Leachable Metals by ICPAES								
Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Barium	7440-39-3	0.1	mg/L	0.2	0.1	<0.1	<0.1	0.2
Beryllium	7440-41-7	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	7440-42-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	7440-43-9	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Chromium	7440-47-3	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	7440-50-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	7439-96-5	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	0.3
Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium	7782-49-2	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Vanadium	7440-62-2	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	7440-66-6	0.1	mg/L	0.2	0.1	0.2	3.8	17.3
EG035C: Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010



Analytical Results

Sub-Matrix: ACETIC ACID LEACHATE
 (Matrix: WATER)

Sample ID

				ATS 25 2-3	ATS 26 2-3	ATS 27 1-2	ATS 27 3-4	ATS 29 2-3
Sampling date / time				[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]
Compound	CAS Number	LOR	Unit	EP2205478-011	EP2205478-012	EP2205478-013	EP2205478-014	EP2205478-015
				Result	Result	Result	Result	Result
EG005(ED093)C: Leachable Metals by ICPAES								
Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Barium	7440-39-3	0.1	mg/L	0.2	<0.1	<0.1	<0.1	<0.1
Beryllium	7440-41-7	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	7440-42-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	7440-43-9	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Chromium	7440-47-3	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	7440-50-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	7439-96-5	0.1	mg/L	0.3	<0.1	<0.1	<0.1	0.2
Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium	7782-49-2	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Vanadium	7440-62-2	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	7440-66-6	0.1	mg/L	15.0	<0.1	0.1	<0.1	<0.1
EG035C: Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010



Analytical Results

Sub-Matrix: ACETIC ACID LEACHATE
 (Matrix: WATER)

Sample ID

				ATS 30 2-3	ATS 31 1-2	ATS 31 2-3	ATS 31 4-5	----
Sampling date / time				[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]	----
Compound	CAS Number	LOR	Unit	EP2205478-016	EP2205478-017	EP2205478-018	EP2205478-019	-----
				Result	Result	Result	Result	----
EG005(ED093)C: Leachable Metals by ICPAES								
Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Barium	7440-39-3	0.1	mg/L	<0.1	<0.1	0.1	<0.1	----
Beryllium	7440-41-7	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	----
Boron	7440-42-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Cadmium	7440-43-9	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	----
Chromium	7440-47-3	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Cobalt	7440-48-4	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Copper	7440-50-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Manganese	7439-96-5	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Selenium	7782-49-2	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	----
Vanadium	7440-62-2	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Zinc	7440-66-6	0.1	mg/L	1.0	<0.1	<0.1	0.1	----
EG035C: Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	----



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				ATS - Tailings slimes	ATS - Tailings sand	ATS 06 1-2	ATS 07 2-3	ATS 10 1-2
Sampling date / time				[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]
Compound	CAS Number	LOR	Unit	EP2205478-001	EP2205478-002	EP2205478-003	EP2205478-004	EP2205478-005
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	3.7	<1.0	1.4	1.3	<1.0
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	16	<5	7	18	<5
Barium	7440-39-3	10	mg/kg	80	<10	20	90	<10
Beryllium	7440-41-7	1	mg/kg	<1	<1	<1	<1	<1
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	51	3	8	15	4
Cobalt	7440-48-4	2	mg/kg	3	<2	2	<2	<2
Copper	7440-50-8	5	mg/kg	<5	<5	<5	<5	<5
Lead	7439-92-1	5	mg/kg	9	<5	<5	6	<5
Manganese	7439-96-5	5	mg/kg	59	<5	5	74	246
Nickel	7440-02-0	2	mg/kg	5	3	2	<2	<2
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Vanadium	7440-62-2	5	mg/kg	89	<5	9	21	<5
Zinc	7440-66-6	5	mg/kg	16	<5	<5	7	<5
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	0.2	<0.1	<0.1	<0.1	<0.1
EN60: ASLP Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)								
Extraction Fluid pH	----	0.1	pH Unit	2.8	2.8	2.8	2.8	2.8
Final pH	----	0.1	pH Unit	3.5	2.9	4.1	2.8	3.2



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ATS 14 2-3	ATS 14 3-4	ATS 23 4-5	ATS 24 2-3	ATS 25 1-2
Sampling date / time					[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]
Compound	CAS Number	LOR	Unit		EP2205478-006	EP2205478-007	EP2205478-008	EP2205478-009	EP2205478-010
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		1.1	<1.0	<1.0	<1.0	<1.0
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		5	<5	19	<5	<5
Barium	7440-39-3	10	mg/kg		20	20	<10	<10	<10
Beryllium	7440-41-7	1	mg/kg		<1	<1	<1	<1	<1
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		19	12	6	<2	4
Cobalt	7440-48-4	2	mg/kg		<2	<2	<2	<2	<2
Copper	7440-50-8	5	mg/kg		<5	<5	<5	<5	<5
Lead	7439-92-1	5	mg/kg		<5	<5	<5	<5	<5
Manganese	7439-96-5	5	mg/kg		9	6	<5	<5	14
Nickel	7440-02-0	2	mg/kg		<2	<2	<2	<2	3
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Vanadium	7440-62-2	5	mg/kg		36	18	<5	<5	<5
Zinc	7440-66-6	5	mg/kg		11	<5	7	78	372
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EN60: ASLP Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)									
Extraction Fluid pH	----	0.1	pH Unit		2.8	2.8	2.8	2.8	2.8
Final pH	----	0.1	pH Unit		3.1	3.1	2.9	2.9	3.0



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ATS 25 2-3	ATS 26 2-3	ATS 27 1-2	ATS 27 3-4	ATS 29 2-3
Sampling date / time					[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]
Compound	CAS Number	LOR	Unit		EP2205478-011	EP2205478-012	EP2205478-013	EP2205478-014	EP2205478-015
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		<1.0	<1.0	<1.0	<1.0	1.2
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		<5	<5	<5	<5	9
Barium	7440-39-3	10	mg/kg		<10	<10	<10	<10	100
Beryllium	7440-41-7	1	mg/kg		<1	<1	<1	<1	<1
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		5	<2	<2	<2	10
Cobalt	7440-48-4	2	mg/kg		<2	<2	<2	<2	<2
Copper	7440-50-8	5	mg/kg		<5	<5	<5	<5	<5
Lead	7439-92-1	5	mg/kg		<5	<5	<5	<5	6
Manganese	7439-96-5	5	mg/kg		14	<5	<5	<5	9
Nickel	7440-02-0	2	mg/kg		<2	<2	<2	<2	<2
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Vanadium	7440-62-2	5	mg/kg		<5	<5	<5	<5	14
Zinc	7440-66-6	5	mg/kg		360	<5	<5	<5	<5
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EN60: ASLP Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)									
Extraction Fluid pH	----	0.1	pH Unit		2.8	2.8	2.8	2.8	2.8
Final pH	----	0.1	pH Unit		3.0	2.8	2.8	2.8	3.0



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ATS 30 2-3	ATS 31 1-2	ATS 31 2-3	ATS 31 4-5	----
Sampling date / time					[04-May-2022]	[04-May-2022]	[04-May-2022]	[04-May-2022]	----
Compound	CAS Number	LOR	Unit		EP2205478-016	EP2205478-017	EP2205478-018	EP2205478-019	-----
					Result	Result	Result	Result	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		<1.0	<1.0	4.8	<1.0	----
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		<5	<5	13	<5	----
Barium	7440-39-3	10	mg/kg		<10	<10	20	<10	----
Beryllium	7440-41-7	1	mg/kg		<1	<1	<1	<1	----
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	----
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	----
Chromium	7440-47-3	2	mg/kg		<2	<2	12	<2	----
Cobalt	7440-48-4	2	mg/kg		<2	<2	<2	<2	----
Copper	7440-50-8	5	mg/kg		<5	<5	<5	<5	----
Lead	7439-92-1	5	mg/kg		<5	<5	6	<5	----
Manganese	7439-96-5	5	mg/kg		<5	<5	<5	<5	----
Nickel	7440-02-0	2	mg/kg		<2	<2	<2	<2	----
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	----
Vanadium	7440-62-2	5	mg/kg		<5	<5	25	<5	----
Zinc	7440-66-6	5	mg/kg		14	<5	<5	<5	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	----
EN60: ASLP Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)									
Extraction Fluid pH	----	0.1	pH Unit		2.8	2.8	2.8	2.8	----
Final pH	----	0.1	pH Unit		3.0	2.9	3.0	2.9	----



Environmental

QUALITY CONTROL REPORT

Work Order : EP2205478

Page : 1 of 8

Client : The Trustee for Mine Earth Unit Trust

Laboratory : Environmental Division Perth

Contact

Address

Telephone

Project : ATS-2102 Atlas mineral sands

Order number : ----

C-O-C number : ----

Sampler : Image Resources

Site : ----

Quote number : EP/177/22_V2

No. of samples received : 19

No. of samples analysed : 19

Date Samples Received : 04-May-2022

Date Analysis Commenced : 09-May-2022

Issue Date : 13-May-2022



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories

Position

Accreditation Category



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 4325720)									
EP2205339-001	Anonymous	EG005T: Beryllium	7440-41-7	1	mg/kg	2	2	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	110	90	14.5	0% - 50%
		EG005T: Chromium	7440-47-3	2	mg/kg	42	38	11.6	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	27	19	33.6	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	51	50	2.0	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	82	74	11.2	0% - 50%
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	396	421	6.1	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Vanadium	7440 62 2	5	mg/kg	99	98	1 2	0% 50%
		EG005T: Zinc	7440-66-6	5	mg/kg	59	57	3.4	0% - 50%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.0	No Limit
EP2205478-002	ATS - Tailings sand	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Barium	7440 39 3	10	mg/kg	10	10	0 0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	3	3	0.0	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	3	4	31.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440 50 8	5	mg/kg	5	5	0 0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	<5	<5	0.0	No Limit

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 Work Order : EP2205478
 Client : The Trustee for Mine Earth Unit Trust
 Project : ATS-2102 Atlas mineral sands



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 4325720) - continued									
EP2205478-002	ATS - Tailings sand	EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Vanadium	7440-62-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.0	No Limit
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 4325722)									
EP2205478-012	ATS 26 2-3	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	<10	<10	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Vanadium	7440-62-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.0	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4325697)									
EP2205478-001	ATS - Tailings slimes	EA055: Moisture Content	----	0.1	%	3.7	3.7	0.0	No Limit
EP2205478-010	ATS 25 1-2	EA055: Moisture Content	----	0.1	%	<1.0	<1.0	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4325721)									
EP2205341-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP2205478-002	ATS - Tailings sand	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4325723)									
EP2205478-015	ATS 29 2-3	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)C: Leachable Metals by ICPAES (QC Lot: 4332223)									
EP2205478-001	ATS - Tailings slimes	EG005C: Beryllium	7440-41-7	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Cadmium	7440-43-9	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Selenium	7782-49-2	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Barium	7440-39-3	0.1	mg/L	0.5	0.5	0.0	No Limit
		EG005C: Boron	7440-42-8	0.1	mg/L	0.2	0.2	0.0	No Limit
		EG005C: Chromium	7440-47-3	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Cobalt	7440-48-4	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Copper	7440-50-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit

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 Work Order : EP2205478
 Client : The Trustee for Mine Earth Unit Trust
 Project : ATS-2102 Atlas mineral sands



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)C: Leachable Metals by ICPAES (QC Lot: 4332223) - continued									
EP2205478-001	ATS - Tailings slimes	EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Manganese	7439-96-5	0.1	mg/L	0.4	0.4	0.0	No Limit
		EG005C: Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Vanadium	7440-62-2	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Zinc	7440-66-6	0.1	mg/L	<0.1	<0.1	0.0	No Limit
EP2205478-011	ATS 25 2-3	EG005C: Beryllium	7440-41-7	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Cadmium	7440-43-9	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Selenium	7782-49-2	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Barium	7440-39-3	0.1	mg/L	0.2	0.2	0.0	No Limit
		EG005C: Boron	7440-42-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Chromium	7440-47-3	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Cobalt	7440-48-4	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Copper	7440-50-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Manganese	7439-96-5	0.1	mg/L	0.3	0.3	0.0	No Limit
		EG005C: Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Vanadium	7440-62-2	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Zinc	7440-66-6	0.1	mg/L	15.0	15.2	0.9	0% - 20%
EG035C: Leachable Mercury by FIMS (QC Lot: 4332224)									
EP2205478-003	ATS 06 1-2	EG035C: Mercury	7439-97-6	0.0001	mg/L	<0.0010	<0.0010	0.0	No Limit
EP2205478-012	ATS 26 2-3	EG035C: Mercury	7439-97-6	0.0001	mg/L	<0.0010	<0.0010	0.0	No Limit



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4325720)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	97.9	81.5	118
EG005T: Barium	7440-39-3	10	mg/kg	<10	143 mg/kg	93.5	77.5	110
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	5.63 mg/kg	106	70.0	130
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	85.1	76.2	106
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	71.5	66.9	138
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	16 mg/kg	86.2	70.0	130
EG005T: Copper	7440-50-8	5	mg/kg	<5	32 mg/kg	91.7	79.1	113
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	87.5	78.9	112
EG005T: Manganese	7439-96-5	5	mg/kg	<5	130 mg/kg	103	70.0	130
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55 mg/kg	83.6	81.5	126
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5.37 mg/kg	90.3	70.0	130
EG005T: Vanadium	7440-62-2	5	mg/kg	<5	29.6 mg/kg	87.8	70.0	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	86.0	81.0	119
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4325722)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	103	81.5	118
EG005T: Barium	7440-39-3	10	mg/kg	<10	143 mg/kg	96.7	77.5	110
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	5.63 mg/kg	106	70.0	130
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	87.3	76.2	106
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	75.8	66.9	138
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	16 mg/kg	88.1	70.0	130
EG005T: Copper	7440-50-8	5	mg/kg	<5	32 mg/kg	91.7	79.1	113
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	96.1	78.9	112
EG005T: Manganese	7439-96-5	5	mg/kg	<5	130 mg/kg	110	70.0	130
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55 mg/kg	88.6	81.5	126
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5.37 mg/kg	93.1	70.0	130
EG005T: Vanadium	7440-62-2	5	mg/kg	<5	29.6 mg/kg	91.0	70.0	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	90.0	81.0	119
EN60: ASLP Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel) (QCLot: 4325880)								
EN60a-G: Extraction Fluid pH	----	0.1	pH Unit	2.8	----	----	----	----
EN60a-G: Final pH	----	0.1	pH Unit	2.9	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4325721)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	103	81.0	115



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4325723)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	103	81.0	115

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EG005(ED093)C: Leachable Metals by ICPAES (QCLot: 4332223)								
EG005C: Arsenic	7440-38-2	0.1	mg/L	<0.1	1 mg/L	104	90.4	124
EG005C: Barium	7440-39-3	0.1	mg/L	<0.1	1 mg/L	102	82.4	137
EG005C: Beryllium	7440-41-7	0.05	mg/L	<0.05	1 mg/L	106	83.5	154
EG005C: Boron	7440-42-8	0.1	mg/L	<0.1	10 mg/L	103	80.0	120
EG005C: Cadmium	7440-43-9	0.05	mg/L	<0.05	0.1 mg/L	98.4	91.0	115
EG005C: Chromium	7440-47-3	0.1	mg/L	<0.1	1 mg/L	96.7	87.4	113
EG005C: Cobalt	7440-48-4	0.1	mg/L	<0.1	1 mg/L	97.4	70.0	130
EG005C: Copper	7440-50-8	0.1	mg/L	<0.1	1 mg/L	101	88.9	123
EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	1 mg/L	96.0	93.7	115
EG005C: Manganese	7439-96-5	0.1	mg/L	<0.1	1 mg/L	107	89.5	116
EG005C: Nickel	7440-02-0	0.1	mg/L	<0.1	1 mg/L	97.6	89.4	114
EG005C: Selenium	7782-49-2	0.05	mg/L	<0.05	1 mg/L	97.2	84.8	130
EG005C: Vanadium	7440-62-2	0.1	mg/L	<0.1	1 mg/L	95.6	86.6	116
EG005C: Zinc	7440-66-6	0.1	mg/L	<0.1	5 mg/L	91.2	90.2	128
EG035C: Leachable Mercury by FIMS (QCLot: 4332224)								
EG035C: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.005 mg/L	98.2	83.1	115

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number			Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4325720)							
EP2205339-001	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	# 52.0	70.0	130
		EG005T: Barium	7440-39-3	50 mg/kg	74.5	70.0	130
		EG005T: Beryllium	7440-41-7	50 mg/kg	103	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	87.6	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	97.0	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	75.1	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	113	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	90.5	70.0	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4325720) - continued							
EP2205339-001	Anonymous	EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	85.8	70.0	130
		EG005T: Vanadium	7440-62-2	50 mg/kg	84.5	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	82.7	70.0	130
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4325722)							
EP2205478-012	ATS 26 2-3	EG005T: Arsenic	7440-38-2	50 mg/kg	96.1	70.0	130
		EG005T: Barium	7440-39-3	50 mg/kg	99.0	70.0	130
		EG005T: Beryllium	7440-41-7	50 mg/kg	103	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	94.4	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	90.0	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	92.6	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	93.9	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	99.1	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	107	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	94.2	70.0	130
		EG005T: Vanadium	7440-62-2	50 mg/kg	88.6	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	89.3	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4325721)							
EP2205341-001	Anonymous	EG035T: Mercury	7439-97-6	1 mg/kg	94.1	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4325723)							
EP2205478-015	ATS 29 2-3	EG035T: Mercury	7439-97-6	1 mg/kg	94.6	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)C: Leachable Metals by ICPAES (QCLot: 4332223)							
EP2205478-002	ATS - Tailings sand	EG005C: Arsenic	7440-38-2	1 mg/L	104	70.0	130
		EG005C: Barium	7440-39-3	1 mg/L	103	70.0	130
		EG005C: Beryllium	7440-41-7	1 mg/L	106	70.0	130
		EG005C: Cadmium	7440-43-9	0.25 mg/L	98.0	70.0	130
		EG005C: Chromium	7440-47-3	1 mg/L	96.2	70.0	130
		EG005C: Cobalt	7440-48-4	1 mg/L	98.0	70.0	130
		EG005C: Copper	7440-50-8	1 mg/L	97.9	70.0	130
		EG005C: Lead	7439-92-1	1 mg/L	96.8	70.0	130
		EG005C: Manganese	7439-96-5	1 mg/L	105	70.0	130
		EG005C: Nickel	7440-02-0	1 mg/L	99.7	70.0	130
		EG005C: Vanadium	7440-62-2	1 mg/L	95.0	70.0	130
		EG005C: Zinc	7440-66-6	1 mg/L	93.6	70.0	130



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035C: Leachable Mercury by FIMS (QCLot: 4332224)							
EP2205478-004	ATS 07 2-3	EG035C: Mercury	7439-97-6	0.005 mg/L	102	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order : EP2205478

Page : 1 of 6

Client : The Trustee for Mine Earth Unit Trust

Laboratory : Environmental Division Perth

Contact

Project : ATS-2102 Atlas mineral sands

Site : ----

Sampler : Image Resources

Order number : ----

Issue Date : 13-May-2022

No. of samples received : 19

No. of samples analysed : 19

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP2205339--001	Anonymous	Arsenic	7440-38-2	52.0 %	70.0-130%	Recovery less than lower data quality objective
EG005(ED093)T: Total Metals by ICP-AES	EP2205339--001	Anonymous	Manganese	7439-96-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results. This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein. Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters. Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA055: Moisture Content (Dried @ 105-110°C)								
Snap Lock Bag (EA055) ATS - Tailings slimes, ATS 06 1-2, ATS 10 1-2, ATS 14 3-4, ATS 24 2-3, ATS 25 2-3, ATS 27 1-2, ATS 29 2-3, ATS 31 1-2, ATS 31 4-5	ATS - Tailings sand, ATS 07 2-3, ATS 14 2-3, ATS 23 4-5, ATS 25 1-2, ATS 26 2-3, ATS 27 3-4, ATS 30 2-3, ATS 31 2-3,	04-May-2022	----	----	----	09-May-2022	18-May-2022	✓



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG005(ED093)T: Total Metals by ICP-AES								
Snap Lock Bag (EG005T)		04-May-2022	09-May-2022	31-Oct-2022	✔	11-May-2022	31-Oct-2022	✔
ATS - Tailings slimes,								

Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	19	10.53	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	3	25	12.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	3	28	10.71	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Total Mercury by FIMS	EG035T	2	25	8.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	28	7.14	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
ASLP for Non & Semivolatile Analytes - Glass Leaching Vessel	EN60a-G	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	25	8.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	28	7.14	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	2	25	8.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	28	7.14	5.00	✔	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Leachable Mercury by FIMS	EG035C	2	19	10.53	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Leachable Metals by ICPAES	EG005C	2	19	10.53	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Leachable Mercury by FIMS	EG035C	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Leachable Metals by ICPAES	EG005C	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Leachable Mercury by FIMS	EG035C	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Leachable Metals by ICPAES	EG005C	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Leachable Mercury by FIMS	EG035C	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Leachable Metals by ICPAES	EG005C	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Leachable Metals by ICPAES	EG005C	SOIL	In house: referenced to APHA 3120; USEPA SW 846 - 6010: The ICPAES technique ionises leachate sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Leachable Mercury by FIMS	EG035C	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the TCLP solution. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals in TCLP Leachate	EN25C	SOIL	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)
ASLP for Non & Semivolatile Analytes - Glass Leaching Vessel	EN60a-G	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).



CHAIN OF CUSTODY

ALS Laboratory: please tick →

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WOLLONGONG 99 Kenny Street, Wollongong NSW 2500
Ph: 02 4225 3129 E: wollongong@alsglobal.com

CLIENT: Mine Earth	TURNAROUND REQUIREMENTS: <input checked="" type="checkbox"/> Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle) COC: 1 2 3 4 5 6 7 REF: 1 2 3 4 5 6 7
OFFICE: Unit 1/94 Forsyth St, O'Connor, WA	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) <input type="checkbox"/> Non Standard or urgent TAT (List due date):	
PROJECT: ATS-2102 Atlas mineral sands	ALS QUOTE NO.: EP/177/22_V2	
PURCHASE ORDER NUMBER:	COUNTRY OF ORIGIN: AUSTRALIA	
PROJECT MANAGER: Matt Braimbridge	CONTACT PH: 0407 086 443	
SAMPLER: Image Resources	SAMPLER MOBILE:	
COC Emailed to ALS? (YES <input checked="" type="checkbox"/> NO)	EDD FORMAT (or default):	
Email Reports to: matt@mineearth.com.au	RELINQUISHED BY:	RECEIVED BY:
Email Invoice to: matt@mineearth.com.au	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:
All samples to be analysed for:
- NEPM 2013 Suite 15 metals (ALS code: S-03)
- Leachable metals (Acetic acid leach) (ALS code: EG005C, EG035C, EN60a-G)
- quote as per EP/177/22_V2 (Suite 3 and Suite 4)

SAMPLE DETAILS		CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)										Additional Information	
MATRIX: Solid(S) Water(W)				Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (filtered bottle required).											
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	(ALS code S-03) USEPA 6010, ALPHA 3112 Hg - B, in house	(ALS code EG005C, EG035C) Leachable metals by ICPAES								
1	ATS - Tailings slimes		S	B	1	x	x								
2	ATS - Tailings sand		S	B	1	x	x								
3	ATS 06 1-2		S	B	1	x	x								
4	ATS 07 2-3		S	B	1	x	x								
5	ATS 10 1-2		S	B	1	x	x								
6	ATS 14 2-3		S	B	1	x	x								
7	ATS 14 3-4		S	B	1	x	x								
8	ATS 23 4-5		S	B	1	x	x								
9	ATS 24 2-3		S	B	1	x	x								
10	ATS 25 1-2		S	B	1	x	x								
11	ATS 25 2-3		S	B	1	x	x								
12	ATS 26 2-3		S	B	1	x	x								
13	ATS 27 1-2		S	B	1	x	x								
14	ATS 27 3-4		S	B	1	x	x								
15	ATS 29 2-3		S	B	1	x	x								
16	ATS 30 2-3		S	B	1	x	x								
17	ATS 31 1-2		S	B	1	x	x								
18	ATS 31 2-3		S	B	1	x	x								
19	ATS 31 4-5		S	B	1	x	x								
					19	19	19								

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic

Environmental Division
Perth
Work Order Reference
EP2205478



Telephone : -- 61-8-9406 1301