REPORT

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Northern Area Material Characterisation

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1 INTRODUCTION

Mount Rawdon Operation (MRO) is an open cut gold mine located approximately 80 kilometres (km) southwest of Bundaberg in Southeast Queensland. MRO is owned and operated by Evolution Mining Limited (Evolution) via its subsidiary Mt Rawdon Operations Pty Ltd, and authorised by the Department of Environment, Science, and Innovation (DESI) under Environmental Authority (EA) EPML00712113.

Mining, processing of ore, and tailings deposition commenced in 2001. Tailings produced at the Carbon-in-Leach (CIL) treatment plant is pumped as slurry to the Tailings Storage Facility (TSF), which occupies an area of approximately 130 hectares (ha). The TSF has been developed in a series of staged construction and comprises a valley type storage formed by three embankments.

1.1 Scope

The area to the east and north of the TSF was identified in previous reports as being the borrow source for suitable rehabilitation materials. This report outlines the methodology and results of a test pit, sampling, and testing program (the program) undertaken by ATC Williams Pty Ltd (ATCW) to support the rehabilitation and closure planning for the TSF and development of field scale cover system trials (the trials) on the northern area. ATCW has also assessed various stockpiles for suitability, being the topsoil, wetland and west rock dump stockpiles, which are reported under separate cover.

Selection of suitable cover materials is important for the successful rehabilitation of the TSF. The materials selection will influence the effectiveness of the chosen cover system design in controlling water infiltration, managing, and promoting long term stability, and assessing the feasibility of the cover system design. The program aimed to supplement previous site investigations and identify the availability and suitability of borrow material for use in the cover system for the rehabilitation of the TSF.

2 DESKTOP REVIEW

2.1 Site Setting

2.1.1 Topography

Local topography is characterised by steep hills and valleys to the north and west of the MRO and rolling hills to the east. The MRO is located within a gently sloping valley to the north towards Swindon Creek. The highest point in the area is Mount Rawdon, which has an elevation of approximately 400 metres Australian Height Datum (m AHD). The surrounding steep hills are generally lower between 120-150 m AHD. Mount Prazier is located to the north and has a small summit area and steep slopes.

The steep slopes suggest a high potential for soil erosion, leading to shallow soil profiles over weathered rock. Additionally, the narrow valleys with limited depositional zones may restrict the availability of suitable cover material. Directly around MRO and to the east, deeper soil may be present due to lower erosion rates and deposition in the broader valley.

2.1.2 Geology

The geological setting is described as follows **[2]**.

> *The Maryborough geological map (1:250 000 scale:1968) indicates the geology of the area to comprise late Triassic Aranbanga Volcanic Group and/or Mount Rawdon Volcanics sequences, which consist typically of rhyolitic or andesitic volcanoclastics. Jurassic aged Hogback Tonalite and much older Permian aged Biggenden Beds also occur on a more regional scale. Jointing/lineations associated with this geology is reported to be subparallel with the Perry fault, which trends generally south to north through the Boolbunda Range. The drainage on which the tailings dam is to be formed therefore appears to be structurally controlled, in alignment with jointing.*

The local geology, based on previous site investigation works within the project area, appears to vary considerably ranging from metasediments to tuff, with trachyte dykes throughout the site. These rocks have been interpreted to be principally volcanics, possibly rhyolite, forming part of the Aranbanga Volcanic Group. Notwithstanding the origin, these sequences are generally deeply weathered, with very weak to weak rock extending to depths greater than 6 m.

2.1.3 Soil Types

Map units in the Atlas of Australian Soils represent soil landscapes, which encompass the spatial distribution of soils with similar characteristics and formed under similar environmental conditions. These map units are shown in **MAP 1.** There are two distinctive soil groups present in proximity of the MRO site:

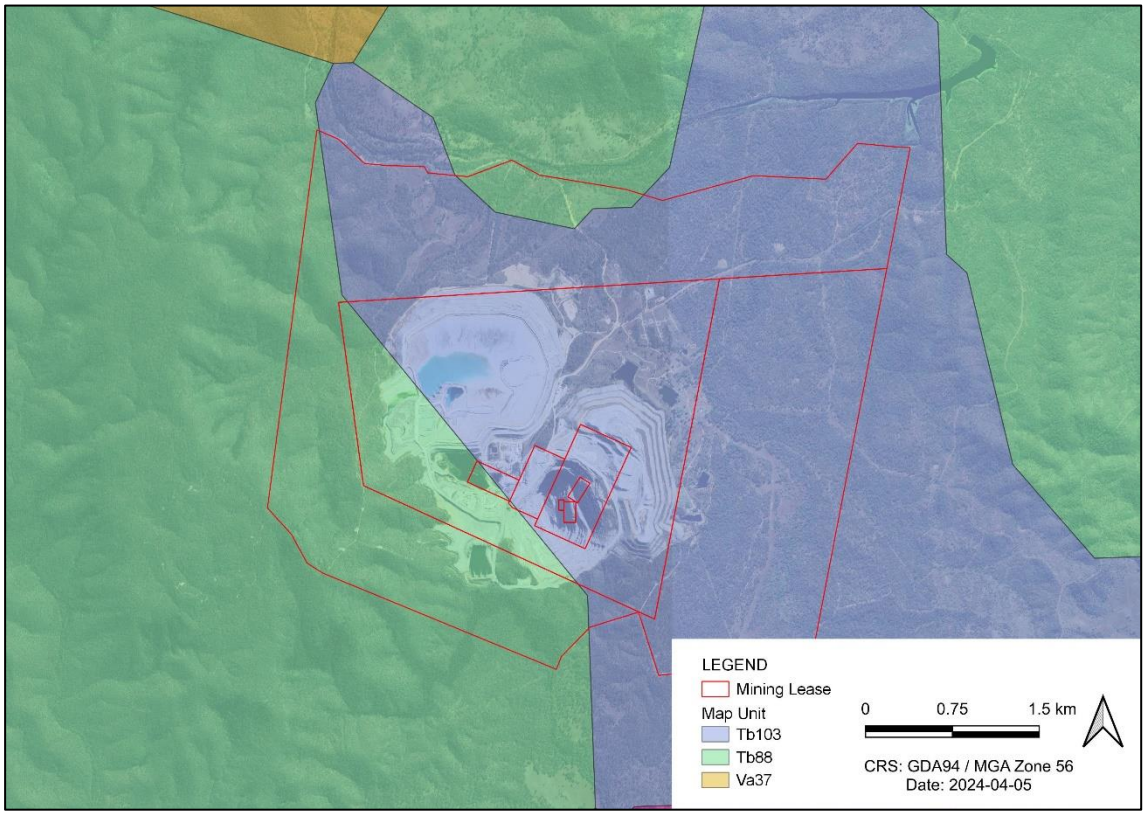
Tb103: Low to moderately hilly lands on phyllites and schists; a close pattern of hills with short to moderate slopes: chief soils are gravelly hard acidic yellow mottled soils (Dy3.41) and (Dy2.41) with shallow gravelly loamy soils (Um2.12) and (Um4.1) on crests and upper slopes. Associated are gravelly (Dr3.41) soils. Minor soil occurrences include gradational non-calcareous grey soil (Gn3.42).

Tb88: Steep hilly to mountainous country on metasediments: chief soils are hard acidic yellow mottled soils (Dy3.41) with hard acidic red soils (Dr3.41) and (Dr2.41), all often stony. Associated are shallow loams (Um1.42) and (Um2.12) on the steeper slopes; (Dr2.21), (Dy2.21), and (Dy2.23) soils with smaller areas of (Uc1.21 and Uc1.23) on included granites; and (Uf6.41) and (Gn3.11) soils on included basic rocks.

The Australian Soil Classification (ASC) order is shown in **MAP 2** and shows soils are typically classed as:

- Tenosol: Shallow, stony, uniform medium/ fine textured soils.
- Rudosol: Very shallow to shallow, uniform, medium textured soils over rock.

MAP 1: SOIL MAP UNITS



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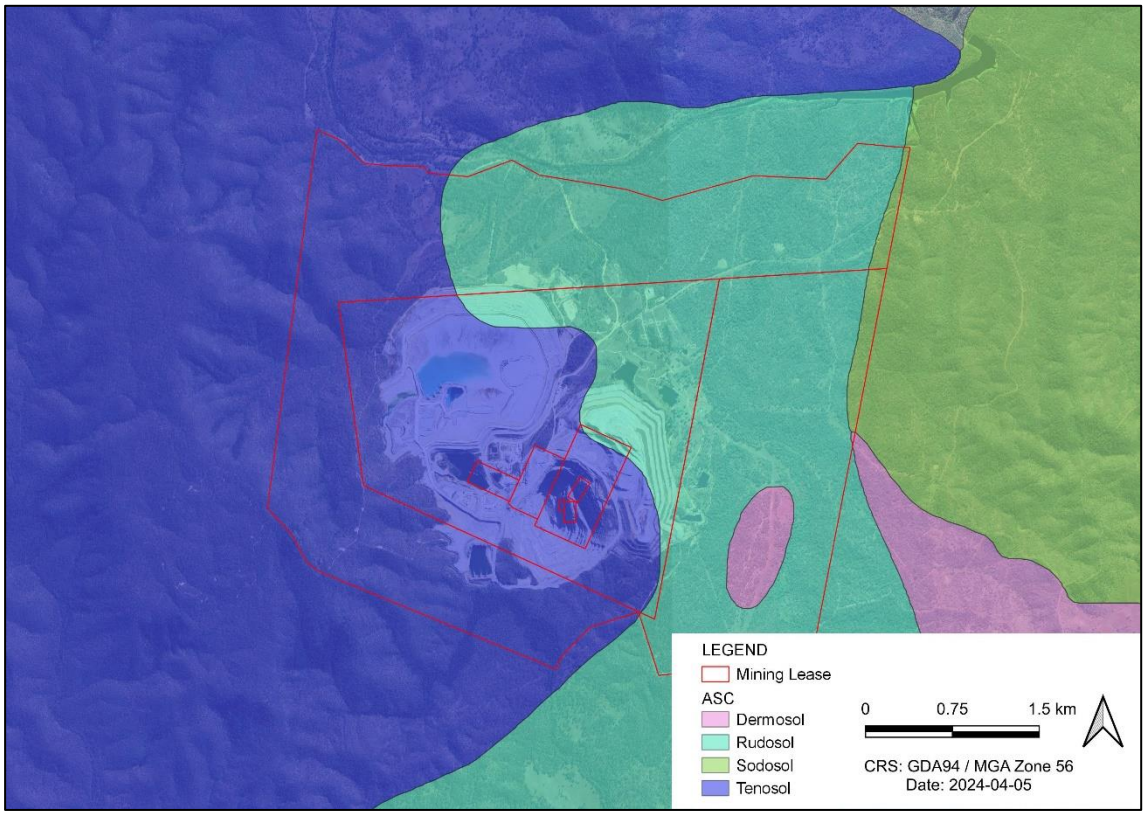
MAP 2: AUSTRALIAN SOIL CLASSIFICATION ORDER



2.2 Conceptual Cover System Design

The investigation into potential cover options for the closure of the TSF has been ongoing since 2007 **[1], [3], [4]**, **[5]**. The most recent was a conceptual cover design completed by ATCW in 2023, which assessed four cover options and identified a store and release cover system design as the preferred cover option **[1]**.

Three cover system options, adapted from **[1],** are proposed to progress to the field scale cover system trials on the TSF. These cover system options include the following layers with the following purpose and function:

- Topsoil Layer: The topsoil layer will serve as the primary medium for vegetation growth. The growth of vegetation will also help prevent surface erosion by stability the soil with plant roots.
- Infiltration Storage Layer (ISL): The ISL will store infiltrated water and slowly release it to reduce risk of percolation into the tailings and maintain soil moisture for vegetation.
- Reduced Permeability Layer (RPL): The RPL is designed to limit the downward movement of water, therefore, minimising the risk of water infiltrating the tailings.
- Capillary Break Layer (cover A only): The capillary break layer will disrupt the upward movement of water through capillary action.

These layers, when combined, can create an effective cover system designed to control the soil water balance (e.g. evapotranspiration, runoff and drainage) and promote the long term stability of the rehabilitated TSF.

2.3 Previous Site Investigations

An outline of previous site investigations is provided in the material characterisation review undertaken by ATCW **[6]** and has been included as an attachment in **APPENDIX A**. Previous extensive investigations were either targeted at shallow depths to 1 m or targeted deeper depths > 2 m and

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ignored the nearer surface layers. It was recommended that additional test pitting was undertaken to gain a better understanding of the material distribution and characteristics.

3 MATERIAL INVESTIGATION METHODOLOGY

3.1 General

The material characterisation review identified gaps in sampling locations and depths as well as gaps in the chemical and physical analyses undertaken. Further investigations were recommended following the material characterisation review **[6]** to expand the spatial distribution of test pit in the north and north east of the TSF. The areas to the west appear too steep and the soil is likely to be relatively shallow.

Details of the material investigation methodology are summarised below:

- Excavation of 15 test pits at various locations including:
  - Logging of the encountered subsurface profile;
  - Collection of disturbed samples;
  - Preparation of samples for distribution to selected laboratories;
- Collection of tailings samples for the purpose of laboratory testing.

3.1.1 Locations

Material investigation locations are displayed in **FIGURE 001** and a summary is displayed in **TABLE 1**. The Material Investigation Plan (**APPENDIX B**) included 16 test pits, however test pit ATP013 was unable to be excavated at the time of the investigation due to access limitations.

TABLE 1: MATERIAL INVESTIGATION LOCATIONS

INVESTIGATION ID	EASTING	NORTHING	TERMINATION DEPTH (m)
ATP001	377109	7204763	1.7
ATP002	376404	7205526	2.0
ATP003	376912	7206325	2.2
ATP004	376934	7206892	0.4
ATP005	377785	7205794	2.0
ATP006	375889	7206931	1.6
ATP007	375261	7207124	2.0
ATP008	375314	7206567	0.7
ATP009	374384	7207122	2.4
ATP010	374236	7206489	2.3
ATP011	375801	7206387	2.3
ATP012	377675	7206471	0.75
ATP014	376352	7206422	2.1
ATP015	374976	7207237	1.3
ATP016	374721	7206740	1.9

3.1.2 Test Pitting

Test pits were excavated using a CAT 44F2 backhoe with a 300 mm toothed bucket operated by an appropriately qualified contractor (Greensills Farming Pty Ltd) engaged by Evolution to facilitate the investigation. An ATCW engineer was present to oversee and facilitate the investigation, including providing sample description and sampling soils.

Test pits excavation depths ranged from 0.4 m to 2.4 m below ground level (BGL). Excavation depths were to the maximum reach of the equipment or until practical refusal on encountered impenetrable materials (as directed by ATCW). On completion of test pit, the excavation was backfilled and track rolled until compacted. *In situ* disturbed samples were collected at selected depths and sent to the selected laboratories for analysis (refer **SECTION 3.3**).

3.1.3 Logging

An ATCW engineer logged the encountered profile within each test pit based on visual and tactile evidence observed in the field. The geotechnical logs document the relevant observations and describe the material in accordance with Australian Standard AS1726:2017. Geotechnical logs are presented in **APPENDIX C.**

3.2 Sample Collection

3.2.1 Soil/Rock

Disturbed bulk and grab sample collection was performed by the ATCW engineer by collecting a disturbed sample from the stockpile. The depth of each sample was recorded, based on the observed profile within each test pit.

3.2.2 Tailings

The following tailings samples were collected from the TSF impoundment by Evolution using hand recovery techniques from the tailings surface:

- Two fines tailings samples (TSF-FN-1 and TSF-FN-2); and
- Two coarse tailings samples (TSF-CRS-1 and TSF-CRS2).

3.3 Laboratory Analysis

3.3.1 Soil/Rock

Representative strata samples were sent to the following laboratories:

- Environmental Analysis Laboratory (EAL) at Southern Cross University; and
- Construction Sciences Rockhampton Laboratory (Construction Sciences).

Test pit sub-samples were analysed by EAL for pH (one part sample to five parts water (1:5)) and Electrical Conductivity (EC) (1:5). Due to time constraints, the selection of composite samples was undertaken based on geotechnical logs and not on screening analyses as originally proposed. Select test pit and composite sub-samples were analysed by EAL for the following:

- pH (1:5) and EC (1:5);
- Available (Ammonium, Nitrate, And Sulphur);
- Exchangeable (Sodium, Potassium, Calcium, Magnesium, Hydrogen, Aluminium, Cation Exchangeable Capacity (CEC));
- Colwell (Phosphorus);
- Available Micronutrients (Zinc, Manganese, Iron, Copper, Boron, and Silicon);
- Total Carbon;

- Total Nitrogen;
- Organic Matter; and
- Five-point Soil Water Characteristic Curves (SWCCs).

In addition, select test pit sub-samples were analysed by Construction Sciences Rockhampton Laboratory for the following physical testing:

- Particle Size Distribution (PSD) (Sieve and Hydrometer);
- Standard Compaction;
- Permeability (Saturated Hydraulic Conductivity);
- Atterberg Limits and Linear Shrinkage; and
- Emerson Class.

3.3.2 Tailings

One tailings fine and one tailings coarse sample was sent to EAL Southern Cross University for the following laboratory analysis:

- Five-point SWCCs;
- Acid base account including:
  - Total Sulphur (TS);
  - Acid Neutralising Capacity (ANC);
  - Net Acid Generation (NAG) pH.

The remaining tailings fine and tailings coarse samples were sent to ATCW Melbourne Laboratory for the following laboratory analysis:

- PSD (Sieve and Hydrometer);
- Standard Compaction;
- Remoulded Permeability (Saturated Hydraulic Conductivity).

3.4 Material Assessment Criteria

Soil used for rehabilitation must be able to support plant establishment and growth. Soil has been assessed by a Certified Professional Soil Scientist with consideration of published guidelines **[7]** & **[8]** and the proposed use of native species.

4 MATERIAL INVESTIGATION RESULTS

4.1 Subsurface Conditions

4.1.1 General

The subsurface conditions encountered during the investigation have been characterised into geotechnical units based on visual and tactile evidence observed in the field, geotechnical logs and laboratory test results. The classification system adopted in the AS 1726:2017 differs from the Unified Soil Classification System (USCS). The primary difference is the criteria used to distinguish between coarse- and fine-grained materials. Geotechnical logging was undertaken in accordance with AS1726:2017 and are presented in **APPENDIX C.**

4.1.2 Soil Profile

The general soil profile encountered in the material investigation is listed below and is grouped by geological unit and presented in general order of depth:

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TOPSOIL: This A1 horizon was encountered in all test pits excluding ATP005 and ATP011, ranging from surface to 0.08 m to 0.15 m bgl. Generally comprising SAND with varying minor components, generally silt dominant. Some fine-grained topsoil was encountered with 3 test pits comprising Sandy SILT and 1 test pit comprising Clayey SAND. Topsoil encountered was generally brown in colouration and included roots / rootlets.

SLOPE WASH: Encountered from surface to 0.1 m BGL in test pit ATP011 only. This layer comprised Silty SAND, fine to medium grained sand and was brown-orange in colour. This slope wash is attributed to run-off from road upstream of test pit location and has covered the natural topsoil, which has been described as alluvium.

ALLUVIUM: Intersected in all test pits below the topsoil or slope wash, with a typical thickness ranging between 0.15 m and 0.4 m, with the exception of ATP006 and ATP016. Clayey SAND to clayey sandy GRAVEL was encountered to 0.9 m bgl at ATP006 and to 1.6 m bgl at ATP016; the latter location is close to Swindon Creek.

For the remaining locations, the alluvium was typically lighter coloured and textured than the topsoil and contained gravel in some locations, suggesting it was an A2 horizon but it was not conspicuously bleached as noted for Soil type TB103 (refer to **Section 2.1.3**). Fine grained soil was typically comprised of grey and brown Silty CLAY / CLAY of low to high plasticity, with occasional trace sand. Test pit ATP012 intersected a layer of dark brown Sandy SILT between 0.1 m and 0.3 m BGL. Coarse grained soil typically comprised Silty / Clayey SAND, fine to medium grained, typically grey and brown, occasionally with gravel. Other coarse-grained layer of fine to medium grained, subrounded to subangular GRAVEL with varying minor components were also encountered.

RESIDUAL: This subsoil layer (B horizon) is derived from the underlying rock and was **e**ncountered in all test pits excluding ATP004, layer ranged between 0.1 m and 1.9 m thick and was encountered to termination depth of 2.3 m BGL in test pit ATP010. Residual soil typically comprised Sandy CLAY, of varying plasticity, typically brown or grey colouration with orange mottling and occasionally with gravels. Noting isolated layers of CLAY and Sandy Gravelly CLAY were present. Coarse grained residual soil was encountered in test pit ATP016 only and comprised Clayey SAND overlying Clayey Sandy GRAVEL (grading to weathered rock).

EXTREMELY WEATHERED (XW) MATERIAL: The extremely weathered material is a soi layer that still contain the appearance of rock, i.e. the C horizon. Intersected between 1.0 m 2.0 m to depths of 1.7 m and 2.3 m bgl (also to termination depths) in test pits ATP003, ATP005, ATP007, ATP009, ATP011 and ATP013. Layer comprised coarse- and fine-grained materials including fine to coarse grained Clayey SAND / SAND, medium plasticity Sandy CLAY and low liquid limit Sandy SILT. Material encountered was typically interbedded with or tending to very low strength weathered rock.

WEATHERED ROCK: Intersected most test pits between 0.3 m and 1.7 m bgl to termination depths (between 0.4 m and 2.4 m bgl). Geological unit comprised various metasedimentary and igneous rocks with varying weathering and colouration. Rock encountered was typically low strength generally increasing in strength with depth and / or until termination at practical bucket refusal.

A summary of the characterised soil units is displayed below in **TABLE 2**. The soil profiles encountered were typically duplex soil with occasional shallow, gravelly loamy soil (Test pit ATP004), as expected based on the soil mapping (**SECTION 2.1.3**). However, the soil classifications nominated also indicate that the soil would contain a conspicuously bleached A2 horizon but this was not noted in the description of the alluvium underlying the topsoil. Also, the clay subsoil (residual) was not yellow as expected.

TABLE 2: SOIL UNIT SUMMARY

TESTPIT ID	TOPSOIL	SLOPE WASH	ALLUVIUM	RESIDUAL	XW MATERIAL	WEATHERED ROCK
ATP001	0.0 - 0.1	-	0.1 - 0.3	0.3 - 1.1	-	1.1 - 1.3^{TD}
ATP002	0.0 - 0.1	-	0.1 - 0.25	0.25 - 0.9	-	0.9 – 2.0 ^{TD}
ATP003	0.0 - 0.1	-	0.1 - 0.3	0.3 - 1	1 - 1.8 ^{TD}	-
ATP004	0.0 - 0.1	-	0.1 - 0.3	-	-	0.3 - 0.4 ^{TD}
ATP005	-	-	0 - 0.3	0.3 - 1.1	1.1 - 1.9 ^{TD}	-

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TESTPIT ID	TOPSOIL	SLOPE WASH	ALLUVIUM	RESIDUAL	XW MATERIAL	WEATHERED ROCK
ATP006	0.0 - 0.15	-	0.15 - 0.9	0.9 - 1.4	-	1.4 - 1.6 TD
ATP007	0.0 - 0.1	-	0.1 - 0.7	0.7 - 1.6	1.6 - 1.7	1.7 – 2.0 TD
ATP008	0.0 - 0.1	-	0.1 - 0.4	0.4 - 0.5	-	0.5 - 0.7 TD
ATP009	0.0 - 0.1	-	0.1 - 0.4	0.4 - 1.6	1.6 - 2.2	2.2 - 2.4 TD
ATP010	0.0 - 0.1	-	0.1 - 0.4	0.4 – 2.3 TD	-	-
ATP011	-	0.0 - 0.1	0.1 - 0.8	0.8 – 2.0	2 - 2.3 TD	-
ATP012	0.0 - 0.1	-	0.1 - 0.3	0.3 - 0.5	-	0.5 - 0.75 TD
ATP014	0.0 - 0.08	-	0.08 - 0.2	0.2 - 1.3	1.3 - 2.1 TD	-
ATP015	0.0 - 0.1	-	0.1 - 0.5	0.5 - 0.9	-	0.9 - 1.3 TD
ATP016	0.0 - 0.1	-	0.1 - 1.6	1.6 - 1.8	-	1.8 - 1.9 TD

Notes: TD denotes termination depth. XW Material is extremely weathered rock.

4.2 Groundwater and Seepage

Material investigation locations where groundwater/seepage was encountered are summarised in **TABLE 3** and shown in **MAP 3**. It is important to note at the time of the investigation ground conditions were wet and boggy due to recent heavy rainfall. Therefore, shallow seepage observed may have formed due to infiltration into the soil profile from the ground surface resulting in 'perched' groundwater. Typically, areas of seepage were observed where the soil profile intersected coarser grained material overlying less permeable material (i.e. clay material).

TABLE 3: SUMMARY OF GROUNDWATER/SEEPAGE OBSERVATIONS

TEST PIT ID	TYPE	DEPTH
ATP001	Seepage	0.3 m BGL
ATP006	Seepage	0.4 m BGL
ATP009	Seepage	0.4 m BGL
ATP016	Seepage	1.6 m BGL

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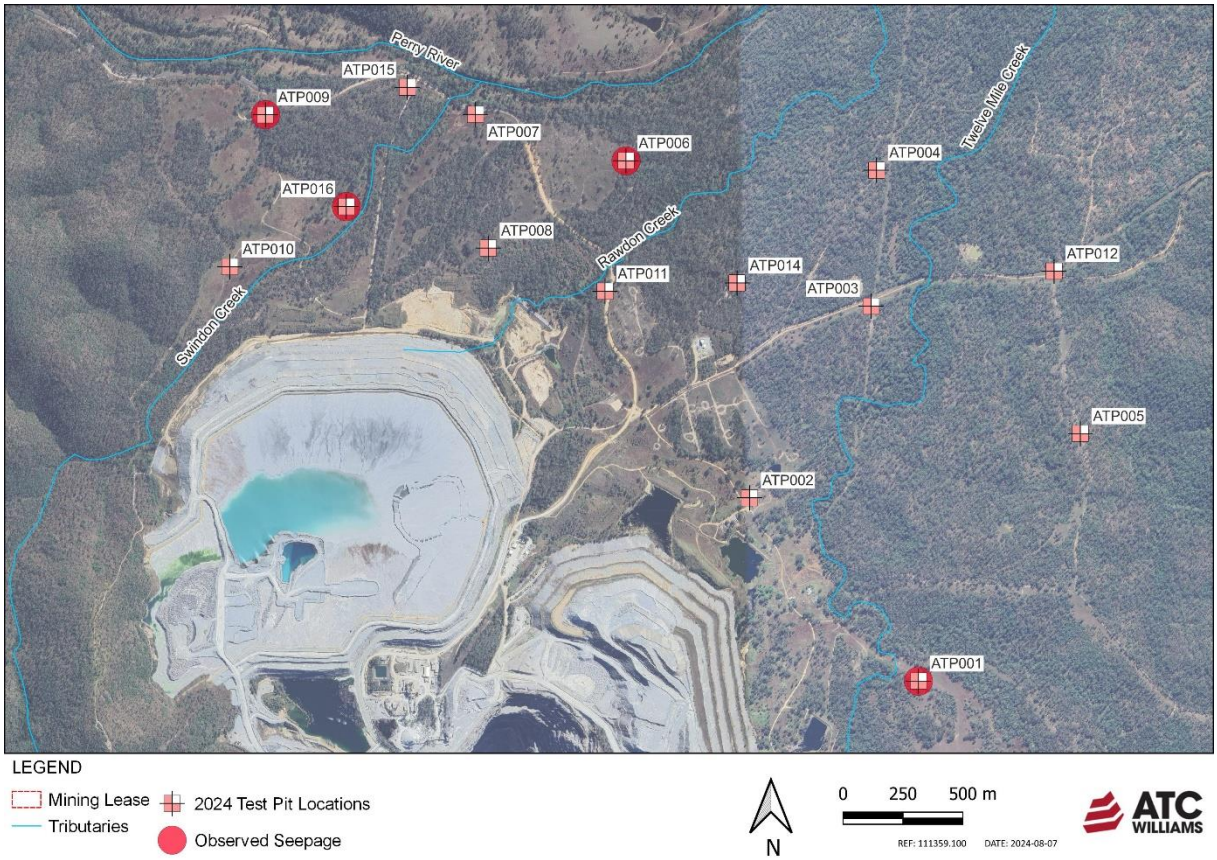
MAP 3: SEEPAGE/GROUNDWATER OBSERVATIONS



4.3 Soil/Rock Laboratory Analysis Results

Laboratory analysis was completed by EAL Southern Cross University, Construction Sciences Rockhampton Laboratory, and ATCW Melbourne Laboratory. A summary table of results is presented in **APPENDIX D** and certificates of analysis are presented in **APPENDIX E**.

4.3.1 General

Individual samples were analysed for pH (1:5) and EC (1:5). Selected samples were then composited, where appropriate, and analysed for a suite of agronomic tests (chemical testing). The compositing plan was prepared by a Certified Professional Soil Scientist and was based on the test pit logs to represent the average properties that are likely to be encountered when bulk excavation of material is undertaken. The sample IDs for the agronomic suite and samples included in the composites are summarised in **TABLE 4**.

TABLE 4: SOIL/ROCK SAMPLE IDENTIFICATION

SAMPLE ID	DISTURBED SAMPLE (CHEMICAL TESTING)	BULK DISTURBED SAMPLE (PHYSICAL TESTING)	GEOLOGICAL UNIT	SOIL UNIT REPRESENTED
Sample 1	ATP008 DS 0 - 0.1	ATP008 BDS 0 - 0.1	TOPSOIL	Topsoil, clayey SAND
Sample 2	ATP002 DS 0.3 - 0.5	ATP002 BDS 0.3 - 0.8	RESIDUAL	Residual, brown sandy CLAY

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SAMPLE ID	DISTURBED SAMPLE (CHEMICAL TESTING)	BULK DISTURBED SAMPLE (PHYSICAL TESTING)	GEOLOGICAL UNIT	SOIL UNIT REPRESENTED
Sample 3	ATP005 DS 0.4 - 0.6	ATP005 BDS 0.3 - 0.6	RESIDUAL	Residual, brown sandy CLAY
Sample 4	ATP010 DS 1.3 - 1.5 ATP011 DS 1.3 - 1.5	ATP010 BDS 1 - 1.5 ATP011 BDS 0.5 - 1	RESIDUAL	Residual, grey sandy CLAY
Sample 5	ATP015 DS 0.8 - 0.9 ATP007 DS 0.5 - 0.7 ATP009 DS 0.8 - 0.9	ATP006 BDS 0.9 - 1.4 ATP007 BDS 0.3 - 0.7 ATP009 BDS 0.5 - 1	RESIDUAL	Residual, grey CLAY
Sample 6	ATP016 DS 0.8 - 1	ATP016 BDS 0.5 - 1	ALLUVIUM	Alluvium, brown sandy GRAVEL
Sample 7	ATP006 DS 1.4 - 1.6 ATP007 DS 1.6 - 1.7	ATP006 BDS 1.4 - 1.6 ATP007 BDS 1.6 - 1.7	XW MATERIAL/ WEATHERED ROCK	Weathered rock to XW material, grey
Sample 8	ATP003 DS 2 - 2.2 ATP014 DS 1.8 - 2	ATP003 BDS 2.0 - 2.2 ATP014 BDS 1.5 - 2	XW MATERIAL	Extremely weathered (EW) material, grey
Sample 9	ATP001 DS 1.1 - 1.3 ATP005 DS 1.8 - 2	ATP001 BDS 1.1 - 1.3 ATP005 BDS 1.5 - 2	XW MATERIAL/ WEATHERED ROCK	Weathered rock to XW material, orange-brown/brown grey
Sample 10	ATP009 DS 1.9 - 2.1	ATP009 BDS 1.9 - 2.1	XW MATERIAL	XW Material, orange-brown sandstone

4.3.2 Physical Testing

Physical testing was undertaken on selected samples from different stratum as characterised in **TABLE 2**. A summary of the results is presented in **TABLE 5**. The combined sieved and hydrometer PSD results for each of the samples are displayed in **GRAPH 1** and **GRAPH 2** and are summarised below, based on International Soil Science Society (ISSS) fractions:

- The topsoil tested (sample 1) had a silt+clay content of 12% (< 5% clay) and sand content of 81% and described as a loamy sand.
- Residual soil samples tested had silt+clay content of 23 - 32% (13 - 17% clay) and sand content of 50 - 75%. There was no apparent difference between the brown clay and the grey clay. The soil is described as a sandy loam, loam or silty loam.
- The alluvial sample tested had a silt+clay content of 9% (3% clay) and a gravel content of 53% and described as a loamy sand.
- The XW material and weathered rock samples tested had silt+clay content 19 - 36% (12 - 26% clay) and sand content of 31 - 68%. The material was described as a sandy loam, sandy clay loam or clay loam.

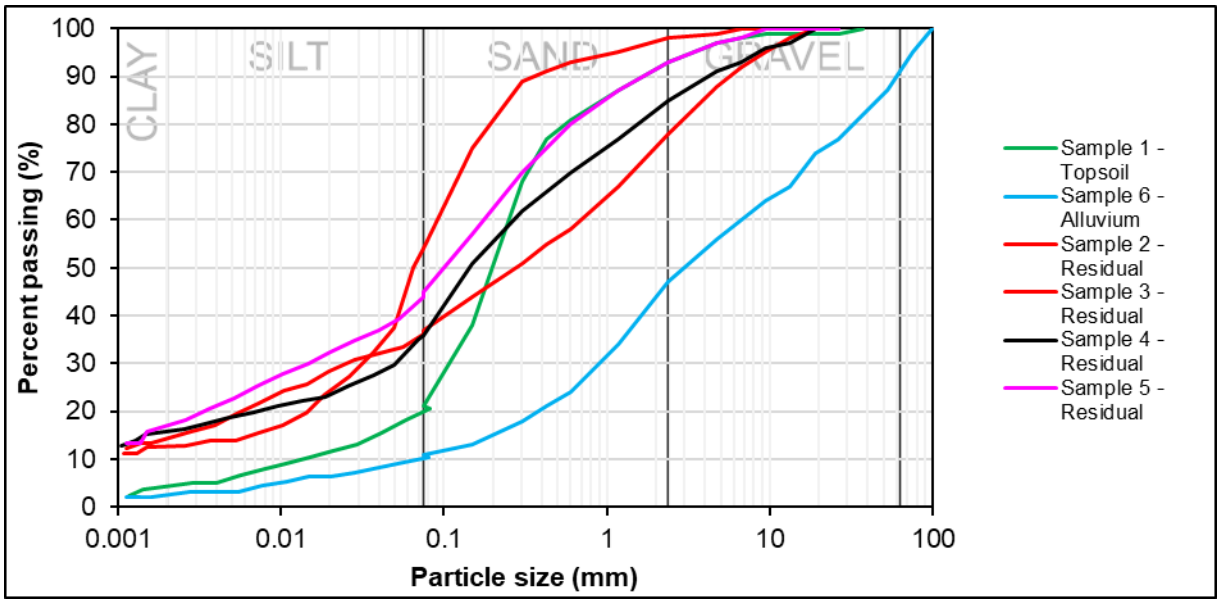
TABLE 5: PHYSICAL TESTING RESULTS SUMMARY

SAMPLE ID	GEOLOGICAL UNIT	DEPTH (m)		PSD				ATTERBERG LIMITS			EMERSON CLASS	STANDARD COMPACTION		PAWC (mm/m)	SATURATED HYDRAULIC CONDUCTIVITY (m/s)
		FROM	TO	GRAVEL (>2 mm)	SAND (0.02-2 mm)	SILT (0.002-0.02 mm)	CLAY (<0.002 mm)	LL (%)	PL (%)	LS (%)		MDD (t/m^3)	OMC (%)		
Sample 1	TOPSOIL	0	0.1	7%	81%	7%	5%	26	16	4.0	5	1.82	13	227	2×10^{-8}
Sample 2	RESIDUAL	0.3	0.8	2%	75%	11%	13%	53	19	12.0	5	1.67	18	412	$<1 \times 10^{-9}$*
Sample 3	RESIDUAL	0.3	0.6	22%	50%	14%	14%	36	22	6.5	5	1.62	22	340	$<1 \times 10^{-9}$*
Sample 4	RESIDUAL	-	-	15%	62%	7%	16%	36	22	6.5	5	1.74	19	348	$<1 \times 10^{-9}$*
Sample 5	RESDIUAL	-	-	7%	61%	15%	17%	42	19	9.0	5	1.72	17	339	3×10^{-10}
Sample 6	ALLUVIUM	0.5	1.0	53%	41%	4%	3%	27	23	2.0	6	1.9	14	152	1×10^{-7}
Sample 7	XW MATERIAL/ WEATHERED ROCK			5%	59%	10%	26%	45	20	10	6	1.83	15	285	4×10^{-9}
Sample 8	XW MATERIAL	-	-	10%	68%	6%	16%	41	1-5	12.5	5	1.72	17.5	438	1×10^{-10}
Sample 9	XW MATERIAL/ WEATHERED ROCK	-	-	50%	31%	7%	12%	38	25	7.0	2	1.63	13	410	2×10^{-8}
Sample 10	XW MATERIAL			7%	64%	6%	23%	53	28	10.5	2	1.83	13.5	160	5×10^{-9}

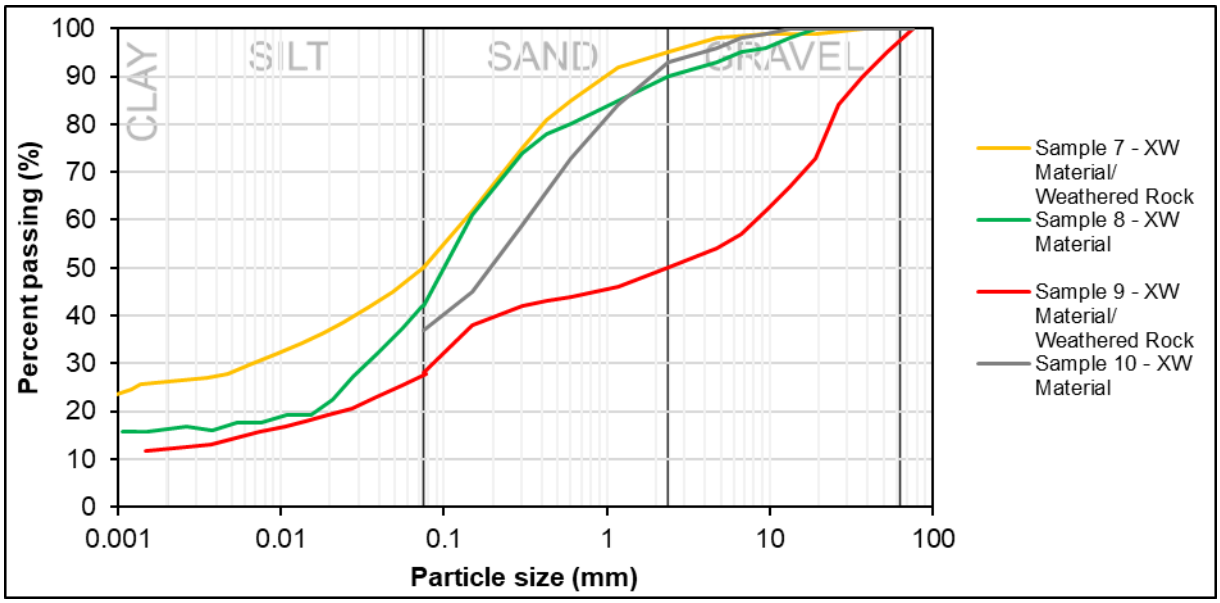
Notes:

Denotes Liquid Limit (LL), Plastic Limit (PL) Plastic index (PI), and Linear Shrinkage (LS).
Denotes Maximum Dry Density (MDD) and Optimum Moisture Content (OMC).
Denotes Plant Available Water Capacity (PAWC).
*The measured coefficient of permeability is less than 1×10^{-9} m/s, which is beyond the published scope of the test method AS1289.6.7.2 (Falling Head).

GRAPH 1: TOPSOIL, ALLUVIUM AND RESIDUAL CLAY PARTICLE SIZE DISTRIBUTION



GRAPH 2: XW MATERIAL PARTICLE SIZE DISTRIBUTION

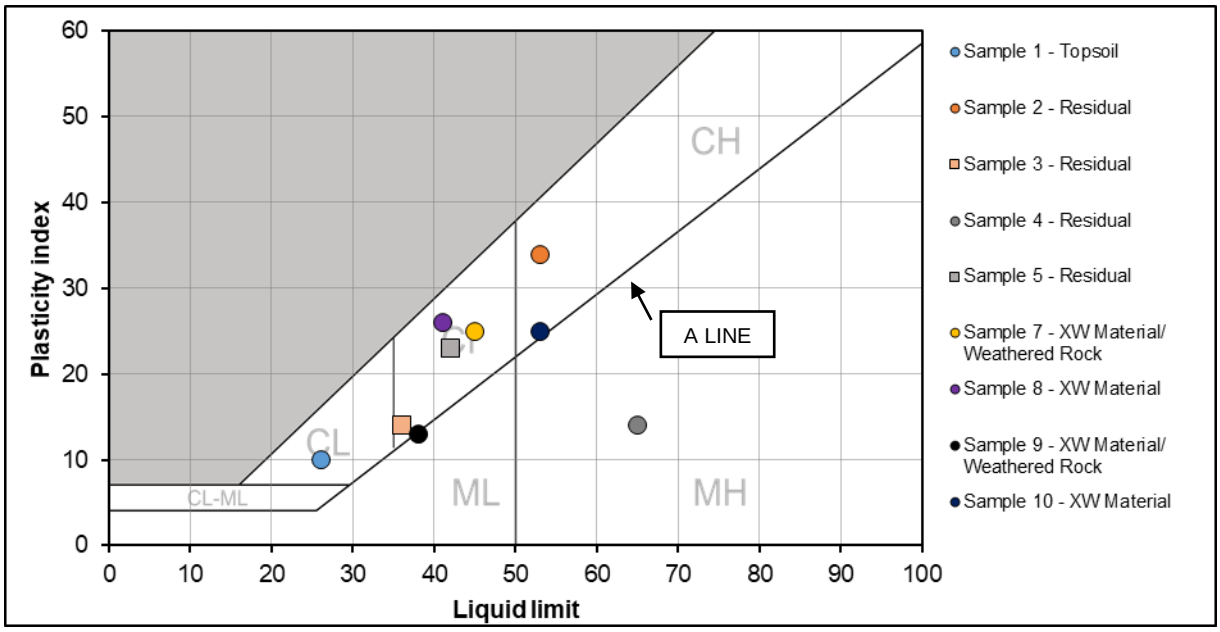


Atterberg limit results for each of the samples are displayed in **GRAPH 3**, and are summarised below:

- The samples all plotted above the A line indicating fines comprised of CLAY, with the exception of samples 4 and 6 indicating that minor fines component of sample comprises of low liquid limit SILT.
- Topsoil sample (sample 1) is low plasticity.
- Residual brown CLAY samples tested range from medium to high plasticity. Sample 4 plotted below the A line indicating that the material has the characteristics of a high liquid limit Silt while Sample 5 plotted above the A line indicating that the material is Clay of medium plasticity.
- Alluvial sample (sample 6) tested plotted below the A-line indicating that minor fines component of sample comprises of low liquid limit SILT.

- XW Material tested comprised of medium to high plasticity CLAY. Sample 9 and 10 plotted on the A line indicating that the fines component of the material could be either a Silt or Clay. Based on the visual tactile evidence of the strata that make up composite sample 9, the characteristics of the separate material indicate the composite would have been the characteristic of a Silt.

GRAPH 3: ATTERBERG LIMITS



Standard compaction at Optimum Moisture Content (OMC) of the soil reported maximum dry density (MDD) results ranging between 1.62 t/m^3 to 1.90 t/m^3. OMC ranged between 13% to 22% across the samples tested. It is noted that no field moisture content was provided as part of the laboratory results, therefore it is unknown whether *in situ* materials sampled where near saturation at the time of the investigation; however, observations note the soil was wet (refer **SECTION 4.2** and **APPENDIX C** for the geotechnical logs).

Emerson class testing indicated that most samples were classified as Class 5, with the alluvium sample (sample 6) classified as Class 6, indicating the material is generally non-dispersive. The exceptions were samples 9 and 10, both of the XW material/weathered rock, which reported Emerson Class 2 with notes of slakes with some dispersion.

The topsoil (sample 1) and sandy alluvial soil (sample 6) drain rapidly from near saturation to field capacity (nominally 10 kPa) compared with the residual clay layer (**GRAPH 4**). The residual clay layer samples show a similar release of moisture over the range of suctions tested, which further suggests there is limited difference between the samples. For all samples, the near saturated moisture contents are higher than expected and higher than is possible at the given dry density. This is likely related to the testing method and the sample size as well as noting that measurements near saturation are prone to inconsistencies.

The moisture content for the XW material/weathered rock samples over the range of suctions shows some variability (**GRAPH 5**). Sample 10 appears to contain the least clay resulting in a lower initial moisture retention but with Samples 8 and 9 showing some bimodality with a sudden decrease in moisture retained between 10 and 33 kPa. As with the topsoil, alluvial and residual samples, there is some inaccuracy noted in the near saturated moisture contents.

The plant available water content (PAWC) is the moisture available for plant uptake and can also indicate the usable storage capacity of the soil. It is defined as the difference between field capacity (nominally 10 kPa for disturbed samples) and permanent wilting point, which is 1500 kPa. All samples demonstrate adequate PAWC with the residual clay layer highest with a mean of 360 mm/m soil.

The saturated hydraulic conductivity of the residual and XW material/weathered rock is extremely low (1.00×10^{-10} to 2.00×10^{-8} m/s) at 95% MDD. The saturated hydraulic conductivity at 95% MDD for the topsoil (sample 1) material is very low at 2.00E-06 m/s and the alluvium is moderate at 1×10^{-5}

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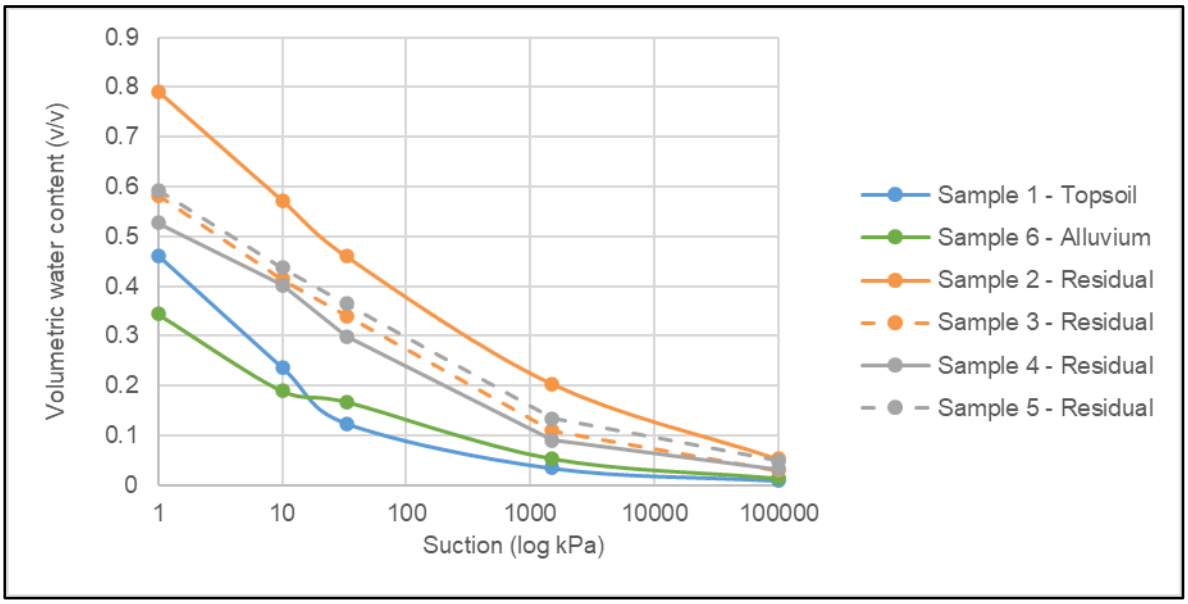
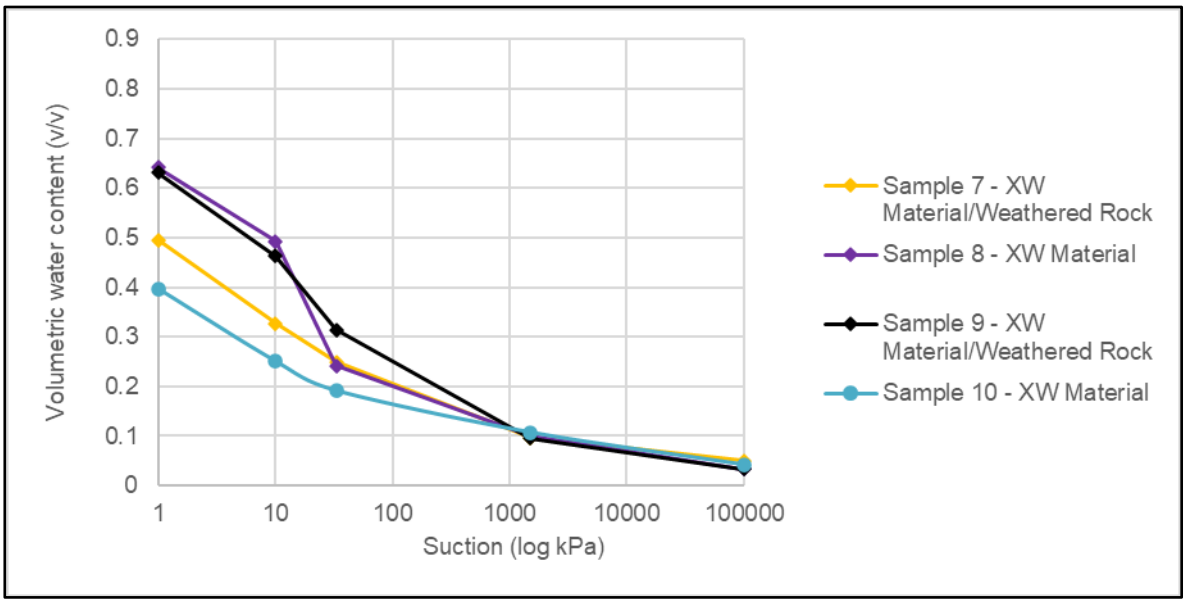
m/s. Material for the topsoil and ISL layers within the cap would be placed at a lower dry density than tested and hence the saturated hydraulic conductivity would be higher

GRAPH 4: TOPSOIL/ALLUVIUM AND RESIDUAL CLAY SOIL WATER CHARACTERISTIC CURVES



GRAPH 5: XW MATERIAL SOIL WATER CHARACTERISTIC CURVES



4.3.3 Chemical Testing

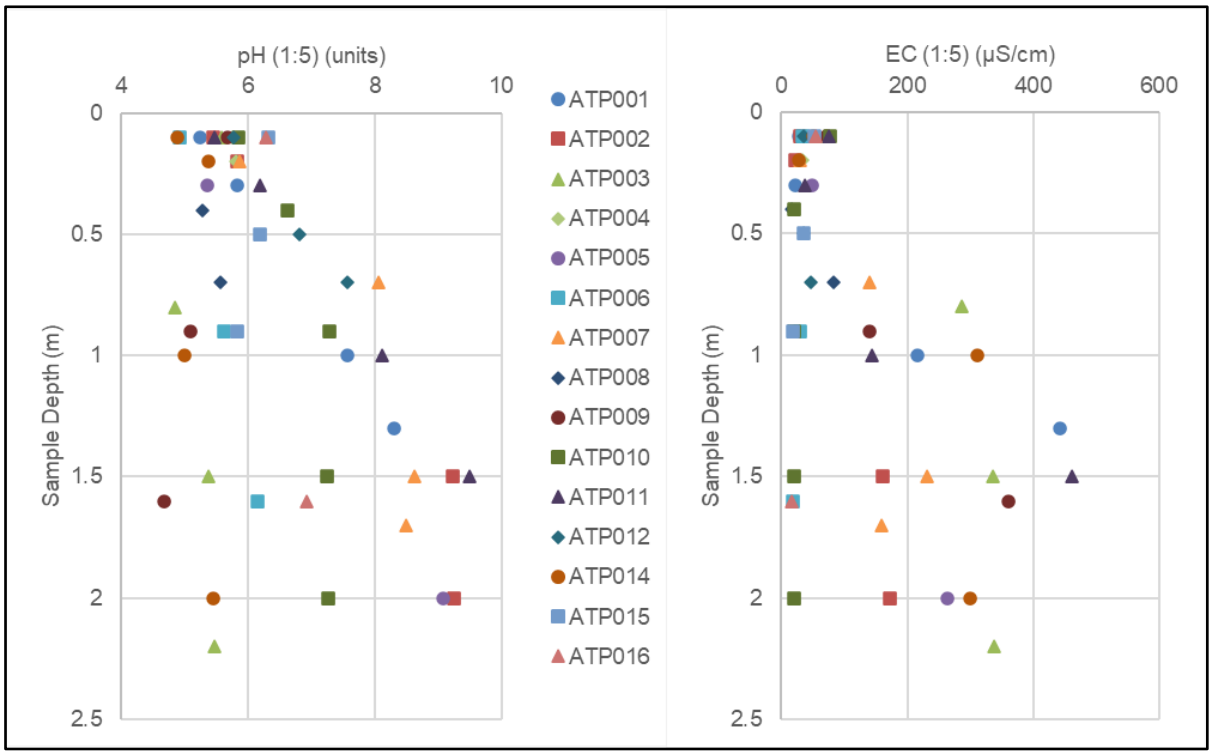
4.3.3.1 pH and Salinity

pH (1:5) and salinity (as measured by electrical conductivity (EC)) (1:5) was analysed on all samples collected. The topsoil pH (including the slope wash) is generally moderately to strongly acidic. **GRAPH 6** shows the pH range increasing with depth. The residual and XW material/weathered rock layers both ranged from < 5 units to > 9 units with a mean of near neutral. The soil reaction trends observed are:

- Alkaline reaction trend: ATP001, ATP002, ATP005, ATP007 and ATP011.
- Neutral reaction trend: ATP010 and ATP016.
- Acidic reaction trend: ATP003, ATP006, ATP009, ATP014 and ATP015.
- Profiles, ATP004, ATP008 and ATP012 were all shallow profiles that encountered weathered rock at < 1 m depth (**TABLE 2**) and hence do not exhibit a strong trend.

The expected soil types in **SECTION 2.1.3** suggest the soil should exhibit an acidic reaction trend and hence the variability in soil pH at depth is unexpected. The grey clay residual layer tended to exhibit an acidic reaction trend; however, ATP007 has a grey clay residual layer which reported a pH of 8.62 units. There is no apparent spatial correlation with samples to the east and north and those at higher and lower elevation both showing acidic and alkaline reaction trends (refer to **FIGURE 007**).

GRAPH 6: PH (1:5) AND EC (1:5)



The soil salinity exhibits a similar trend to pH with a non-saline topsoil reporting a narrow range of salinity (10-77 µS/cm) compared with the residual soil and weathered rock layers (Coefficient of Variation of 47%, 84% and 64% respectively). The residual clay and rock layers both range from non-saline to moderately saline with no apparent spatial correlation (refer to **FIGURE 008** for the residual layer EC (1:5)).

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4.3.3.2 Agronomic Properties

Selected samples (as listed in **TABLE 4**) were analysed for a range of agronomic parameters to indicate the fertility of the soil and highlight any potential deficiencies or toxicities. The CEC is moderate and indicates the potential to retain cations in the soil without leaching. For all materials, the exchangeable cations are dominated by magnesium with very low to low calcium content (Ca/Mg ratio is less than 4) (**TABLE 6**).

Soils with an exchangeable sodium percentage (ESP) greater than six are considered sodic and strongly sodic when ESP is greater than 15. Sodic soils are prone to dispersion, which can lead to reduced infiltration and increased potential for erosion. All samples are classified as sodic or strongly sodic with the exception of sample 1 (topsoil) and sample 6 (alluvium).

The topsoil exhibits moderate fertility and is higher than the deeper soil, as expected. Moderate nitrogen and organic carbon content are present and exchangeable potassium and extractable phosphorus are low. Zinc, manganese and copper are below the optimal level for plant growth. There is no evidence of the potential for boron toxicity or other metal or metalloid toxicities at depth in the profile.

TABLE 6: SUMMARY AGRONOMIC TEST RESULTS

ANALYTE	UNITS	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5	SAMPLE 6	SAMPLE 7	SAMPLE 8	SAMPLE 9	SAMPLE 10
		TOPSOIL	RESIDUAL	RESIDUAL	RESIDUAL	RESIDUAL	ALLUVIUM	XW MATERIAL /WEATHERED ROCK	XW MATERIAL	XW MATERIAL/ WEATHERED ROCK	XW MATERIAL
Exchangeable Cations											
Calcium	%	37	2.3	2.3	50	18	59	30	2.3	1.2	2.1
Magnesium	%	23	60	76	34	56	34	52	47	66	54
Potassium	%	12	1.0	1.9	1.7	1.2	3.2	1.2	0.76	2.0	0.80
Sodium/ESP	%	2.0	**37**	**17**	15	11	3.3	15	**20**	**31**	14
Ca/Mg Ratio		2	0	0	1	0	2	1	0	0	0
CEC	meq/ 100g	1.9	15	12	20	16	5	11	14	13	17
Major Nutrients											
Total Nitrogen	%	0.15	0.09	0.10	0.05	0.06	0.06	0.06	0.04	0.04	0.05
Total Carbon	%	1.40	0.55	0.83	0.08	0.27	0.22	0.21	0.11	0.10	0.16
C:N		9	6	8	2	5	4	4	3	3	3
Colwell Phosphorus	mg/kg	4.9	1.3	2.6	4.9	3.6	7.2	2.6	2.6	3.3	3.0
Available Micronutrients											
Sulfur	mg/kg	6.7	27.3	7.8	12.0	8.2	7.6	7.0	15.6	10.2	7.2
Zinc	mg/kg	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

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ANALYTE	UNITS	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5	SAMPLE 6	SAMPLE 7	SAMPLE 8	SAMPLE 9	SAMPLE 10
		TOPSOIL	RESIDUAL	RESIDUAL	RESIDUAL	RESIDUAL	ALLUVIUM	XW MATERIAL /WEATHERED ROCK	XW MATERIAL	XW MATERIAL/ WEATHERED ROCK	XW MATERIAL
Copper	mg/kg	0.18	0.51	0.68	0.21	0.36	0.16	0.32	0.18	0.27	0.43
Manganese	mg/kg	5.80	1.70	0.96	7.34	2.98	7.59	4.40	0.19	0.36	0.46
Iron	mg/kg	194	11	91	11	27	11	21	21	10	26
Boron	mg/kg	0.29	1.11	0.91	0.44	0.63	0.40	0.46	0.35	0.38	0.49

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4.4 Tailings Laboratory Analysis Results

Coarse and fine samples were collected from tailings beach storage area for laboratory testing, with the certificates of analysis in **APPENDIX E**.

Tailings fine (TSF-FN-1) and coarse (TSF-CRS-1) samples were analysed by the ATCW Melbourne Laboratory for PSD, standard compaction and saturated hydraulic conductivity. The PSD for the tailings fine and coarse samples are presented in **GRAPH 7**. The tailings fine sample has higher silt and clay content which contribute to higher cohesion and lower permeability. Whereas, the tailings coarse sample has higher sand and gravel content, which may contribute to higher permeability and lower water retention.

GRAPH 7: TAILINGS PARTICLE SIZE DISTRIBUTION

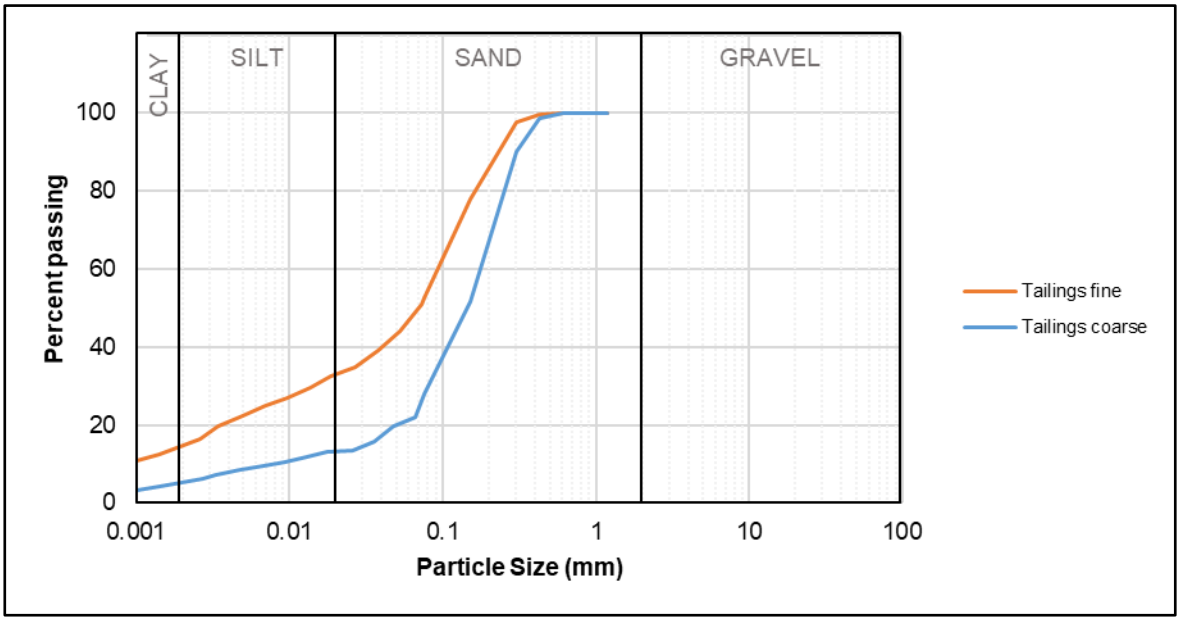


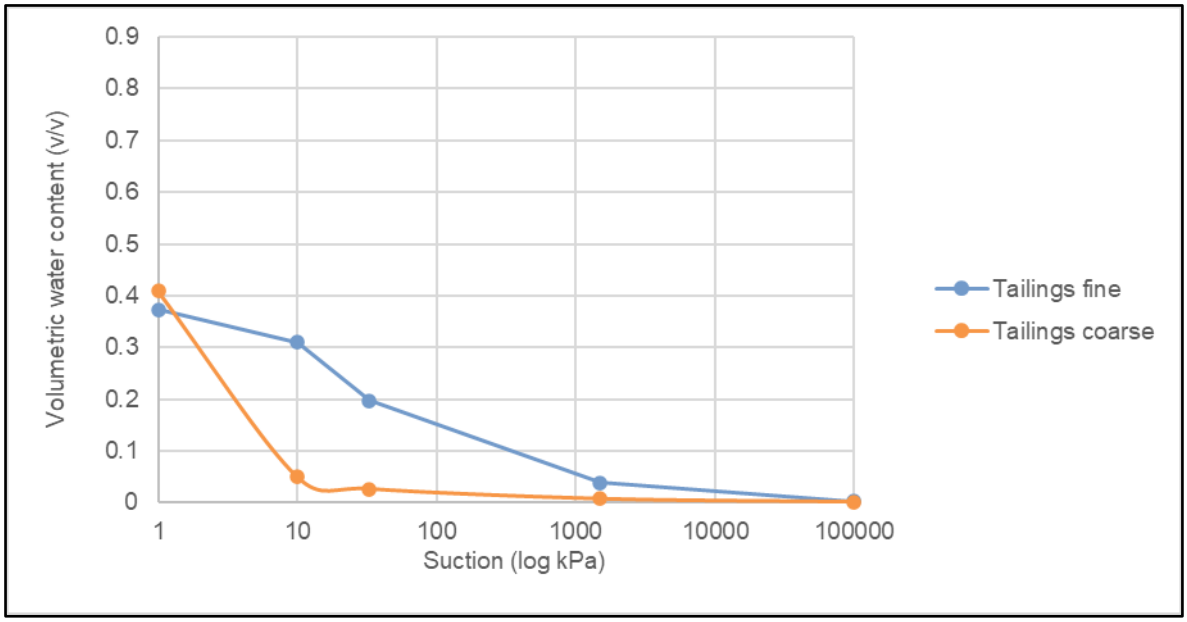
TABLE 7 summarises the results of the standard compaction and permeability tests. Standard compaction tests were completed to determine the MDD and OMC. The tailings fine sample (TSF-FN-1) has a higher MDD (1.87 t/m^3) compared to the tailings coarse sample (1.28 t/m^3). The tailings fine samples also has a lower permeability (2.60E-08 m/s) than the tailing coarse sample (1.06E-07 m/s).

TABLE 7: TAILINGS STANDARD COMPACTION AND PERMEABILITY

DESCRIPTION	SAMPLE ID	MDD (t/m^3)	OMC (%)	PERMEABILITY (m/s)
Tailings fine	TSF-FN-1	1.87	14.0	2.60E-08
Tailings coarse	TSF-CRS-1	1.28	-	1.06-07

Tailings fine and coarse samples were sent to EAL Southern Cross University for SWCCs, which are presented in **GRAPH 8**. The coarse sample releases moisture quickly as it dries and as a result has limited moisture holding capacity whilst the fine sample releases moisture slowly as it dries.

GRAPH 8: TAILINGS SOIL WATER CHARACTERISTIC CURVES



5 MATERIAL AVAILABILITY

The estimated material availability based on the material investigation is summarised in **TABLE 8** and **FIGURE 011**. It is important to note that the estimated material quantities are based on average ranges and the material depth should be interpreted with discretion.

FIGURE 011 shows borrow area constraints including vegetation management regional ecosystems and essential habitat as well as water course buffer zones. These constraints were provided by SLR Consulting Australia Pty Ltd in October 2024; after the material investigation was undertaken in April 2024.

TABLE 8 indicates that a large disturbance footprint would be required to meet the material requirements for the cover system for the RPL and even larger footprint to source material for the ISL (XW Material/Weathered Rock).

TABLE 8: MATERIAL AVAILABILITY

BORROW AREA	TEST PITS	MATERIAL	QUANTITY REQUIRED[1] (m^3)	QUANTITY AVAILABLE[2] (m^3)	MATERIAL BALANCE (m^3)
Borrow Area 1 (~70 ha)	ATP010, ATP009, ATP016, ATP015, ATP007, ATP008	Topsoil/ Alluvium	260,000	315,000 to 470,000	55,000 to 210,000
		XW Material/ Weathered Rock	1,690,000	385,000 to 415,000	**-1,275,000** to **-1,305,000**
		Residual	520,000	455,000 to 550,000	**-65,000** to 30,000
Borrow Area 2 (~55 ha)	ATP001, ATP014	Topsoil/ Alluvium	260,000	110,000 to 440,000	-150,000 to 180,000

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BORROW AREA	TEST PITS	MATERIAL	QUANTITY REQUIRED[1] (m^3)	QUANTITY AVAILABLE[2] (m^3)	MATERIAL BALANCE (m^3)
		XW Material/ Weathered Rock	1,690,000	165,000 to 440,000	**-1,250,000** to **-1,525,000**
		Residual	520,000	605,000 to 660,000	85,000 to 140,000
Borrow Area 3 (~75 ha)	ATP002, ATP001	Topsoil/ Alluvium	260,000	185,000 to 225,000	**-35,000** to **-75,000**
		XW Material/ Weathered Rock	1,690,000	150,000 to 825,000	**-865,000** to **-1,540,000**
		Residual	520,000	485,000 to 600,000	**-35,000** to 80,000

Note: [1] Required quantity assumes a surface area of 130 ha. Cover system includes: 0.2 m topsoil layer, 1.3 m of infiltrations storage layer (ISL) comprising XW Material/Weathered Rock, and 0.4 m Reduced Permeability Layer (RPL) comprising Residual material, based on **[9]**.

[2] For the proposed borrow area 1, material quantity has been provided as a range based on the minimum and mean value encountered in the material investigation and historic test pitting.

[3] Quantities are in BCM. No bulking factors have been included.

[4] Termination depth was approximately 2 m.

6 MATERIAL INVESTIGATION DISCUSSION

The soil located to the north and east of the TSF is likely to be relatively shallow undeveloped soil consisting of a sandier topsoil over a yellow or grey clay. The material investigation found that the sandier topsoil/alluvium layer was at least 0.2 m thick across the area extending to 0.3 m to the east but more variable to the north and is consistent with historic test pits (**FIGURE 002**). The residual layer extended to 0.9-2 m bgl and is underlain by weathered sandstone resulting a total profile depth of around 2 m with the exception of ATP004, ATP008 and ATP012 (**FIGURE 003**). Shallower profiles are expected on higher areas with increased erosion; however no spatial correlation is evident.

The topsoil has a high sand content with a field description of silty sand for most locations and the PSD suggesting loamy sand. The liquid limit is below the near saturated gravimetric moisture content and the plastic limit is low hence there is potential for mass movement on slopes. The Emerson Class and sodicity suggest the soil is likely to be stable with slight dispersion possible and combined with the limited silt content is not likely to be highly erodible. The soil would benefit from the addition of organic matter to improve soil cohesion and reduce the potential for mass movement. The topsoil is acidic (**FIGURE 005**) and non-saline (**FIGURE 006**) with a moderate capacity to hold moisture and nutrients, but it is noted that the soil fertility is below optimum. Based on the use of native species, a slow-release complete fertiliser for natives should be applied to increase potassium, phosphorus and micronutrients. Contrary to popular belief, many native species thrive with the application of phosphorus; however, care must be taken to ensure that conditions do not promote excessive weed growth.

The residual layer was described as a sandy clay and occasionally as a silty clay with PSDs suggesting the soil is a sandy loam to silty loam. The four samples selected were still predominantly sand but also contained 13 - 17% clay. The clay has increased the cohesion and hence reduced the

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risk of mass movement. The Atterberg limits suggest variable plasticity, however, overall the residual layer is likely to be compactible and unlikely to be difficult to moisture condition and compact. The Emerson Class suggests that the soil is likely to be stable with only minor dispersion; however, it is noted that the soil has > 20% silt+fine sand and is sodic and magnesic and hence there is an erosion risk for wind and water. The residual layer varies from strongly acidic to strongly alkaline and non-saline to moderately saline with little spatial correlation evident (**FIGURE 007** and **FIGURE 008**, respectively). There is no evidence of toxic concentrations of metals or metalloids. The residual layer has lower fertility than the topsoil and hence should not be placed at the surface but can be placed below the topsoil and within the root zone of the plants with limited impact on the vegetation.

The XW material and weathered rock exhibited highly variable properties depending on the clay content of the sample. Assuming the material was mixed during excavation, the average properties of the material may be the best indicator of potential performance. The weathered rock contained approximately 56% sand and 19% clay with up to 50% gravel. The Emerson Class also varied being reported as 2, 5 and 6 and hence this material may be highly erodible; exchangeable calcium content was noted as <5%, which is a further indicator that the soil may not be stable and could be easily eroded. The water storage capacity is high, but the sand and gravel content may result in a higher saturated hydraulic conductivity than the residual clay. Similarly to the residual layer, the XW material and weathered rock exhibited low fertility but did not have any concentrations likely to be toxic to native plants and hence can be placed within the rooting zone of the native species but not at the surface. Where the material is placed within the upper portion of the soil profile, consideration must be given to increasing the calcium content to reduce the potential for tunnelling.

7 CONCLUSIONS AND RECOMMENDATIONS

The selection of suitable cover materials is important for the successful rehabilitation and closure of the TSF. The program aimed to supplement previous site investigations (refer **APPENDIX A**) and identify available and suitable borrow material for use in the construction of the TSF cover system.

The main conclusions and recommendations from the material investigation are:

- Topsoil/Alluvium:
  - Strip to a depth of <0.25 m across the area and potentially to 0.3 m to east. This soil should be reserved for placement as topsoil across the cover system to a depth of at least 0.1 m due to its higher fertility than the residual layer.
  - Addition of organic matter would be beneficial to improve soil cohesion due to the high sand content, enhancing soil structure and stability.
  - Addition of a slow-release complete fertiliser suitable for natives to increase available macro and micro nutrients.
- Residual:
  - Suitable for use as the reduced permeability layer due to the clay content (13 - 17%), compactability, stability and very low permeability at 95% MDD.
  - Suitable for the infiltration storage layer if placed at a lower “natural” compaction (i.e., approximately 75 - 85% MDD) as unlikely to be susceptible to tunnel erosion and no apparent toxicities which would reduce plant growth. The good moisture holding potential and available moisture would assist in retaining moisture for plant growth through drier periods.
  - Variable pH and salinity suggest this material should not be used near the surface without further delineation of acidic and alkaline areas; however, it is unlikely to impact the growth of most native plants if placed below the topsoil within the rooting zone.
- XW Material/Weathered Rock:
  - Suitable as infiltration storage layer due to the presence of clay and available water storage capacity combined with non-limiting salinity and low available metal and metalloid concentrations. However, this material has a higher erosion potential (due to silt+fine sand content and low calcium) and requires incorporation of calcium source (e.g. gypsum) and compaction to 85-90% MDD to reduce the potential for tunnelling.

- May be suitable as reduced permeability layer due to the very low permeability at 95% MDD; however, variable texture and gravel content may impact its suitability and may require screening.
- During construction, cover this layer with topsoil as soon as practical before rain to reduce the potential for erosion and rework.

The available depth of soil for the cover system construction is greater than 1 m and appears to extend to greater than 2 m. Although the termination depth of many of the test pits during the program was due to the machinery limits, most profiles encountered XW material or weathered rock; however, it is noted that this layer may be able to be excavated to around 3 - 4 m depth based on the depth of the existing North Borrow Area.

The residual layer thickness varies across the site, generally ranging from 0.1 m to 1.3 m to the east of the TSF. While a thicker clay layer (1.9 m) was identified to the north of the TSF (ATP010), shallower depths (less than 0.1 m) were encountered approximately 200 m northeast of ATP010 (refer **FIGURE 002**). The most consistent thickness of residual was observed to the north-east between Rawdon Creek and Twelve Mile Creek.

The thickness of XW material/weathered rock encountered generally ranged from 0.1 m to 1.6 m to the east and 0.1 m to 2.3 m to the northeast of the TSF, based on the profiles encountered during the previous site investigations (refer **FIGURE 003**).

Given the variability of the material encountered at depth the following recommendations are made:

- Given the large area required to source materials, it is recommended that other sources of material are investigated.
- If material does need to be sourced from this area:
  - Further analysis is undertaken of the materials excavated during construction and prior to placement to better define the trial parameters. The variability observed in the selected samples analysed and the lack of spatial correlation will make consistent trial materials potentially difficult to source. This variability will only increase as additional material is required for full scale construction of cover systems over mine waste landforms.
  - Consideration be given to trialling organic matter addition to the topsoil to improve structural stability and nutrient holding capacity to improve plant establishment and growth.
  - If the XW material/weathered rock is placed within the upper 0.5 m of the ISL, a calcium source (e.g. gypsum) is incorporated to improve clay aggregation and reduce dispersion potential thereby increase stability and reducing erosion potential. An application of at least 1.5 tonnes gypsum per 1000 m^3 soil is recommended.
- Vegetation is selected from endemic plants, as these will be suited to the soil conditions described herein. If non-native species are incorporated (such as perennial pasture consistent with a grazing land use) the species selected must be suited to acidic topsoil, variable subsoil pH and moderate salinity. Higher fertiliser application rates may be required to ensure adequate establishment and growth. Native trees and shrubs must be planted with weed matting to reduce competition if non-native perennial pasture if used.

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CONDITIONS OF REPORT

1. This report must be read in its entirety.
2. This report has been prepared by ATCW for the purposes stated herein and ATCW's experience, having regard to assumptions that can reasonably be expected to make in accordance with sound professional principles. ATCW does not accept responsibility for the consequences of extrapolation, extension or transference of the findings and recommendations of this report to different sites, cases, or conditions.
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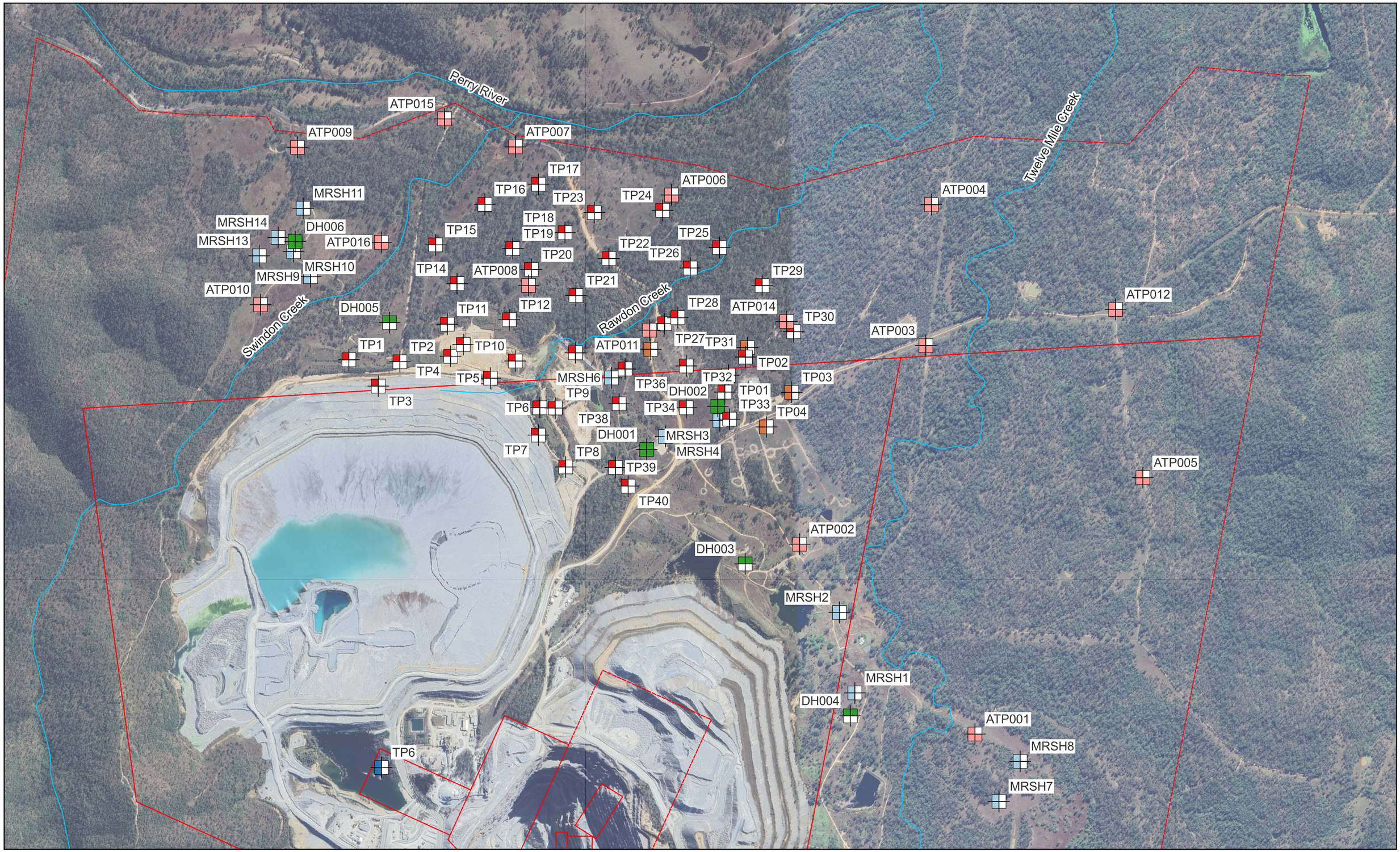
CONDITIONS OF GEOTECHNICAL INVESTIGATION

1. Geotechnical site investigation necessarily involves the investigation of the subsurface conditions at a site at a few isolated locations, and the interpretation and extrapolation of those conditions to elsewhere on the site not so investigated. This procedure has been adopted at the site that is the subject of this report and due care and skill has been applied in carrying out and reporting on the work. Thus, the findings, conclusions and comments contained in this report represent professional estimates and opinions and are not to be read as facts unless the context makes it clear to the contrary. In general, statements of fact are confined to statements as to what was done and/or what was observed. Other statements have been based on professional judgement.
2. The scope of the work has been planned in the absence of any fore knowledge of the site other than that stated in the report. Unless otherwise stated we consider that the number of locations investigated and the depths to which they have been investigated are reasonable bearing in mind the scale and nature of the project, and the defined purpose for which the investigation was undertaken.
3. We do not accept any responsibility for any variance between the interpreted and extrapolated conditions and those that are revealed by any means subsequently. Specific warning is also given that many factors, either natural or artificial, may render ground conditions different from those which pertained at the time of the investigation. Should there be revealed during the construction or at any other time any apparent difference from subsurface conditions described or assessed in this report, it is strongly recommended that such differences be brought to our attention so that its significance may be assessed, and appropriate advice given.

.

FIGURES



LEGEND

- Mining Lease
- Tributaries
- 2013 Soil and Land Suitability Assessment
- 2015 TSF2 Site Investigation
- 2016 Borrow Pit Investigation
- 2017 2016 Irrigation Investigation
- 2023 Irrigation Investigation
- 2024 Material Investigation

FIGURE 001
MOUNT RAWDON OPERATION
TEST PIT LOCATIONS

N

0 250 500 m

ATC WILLIAMS

REF: 111359.100 DATE: 2024-11-04

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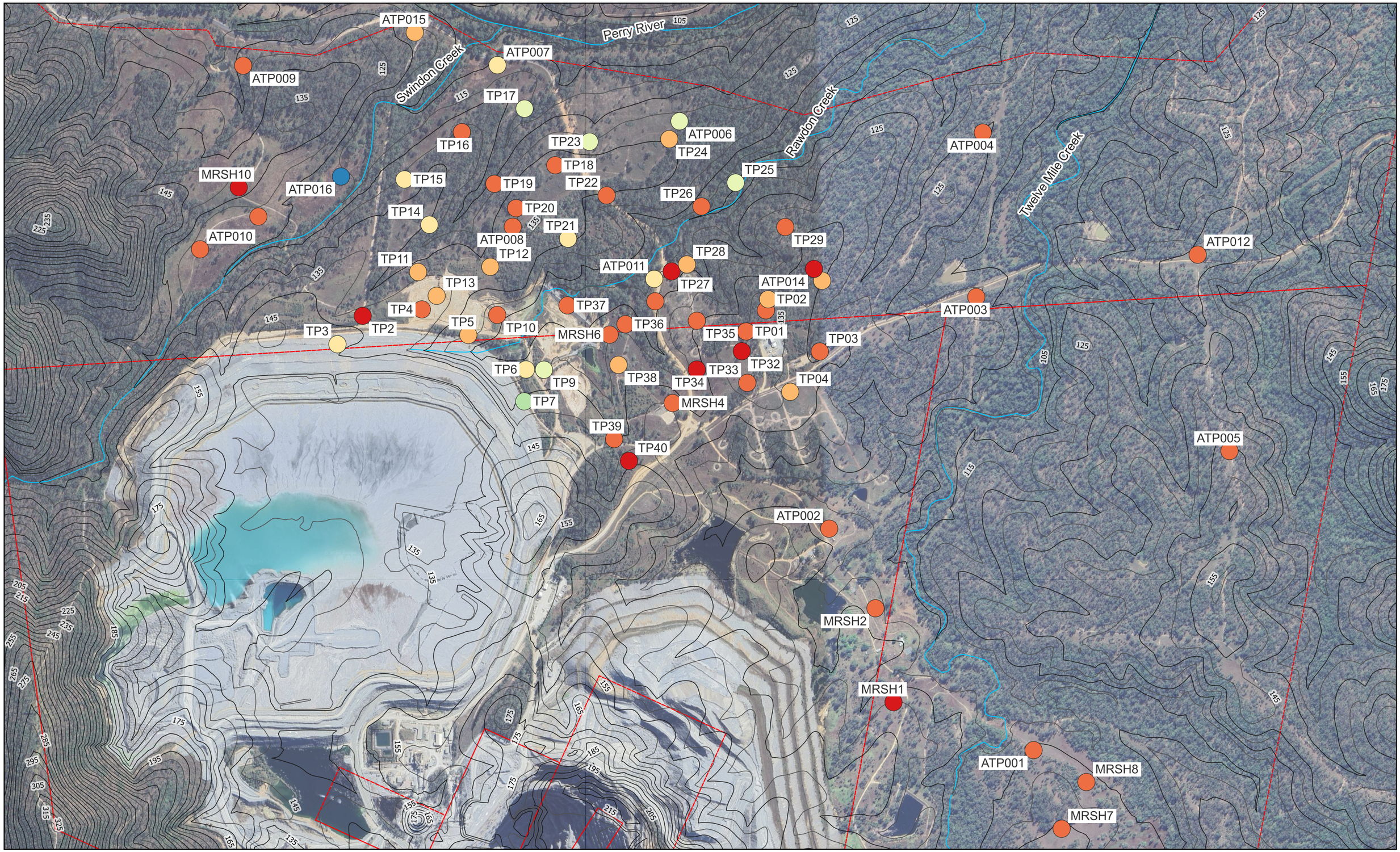

LEGEND

- Mining Lease
- Tributaries

Contours
- 5 m
- 10 m

Topsoil/Alluvium Thickness (m)
- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1
- 1 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6

FIGURE 002
MOUNT RAWDON OPERATION
TOPSOIL/ALLUVIUM THICKNESS

N

0 250 500 m

ATC WILLIAMS

REF: 111359.100 DATE: 2024-08-08

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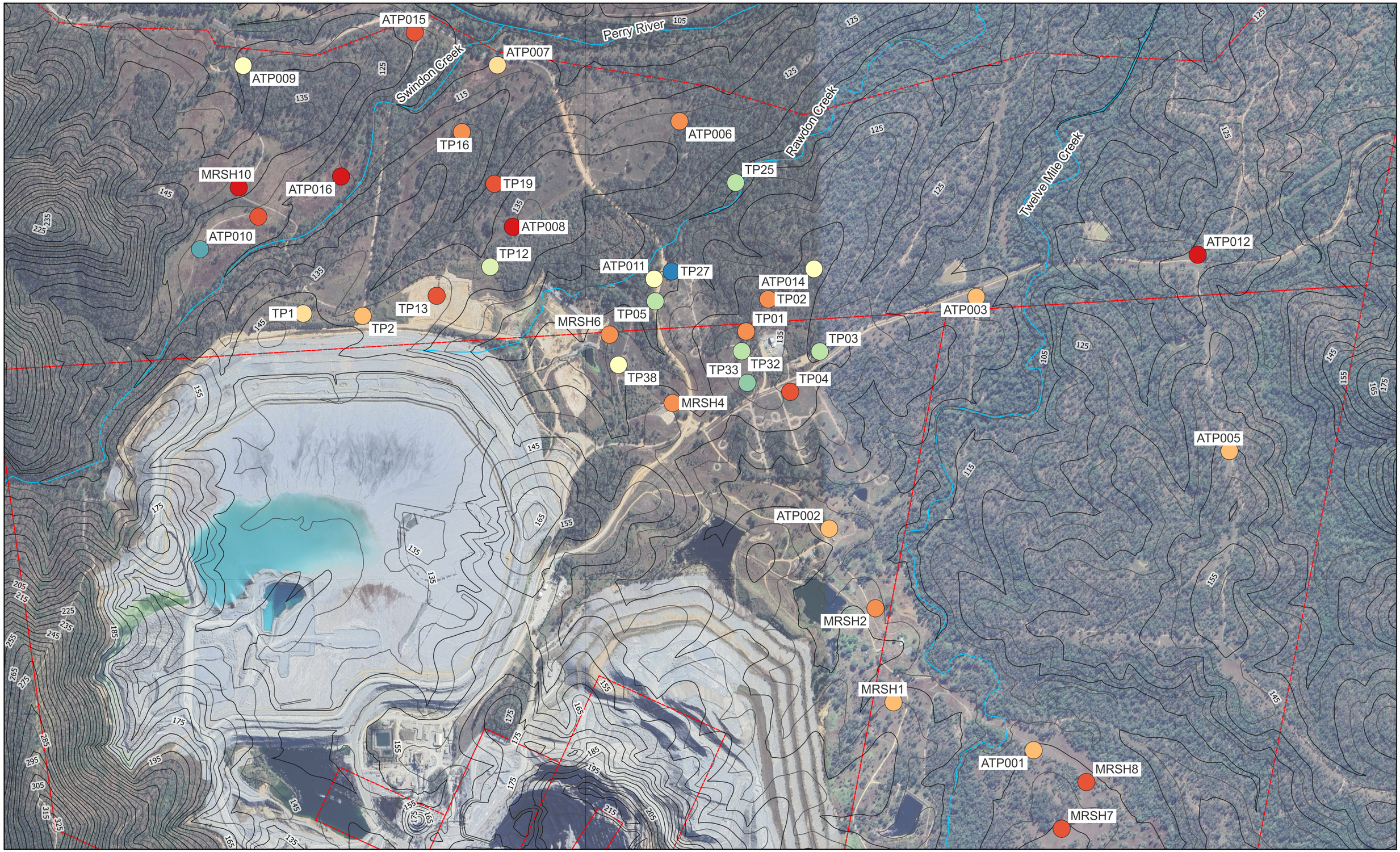

LEGEND

- Mining Lease
- Tributaries

Contours
- 5 m
- 10 m

Residual Clay Thickness (m)
- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1
- 1 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2
- 2 - 2.2

FIGURE 003
MOUNT RAWDON OPERATION
RESIDUAL THICKNESS

N

0 250 500 m

ATC WILLIAMS

REF: 111359.100 DATE: 2024-08-08

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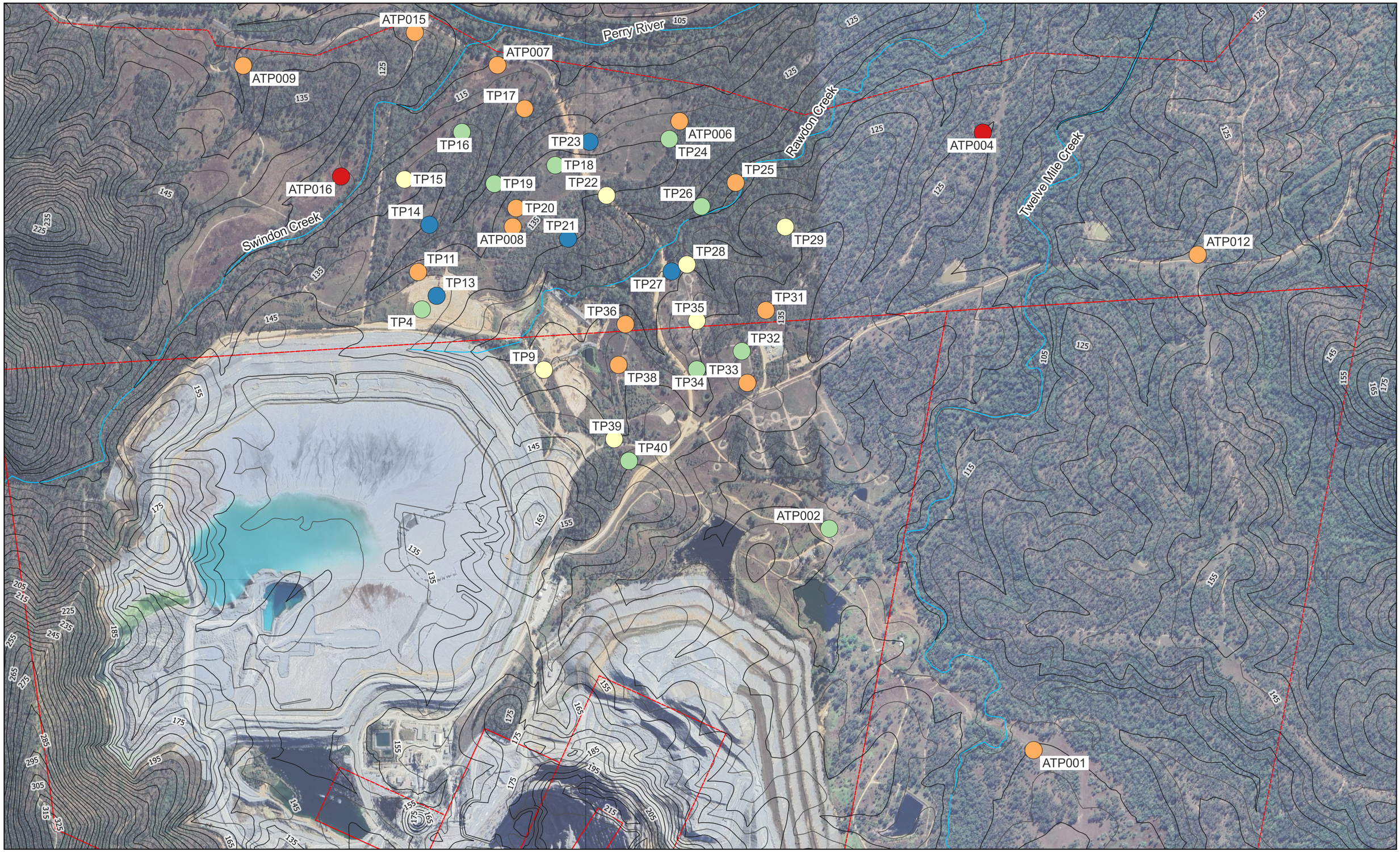

LEGEND

- Mining Lease
- Tributaries
- Contours
  - 10 m
  - 5 m

Weathered Rock/ XW Material Thickness (m)

- 0 - 0.1
- 0.1 - 0.4
- 0.4 - 0.8
- 0.8 - 1.3
- 1.3 - 2.3

FIGURE 004
MOUNT RAWDON OPERATION
WEATHERED ROCK/XW MATERIAL THICKNESS

N

0 250 500 m

ATC WILLIAMS

REF: 111359.100 DATE: 2024-08-08

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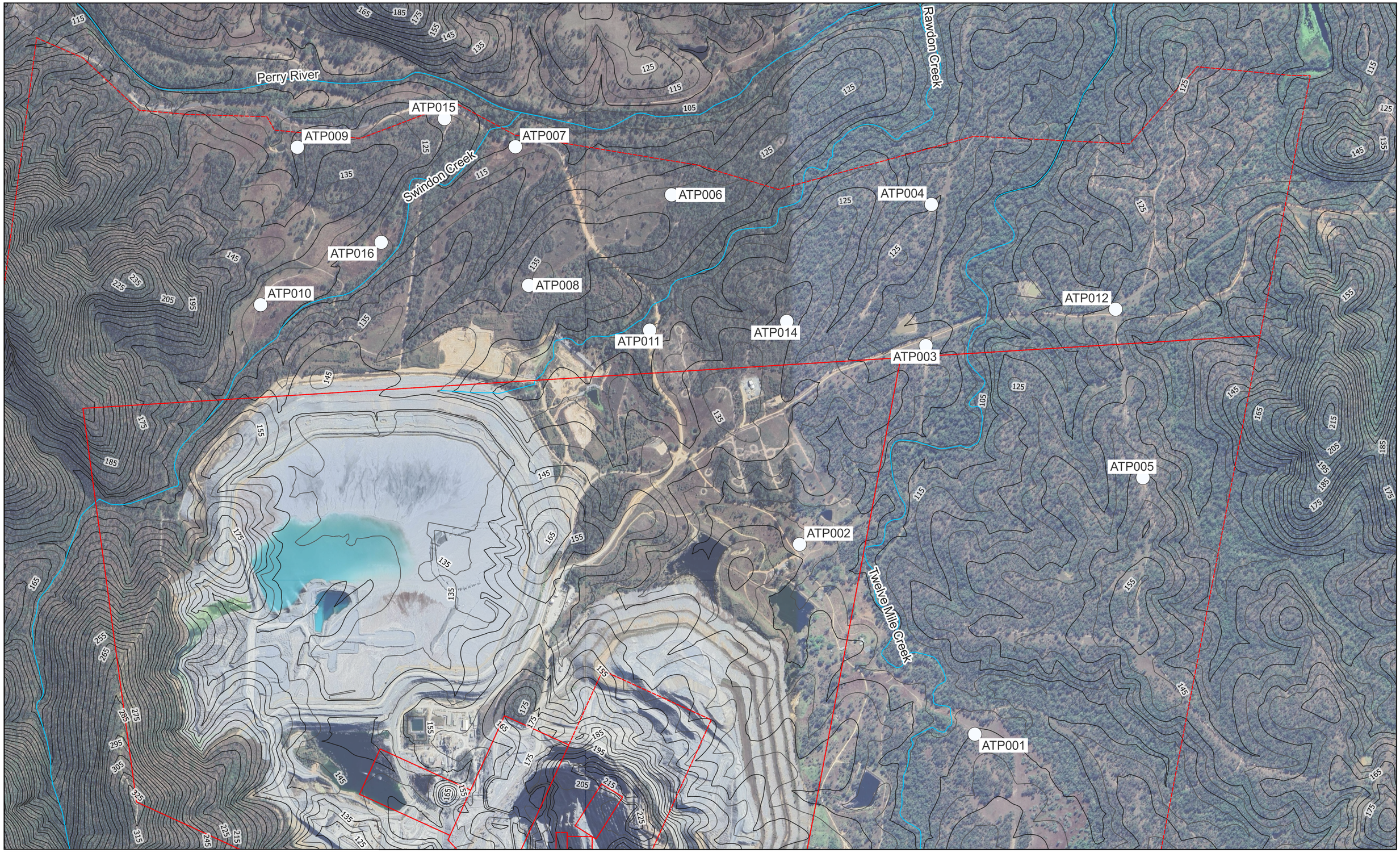

LEGEND

Mining Lease
Tributaries

Contours
5 m
10 m

Test Pit - Topsoil pH (1:5)
<6.5

FIGURE 005
MOUNT RAWDON OPERATION
TEST PIT TOPSOIL PH

N

0 250 500 m

ATC WILLIAMS

REF: 111359.100 DATE: 2024-07-09

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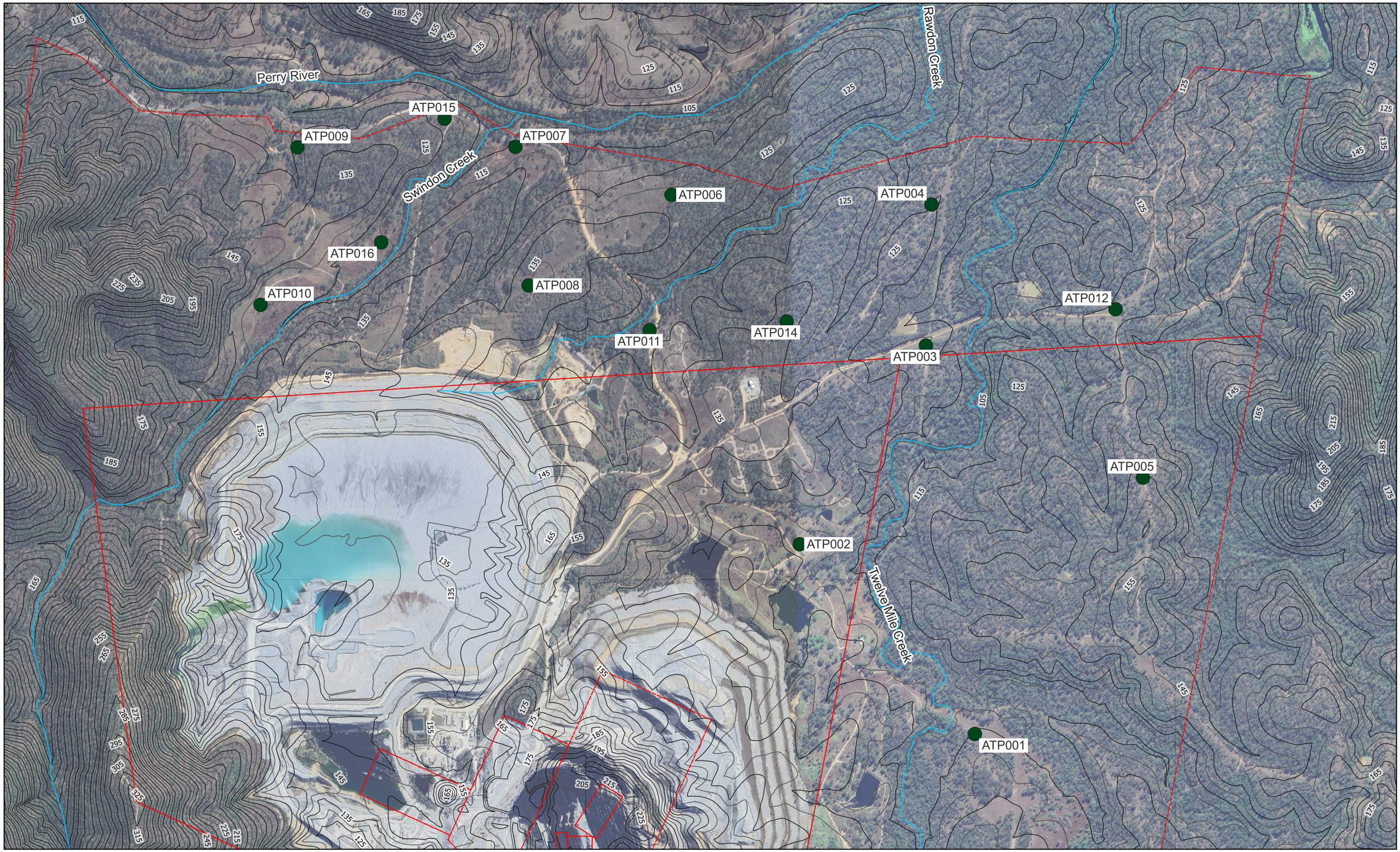

LEGEND

- Mining Lease
- Tributaries
- Contours
  - 5 m
  - 10 m
- Test Pit - Topsoil EC (1:5)
  - Non-Saline (<0.2 dS/m)

FIGURE 006
MOUNT RAWDON OPERATION
TEST PIT TOPSOIL ELECTRICAL CONDUCTIVITY

N

0 250 500 m

ATC WILLIAMS

REF: 111359.100 DATE: 2024-07-09

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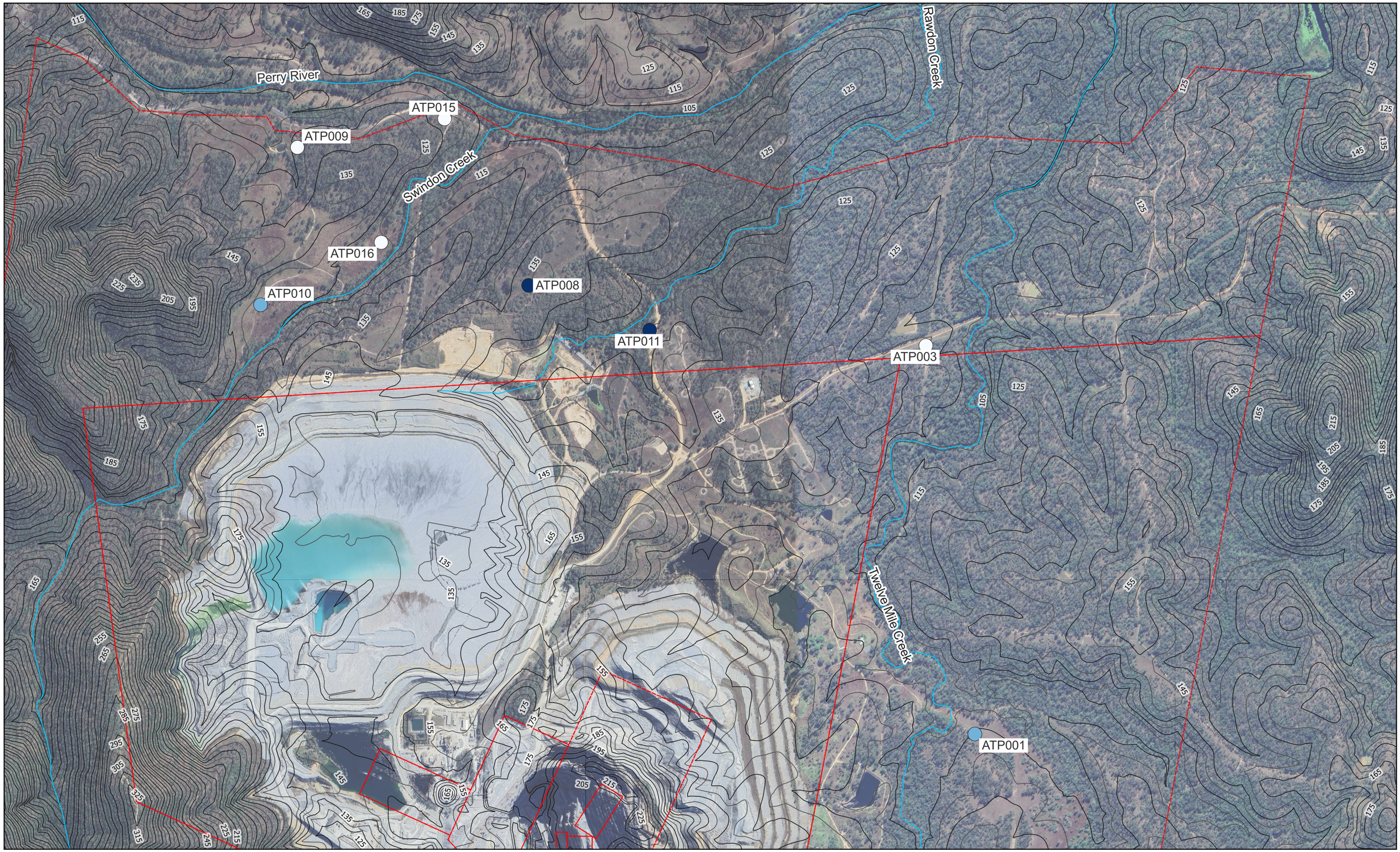

LEGEND

- Mining Lease
- Tributaries

Contours
- 5 m
- 10 m

Test Pit - Residual Clay pH (1:5)
- <6.5
- 6.5-8.0
- >8.0

FIGURE 007
MOUNT RAWDON OPERATION
TEST PIT RESIDUAL CLAY PH

N

0 250 500 m

ATC WILLIAMS

REF: 111359.100 DATE: 2024-07-09

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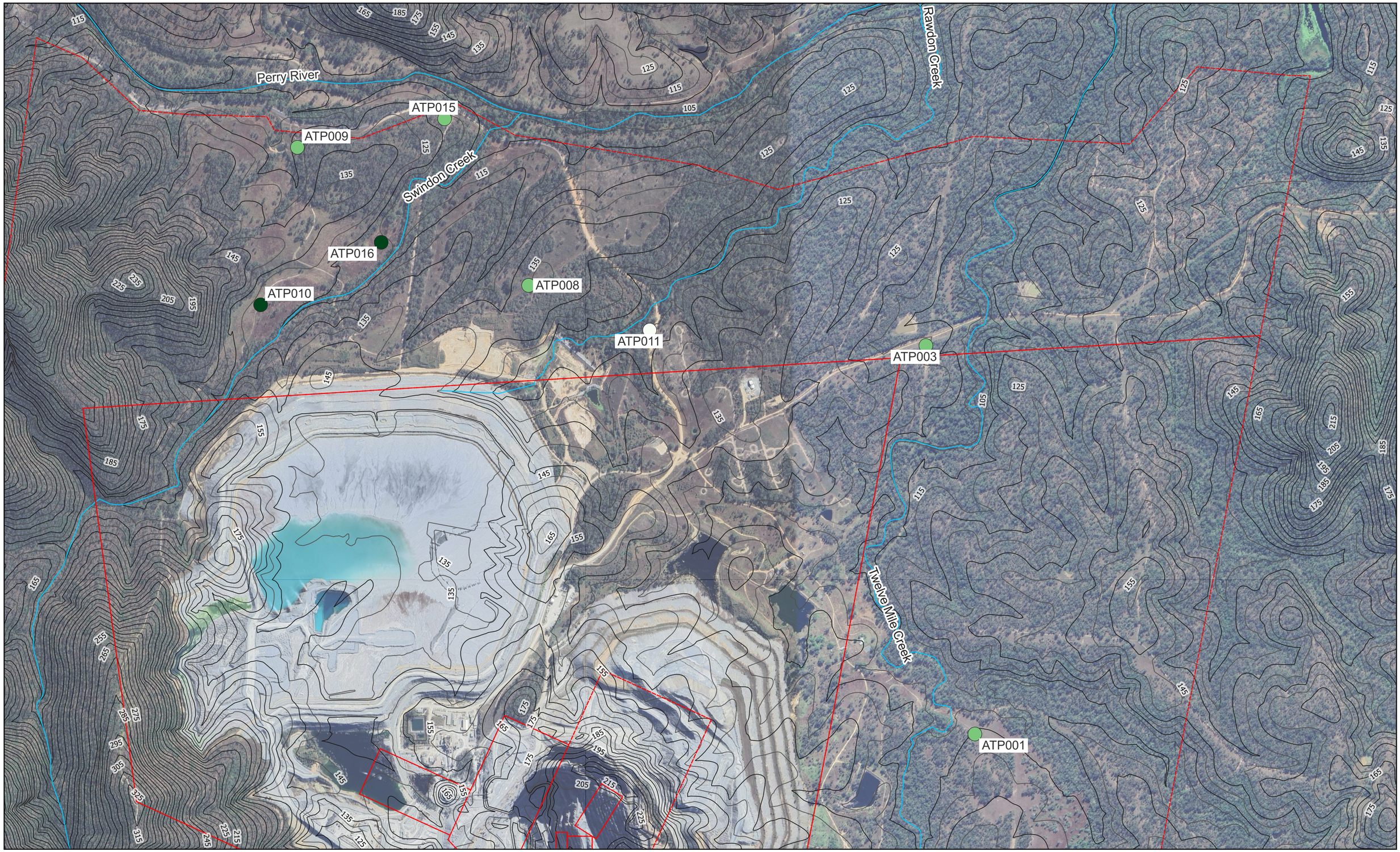

LEGEND

- Mining Lease
- Tributaries

Contours
- 5 m
- 10 m

Test Pit - Residual Clay EC (1:5)
- Non-Saline (<0.2 dS/m)
- Slightly Saline (0.2-0.4 dS/m)
- Moderately Saline (>0.4 dS/m)

FIGURE 008
MOUNT RAWDON OPERATION
TEST PIT RESIDUAL CLAY ELECTRICAL CONDUCTIVITY

N

0 250 500 m

ATC WILLIAMS

REF: 111359.100 DATE: 2024-07-09

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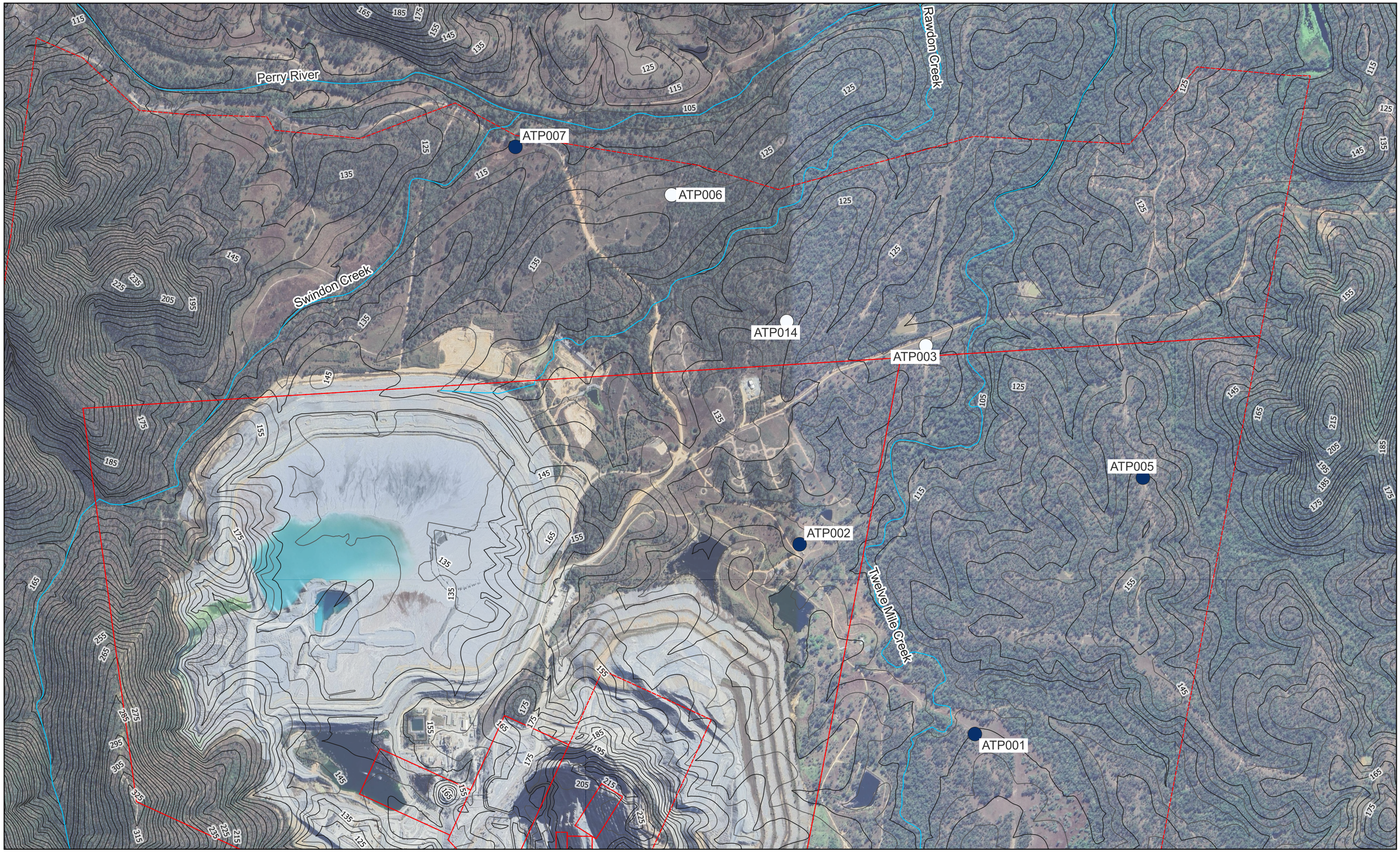

LEGEND

- Mining Lease
- Tributaries

Contours
- 5 m
- 10 m

Test Pit - Weathered Rock pH (1:5)
- <6.5
- >8.0

FIGURE 009
MOUNT RAWDON OPERATION
TEST PIT WEATHERED ROCK PH

N

0 250 500 m

ATC WILLIAMS

REF: 111359.100 DATE: 2024-07-09

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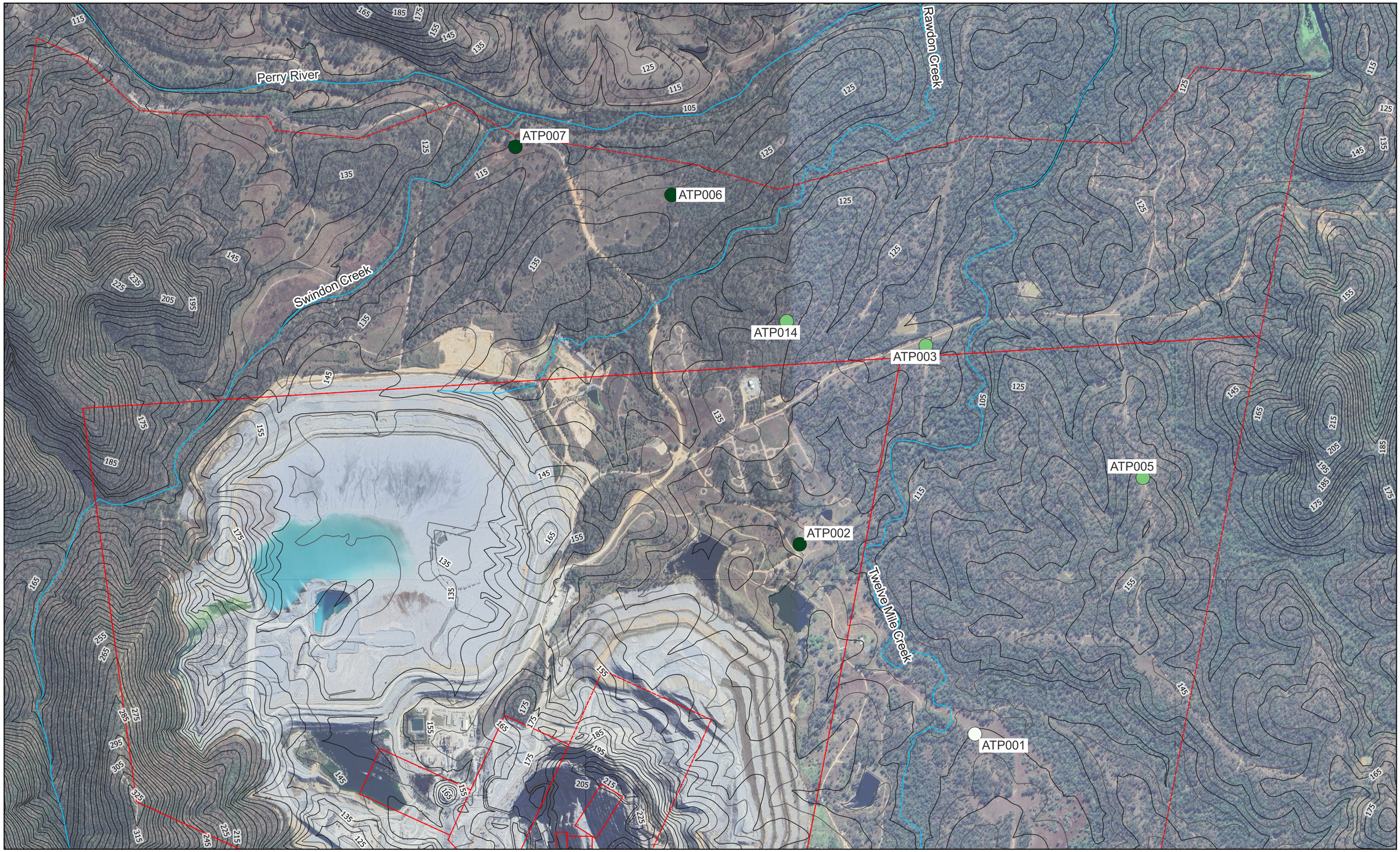

LEGEND

- Mining Lease
- Tributaries

Contours
- 5 m
- 10 m

Test Pit - Weathered Rock EC
- Non-Saline (<0.2 dS/m)
- Slightly Saline (0.2-0.4 dS/m)
- Moderately Saline (>0.4 dS/m)

FIGURE 010
MOUNT RAWDON OPERATION
TEST PIT WEATHERED ROCK ELECTRICAL CONDUCTIVITY

N

0 250 500 m

ATC WILLIAMS

REF: 111359.100 DATE: 2024-07-09

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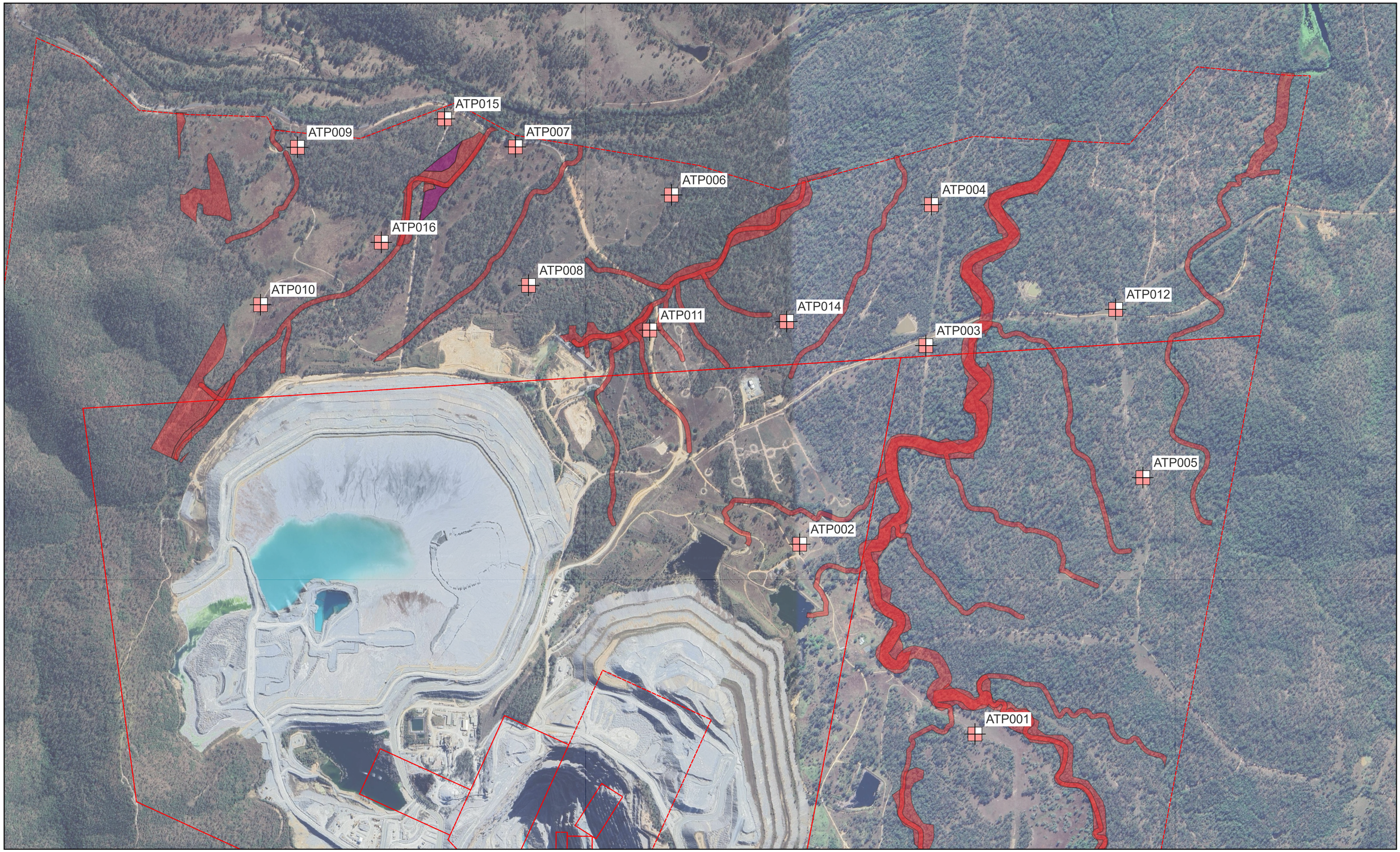

LEGEND

- Mining Lease
- Watercourse Buffer Zones
- Vegetation Management Regional Ecosystems
- Vegetation Management Essential Habitat

FIGURE 011
MOUNT RAWDON OPERATION
BORROW AREAS AND CONSTRAINTS

N

0 250 500 m

ATC WILLIAMS

REF: 111359.100 DATE: 2024-11-05

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APPENDICES

APPENDIX A – MATERIAL CHARACTERISATION REVIEW

MEMORANDUM

TO	Paul Dielemans (Paul.Dielemans@evolutionmining.com) Martine Goldner (Martine.Goldner@evolutionmining.com)	**COMPANY**	Evolution Mining Limited
FROM	Georgia Greening (reviewed Melissa Salt and Philippe Garneau)	**OFFICE**	Brisbane
EMAIL	GeorgiaG@ACTWilliams.com.au	**PHONE**	+61402 031 768
PROJECT TITLE	Mount Rawdon Operation: Tailings Storage Facility Cover System Trials		
SUBJECT	Material Characterisation Review		
DATE	9 August 2024	**OUR REF**	111359-100M02-rev0

1 INTRODUCTION

1.1 Preface

Mount Rawdon Operation (MRO) is an open cut gold mine, located approximately 80 kilometres (km) southwest of Bundaberg in South East Queensland. It is owned and operated by Evolution Mining Limited (Evolution) via its subsidiary Mt Rawdon Operations Pty Ltd.

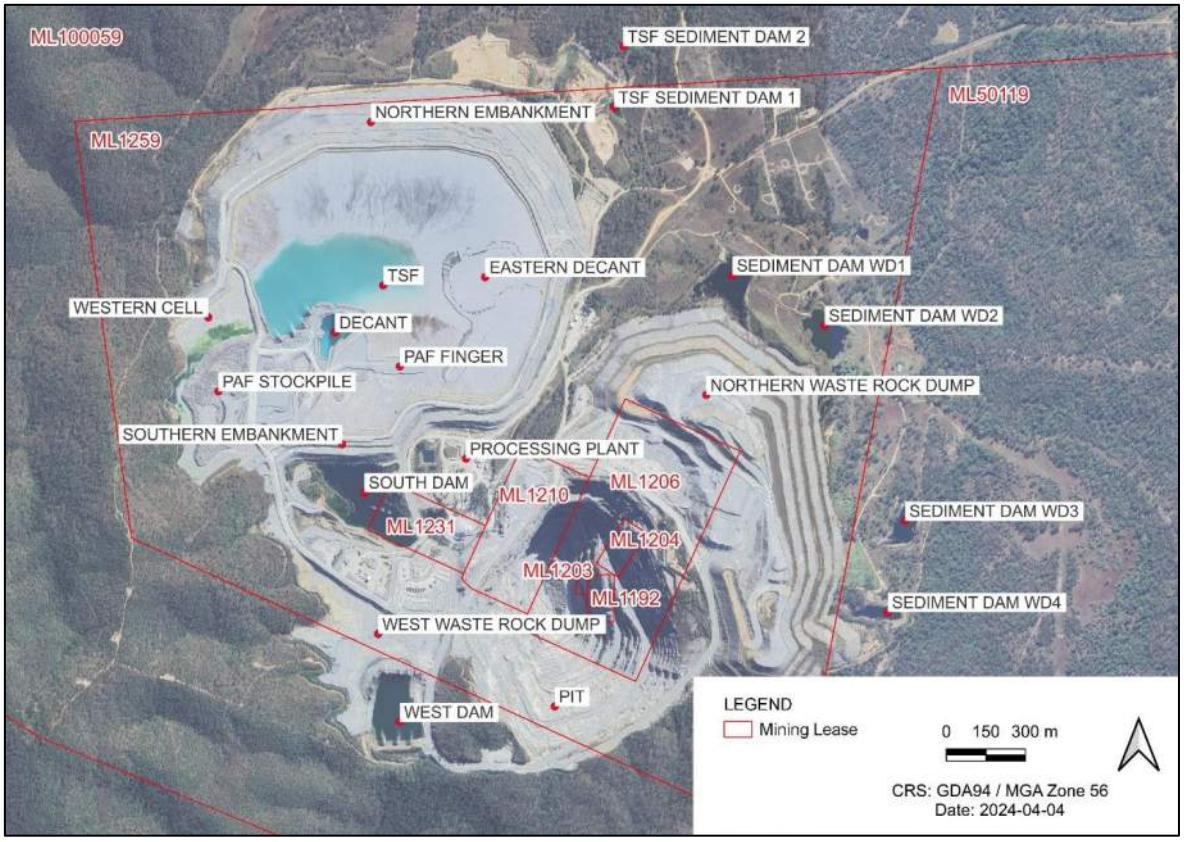
MRO is authorised by the Department of Environment, Science, and Innovation (DESI) under Environmental Authority (EA) EPML00712113 and Mining Lease (ML) 1231, ML1259, ML50119, ML100059, ML1192, ML1203, ML1204, ML1206, and ML1210.

1.2 Tailings Storage Facility

Ore is processed at a Carbon-in-Leach (CIL) treatment plant with the tailings stored in the Tailings Storage Facility (TSF) (**MAP 1**). The TSF comprises a valley type storage formed by three embankments:

- Northern Embankment: A primary embankment at the northern end;
- Southern Embankment: An embankment at the southern end that extends around the eastern perimeter; and
- Western Saddle Embankment: A saddle embankment formed on the western perimeter.

MAP 1: TAILINGS STORAGE FACILITY AND KEY FEATURES



1.2.1 Conceptual Cover System Design

The investigation into potential cover options for the closure of the TSF has been ongoing since 2007 **[8] [6] [16]**, **[20]** & **[6]**. The most recent was a conceptual cover design completed by ATCW in 2023, which assessed four cover options and identified a store and release cover system design as the preferred cover option (referred to as Cover D) **[6]**.

1.2.1.1 Cover System Trial Options

The Forward Management Plan, developed as part of **[6],** recommended that variations of the store and release cover (Cover D) (refer **SECTION 3.4**) should be trialled to verify and allow calibration of desktop modelling as well as assess vegetation establishment prior to full-scale construction of the cover system.

The following three potential cover system trial options have been adapted from **[6]**:

- Cover system incorporating a reduced permeability layer (Cover D):
  - 0.20 metre (m) Topsoil Layer;
  - 1.30 m Infiltration Storage Layer (ISL);
  - 0.60 m Reduced Permeability Layer (RPL).
- Cover system incorporating a capillary break (Modified DES Option: Cover A):
  - 0.20 m Topsoil Layer;
  - 1.45 m ISL;

- 0.50 m RPL;
- 0.60 m Capillary Break (CB) Layer.

- Cover system promoting shedding (Modified Cover D).
  - Layer thickness to be determined pending material characterisation campaign.

1.2.1.2 Material Source and Quantities

The preliminary material quantities required for closure to install each cover system option on the TSF were estimated as part of this review and are summarised in **TABLE 1**.

TABLE 1: SUMMARY OF MATERIAL QUANTITIES REQUIRED FOR EACH COVER SYSTEM OPTION

LAYER	PURPOSE	COVER D / MODIFIED COVER D	COVER A
Topsoil Layer	Promote vegetation growth	260,000 m^3	260,000 m^3
ISL (Infiltration Storage Layer)	Infiltration storage layer for vegetation growth	1,690,000 m^3	1,885,000 m^3
RPL (Reduced Permeability Layer)	Low permeability layer (generally less than $1x10^{-8}$m/s when compacted to specification requirements	780,000 m^3	650,000 m^3
CB (Capillary Break)	Poorly graded gravel, with relatively high permeability	-	780,000 m^3

Note: Material quantity estimates assume a TSF surface area of 130 hectares (ha).

1.3 Scope

ATC Williams Pty Ltd (ATCW) has been engaged by Evolution to develop field scale cover system trials for three potential cover options for the rehabilitation of the TSF. The quantity and characteristics of the cover materials available for rehabilitation can influence the selection of appropriate cover system designs. Several site investigations, which characterised topsoil, subsoil, waste rock and tailings, have been undertaken at MRO. While not all of these site investigations were specifically focused on rehabilitation, they may provide valuable data for use in developing the field cover system trials.

The scope of this material characterisation memorandum is to provide a review of existing information regarding tailings and rehabilitation materials properties and inventories. This review will identify data gaps and compile an analytical description of the materials most suitable for use in the proposed cover systems.

2 SITE SETTING

2.1 Topography

Local topography is characterised by steep hills and valleys to the north and west of the MRO and rolling hills to the east. The MRO is located within a gently sloping valley to the north towards Swindon Creek. The highest point in the area is Mount Rawdon, which has an elevation of approximately 400 metres Australian Height Datum (m AHD). The surrounding steep hills are generally lower between 120-150 m AHD. Mount Prazier is located to the north and has a small summit area and steep slopes.

The steep slopes suggest a high potential for soil erosion, leading to shallow soil profiles over weathered rock. Additionally, the narrow valleys with limited depositional zones may restrict the availability of suitable cover material. Directly around MRO and to the east, deeper soil may be present due to lower erosion rates and deposition in the broader valley.

2.2 Geology

The geological setting is described as follows **[7]**.

> The Maryborough geological map (1:250 000 scale:1968) indicates the geology of the area to comprise late Triassic Aranbanga Volcanic Group and/or Mount Rawdon Volcanics sequences, which consist typically of rhyolitic or andesitic volcanoclastics. Jurassic aged Hogback Tonalite and much older Permian aged Biggenden Beds also occur on a more regional scale. Jointing/lineations associated with this geology is reported to be subparallel with the Perry fault, which trends generally south to north through the Boolbunda Range. The drainage on which the tailings dam is to be formed therefore appears to be structurally controlled, in alignment with jointing.
>
> The local geology, based on previous site investigation works within the project area, appears to vary considerably ranging from metasediments to tuff, with trachyte dykes throughout the site. These rocks have been interpreted to be principally volcanics, possibly rhyolite, forming part of the Aranbanga Volcanic Group. Notwithstanding the origin, these sequences are generally deeply weathered, with very weak to weak rock extending to depths greater than 6 m.

2.3 Soil Types

Map units in the Atlas of Australian Soils represent soil landscapes, which encompass the spatial distribution of soils with similar characteristics and formed under similar environmental conditions. The map units are shown in **MAP 2.** There are two distinctive soil groups:

Tb103: Low to moderately hilly lands on phyllites and schists; a close pattern of hills with short to moderate slopes: chief soils are gravelly hard acidic yellow mottled soils (Dy3.41) and (Dy2.41) with shallow gravelly loamy soils (Um2.12) and (Um4.1) on crests and upper slopes. Associated are gravelly (Dr3.41) soils. Minor soil occurrences include (Gn3.42).

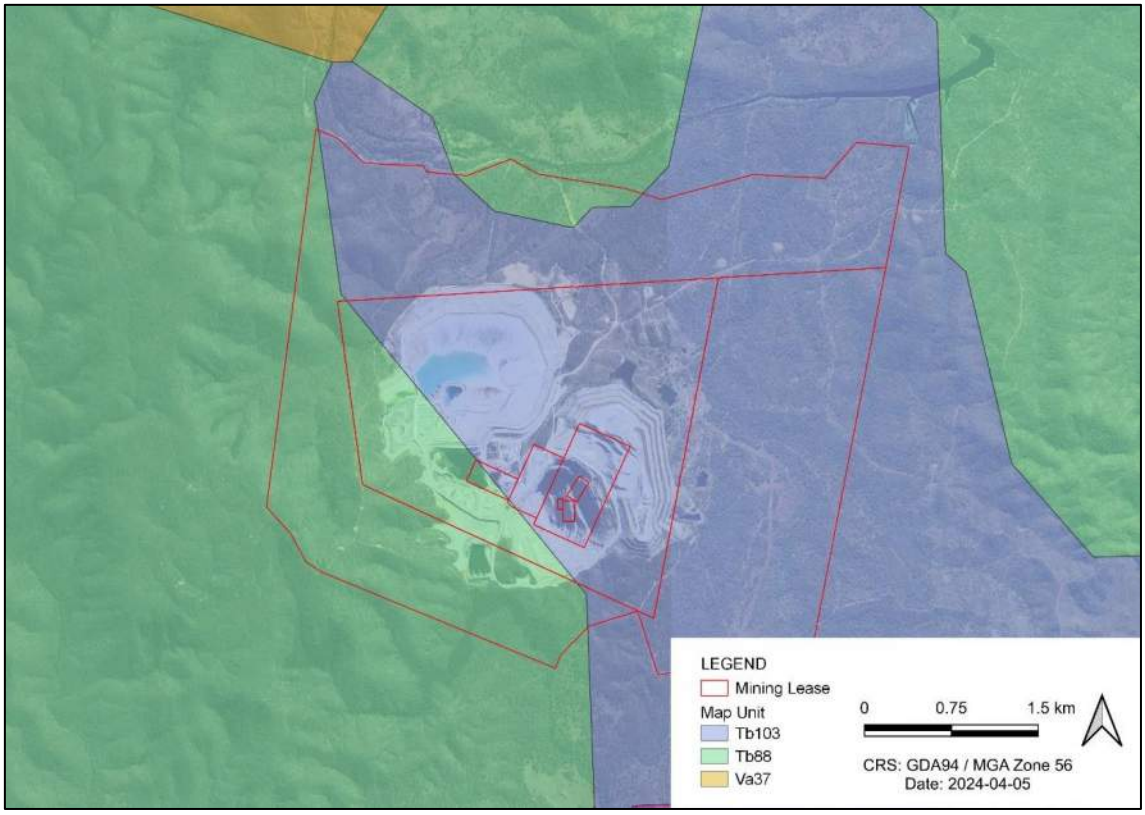
Tb88: Steep hilly to mountainous country on metasediments: chief soils are hard acidic yellow mottled soils (Dy3.41) with hard acidic red soils (Dr3.41) and (Dr2.41), all often stony. Associated are shallow loams (Um1.42) and (Um2.12) on the steeper slopes; (Dr2.21), (Dy2.21), and (Dy2.23) soils with smaller areas of (Uc1.21 and Uc1.23) on included granites; and (Uf6.41) and (Gn3.11) soils on included basic rocks.

The Australian Soil Classification (ASC) order is shown in **MAP 3**:

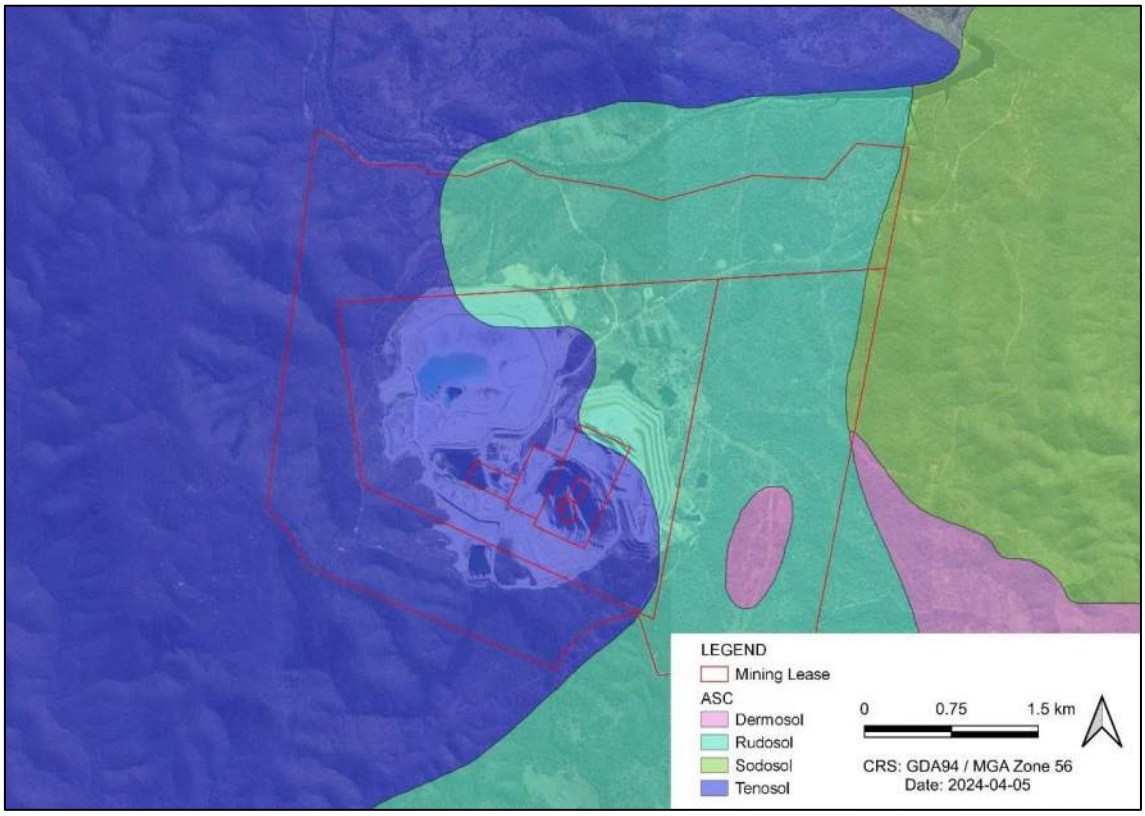
Tenosol: Shallow, stony, uniform medium/ fine textured soils.

Rudosol: Very shallow to shallow, uniform, medium textured soils over rock.

MAP 2: SOIL MAP UNITS



MAP 3: AUSTRALIAN SOIL CLASSIFICATION ORDER



3 SITE INVESTIGATIONS

3.1 Overview

There were six site investigations undertaken from 2013 to 2023:

2013 Soil and Land Suitability Assessment **[11]**:	In 2013, Northern Resource Consultants Pty Ltd (NRC) completed a soil and land suitability assessment for the proposed west dump waste rock dump development south of the TSF. Test pits were excavated at six locations (Pit 1, Pit 2, Pit 3, Pit 4, Pit 5, and Pit 6) up to 2 m depth. Thirteen samples were analysed for a range of agronomic chemical parameters but did not include soil water retention curve or other physical parameters.
2015 TSF2 Site Investigation **[2]**:	In 2015, ATCW completed a site investigation for a proposed TSF (referred to as TSF2) to provide additional storage capacity. The proposed location of TSF2 was adjacent to and northeast of the TSF. The site investigation included six geotechnical boreholes drilled to maximum depth of 50 m below existing ground level (BH01 to BH06) and 40 test pits (TP01 to TP40), which were excavated to depths ranging between 0.6 m to 5.3 m below existing ground level. This investigation focussed on the deeper layers and not on the nearer surface soils.
2016 Borrow Pit Investigation **[16]**:	In 2016, RGS Environmental Pty Ltd (RGS) and ATCW completed test pit and drilling program to quantify volumes and soil quality, geochemical and physical properties of pedolith units that could be used to construct the cover system as part of the development of the conceptual closure, decommissioning, and rehabilitation plan (CDaR Plan) for the TSF. RGS and ATCW identified four potential borrow areas where six test pits and six drilling locations were selected. Six sub samples were analysed for a range of parameters but did not include Soil Water Characteristic Curves (SWCCs).
2016 Irrigation Investigation **[12]**:	In 2016, 14 soil profiles to 0.8 m in six investigation areas bounding the eastern to northern areas of MRO were described by NRC for their potential irrigation capability. Twelve samples were recovered and analysed for a range of agronomic chemical parameters.
2022 Borrow Pit Investigation **[21]**:	In 2022, Evolution on behalf of RGS collected five bulk samples from the potential borrow pit locations as part of the erosion measurement and modelling to support the proposed PRC plan. The bulk samples included both pedolith (topsoil and subsoil) and saprolith (saprolite and saprock) and were analysed for SWCCs.
2023 Irrigation Investigation **[23]**:	In 2023, SLR Consulting Australia Pty Ltd (SLR) undertook field sampling for soil monitoring as part of the annual irrigation management and monitoring program (IMMP) report. The soil monitoring sites were selected based on areas identified as the land on site receiving mine affected water for irrigation. Five test pits were excavated.

3.2 Sampling Locations

Test pit locations are shown in **FIGURE 001** to **FIGURE 004** (attached) and summarised below.

2013 Soil and Land Suitability Assessment:	Pit 1-Pit 6
2015 TSF2 Site Investigation:	TP1-TP40
2016 Borrow Pit Investigation:	DH001-DH006
2016 Irrigation Investigation:	MRSH1-4, MRSH6-11, MSRH 13-MRSH14
2022 Borrow Pit Investigation:	Sample #1-Sample #5*
2023 Irrigation Investigation:	TP01-TP05

*Samples locations were not reported for Samples #1-Sample #5; however, were described as:

- Sample #1: Topsoil recovered from an existing stockpile.
- Sample #2: Topsoil (0 to 1 m bgl) recovered from a potential borrow area to the northwest of the TSF.
- Sample #3: Topsoil (0 to 1 m bgl) recovered from the West Hill between West Dam and the Open Pit.
- Sample #4: Saprolite (1 to 2 m bgl) recovered from the West Hill between West Dam and the Open Pit.
- Sample #5: Saprock recovered from exposed material on the access track of West Hill between West Dam and the Open Pit.

3.3 Laboratory Analysis

TABLE 2 summarises the key soil parameters analysed in the laboratory for samples collected during the site investigations. The key soil parameters include:

Chemical Properties:

- pH;
- Electrical Conductivity (EC);
- Exchangeable cations and Cation Exchange Capacity (CEC);
- Nitrogen (N);
- Phosphorous (P);
- Total Organic Carbon (TOC);
- Organic Matter (OM);
- Total metals and metalloids;

Physical Properties:

- Emerson Class;
- Particle Size Distribution (PSD);
- Atterberg Limits;
- Permeability;
- Soil Water Characteristic Curve (SWCC).

TABLE 2: SUMMARY OF LABORATORY ANALYSIS

SAMPLE ID	REFERENCE	PH	EC	EXCHANGEABLE CATIONS & CEC	N	P	TOC	OM	TOTAL METALS & METALLOIDS	EMERSON CLASS	PSD	ATTERBERG LIMITS	PERMEABILITY	SWCC	TOPSOIL	SUBSOIL	WEATHERED ROCK
COUNT	**-**	**31**	**31**	**31**	**26**	**31**	**26**	**17**	**18**	**23**	**17**	**13**	**13**	**5**	**29**	**37**	**1**
2013 SOIL AND LAND SUITABILITY ASSESSMENT																	
Pit 1	**[11]**	1	1	1	1	1	1		1		1*				1	1	
Pit 2	**[11]**	1	1	1	1	1	1		1		1*				1	1	
Pit 3	**[11]**	1	1	1	1	1	1		1		1*				1	1	
Pit 4	**[11]**	1	1	1	1	1	1		1		1*				1	1	
Pit 5	**[11]**	1	1	1	1	1	1		1		1*				1	1	
Pit 6	**[11]**	1	1	1	1	1	1		1		1*				1	1	
2015 TSF2 SITE INVESTIGATION																	
Composite Sample 1	**[2]**									1	1	1	1			1	
Composite Sample 2	**[2]**									1	1	1	1			1	
Composite Sample 3	**[2]**									1	1	1	1			1	
Composite Sample 4	**[2]**									1	1	1	1			1	
Composite Sample 5	**[2]**									1	1	1	1			1	
Composite Sample 6	**[2]**									1	1	1				1	
Composite Sample 7	**[2]**									1	1	1				1	
Composite Sample 8	**[2]**									1	1	1				1	
Composite Sample 9	**[2]**									1	1	1				1	
Composite Sample 10	**[2]**									1	1	1				1	
2016 BORROW PIT INVESTIGATION																	

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SAMPLE ID	REFERENCE	PH	EC	EXCHANGEABLE CATIONS & CEC	N	P	TOC	OM	TOTAL METALS & METALLOIDS	EMERSON CLASS	PSD	ATTERBERG LIMITS	PERMEABILITY	SWCC	TOPSOIL	SUBSOIL	WEATHERED ROCK
DH001	**[16]**	1	1	1	1	1	1			1	1	1	1		1	1	
DH002	**[16]**	1	1	1	1	1	1			1	1	1	1		1	1	
DH006	**[16]**	1	1	1	1	1	1			1		1	1		1	1	
2016 IRRIGATION INVESTIGATION																	
MRSH1	**[12]**	1	1	1	1	1	1	1	1						1	1	
MRSH2	**[12]**	1	1	1	1	1	1	1	1						1	1	
MRSH3	**[12]**	1	1	1	1	1	1	1	1						1	1	
MRSH4	**[12]**	1	1	1	1	1	1	1	1						1	1	
MRSH6	**[12]**	1	1	1	1	1	1	1	1						1	1	
MRSH7	**[12]**	1	1	1	1	1	1	1	1						1	1	
MRSH8	**[12]**	1	1	1	1	1	1	1	1						1	1	
MRSH9	**[12]**	1	1	1	1	1	1	1	1						1	1	
MRSH10	**[12]**	1	1	1	1	1	1	1	1						1	1	
MRSH11	**[12]**	1	1	1	1	1	1	1	1						1	1	
MRSH13	**[12]**	1	1	1	1	1	1	1	1						1	1	
MRSH14	**[12]**	1	1	1	1	1	1	1	1						1	1	
2022 BORROW PIT INVESTIGATION																	
Sample #1	**[21]**	1	1	1	1	1	1	1		1	1		1	1	1		
Sample #2	**[21]**	1	1	1	1	1	1	1		1	1		1	1	1		
Sample #3	**[21]**	1	1	1	1	1	1	1		1	1		1	1	1		
Sample #4	**[21]**	1	1	1	1	1	1	1		1	1		1	1		1	
Sample #5	**[21]**	1	1	1	1	1	1	1		1	1		1	1			1
2023 IRRIGATION INVESTIGATION																	
TP01	**[23]**	1	1	1		1				1					1	1	
TP02	**[23]**	1	1	1		1				1					1	1	
TP03	**[23]**	1	1	1		1				1					1	1	

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SAMPLE ID	REFERENCE	PH	EC	EXCHANGEABLE CATIONS & CEC	N	P	TOC	OM	TOTAL METALS & METALLOIDS	EMERSON CLASS	PSD	ATTERBERG LIMITS	PERMEABILITY	SWCC	TOPSOIL	SUBSOIL	WEATHERED ROCK
TP04	**[23]**	1	1	1		1				1					1	1	
TP05	**[23]**	1	1	1		1				1					1	1	

Note: *PSD was reported; however, the certificate of analysis was provided in **[11].**

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4 MATERIAL CHARACTERISATION

This section provides a review of materials encountered during the site investigations, as detailed in **SECTION 3**. The material characterisation focuses on topsoil, subsoil, weathered rock, and gravel.

4.1 Topsoil

Topsoil encountered during the site investigations was characterised based on field observations and laboratory analyses reported in **[11]**, **[2]**, **[16]**, **[12]** & **[23]**.

Topsoil was generally described as brown to dark brown sandy silt with low plasticity **[2]**. However, a gravelly loam/gravelly sand layer was identified at the surface near the Orica explosive magazine and Swindon Road **[12]**. Topsoil depth is shallow, ranging from approximately 0.2 m to 0.3 m northeast of the TSF **[2]** & **[23]**.

Clay content varies from 9% to 16% south of the TSF and west of the Pit **[11]**, which aligns with the 7% clay content measured in the topsoil stockpile sample (Sample #1) **[21]**. Test pits suggest a fairly uniform topsoil across the site, exhibiting acidic to slightly acidic pH, non-sodic characteristics, and low salinity. Topsoil generally exhibits plant growth limitations due to low levels of N and P as well as other key soil fertility indicators such as exchangeable cations and TOC. Analysis of total metals and metalloids revealed low concentrations or values below the limit of reporting.

The Emerson aggregate test measure the instability of the soil structure when immersed in water. Test pits undertaken by SLR **[23]** classified topsoil as Emerson Class 3, indicating that the remoulded (heavily trafficked) soil at the plastic limit will disperse in water.

It is important to note stockpiled topsoil may not reflect the characteristics of *in situ* topsoil, depending on factors such as topsoil stripping procedures and storage duration. Stockpiling disrupts the natural soil structure and microbial communities, leading to decreased OM content and nutrient availability. Additionally, improper topsoil stripping practices might result in uneven mixing of soil horizons, while extended storage durations could exacerbate nutrient loss. There has been limited sampling (one sample) of existing topsoil stockpiles designated for use in the TSF cover.

A SWCC was determined for the topsoil stockpile sample (Sample #1, Sample #2 and Sample #3) **[21]**. Sample #2 and Sample #3 were referred to as topsoil (0-1 metre below ground level (m bgl)), however, this would reflect subsoil material based on the shallow topsoil depths reported. Measured SWCC and permeability are presented in **TABLE 3**

TABLE 3: SOIL WATER CHARACTERISTIC CURVES

ID	DESCRIPTION	VOLUMETRIC WATER CONTENT (VWC) (%)					Permeability (m/s)
		0 kPa	10 kPa	33 kPa	100 kPa	1,500 kPa	
Sample #1	Topsoil Stockpile	34.86	21.18	18.37	15.03	8.94	3.0×10^{-10}
Sample #2	Subsoil	35.53	20.77	17.29	13.24	6.66	6.0×10^{-10}
Sample #3	Subsoil	35.11	32.74	28.16	25.04	20.03	2.0×10^{-10}

Note: *Permeability at 98% of Standard Dry Density.

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4.2 Subsoil

Subsoil in the area to the east of the TSF was described as Clayey Sand/Sandy Clay with Clayey Gravelly Sand/Clayey Sandy Gravel on the lower slopes towards the southeast portion of Borrow Area 1 **[2].**

Test pits to the northeast of the TSF intersected predominately residual soils (formed by weathering of the underlying Curtis Island Group rocks). Topsoil overlies the residual profile, which grades into low to medium plasticity clayey sands, and clayey gravelly sands overlying highly weathered quartzite/sandstone.

Excavation refusal was encountered in a number of these test pits to within the weathered quartzite/sandstone **[2]**. Subsoil depth varies across the site. No subsoil was encountered at TP20, TP22, TP29 and TP31, where highly weathered sandstone was overlain by topsoil. Subsoil depth increased in the area immediately adjacent to the Northern Embankment (in excess of 3.0 m) and decreased the northeast. Shallow subsoil was recorded in TP24 (0.4 m) and TP26 (0.6 m).

Permeability was low for three composite samples (Composite Sample 1-3) and ranged from 2 x 10^{-10} m/s to 6 x 10^{-10} m/s at 98% of Standard Dry Density **[2]** (refer **TABLE 3**). Based on the properties of clay soils within the site, low compacted permeabilities (generally of the order of 5x10^{-9} m/s) were expected to be achievable. Liquid limit, plasticity index and linear shrinkage suggest a low potential for shrink/swell **[2].**

Subsoil generally exhibited low soil fertility due to low N, P, exchangeable cations, and TOC. Metals and metalloids were generally low. Subsoil pH ranged from acidic to alkaline. ESP and salinity generally increased with depth. High ESP at depth could cause soil stability issues. Composite subsoil samples in generally had an Emerson Class of 2, indicating that they are potentially dispersive **[2]**.

The percentage of clay in subsoil varied across the site from approximately 9 % (DH001 in **[16]**) to 63% (Composite Sample 10 in **[2]**). Additionally, subsoil with a high percentage of silt and clay was identified in the area to the north of the TSF (Borrow Area 3). NRC **[12]** noted the following:

- The MRSH9 soil profile is predominately comprised of silt and clay (80%). The high percentage of silt and clay present within this area maybe directly related to the high quality clay found in MRSH10, although the horizons were not directly relatable in the field.

SWCC's were derived for the following samples; although reported as topsoil, these samples are representative of subsoil as topsoil depths are shallow across the site **[21]**.

4.3 Weathered Rock

Several geotechnical boreholes were drilled and logged as part the 2015 TSF2 Site Investigation to the northeast of the TSF **[2]:**

- The geological descriptions in borehole logs indicate intersection of pale grey and brown, highly weathered, and low strength near the surface to medium strength, moderately weathered at depths between 5 m to 12 m, becoming slightly weathered to fresh at depths between 12 m to 18 m.

As part of the 2016 Borrow Pit Investigation **[16]**, diamond core drilling was undertaken at six locations (DH001 to DH006) and logged, to verify depth to fresh rock and provide intact core samples for chemical and physical analysis:

- DH001 and DH002 are within a very deep weathered profile that extend to at least 25 m depth.
- DH003 and DH004 are within very shallow weathered profiles (1.3 m and 8 m depth).
- DH005 and DH006 are on deep weathered profiles (19 and 11 m depth).
- Two samples from DH001 and DH002 were analysed for geochemical and fertility data:

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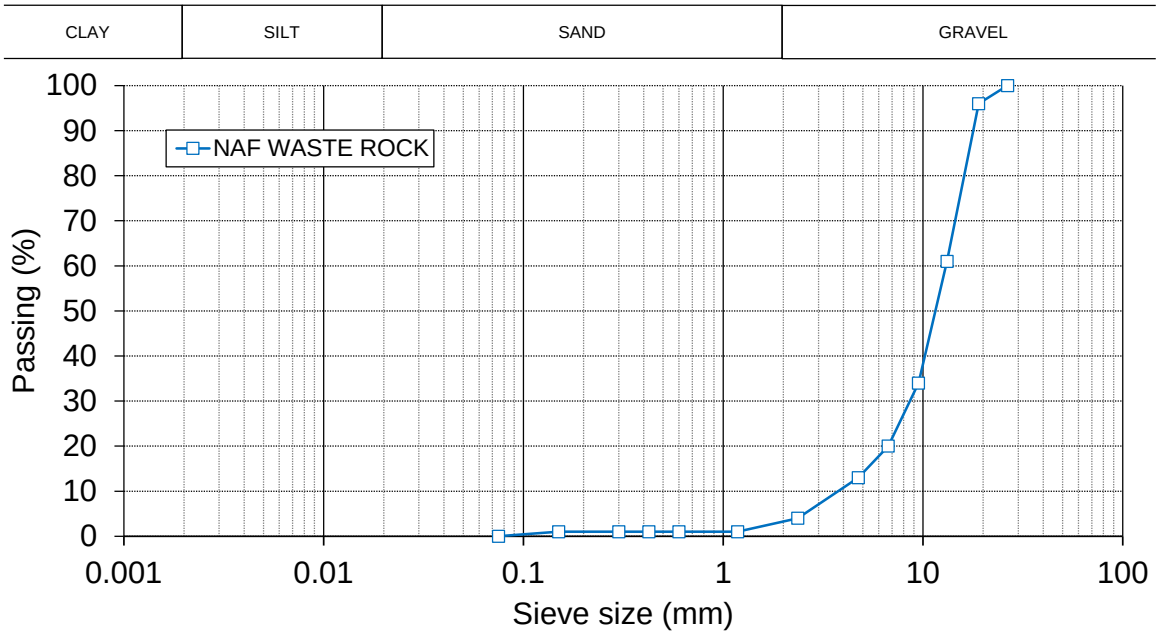
- Weathered rockwas barren of sulphur (less than the limit of reporting) with a negative Net Acid Production Potential (NAPP), indicating a negligible risk of acid generation.
- pH was neutral to alkaline with low salinity. Weathered rock has very low soil fertility due to low N, P, TOC, and exchangeable cations.
- Typically, the gravel content of crushed core samples was very high (approximately 40-80%), particularly for deeper samples. The sand content ranged from 15-80% with less than 10% clay or silt.

4.4 Gravel/Rock

Cover A requires a CB layer, which would require competent, poorly graded gravel with relatively high permeability. Based on **[6]**, it was proposed that this material would be imported from a local quarry. It is understood that Evolution would prefer to source this material on site.

RGS completed static and kinetic geochemical assessment of representative bulk samples including NAF waste rock **[18]**. PSD was measured as part of this assessment, which is shown in **GRAPH 1**. The NAF waste rock bulk sample location was not reported. It is also unclear whether this sample had been selectively sampled to avoid fines.

GRAPH 1: PSD NAF WASTE ROCK



5 MATERIAL INVENTORY

Cover material source and required quantities are summarised in **SECTION 2.2.6**. Potential cover material locations have been identified but have not been confirmed.

5.1 Topsoil Stockpiles

There are several topsoil stockpiles located across the site. The available stockpile balance as of 2021 was approximately 670,000 m^3; these topsoil stockpiles are shown in **MAP 4** below. It is understood that some of topsoil stockpiles have been depleted; however, the location of these

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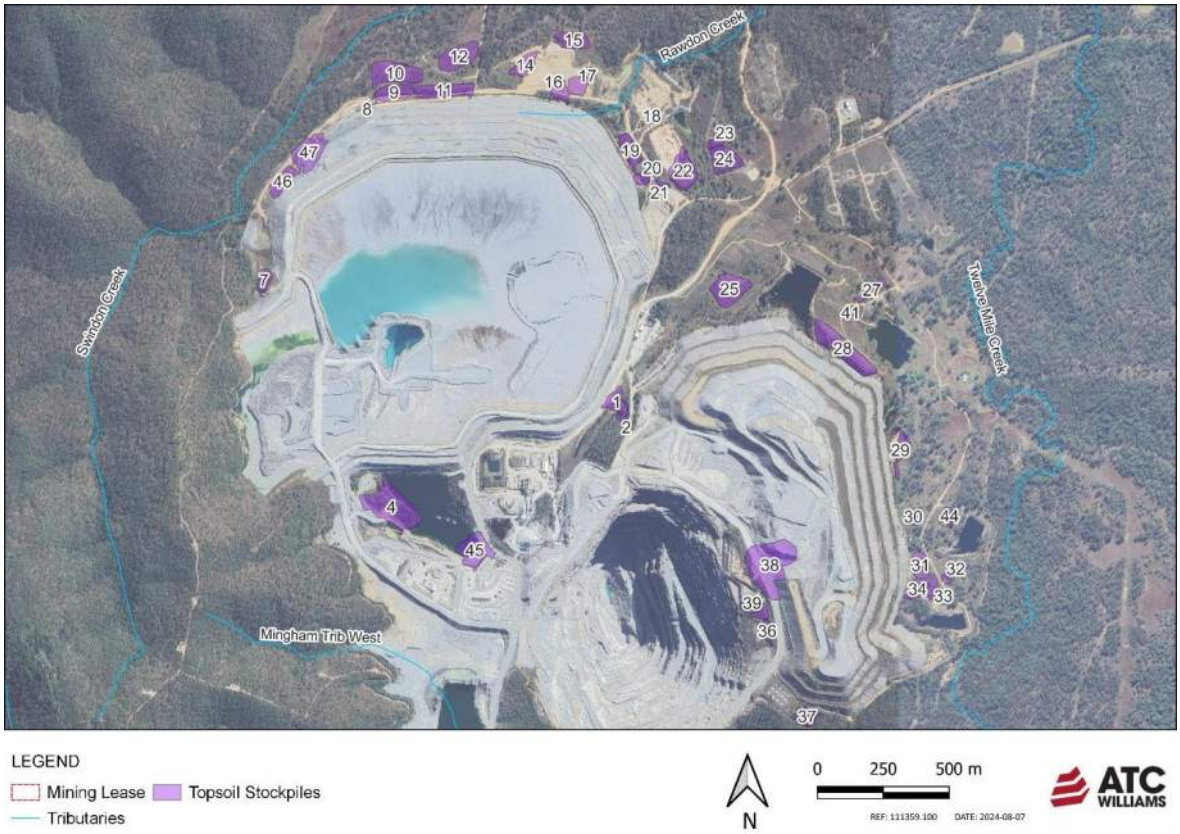
stockpiles cannot be confirmed at this stage and will require a drone survey. Notwithstanding, there required topsoil volume for the TSF surface is 260,000 m³.

MAP 4: TOPSOIL STOCKPILES



5.2 Subsoil

Subsoil depth varies across the site with the deepest subsoil depth adjacent to the Northern Embankment of the TSF.

TABLE 4 presents a high level subsoil borrow estimate assuming a depth of 1.5 m (refer to **SECTION 4.2**). It is understood that seepage has been identified at the toe of the Northern Embankment so potential borrow pits should avoid this area.

TABLE 4: SUBSOIL BORROW ESTIMATE

BORROW AREA	AREA	VOLUME ESTIMATE
Borrow Area 1	30.7 ha	459,750 m³
Borrow Area 2	16.0 ha	239,550 m³
Borrow Area 3	17.2 ha	258,000 m³
TOTAL	**63.8 ha**	**957,300** m³
Estimated Subsoil Required if used for the ISL and RPL for Cover D		2,470,000 m³

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BORROW AREA	AREA	VOLUME ESTIMATE
Estimated Subsoil Required if used for the ISL and RPL for Cover A		2,535,000 m^3

5.3 Weathered Rock

No material inventory assessment for weathered rock has been made as part of this review.

5.4 Gravel/Rock

No material inventory assessment has been made for potential gravel/rock materials.

6 TAILINGS STORAGE FACILITY

6.1 Overview

This section provides a review of geochemical and geotechnical characteristics of the tailings and Potentially Acid Forming (PAF) waste rock stored within the TSF.

6.2 Geochemical Characterisation

Since 2009, RGS have completed several static and kinetic geochemical assessments on tailings and waste rock materials **[14]**, **[15]**, **[17]**, **[18]**, **[19]** & **[20]**.

6.2.1 Tailings

RGS found that:

- Daily tailings samples have variable geochemical characteristics; however, most samples are classified as NAF and/or Uncertain **[20]**.
- Results from weekly and monthly composite tailings samples indicate that tailings blends are mostly likely NAF **[20]**.
- Tailings material have a significant amount of readily available alkalinity and buffering capacity that neutralises any acidity generated from sulfide oxidation and generally maintains an alkaline pH **[20]**.
- Based on the static geochemistry results **[20]**, previous long term Kinetic Leach Column (KLC) test results **[18]** & **[19]**, & and field monitoring data on tailings materials currently stored at the TSF, the risk of any acid generation now and following rehabilitation is expected to be very low.
- While tailings solid contained enriched concentrations of some metals/metalloids (arsenic, cadmium, silver and zinc) compared to typical soil background concentrations, most metals/metalloids appear to be relatively immobile and sparingly soluble at neutral to alkaline pH **[20]**.
- The concentration of major ions (including sulphate) in any seepage from the TSF is expected to gradually decrease over time following closure and rehabilitation **[19]**.
- EC (1:5), which provides an indicator of salinity, was relatively low (335 µS/cm) (however higher in tailings than waste rock) **[18]**.
- The final surface of the TSF is to be directed to the north into Perry River via Swindon Creek to the west of the TSF based on the outcome of **[6]**.

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6.2.2 Potentially Acid Forming Waste Rock

High Capacity Potentially Acid Forming (PAF-HC) waste rock has been used to construct decant structures within the TSF, with excess PAF-HC waste rock placed into a PAF Stockpile adjacent to the Western Decant (refer **MAP 1**).

The CDaR Plan for the TSF **[16]** and **[20]** describe the PAF waste rock management strategies, which includes:

- Continued placement of PAF-HC waste rock into the decant structures within the TSF to fully encapsulate this material within fine grained NAF low permeability tailings to eliminate oxygen entry into bulk PAF-HC waste rock materials and reduce/ negate sulfide oxidation.
- Placement of Medium Capacity Potential Acid Forming (PAF-MC) waste rock into a series of low-profile benches on the western TSF cell that will be encapsulated progressively within NAF tailings. The key design criteria for this are that PAF-MC waste rock will not be placed within 25 m horizontal of the natural ground to the west of the TSF, 50 m of the external final TSF landform, and the top of the waste rock will be covered with at least 3 m of NAF tailings.
- Consideration will be given to increasing the acid neutralising capacity of the tailings stream to maintain an ANC:MPA ratio of > 2 within the TSF from the existing to final elevation of the tailings beach.
- Utilising NAF rock crusher dust (from above) to increase the ANC of the tailings stream from 2017 to 2027.
- Location and landform design of the PAF-MC waste rock stockpiles will be assessed based on final closure landforms for the entire site and to accommodate surface water management features.

RGS undertook a static and kinetic geochemical assessment of representative bulk samples of both PAF-HC and PAF-MC waste rock **[18]**. The static geochemical tests classified PAF-MC as uncertain and PAF-HC as PAF. The PAF-MC and PAF-HC had elevated sulphur content, moderate ANC, and a reduced factor of safety with respect to potential to generate AMD. Kinetic test data indicated that there may be a lag period preceding acid generation greater than 24 months. EC (1:5) was relatively low and ranged from 120 to 187 µS/cm. PAF-HC waste rock was enriched in cadmium and silver. PAF-MC was not enriched when compared to the median crustal abundance in unmineralized soils.

RGS noted that as the tailings are NAF with low reactivity, the placement of high and moderate PAF waste rock into the TSF may change the overall static classification of the NAF TSF **[20]**.

6.3 Geotechnical Characterisation

6.3.1 Tailings

Physical and geotechnical test work was undertaken on tailings samples as part of the Stage 3A, 3B, 3C and 3E embankment raises, and samples recovered as part of the Stage 5C design raise **[7]**. Test work results are summarised in **TABLE 5** and **TABLE 6**.

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TABLE 5: HISTORICAL PHYSICAL CHARACTERISTICS OF TAILINGS

Parameter	Result
Geotechnical Classification	Sandy SILT / Silty SAND (SM-ML), Non-Plastic
Particle Density	2.6 t/m^3
Particle Size Distribution	P_{80} 106um
Atterberg Limits	Non-Plastic
Permeability	10^{-6} to 10^{-8} m/s

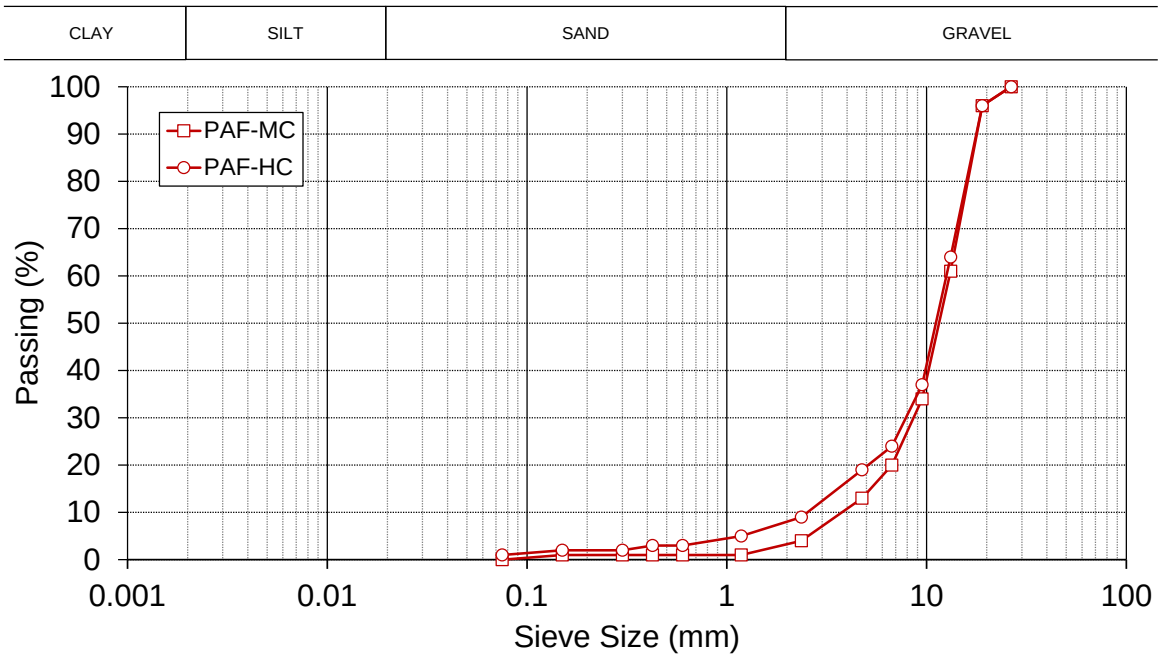
TABLE 6: STAGE 5C PHYSICAL CHARACTERISTICS OF TAILINGS

Parameter	Result
Geotechnical Classification	Silty SAND & Sandy SILT with band of Sand and Silty SAND / Silty SAND & Sandy SILT,
Particle Density	2.7-2.72 t/m^3
Particle Size Distribution	Varies, (30.1-52.4 passing 75µm sieve)
Atterberg Limits	PL = <10 and NP
Permeability	10^{-6} to 10^{-8} m/s

6.3.2 Potentially Acid Forming Waste Rock

There is limited geotechnical characterisation of PAF waste rock. PSD was reported in **[18]** and presented in **GRAPH 2.**

GRAPH 2: PSD PAF WASTE ROCK



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7 CONCLUSIONS AND RECOMMENDATIONS

To support the development of the field cover system trials, it is recommended to conduct additional test pit sampling to:

- Gain a better understanding of available material quantities and characteristics; and
- Obtain SWCC's and further characterisation for refined cover system modelling.

Analysis of existing data revealed inconsistencies in the upper 1-2 m of the soil profile. TSF investigation data primarily targeted deeper soil horizons, while irrigation assessments focused on shallow depths, with limited data extending to 1 m. Limited analytical data area available for the complete suite of analytes assessed as part of capping to maximise the potential for plants to establish. In addition, SWCC information, which is critical for soil hydraulic modelling has only been analysed on a limited number of samples.

The estimated volume of topsoil and subsoil required necessitates excavation of approximately 120 ha to a depth of 2 m, if subsoil is to be used for the RPL and ISL. This suggests that a broad area should be assessed at depth to locate the borrow pit and minimise the area of disturbance as far as practical. To overcome the limitations identified in the previous campaigns for their application to closure planning, we propose a program of ten primary test pits with an additional six contingency pits across the northern area of the MRO. This aligns with the proposed budget and anticipates a two day sampling campaign.

Selection criteria for test pit locations:

- Spatial Distribution: Test pits are strategically distributed across the investigation area to achieve comprehensive coverage. Existing data will be used for interpolation between test pit locations. Test pits are placed further north, east, and south of the primary investigation area to assess the suitability of these regions.
- Accessibility: Wherever possible, test pits will be positioned in clear, accessible locations or adjacent to roads for ease of access.
- Topographical Considerations: Steeper terrain to the west was excluded due to anticipated shallow soil depths and potential rehabilitation challenges associated with erosion.

It is understood that Evolution is not permitted to disturb the potential borrow pit locations and would seek an EA amendment at a later date.

8 ATTACHMENTS

- FIGURE 001 – Sample Locations
- FIGURE 002 – Sample Locations (North & Northeast Of TSF)
- FIGURE 003 – Sample Locations (Southeast Of The TSF)
- FIGURE 004 – Sample Locations (South Of The TSF)

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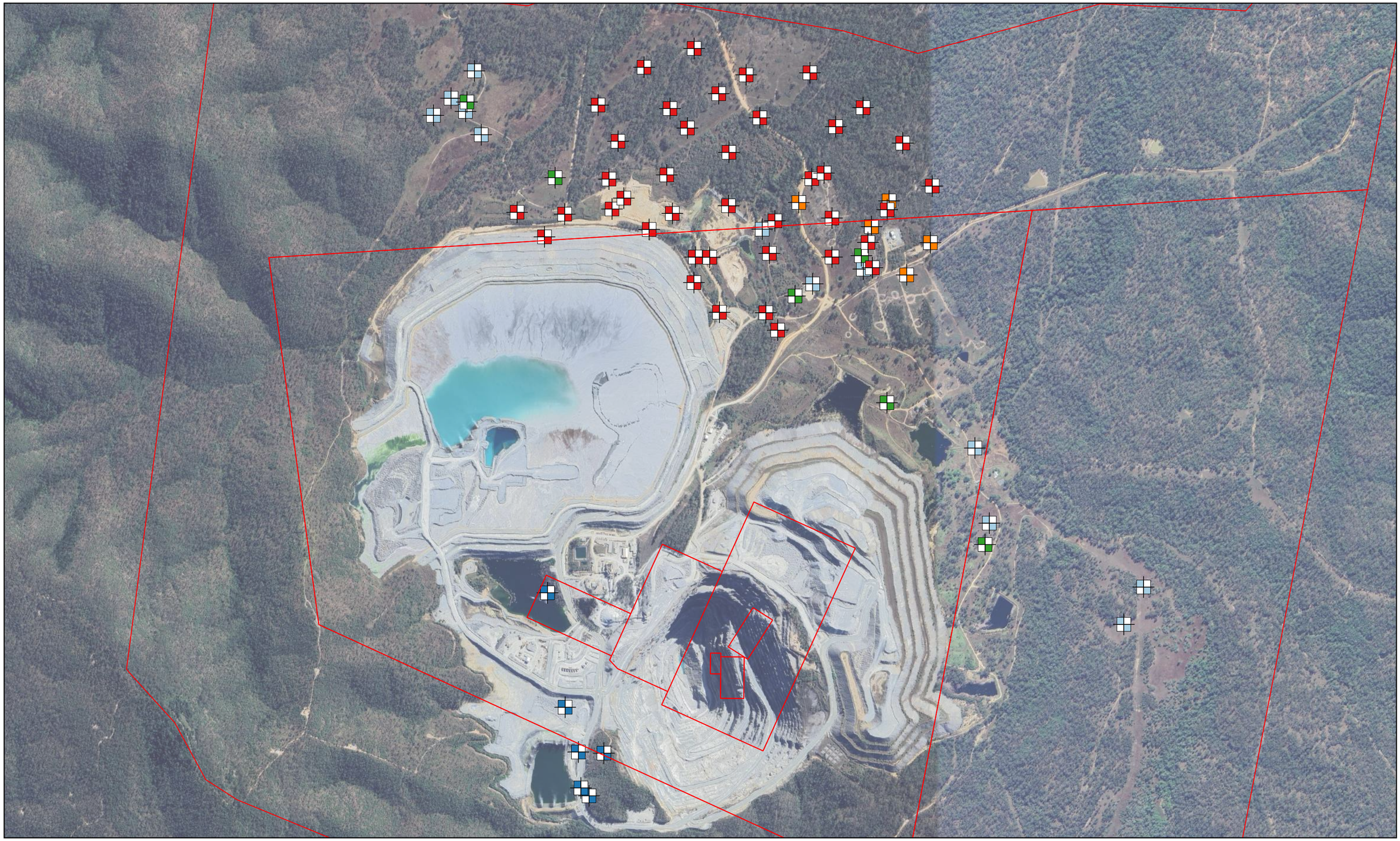
ATTACHMENTS



Legend

- Mining Lease
- 2013 Soil and Land Suitability Asessment
- 2015 TSF2 Site Investigation
- 2016 Borrow Pit Investigation
- 2016 Irrigation Investigation
- 2023 Irrigation Investigation

FIGURE 001
MOUNT RAWDON OPERATION
SAMPLE LOCATIONS

N

0 0.5 1 km

ATC WILLIAMS

REF: 116091.17 DATE: 2024-04-08

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Legend

- Mining Lease
- 2013 Soil and Land Suitability Asessment
- 2015 TSF2 Site Investigation
- 2016 Borrow Pit Investigation
- 2016 Irrigation Investigation
- 2023 Irrigation Investigation

Test Pit	Test Borehole
Chemical Properties	Physical Properties

FIGURE 002
MOUNT RAWDON OPERATION
SAMPLE LOCATIONS (NORTH & NORTHEAST)

N

0 200 400 m

ATC WILLIAMS

REF: 116091.17 DATE: 2024-04-08

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Legend

- Mining Lease
- 2013 Soil and Land Suitability Asessment
- 2015 TSF2 Site Investigation
- 2016 Borrow Pit Investigation
- 2016 Irrigation Investigation
- 2023 Irrigation Investigation

Test Pit	Test Borehole
Chemical Properties	Physical Properties

FIGURE 003
MOUNT RAWDON OPERATION
SAMPLE LOCATIONS (SOUTHEAST)

N

0 200 400 m

ATC WILLIAMS

REF: 116091.17 DATE: 2024-04-08

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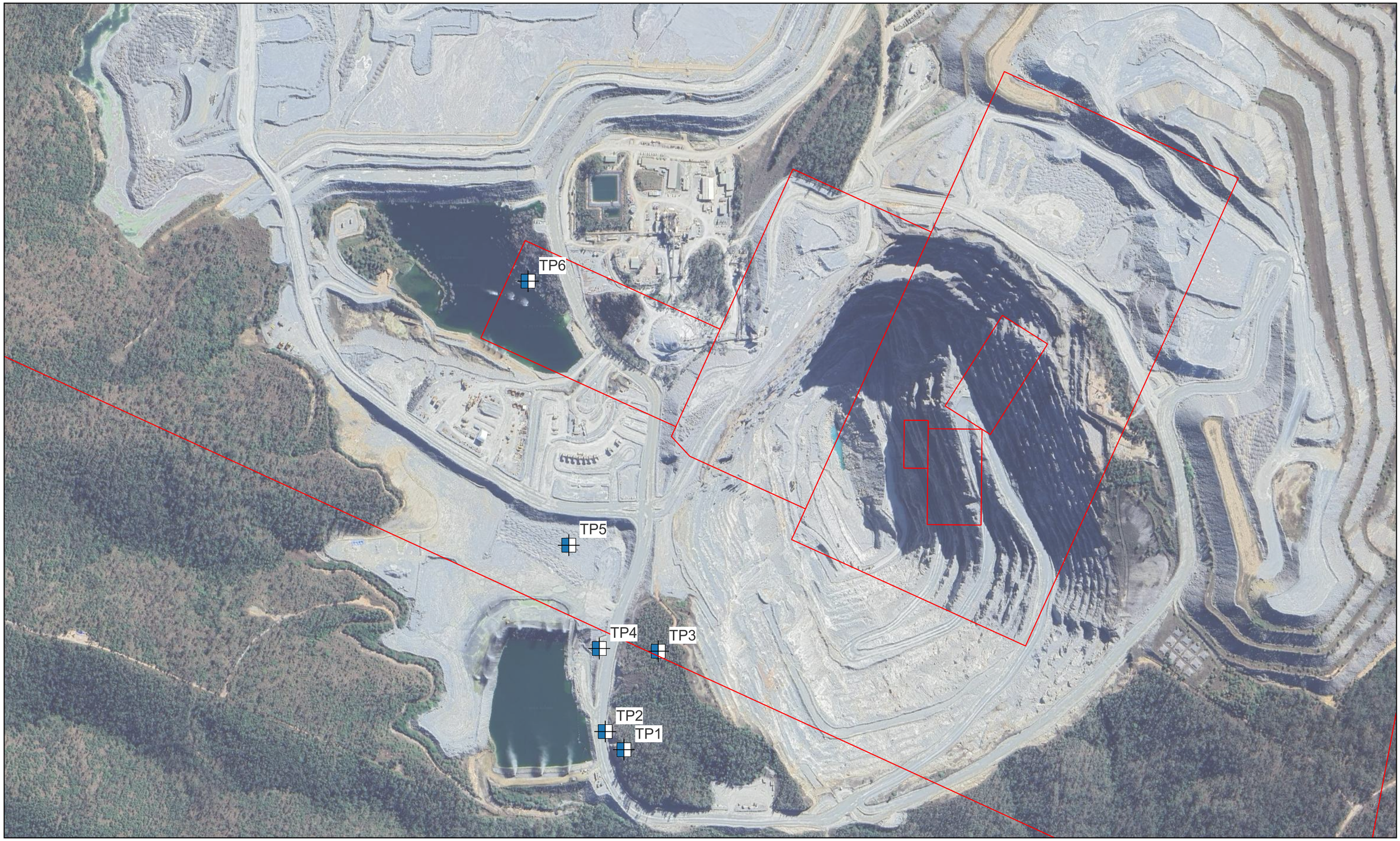

Legend

- Mining Lease
- 2013 Soil and Land Suitability Asessment
- 2015 TSF2 Site Investigation
- 2016 Borrow Pit Investigation
- 2016 Irrigation Investigation
- 2023 Irrigation Investigation

Test Pit	Test Borehole
Chemical Properties	Physical Properties

FIGURE 004
MOUNT RAWDON OPERATION
SAMPLE LOCATIONS (SOUTH)

N

0 200 400 m

ATC WILLIAMS

REF: 116091.17 DATE: 2024-04-08

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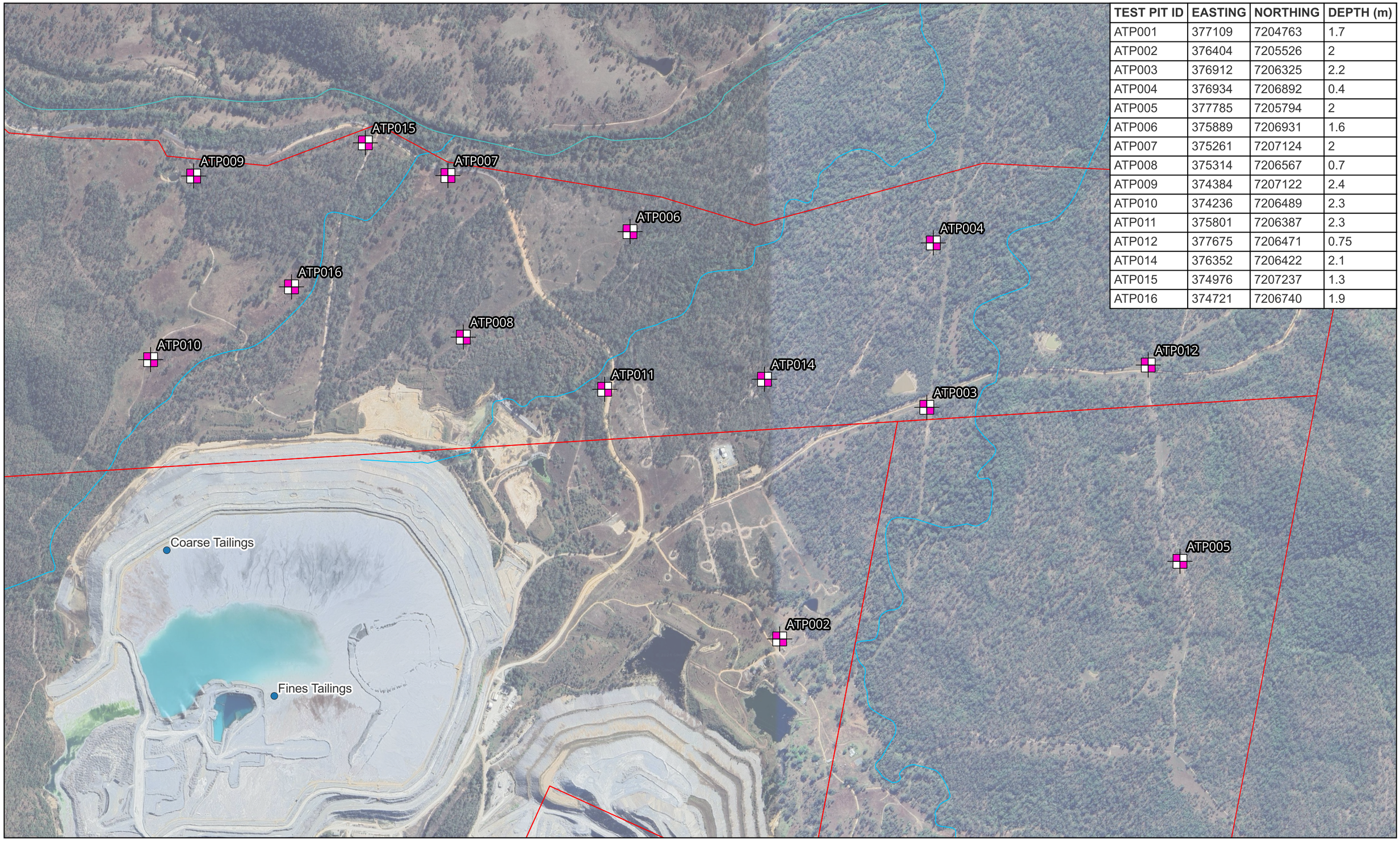
APPENDIX B – GEOTECHNICAL INVESTIGATION PLAN



TEST PIT ID	EASTING	NORTHING	DEPTH (m)
ATP001	377109	7204763	1.7
ATP002	376404	7205526	2
ATP003	376912	7206325	2.2
ATP004	376934	7206892	0.4
ATP005	377785	7205794	2
ATP006	375889	7206931	1.6
ATP007	375261	7207124	2
ATP008	375314	7206567	0.7
ATP009	374384	7207122	2.4
ATP010	374236	7206489	2.3
ATP011	375801	7206387	2.3
ATP012	377675	7206471	0.75
ATP014	376352	7206422	2.1
ATP015	374976	7207237	1.3
ATP016	374721	7206740	1.9

LEGEND

- TEST PIT LOCATIONS
- APPROX. TAILINGS SAMPLE LOCATIONS
- MINING LEASE
- WATERCOURSES

FIGURE 001
MOUNT RAWDON OPERATION
GEOTECHNICAL INVESTIGATION LOCATIONS

N

0 250 500 m

ATC WILLIAMS

REF: 116091.17 DATE: 2024-07-08

M:\Synergy\Projects\111\111359 Mt Rawdon Gold Mine\100 TSF Rehab & Cover System Trails\GIS\PROJECT MRO Cover Trials_GI Locations.qgz

APPENDIX C – GEOTECHNICAL LOGS

ID	Depth From	Depth To	Origin	Major	Minor	Description	Details	Moisture	Notes
ATP001	0	0.1	TOPSOIL	SILT	Sandy	Sandy SILT	low liquid limit, dark brown, fine to medium grained sands, with rootlets	M-W	
ATP001	0.1	0.3	ALLUVIUM	SAND	Silty	Silty SAND	fine to medium grained, grey, low liquid limit silt	M-W	Seepage at 0.3m BGL.
ATP001	0.3	1.1	RESIDUAL	CLAY	Sandy	Sandy CLAY	medium plasticity, brown mottled orange, fine to medium grained sands, with fined to medium grained, subrounded to subangular, gravel and cobbles up 100mm in size	W<PL	
ATP001	1.1	1.3	WEATHERED ROCK	SANDSTONE		SANDSTONE	highly weathered, very low strength, fine to medium grained, brown grey, massive	-	
ATP001	1.3	**1.7**					becoming low to medium strength and distinctly weathered	-	Test pit Terminated 1.7m BGL, practical bucket refusal in weathered rock.
ATP002	0	0.1	TOPSOIL	SAND	Silty	Silty SAND	fine to medium grained, brown, with rootlets, tending to Sandy SILT	M	
ATP002	0.1	0.25	ALLUVIUM	SAND	Silty	Silty SAND	fine to medium grained, grey, tending to Sandy SILT	M	
ATP002	0.25	0.9	RESIDUAL	CLAY	Sandy	Sandy CLAY	high plasticity, brown mottled orange, fined to medium grained, trace of fine grained, subrounded to subangular gravel	W<PL	
ATP002	0.9	**2.0**	WEATHERED ROCK	MUDSTONE		MUDSTONE	very low strength, highly weathered, brown grey, fine grained remoulds as fine to medium grained Silty SAND	-	Characteristics of indurated SAND. Test pit terminated 2.0m BGL target depth.
ATP003	0	0.1	TOPSOIL	SILT	Sandy	Sandy SILT	low liquid limit, dark brown, fine grained sands, with rootlets	M	
ATP003	0.1	0.3	ALLUVIUM	GRAVEL	Silty Sandy	Silty Sandy GRAVEL	fine to medium grained, sub rounded to subangular, grey, fine to medium grained sands	M - W	
ATP003	0.3	1	RESIDUAL	CLAY		CLAY	medium plasticity, grey mottled orange	W<PL	
ATP003	1	1.8	XW MATERIAL	SAND	Clayey	Clayey SAND	fine to medium grained, pale grey mottled orange, tending to low plasticity Clayey SAND	D	
ATP003	1.8	**2.2**					becoming interbedded with very low strength SANDSTONE	D	Test pit terminated 2.2 m BGL target depth.
ATP004	0	0.1	TOPSOIL	SAND	Silty	Silty SAND	fine to medium grained, brown, with rootlets	M	
ATP004	0.1	0.3	ALLUVIUM	SAND	Silty	Silty SAND	fine to medium grained, grey	M	
ATP004	0.3	**0.4**	WEATHERED ROCK	GRANITE		GRANITE	low to medium strength, moderately weathered, orange, fine to medium grained, massive	-	Test pit Terminated 0.4m BGL, practical bucket refusal in weathered rock.
ATP005	0	0.3	ALLUVIUM	SAND	Silty	Silty SAND	fine grained, brown, tending to Sandy SILT, rootlets present to 0.1m	M	No topsoil in area some rootlets present
ATP005	0.3	0.6	RESIDUAL	CLAY	Sandy	Sandy CLAY	medium plasticity, brown mottled orange, fine to medium grained sands, with fine to medium grained , subrounded to subangular gravel	W<PL	
ATP005	0.6	1.1	RESIDUAL				becoming brown mottled orange and grey	W<PL	
ATP005	1.1	1.9	XW MATERIAL	SILT	Sandy	Sandy SILT	low liquid limit, orange brown mottled pale grey, some peds with rock like structure	D - M	Soil peds with some rocklike structure in layer
ATP005	1.9	**2.0**					interbedded with very low strength SANDSTONE	-	Test pit terminated 2.0 m BGL target depth.
ATP006	0	0.15	TOPSOIL	SAND	Silty	Silty SAND	fine to medium grained, dark brown, with rootlets	M	
ATP006	0.15	0.5	ALLUVIUM	GRAVEL	Clayey Sandy	Clayey Sandy GRAVEL	fine to coarse grained, dark brown, sub angular to sub rounded, with boulders and cobbles up to 300mm	M -W	Seepage at 0.4m BGL.
ATP006	0.5	0.9	ALLUVIUM				becoming grey and pale brown	W	
ATP006	0.9	1.4	RESIDUAL	CLAY	Sandy	Sandy CLAY	medium plasticity, pale grey mottled orange and red, fine to medium grained sands	W<PL	
ATP006	1.4	**1.6**	WEATHERED ROCK	SANDSTONE		SANDSTONE	low strength, distinctly weathered, pale grey stained orange, fine to medium grained	-	Test pit Terminated 1.6m BGL, practical bucket refusal in weathered rock.
ATP007	0	0.1	TOPSOIL	SAND	Silty Clayey	Silty Clayey SAND	fine to medium grained, dark brown, low plastic clay fines, low liquid limit silt, with rootlets	M	
ATP007	0.1	0.2	ALLUVIUM	SAND	Silty Clayey	Silty Clayey SAND	fine to medium grained, dark brown, low plastic clay fines, low liquid limit silt	M	
ATP007	0.2	0.3	ALLUVIUM				becoming grey	W<PL	
ATP007	0.3	0.7	ALLUVIUM	CLAY		CLAY	medium to high plasticity, grey mottled orange, trace fine to medium grained sand	W<PL	
ATP007	0.7	1.5	RESIDUAL	CLAY	Sandy	Sandy CLAY	medium plasticity, grey, fine to medium grained sand	W<PL	
ATP007	1.5	1.6	RESIDUAL				tending to XW material interbedded with very low strength SANDSTONE	W<PL	
ATP007	1.6	1.7	XW MATERIAL	CLAY	Sand	Sand CLAY	medium plasticity, grey, fine to medium grained sand, tending to low strength sandstone, trace of fine to medium grained gravel	W<PL	
ATP007	1.7	**2.0**	WEATHERED ROCK	SANDSTONE		SANDSTONE	low to medium strength, distinctly weathered, pale grey, fine to coarse grained, massive	-	Test pit terminated 2.0 m BGL target depth.
ATP008	0	0.1	TOPSOIL	SAND	Clayey	Clayey SAND	fine to medium grained, dark brown, low plasticity clay fines with rootlets	M	
ATP008	0.1	0.4	ALLUVIUM	SAND	Silty	Silty SAND	fine to medium grained, grey with cobbles up to 150mm	M	
ATP008	0.4	0.5	RESIDUAL	CLAY	Sandy	Sandy CLAY	medium plasticity, pale grey mottled orange brown, fine to medium grained sands	W<PL	
ATP008	0.5	**0.7**	WEATHERED ROCK	SANDSTONE		SANDSTONE	medium strength, distinctly weathered, pale grey stained orange, fine to coarse grained, with volcanic clasts (potentially porphyritic rock)	-	Test pit Terminated 0.7m BGL, practical bucket refusal in weathered rock.
ATP009	0	0.1	TOPSOIL	SAND	Silty	Silty SAND	fine to medium grained, with fine to medium grained, subrounded to subangular gravel and rootlets	M	
ATP009	0.1	0.4	ALLUVIUM	GRAVEL	Silty Sandy	Silty Sandy GRAVEL	fine to medium grained, sub rounded to subangular, dark brown, fine to medium grained sands	M	Minor seepage at 0.4m BGL
ATP009	0.4	0.9	RESIDUAL	CLAY	Sandy	Sandy CLAY	medium plasticity, grey mottled orange, fine to medium grained sands	W<PL	
ATP009	0.9	1.6	RESIDUAL	CLAY	Sandy	Sandy CLAY	medium plasticity, grey mottled orange, fine to coarse grained sand, with fine to medium grained, subangular to subrounded gravel	W<PL	
ATP009	1.6	2.1	XW MATERIAL	SAND		SAND	fine to coarse grained, pale brown and orange, with very low strength SANDSTONE and fine grained, subrounded to subangular gravel	M	
ATP009	2.1	2.2	XW MATERIAL				tending to very low strength SANDSTONE	M	
ATP009	2.2	**2.4**	WEATHERED ROCK	SANDSTONE		SANDSTONE	very low to low strength, highly weathered, orange and brown, fine to coarse grained	-	Test pit terminated 2.4 m BGL target depth.
ATP010	0	0.1	TOPSOIL	CLAY	Silty	Silty CLAY	low plasticity, brown, low liquid limit SILT, with rootlets, tending to Clayey SILT	W<PL	
ATP010	0.1	0.4	ALLUVIUM	CLAY	Silty	Silty CLAY	low to medium plasticity, brown grey, low liquid limit SILT, tending to Clayey SILT	W<PL	
ATP010	0.4	0.9	RESIDUAL	CLAY	Sandy	Sandy CLAY	medium plasticity, grey mottled orange brown, fine to medium grained sands, with fine to medium grained, subangular to subrounded gravel and cobbles up to 100mm	W<PL	
ATP010	0.9	**2.3**	RESIDUAL	CLAY	Sandy	Sandy CLAY	low plasticity, grey mottled orange brown, fine to coarse grained sands, with fine to medium grained, subangular to subrounded gravel and cobbles up to 150mm, occasionally tending to Clayey SAND	W<PL	Test pit terminated 2.3 m BGL target depth.
ATP011	0	0.1	SLOPE WASH	SAND	Silty	Silty SAND	fine to medium grained, brown orange	M	
ATP011	0.1	0.5	ALLUVIUM	SAND	Silty	Silty SAND	fine grained, grey, with low plasticity clay fines, tending to Sandy SILT	M	
ATP011	0.5	0.8	ALLUVIUM	CLAY	Silty	Silty CLAY	medium plasticity, grey, trace fine grained sands	W<PL	
ATP011	0.8	2	RESIDUAL	CLAY	Sandy	Sandy CLAY	low to medium plasticity, pale grey, fine to medium grained sands	W<PL	
ATP011	2	**2.3**	XW MATERIAL				tending to very low strength SANDSTONE	W<PL	Test pit terminated 2.3 m BGL target depth.

ID	Depth From	Depth To	Origin	Major	Minor	Description	Details	Moisture	Notes
ATP012	0.1	0.3	ALLUVIUM	SILT	Sandy	Sandy SILT	low liquid limit, dark brown, fine to medium grained sand	M	
ATP012	0.3	0.5	RESIDUAL	CLAY	Silty	Silty CLAY	high plasticity, brown, low liquid limit silt	W≈PL	
ATP012	0.5	**0.75**	WEATHERED ROCK	SANDSTONE		SANDSTONE	low strength, distinctly weathered, grey, fine grained, massive		Test pit Terminated 0.75m BGL, practical bucket refusal in weathered rock.
ATP014	0	0.08	TOPSOIL	SAND	Silty	Silty SAND	fine to medium grained, dark brown, trace rootlets	M	
ATP014	0.08	0.2	ALLUVIUM	SAND	Silty	Silty SAND	fine to medium grained, GREY	M - W	
ATP014	0.2	0.4	RESIDUAL	CLAY	Sandy	Sandy CLAY	medium plasticity, grey, fine to medium grained sands	W<PL	
ATP014	0.4	1.3	RESIDUAL				becoming grey mottled orange	W<PL	
ATP014	1.3	**2.1**	XW MATERIAL	SAND	Clayey	Clayey SAND	fine to medium grained, orange and grey, interbedded with very low strength SANDSTONE	D	Test pit terminated 2.1 m BGL target depth.
ATP015	0	0.1	TOPSOIL	SAND	Silty	Silty SAND	fine to coarse grained, brown, with rootlets	M	
ATP015	0.1	0.3	ALLUVIUM	SAND	Silty	Silty SAND	fine to coarse grained, brown, with fine to coarse grained, surrounded to subangular gravel and cobbles up to 200mm and low plasticity clay fines	M	
ATP015	0.3	0.5	ALLUVIUM				tending to Clayey Sandy GRAVEL	M	
ATP015	0.5	0.9	RESIDUAL	CLAY	Sandy Gravelly	Sandy Gravelly CLAY	low plasticity, pale grey, fine to coarse grained sands, sub rounded to sub angular fine to coarse grained gravels	W≈PL	
ATP015	0.9	**1.3**	WEATHERED ROCK	SANDSTONE		SANDSTONE	low to medium strength, distinctly weathered, grey stained orange and brown, fine to medium grained, massive		Test pit Terminated 1.3m BGL, practical bucket refusal in weathered rock.
ATP016	0	0.1	TOPSOIL	SAND	Clayey	Clayey SAND	fine to medium grained, brown, with rootlets tending to low plasticity Sandy CLAY	M	
ATP016	0.1	0.2	ALLUVIUM	SAND	Clayey	Clayey SAND	fine to medium grained, brown, tending to low plasticity Sandy CLAY, with boulders and cobbles up 200mm	M	
ATP016	0.2	0.5	ALLUVIUM	SAND	Clayey	Clayey SAND	becoming with fine to medium grained subrounded to subangular gravel	M	
ATP016	0.5	0.9	ALLUVIUM	GRAVEL	Sandy	Sandy GRAVEL	fine to coarse grained, subangular to subrounded, brown, fine to medium grained sand, trace low liquid limit SILT	M	Photos of sample are pretty sandy, adjusted as per test
ATP016	0.9	1.6	ALLUVIUM	GRAVEL	Sandy	Sandy GRAVEL	becoming with gravels and cobbles and boulders up to 200mm	M	Seepage at 1.6 m BGL.
ATP016	1.6	1.7	RESIDUAL	SAND	Clayey	Clayey SAND	fine to coarse grained, brown and pale grey,	M - W	
ATP016	1.7	1.8	RESIDUAL	GRAVEL	Clayey Sandy	Clayey Sandy GRAVEL	fine to medium grained, sub angular to sub rounded, brown and pale great, fine to coarse grained sands, low plasticly clay fines, with cobbles up to 200mm	W	
ATP016	1.8	**1.9**	WEATHERED ROCK	SANDSTONE		SANDSTONE	low to medium strength, moderately weathered, grey brown, fine to medium grained, massive		Test pit Terminated 0.1.9m BGL, practical bucket refusal in weathered rock.

APPENDIX D – RESULTS TABLE

TABLE D1: PH (1:5) AND EC (1:5)

TESTPIT ID	DEPTH (m BGL)		GEOLOGICAL UNIT	pH (1:5)	EC (1:5) (dS/m)
	From	To			
ATP001	0	0.1	TOPSOIL	5.24	0.027
ATP001	0.2	0.3	TOPSOIL	5.83	0.022
ATP001	0.8	1	RESIDUAL	7.56	0.216
ATP001	1.1	1.3	WEATHERED ROCK	8.30	0.442
ATP002	0	0.1	TOPSOIL	5.45	0.029
ATP002	0.1	0.2	TOPSOIL	5.82	0.022
ATP002	1.3	1.5	WEATHERED ROCK	9.22	0.160
ATP002	1.8	2	WEATHERED ROCK	9.25	0.172
ATP003	0	0.1	TOPSOIL	5.59	0.071
ATP003	0.6	0.8	RESIDUAL	4.84	0.287
ATP003	1.3	1.5	RESIDUAL	5.37	0.336
ATP003	2	2.2	XW MATERIAL	5.47	0.337
ATP004	0.1	0.2	TOPSOIL	5.81	0.033
ATP005	0.1	0.3	TOPSOIL	5.36	0.049
ATP005	1.8	2	XW MATERIAL	9.07	0.263
ATP006	0	0.1	TOPSOIL	4.91	0.034
ATP006	0.7	0.9	ALLUVIUM	5.61	0.029
ATP006	1.4	1.6	WEATHERED ROCK	6.14	0.018
ATP007	0.1	0.2	TOPSOIL	5.87	0.030
ATP007	0.5	0.7	RESIDUAL	8.06	0.140
ATP007	1.3	1.5	RESIDUAL	8.62	0.231
ATP007	1.6	1.7	XW MATERIAL	8.50	0.159
ATP008	0.2	0.4	TOPSOIL	5.28	0.017
ATP008	0.5	0.7	WEATHERED ROCK	5.56	0.083
ATP009	0	0.1	TOPSOIL	5.67	0.071
ATP009	0.8	0.9	RESIDUAL	5.09	0.140
ATP009	1.4	1.6	RESIDUAL	4.67	0.360
ATP010	0	0.1	TOPSOIL	5.84	0.077
ATP010	0.2	0.4	ALLUVIUM	6.63	0.021
ATP010	0.7	0.9	RESIDUAL	7.28	0.021
ATP010	1.3	1.5	RESIDUAL	7.24	0.021
ATP010	1.8	2	RESIDUAL	7.27	0.021
ATP011	0	0.1	SLOPE WASH	5.47	0.075
ATP011	0.1	0.3	TOPSOIL	6.18	0.038
ATP011	0.8	1	RESIDUAL	8.11	0.144
ATP011	1.3	1.5	RESIDUAL	9.50	0.462
ATP012	0	0.1	TOPSOIL	5.77	0.035
ATP012	0.3	0.5	RESIDUAL	6.81	0.036
ATP012	0.5	0.7	WEATHERED ROCK	7.56	0.046
ATP014	0	0.1	TOPSOIL	4.89	0.051
ATP014	0.1	0.2	TOPSOIL	5.37	0.027
ATP014	0.8	1	RESIDUAL	4.99	0.312
ATP014	1.8	2	XW MATERIAL	5.45	0.299
ATP015	0	0.1	TOPSOIL	6.32	0.052
ATP015	0.3	0.5	TOPSOIL	6.18	0.036

TESTPIT ID	DEPTH (m BGL)		GEOLOGICAL UNIT	pH (1:5)	EC (1:5) (dS/m)
	From	To			
ATP015	0.8	0.9	RESIDUAL	5.83	0.019
ATP016	0	0.1	TOPSOIL	6.28	0.054
ATP016	1.4	1.6	ALLUVIUM	6.93	0.017

TABLE D2: SUMMARY PHYSICAL PROPERTIES

SAMPLE ID	GEOLOGICAL UNIT	SOIL UNIT REPRESENTED	DEPTH (m)		PARTICLE SIZE DISTRIBUTION				ATTERBERG LIMITS					EMERSON CLASS NUMBER	STANDARD COMPACTION		AVERAGE PARTICLE DENSITY FINES (t/m³)
			from	to	GRAVEL (>2 mm)	SAND (0.02 - 2 mm)	SILT (0.002 - 0.02 mm)	CLAY (<0.002 mm)	LL (%)	PL (%)	PI (%)	LS (%)	WPI		MDD (t/m³)	OMC (%)	
Sample 1	TOPSOIL	Topsoil, silty SAND	0	0.1					26	16	10	4.0	772.3	5	1.82	13	2.41
Sample 2	RESIDUAL	Residual, brown CLAY	0.3	0.8	2%	75%	11%	13%	53	19	34	12.0	3090.6	5	1.67	18	2.50
Sample 3	RESIDUAL	Residual, brown CLAY	0.3	0.6	22%	50%	14%	14%	36	22	14	6.5	764.4	5	1.62	22	2.35
Sample 4	RESIDUAL	Residual, grey CLAY	-	-	15%	62%	7%	16%	36	22	14	6.5	921.2	5	1.74	19	2.55
Sample 5	RESIDUAL	Residual, grey CLAY	-	-	7%	61%	15%	17%	42	19	23	9.0	1727.3	5	1.72	17	2.48
Sample 6	ALLUVIUM	Alluvium, brown SAND	0.5	1	53%	41%	4%	3%	27	23	4	2.0	83.1	6	1.9	14	2.51
Sample 7	XW MATERIAL/ WEATHERED ROCK	SANDSTONE, grey	-	-	5%	59%	10%	26%	45	20	25	10	2033.2	6	1.83	15	2.52
Sample 8	XW MATERIAL	Extremely weathered (EW) material, grey	-	-	10%	68%	6%	16%	41	15	26	12.5	2020.2	5	1.72	17.5	2.44
Sample 9	XW MATERIAL/ WEATHERED ROCK	Weathered rock to XW material, orange-brown/brown grey	-	-	50%	31%	7%	12%	38	25	13	7.0	556.3	2	1.63	13	2.50
Sample 10	XW MATERIAL	XW Material, orange-brown sandstone	-	-	7%	64%	6%	23%	53	28	25	10.5	1647.5	2	1.83	13.5	2.41

Notes:

Denotes Atterberg Limits: Liquid Limit (LL), Plastic Limit (PL), Plastic Limit (PI), Linear Shrinkage (LS).

Denotes weighted plasticity index (WPI).

Denotes Maximum Dry Denstiy (MDD) and Optimum Moisture Content (OMC).

TABLE D3: SUMMARY CHEMICAL PROPERTIES

ANALYTE	GEOLOGICAL UNIT	SOIL UNIT REPRESENTED	pH (1:5)	EC (1:5) (dS/m)	OM (%)	TOTAL CARBON (%)	TOTAL NITROGEN (%)	COLWELL PHOSPHORUS (mg/kg)	NITRATE NITROGEN (mg/kg)	AMMONIUM NITROGEN (mg/kg)	SULFUR (mg/kg)	EXCHANGEABLE CATIONS				
												CALCIUM (%)	MAGNESIUM (%)	POTASSIUM (%)	SODIUM (%)	CEC (meq/100g)
SAMPLE 1	TOPSOIL	Topsoil, silty SAND	5.43	0.035	2.45	1.4	0.15	4.9	2.47	11.4	6.7	37	23	12	2	1.9
SAMPLE 2	RESIDUAL	Residual, brown CLAY	8.26	0.359	0.97	0.55	0.09	1.3	0.4	1.2	27.3	2.3	60	1	37	15
SAMPLE 3	RESIDUAL	Residual, brown CLAY	6.41	0.144	1.46	0.83	0.1	2.6	0.97	1.2	7.8	2.3	76	1.9	17	12
SAMPLE 4	RESIDUAL	Residual, grey CLAY	9.1	0.363	0.14	0.08	0.05	4.9	0.4	0.8	12	50	34	1.7	15	20
SAMPLE 5	RESIDUAL	Residual, grey CLAY	5.88	0.095	0.46	0.27	0.06	3.6	0.42	1.2	8.2	18	56	1.2	11	16
SAMPLE 6	ALLUVIUM	Alluvium, brown SAND	6.81	0.018	0.39	0.22	0.06	7.2	0.89	1.4	7.6	59	34	3.2	3.3	5
SAMPLE 7	XW MATERIAL/ WEATHERED ROCK	SANDSTONE, grey	6.72	0.109	0.37	0.21	0.06	2.6	0.43	0.9	7	30	52	1.2	15	11
SAMPLE 8	XW MATERIAL	Extremely weathered (EW) material, grey	5.21	0.333	0.19	0.11	0.04	2.6	0.42	0.9	15.6	2.3	47	0.76	20	14
SAMPLE 9	XW MATERIAL/ WEATHERED ROCK	Weathered rock to XW material, orange-brown/brown grey	8.64	0.378	0.18	0.1	0.04	3.3	0.47	0.7	10.2	1.2	66	2	31	13
SAMPLE 10	XW MATERIAL	XW Material, orange-brown sandstone	5.26	0.209	0.28	0.16	0.05	3	0.41	1.2	7.2	2.1	54	0.8	14	17

Notes:

Denotes Organic Matter (OM).

Denotes Cation Exchange Capacity (CEC).

TABLE D4: SUMMARY CHEMICAL PROPERTIES

ANALYTE	GEOLOGICAL UNIT	SOIL UNIT REPRESENTED	AVAILABLE MICRONUTRIENTS					
			ZINC (mg/kg)	MANGANESE (mg/kg)	IRON (mg/kg)	COPPER (mg/kg)	BORON (mg/kg)	SILICON (mg/kg)
Sample 1	TOPSOIL	Topsoil, silty SAND	1.1	5.8	194	0.18	0.29	16
Sample 2	RESIDUAL	Residual, brown CLAY	<0.5	1.7	11	0.51	1.11	7
Sample 3	RESIDUAL	Residual, brown CLAY	<0.5	0.96	91	0.68	0.91	44
Sample 4	RESIDUAL	Residual, grey CLAY	<0.5	7.34	11	0.21	0.44	38
Sample 5	RESIDUAL	Residual, grey CLAY	<0.5	2.98	27	0.36	0.63	141
Sample 6	ALLUVIUM	Alluvium, brown SAND	<0.5	7.59	11	0.16	0.4	30
Sample 7	XW MATERIAL/ WEATHERED ROCK	SANDSTONE, grey	<0.5	4.4	21	0.32	0.46	140
Sample 8	XW MATERIAL	Extremely weathered (EW) material, grey	<0.5	0.19	21	0.18	0.35	67
Sample 9	XW MATERIAL/ WEATHERED ROCK	Weathered rock to XW material, orange-brown/brown grey	<0.5	0.36	10	0.27	0.38	40
Sample 10	XW MATERIAL	XW Material, orange-brown sandstone	<0.5	0.46	26	0.43	0.49	100

APPENDIX E – LABORATORY CERTIFICATES OF ANALYSIS

RESULTS OF SOIL ANALYSIS

25 samples supplied by ATC Williams Pty Ltd on 17/05/2024. Lab Job No.R4371
Analysis requested by Georgia Greening. Your Job: PO 111359.100
Level 3 MAROOCHYDORE QLD 4558

SAMPLE ID	*Job No.*	Soil pH (1:5 water)	Soil Conductivity (1:5 water)
	Method	***Rayment & Lyons 2011 - 4A1*	*Rayment & Lyons 2011 - 3A1*
ATP010 DS 1.3-1.5	*R4371/4*	7.24	0.021
ATP011 DS 1.3-1.5	*R4371/5*	9.50	0.462
ATP015 DS 0.8-0.9	*R4371/6*	5.83	0.019
ATP007 DS 0.5-0.7	*R4371/7*	8.06	0.140
ATP009 DS 0.8-0.9	*R4371/8*	5.09	0.140
ATP006 DS 1.4-1.6	*R4371/10*	6.14	0.018
ATP007 DS 1.6-1.7	*R4371/11*	8.50	0.159
ATP003 DS 2-2.2	*R4371/12*	5.47	0.337
ATP014 DS 1.8-2	*R4371/13*	5.45	0.299
ATP001 DS 1.1-1.3	*R4371/14*	8.30	0.442
ATP005 DS 1.8-2	*R4371/15*	9.07	0.263

Notes:

1. ECEC = Effective Cation Exchange Capacity = sum of the exchangeable Mg, Ca, Na, K, H and Al
2. Exchangeable bases determined using standard Ammonium Acetate extract (Method 15D3) with no pretreatment for soluble salts. When Conductivity ≥0.25 dS/m soluble salts are removed (Method 15E2).
3. ppm = mg/Kg dried sample
4. Exchangeable sodium percentage (ESP) is calculated as sodium (cmol+/Kg) divided by ECEC
5. All results as dry weight DW - samples were dried at 40oC for 24-48hrs prior to crushing and analysis.
6. Aluminium detection limit is 0.05 cmol+/Kg; Hydrogen detection limit is 0.1 cmol+/Kg. However for calculation purposes a value of 0 is used.
7. For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
8. 1 cmol+/Kg = 1 meq/100g
9. Methods from Rayment and Lyons, Soil Chemical Methods - Australasia
10. Conversion of cmol+/Kg to mg/Kg multiply cmol+/Kg by:
    230 for Sodium; 391 for Potassium; 200 for Calcium; 122 for Magnesium; 90 for Aluminium
11. Metals analysed by ICP-MS (Inductively Coupled Plasma - Mass Spectrometry)
12. In Pesticide Analysis Screening the following pesticides are included:
    Organochlorine pesticide (OC's) screen:

    Organophosphorus pesticide (OP's) screen:
13. Analysis conducted between sample arrival date and reporting date.
14. ** NATA accreditation does not cover the performance of this service.
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18. This report was issued on 28/06/2024.

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Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked:.....
Graham Lancaster

RESULTS OF SOIL ANALYSIS

37 samples supplied by ATC Williams Pty Ltd on 3/6/2024. Lab Job No.R4937
Analysis requested by Georgia Greening. Your Job: PO 111359.100
Level 3 MAROOCHYDORE QLD 4558

SAMPLE ID	*Job No.*	Soil pH (1:5 water)	Soil Conductivity (1:5 water)
	Method	***Rayment & Lyons 2011 - 4A1*	*Rayment & Lyons 2011 - 3A1*
ATP001 DS 0.0-0.1	*R4937/1*	5.24	0.027
ATP001 DS 0.2-0.3	*R4937/2*	5.83	0.022
ATP001 DS 0.8-1.0	*R4937/3*	7.56	0.216
ATP002 DS 0.0-0.1	*R4937/4*	5.45	0.029
ATP002 DS 0.1-0.2	*R4937/5*	5.82	0.022
ATP002 DS 1.3-1.5	*R4937/6*	9.22	0.160
ATP002 DS 1.8-2.0	*R4937/7*	9.25	0.172
ATP003 DS 0.0-0.1	*R4937/8*	5.59	0.071
ATP003 DS 0.6-0.8	*R4937/9*	4.84	0.287
ATP003 DS 1.3-1.5	*R4937/10*	5.37	0.336
ATP004 DS 0.1-0.2	*R4937/11*	5.81	0.033
ATP005 DS 0.1-0.3	*R4937/12*	5.36	0.049
ATP006 DS 0.0-.01	*R4937/13*	4.91	0.034
ATP006 DS 0.7-0.9	*R4937/14*	5.61	0.029
ATP007 DS 0.1-0.2	*R4937/15*	5.87	0.030
ATP007 DS 1.3-1.5	*R4937/16*	8.62	0.231
ATP008 DS 0.2-0.4	*R4937/17*	5.28	0.017
ATP008 DS 0.5-0.7	*R4937/18*	5.56	0.083
ATP009 DS 0.0-0.1	*R4937/19*	5.67	0.071
ATP009 DS 1.4-1.6	*R4937/20*	4.67	0.360
ATP010 DS 0.0-0.1	*R4937/21*	5.84	0.077
ATP010 DS 0.2-0.4	*R4937/22*	6.63	0.021
ATP010 DS 0.7-0.9	*R4937/23*	7.28	0.021
ATP010 DS 1.8-2.0	*R4937/24*	7.27	0.021
ATP011 DS 0.0-0.1	*R4937/25*	5.47	0.075
ATP011 DS 0.1-0.3	*R4937/26*	6.18	0.038
ATP011 DS 0.8-1.0	*R4937/27*	8.11	0.144
ATP012 DS 0.0-0.01	*R4937/28*	5.77	0.035
ATP012 DS0.3-0.5	*R4937/29*	6.81	0.036
ATP012 DS 0.5-0.7	*R4937/30*	7.56	0.046
ATP014 DS 0.0-0.1	*R4937/31*	4.89	0.051
ATP014 DS 0.1-0.2	*R4937/32*	5.37	0.027
ATP014 DS 0.8-1.0	*R4937/33*	4.99	0.312
ATP015 DS 0.0-0.1	*R4937/34*	6.32	0.052
ATP015 DS 0.3-0.5	*R4937/35*	6.18	0.036
ATP016 DS0.0-0.1	*R4937/36*	6.28	0.054
ATP016 DS 1.4-1.6	*R4937/37*	6.93	0.017

Notes:

1. ECEC = Effective Cation Exchange Capacity = sum of the exchangeable Mg, Ca, Na, K, H and Al
2. Exchangeable bases determined using standard Ammonium Acetate extract (Method 15D3) with no pretreatment for soluble salts. When Conductivity ≥0.25 dS/m soluble salts are removed (Method 15E2).
3. ppm = mg/Kg dried sample
4. Exchangeable sodium percentage (ESP) is calculated as sodium (cmol+/Kg) divided by ECEC
5. All results as dry weight DW - samples were dried at 40oC for 24-48hrs prior to crushing and analysis.
6. Aluminium detection limit is 0.05 cmol+/Kg; Hydrogen detection limit is 0.1 cmol+/Kg. However for calculation purposes a value of 0 is used.
7. For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
8. 1 cmol+/Kg = 1 meq/100g
9. Methods from Rayment and Lyons, Soil Chemical Methods - Australasia
10. Conversion of cmol+/Kg to mg/Kg multiply cmol+/Kg by:
    230 for Sodium; 391 for Potassium; 200 for Calcium; 122 for Magnesium; 90 for Aluminium
11. Metals analysed by ICP-MS (Inductively Coupled Plasma - Mass Spectrometry)
12. In Pesticide Analysis Screening the following pesticides are included:
    Organochlorine pesticide (OC's) screen:

    Organophosphorus pesticide (OP's) screen:
13. Analysis conducted between sample arrival date and reporting date.
14. ** NATA accreditation does not cover the performance of this service.
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AGRICULTURAL SOIL ANALYSIS REPORT

25 samples supplied by ATC Williams Pty Ltd on 17/05/2024. Lab Job No.R4371
Analysis requested by Georgia Greening. Your Job: PO 111359.100
Level 3 MAROOCHYDORE QLD 4558

			Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
		Sample ID:	ATP008 DS 0-0.1	ATP002 DS 0.3-0.5	ATP005 DS 0.4-0.6	ATP010 DS 1.3-1.5 & ATP011 DS 1.3-1.5	ATP15DS0.8-0.9&ATP7DS0.5-0.7&ATP9DS0.8-0.9
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	Evolution Mining	Evolution Mining	Evolution Mining	Evolution Mining	Evolution Mining
Parameter		Method reference	R4371/1	R4371/2	R4371/3	R4371/C1	R4371/C2
Phosphorus (mg/kg P)		**Rayment & Lyons 2011 - 9B2 (Colwell)	4.9	1.3	2.6	4.9	3.6
Nitrate Nitrogen (mg/kg N)		**Inhouse S37 (KCl)	2.5	0.40	0.97	0.40	0.42
Ammonium Nitrogen (mg/kg N)			11	1.2	1.2	0.8	1.2
Sulfur (mg/kg S)			6.7	27	7.8	12.0	8.2
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.43	8.26	6.41	9.10	5.88
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.035	0.359	0.144	0.363	0.095
Estimated Organic Matter (% OM)		**Calculation: Total Carbon x 1.75	2.5	0.97	1.5	0.14	0.46
Exchangeable Calcium	(cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	0.72	0.34	0.26	9.98	3.02
	(kg/ha)		325	153	118	4,481	1,355
	(mg/kg)		145	68	53	2001	605
Exchangeable Magnesium	(cmol+/kg)		0.45	8.9	8.7	6.8	9.3
	(kg/ha)		122	2,427	2,380	1,855	2,521
	(mg/kg)		54	1,083	1,062	828	1,125
Exchangeable Potassium	(cmol+/kg)		0.23	0.15	0.22	0.34	0.20
	(kg/ha)		203	129	190	298	175
	(mg/kg)		91	58	85	133	78
Exchangeable Sodium	(cmol+/kg)		<0.065	5.5	1.9	3.0	1.8
	(kg/ha)		<33	2,857	991	1,540	935
	(mg/kg)		<15	1,275	442	687	418
Exchangeable Aluminium	(cmol+/kg)	**Inhouse S37 (KCl)	0.27	0.01	0.22	<0.01	1.1
	(kg/ha)		54	2.6	44	<1	223
	(mg/kg)		24	1.2	19	<1	100
Exchangeable Hydrogen	(cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.22	<0.01	0.18	<0.01	1.1
	(kg/ha)		5.0	<1	4.1	<1	25
	(mg/kg)		2.2	<1	1.8	<1	11
Effective Cation Exchange Capacity (ECEC) (cmol+/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	1.9	15	12	20	16
Calcium (%)		**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	37	2.3	2.3	49.6	18.3
Magnesium (%)			23	60	76	33.8	56.1
Potassium (%)			12	0.98	1.9	1.7	1.2
Sodium - ESP (%)			2.0	37	17	14.9	11.0
Aluminium (%)			14	0.09	1.9	0.0	6.7
Hydrogen (%)			11	0.00	1.6	0.0	6.6
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol+/kg)	1.6	0.04	0.03	1.47	0.33
Zinc (mg/kg)		Rayment & Lyons 2011 - 12A1 (DTPA)	1.1	<0.5	<0.5	<0.5	<0.5
Manganese (mg/kg)			5.8	1.7	0.96	7.34	2.98
Iron (mg/kg)			194	11	91	11	27
Copper (mg/kg)			0.18	0.51	0.68	0.21	0.36
Boron (mg/kg)		**Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$)	0.29	1.1	0.91	0.44	0.63
Silicon (mg/kg Si)		**Inhouse S11 (Hot CaCl2)	16	7.2	44	38	141
Total Carbon (%)		Inhouse S4a (LECO Trumac Analyser)	1.4	0.55	0.83	0.08	0.27
Total Nitrogen (%)			0.15	0.09	0.10	0.05	0.06
Carbon/Nitrogen Ratio		**Calculation: Total Carbon/Total Nitrogen	9.3	6.1	8.6	1.7	4.5
Basic Texture		**Inhouse S65	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam
Basic Colour			Brownish	Brownish	Brownish	Brownish	Brownish
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	22	230	92	232	61
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	4.4	7.1	5.2	8.0	4.5

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AGRICULTURAL SOIL ANALYSIS REPORT

25 samples supplied by ATC Williams Pty Ltd on 17/05/2024. Lab Job No.R4371

Analysis requested by Georgia Greening. Your Job: PO 111359.100

Level 3 MAROOCHYDORE QLD 4558

		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
	Sample ID:	ATP008 DS 0-0.1	ATP002 DS 0.3-0.5	ATP005 DS 0.4-0.6	ATP010 DS 1.3-1.5 & ATP011 DS 1.3-1.5	ATP15DS0.8-0.9&ATP7DS0.5-0.7&ATP9DS0.8-0.9
	Crop:	N/G	N/G	N/G	N/G	N/G
	Client:	Evolution Mining	Evolution Mining	Evolution Mining	Evolution Mining	Evolution Mining
Parameter	Method reference	R4371/1	R4371/2	R4371/3	R4371/C1	R4371/C2

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
10. Conversions for 1 cmol$_+$/kg = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
13. ** NATA accreditation does not cover the performance of this service.
14. Analysis conducted between sample arrival date and reporting date.
15. This report is not to be reproduced except in full. Results only relate to the item tested.
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17. This report was issued on 6/06/2024.

Quality Checked: Kris Saville
Agricultural Co-Ordinator

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AGRICULTURAL SOIL ANALYSIS REPORT

25 samples supplied by ATC Williams Pty Ltd on 17/05/2024. Lab Job No.R4371
Analysis requested by Georgia Greening. Your Job: PO 111359.100
Level 3 MAROOCHYDORE QLD 4558

			Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
		Sample ID:	ATP016 DS 0.8-1	ATP006 DS 1.4-1.6 & ATP007 DS 1.6-1.7	ATP003 DS 2-2.2 & ATP014 DS 1.8-2	ATP001 DS 1.1-1.3 & ATP005 DS 1.8-2	ATP009 DS 1.9-2.1
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	Evolution Mining	Evolution Mining	Evolution Mining	Evolution Mining	Evolution Mining
Parameter		Method reference	R4371/9	R4371/C3	R4371/C4	R4371/C5	R4371/16
Phosphorus (mg/kg P)		**Rayment & Lyons 2011 - 9B2 (Colwell)	7.2	2.6	2.6	3.3	3.0
Nitrate Nitrogen (mg/kg N)		**Inhouse S37 (KCl)	0.89	0.43	0.42	0.47	0.41
Ammonium Nitrogen (mg/kg N)			1.4	0.9	0.9	0.7	1.2
Sulfur (mg/kg S)			7.6	7.0	15.6	10.2	7.2
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.81	6.72	5.21	8.64	5.26
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.018	0.109	0.333	0.378	0.209
Estimated Organic Matter (% OM)		**Calculation: Total Carbon x 1.75	0.39	0.37	0.19	0.18	0.28
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.8	3.24	0.33	0.16	0.36
	(kg/ha)		1,250	1,453	146	74	160
	(mg/kg)		558	649	65	33	72
Exchangeable Magnesium	(cmol$_+$/kg)		1.6	5.7	6.7	8.7	9.1
	(kg/ha)		430	1,541	1,817	2,369	2,490
	(mg/kg)		192	688	811	1,057	1,111
Exchangeable Potassium	(cmol$_+$/kg)		0.15	0.13	<0.12	0.27	0.13
	(kg/ha)		131	114	<112	237	117
	(mg/kg)		59	51	<50	106	52
Exchangeable Sodium	(cmol$_+$/kg)		0.16	1.6	2.9	4.1	2.4
	(kg/ha)		81	836	1,491	2,103	1,243
	(mg/kg)		36	373	666	939	555
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.3	2.2	0.0	2.6
	(kg/ha)		3.5	57	452	06	528
	(mg/kg)		1.6	26	202	03	236
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	2.0	<0.01	2.1
	(kg/ha)		<1	<1	45	<1	48
	(mg/kg)		<1	<1	20	<1	21
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	4.7	11	14	13	17
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	59	29.6	2.3	1.2	2.1
Magnesium (%)			34	51.8	46.9	65.7	54
Potassium (%)			3.2	1.2	0.8	2.0	0.80
Sodium - ESP (%)			3.3	14.8	20.3	30.8	14
Aluminium (%)			0.37	2.6	15.8	0.2	16
Hydrogen (%)			0.00	0.0	14.0	0.0	13
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.8	0.57	0.05	0.02	0.04
Zinc (mg/kg)		Rayment & Lyons 2011 - 12A1 (DTPA)	<0.5	<0.5	<0.5	<0.5	<0.5
Manganese (mg/kg)			7.6	4.40	0.19	0.36	0.46
Iron (mg/kg)			11	21	21	10	26
Copper (mg/kg)			0.16	0.32	0.18	0.27	0.43
Boron (mg/kg)		**Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$)	0.40	0.46	0.35	0.38	0.49
Silicon (mg/kg Si)		**Inhouse S11 (Hot CaCl2)	30	140	67	40	100
Total Carbon (%)		Inhouse S4a (LECO Trumac Analyser)	0.22	0.21	0.11	0.10	0.16
Total Nitrogen (%)			0.06	0.06	0.04	0.04	0.05
Carbon/Nitrogen Ratio		**Calculation: Total Carbon/Total Nitrogen	3.9	3.4	2.4	2.5	3.5
Basic Texture		**Inhouse S65	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam
Basic Colour			Brownish	Brownish	Brownish	Brownish	Brownish
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	12	70	213	242	134
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.1	5.6	4.3	7.5	4.2

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AGRICULTURAL SOIL ANALYSIS REPORT

25 samples supplied by ATC Williams Pty Ltd on 17/05/2024. Lab Job No.R4371

Analysis requested by Georgia Greening. Your Job: PO 111359.100

Level 3 MAROOCHYDORE QLD 4558

			Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
		Sample ID:	ATP016 DS 0.8-1	ATP006 DS 1.4-1.6 & ATP007 DS 1.6-1.7	ATP003 DS 2-2.2 & ATP014 DS 1.8-2	ATP001 DS 1.1-1.3 & ATP005 DS 1.8-2	ATP009 DS 1.9-2.1
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	Evolution Mining	Evolution Mining	Evolution Mining	Evolution Mining	Evolution Mining
	Parameter	Method reference	R4371/9	R4371/C3	R4371/C4	R4371/C5	R4371/16

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
10. Conversions for 1 cmol$_c$/kg = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
13. ** NATA accreditation does not cover the performance of this service.
14. Analysis conducted between sample arrival date and reporting date.
15. This report is not to be reproduced except in full. Results only relate to the item tested.
16. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions
17. This report was issued on 6/06/2024.

NATA
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Accreditation No. 14960
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Quality Checked: Kris Saville
Agricultural Co-Ordinator

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AGRICULTURAL SOIL ANALYSIS REPORT

25 samples supplied by ATC Williams Pty Ltd on 17/05/2024. Lab Job No.R4371
Analysis requested by Georgia Greening. Your Job: PO 111359.100
Level 3 MAROOCHYDORE QLD 4558

			Heavy Soil	Medium Soil	Light Soil	Sandy Soil
		Sample ID:				
		Crop:				
		Client:	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
Parameter		**Method reference**	**Indicative guidelines - refer to Notes 6 and 8**			
Phosphorus (mg/kg P)		**Rayment & Lyons 2011 - 9B2 (Colwell)	80	50	45	35
Nitrate Nitrogen (mg/kg N)		**Inhouse S37 (KCl)	15	13	10	10
Ammonium Nitrogen (mg/kg N)			20	18	15	12
Sulfur (mg/kg S)			10.0	8.0	8.0	7.0
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.5	6.5	6.3	6.3
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.200	0.150	0.120	0.100
Estimated Organic Matter (% OM)		**Calculation: Total Carbon x 1.75	> 5.5	>4 .5	> 3.5	> 2.5
Exchangeable Calcium	**(cmol$_+$/kg)**	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	15.6	10.8	5.0	1.9
	(kg/ha)		7000	4816	2240	840
	(mg/kg)		3125	2150	1000	375
Exchangeable Magnesium	**(cmol$_+$/kg)**		2.4	1.7	1.2	0.60
	(kg/ha)		650	448	325	168
	(mg/kg)		290	200	145	75
Exchangeable Potassium	**(cmol$_+$/kg)**		0.60	0.50	0.40	0.30
	(kg/ha)		526	426	336	224
	(mg/kg)		235	190	150	100
Exchangeable Sodium	**(cmol$_+$/kg)**		0.3	0.26	0.22	0.11
	(kg/ha)		155	134	113	57
	(mg/kg)		69	60	51	25
Exchangeable Aluminium	**(cmol$_+$/kg)**	**Inhouse S37 (KCl)	0.6	0.5	0.4	0.2
	(kg/ha)		121	101	73	30
	(mg/kg)		54	45	32	14
Exchangeable Hydrogen	**(cmol$_+$/kg)**	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.6	0.5	0.4	0.2
	(kg/ha)		13	11	8	3
	(mg/kg)		6	5	4	2
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	20.1	14.3	7.8	3.3
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	77.6	75.7	65.6	57.4
Magnesium (%)			11.9	11.9	15.7	18.1
Potassium (%)			3.0	3.5	5.2	9.1
Sodium - ESP (%)			1.5	1.8	2.9	3.3
Aluminium (%)			6.0	7.1	10.5	12.1
Hydrogen (%)						
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	6.5	6.4	4.2	3.2
Zinc (mg/kg)		Rayment & Lyons 2011 - 12A1 (DTPA)	6.0	5.0	4.0	3.0
Manganese (mg/kg)			25	22	18	15
Iron (mg/kg)			25	22	18	15
Copper (mg/kg)			2.4	2.0	1.6	1.2
Boron (mg/kg)		**Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$)	2.0	1.7	1.4	1.0
Silicon (mg/kg Si)		**Inhouse S11 (Hot CaCl2)	50	45	40	35
Total Carbon (%)		Inhouse S4a (LECO Trumac Analyser)	> 3.1	> 2.6	> 2.0	> 1.4
Total Nitrogen (%)			> 0.30	> 0.25	> 0.20	> 0.15
Carbon/Nitrogen Ratio		**Calculation: Total Carbon/Total Nitrogen	10–12	10–12	10–12	10–12
Basic Texture		**Inhouse S65	..	..	..	..
Basic Colour			..	..	..	..
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	..	..	..	..
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	..			

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AGRICULTURAL SOIL ANALYSIS REPORT

25 samples supplied by ATC Williams Pty Ltd on 17/05/2024. Lab Job No.R4371

Analysis requested by Georgia Greening. Your Job: PO 111359.100

Level 3 MAROOCHYDORE QLD 4558

			Heavy Soil	Medium Soil	Light Soil	Sandy Soil
		Sample ID:				
		Crop:				
		Client:	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
	Parameter	**Method reference**	**Indicative guidelines - refer to Notes 6 and 8**			

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
10. Conversions for 1 cmol$_{+}$/kg = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
13. ** NATA accreditation does not cover the performance of this service.
14. Analysis conducted between sample arrival date and reporting date.
15. This report is not to be reproduced except in full. Results only relate to the item tested.
16. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions
17. This report was issued on 6/06/2024.

Quality Checked: Kris Saville
Agricultural Co-Ordinator

KS

RESULTS OF ACID SULFATE ROCK ANALYSIS

2 of 25 samples supplied by ATC Williams Pty Ltd on 17/05/2024. Lab Job No. R4371.

Analysis requested by Georgia Greening. Your Job: PO 111359.100.

Level 3 MAROOCHYDORE QLD 4558

Sample Site	EAL Lab Code	Moisture		Total Sulfur		Acid Neutralising Capacity (ANC_{BT})		NAG pH	NAG Net Acidity to pH 7 (Net Acid Generation)	CLASSIFICATION (based on NAG pH and NAPP)	ANC/MPA RATIO	NAPP (Net Acid Producing Potential)	CLASSIFICATION (based on NAPP)
		(% moisture of total wet weight)	(g moisture / g of oven dry soil)	%S	(mol H^+/t)	(% $CaCO_3$)	(mol H^+/t)		kg H_2SO_4/t	(ie. NAF, PAF, UC)	(as kg H_2SO_4/t) > 2 ideal	kg H_2SO_4/t	(i.e. 1- ACM; 2- NAF, 3- PAF-LC, 4- PAF)
Method No.		**		*LECO CNS TruMac*		*(In-house method S14)*		**	**	**	**	**	**
TSF-CRS-2	*R4371/19*	3.9	0.04	2.22	1385	2.59	517	2.39	25.1	PAF	0.37	44	PAF
TSF-FN-2	*R4371/C6*	19.7	0.25	1.00	624	2.65	529	4.13	1.9	PAF	0.85	5	PAF-LC

Notes:

1. All analysis is Dry Weight (DW) - samples dried and ground immediately upon arrival (unless supplied dried and ground)
2. Rock methods and classification from AMIRA international, May 2002. ARD Test Handbook, Project P387A Prediction and Kinetic Control of Acid Mine Drainage. Ian Walk Institute, Melbourne.
3. Soil Analytical procedures are sourced from Sullivan L, Ward N, Toppler N and Lancaster G. 2018. National acid sulfate soils guidance: national acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0.
4. Results at or below detection limits are replaced with '0' for calculation purposes.
5. Rock Classification = 1-ACM: acid consuming potential; 2-NAF: non-acid forming; 3-PAF-LC: potentially acid forming, low capacity (<5kg H2SO4/tonne); 4-PAF: potentially acid forming); UC = Uncertain.
6. Analysis conducted between sample arrival date and reporting date.
7. ** NATA accreditation does not cover the performance of this service.
8. .. Denotes not requested.
9. This report is not to be reproduced except in full.
10. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer SCU.edu.au/eal or on request).
11. Results relate only to the samples tested.
12. This report was issued on 18/06/2024 and replaces the previous report issued on 07/06/2024. Sample IDs are now correct.

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checked: .....
Graham Lancaster
Laboratory Manager

SOIL WATER RETENTION CURVE POINTS - LAB DETERMINATIONS

12 soil samples supplied by ATC Williams. Client job reference: 111359.100

Contact: Georgia Greening
mobile: +61 402 031 768
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Lab R4371		Client Sample#	ATP008 DS 0-0.1	ATP002 DS 0.3-0.5	ATP005 DS 0.4-0.6	ATP016 DS 0.8-1	ATP009 DS 1.9-2.1	TSF-CRS-2	C (ATP010 DS 1.3-1.5, ATP011 DS 1.3-1.5)	C (ATP15DS0.8-0.9, ATP7DS0.5-0.7, ATP9DS0.8-0.9)	C (ATP006 DS 1.4-1.6, ATP007 DS 1.6-1.7)	C (ATP003 DS 2-2.2, ATP014 DS 1.8-2)	C (ATP001 DS 1.1-1.3, ATP005 DS 1.8-2)	C (TSF-FN-2)	
		EAL prep ID	R4371/1	R4371/2	R4371/3	R4371/9	R4371/16	R4371/19	R4371/C1	R4371/C2	R4371/C3	R4371/C4	R4371/C5	R4371/C6	
		Testing ID	1	2	3	4	5	6	7	8	9	10	11	12	Comment
	Soil suction (kPa)	Soil suction (cm H_2O)													
Gravimetric water content (cm^3/cm^3)	**1**	10.2	**0.33**	**0.57**	**0.42**	**0.25**	**0.29**	**0.28**	**0.38**	**0.43**	**0.36**	**0.46**	**0.46**	**0.26**	Hanging water column ceramic plate tests.
Gravimetric water content (accepted upper limit of field capacity) (cm^3/cm^3)	**10**	102.0	**0.17**	**0.41**	**0.30**	**0.14**	**0.18**	**0.03**	**0.29**	**0.32**	**0.24**	**0.36**	**0.33**	**0.21**	"
Gravimetric water content (accepted lower limit of field capacity) (cm3/cm3)	**33**	336.5	**0.09**	**0.33**	**0.25**	**0.12**	**0.14**	**0.02**	**0.22**	**0.26**	**0.18**	**0.17**	**0.23**	**0.14**	"
Gravimetric water content (permanent wilting point) (cm3/cm3) [See Note 3]	**1500**	15296	**0.025**	**0.147**	**0.079**	**0.039**	**0.078**	**0.005**	**0.066**	**0.097**	**0.070**	**0.073**	**0.069**	**0.027**	WP4C dewpoint potentiameter tests
Gravimetric water content (air-dry standardized @ 100MPa (cm^3/cm^3) [See Note 3]	**100000**	1019716	**0.007**	**0.043**	**0.027**	**0.013**	**0.036**	**0.001**	**0.025**	**0.038**	**0.041**	**0.029**	**0.024**	**0.002**	**"**
Gravimetric water content (measured 40deg air-dry) (cm^3/cm^3)			**0.005**	**0.025**	**0.014**	**0.006**	**0.017**	**0.001**	**0.012**	**0.019**	**0.020**	**0.014**	**0.013**	**0.002**	WP4C dewpoint potentiameter tests
Corresponding soil suction at air dry (40degC) (MPa)			*92.28*	*150.54*	*162.18*	*183.29*	*187.82*	*53.13*	*191.05*	*173.45*	*180.97*	*189.83*	*180.04*	*64.73*	"

Client request: It was agreed to provide water content at 1kPa, 10kPa,33 kPa, 1500 kPa and air-dry.

Comments: Bulk Density was estimated using RETC in conjunction with USDA particle size analysis. Alter row 10 above with correct values if known.

Notes:

1. Hanging Water Column method with ceramic plates was used to determine relationship between soil suction (-matric potential) and volumetric water content for the wet end of the soil water retention curve.
2. Meter Group WP4C dewpoint potentiameter was used to determine volumetric water content at permanent wilting point and air-dry state at the dry end of the soil water retention curve.
   "In the past, a pressure plate has been used to determine the -1.5 MPa water content, but a number of publications have shown that the hydraulic conductivity of samples on a pressure plate is too low for equilibration to occur at these potentials.
   For example, see Gee et al. (2002), *Vadose Zone Journal* 1:172-178. The WP4C and other similar vapor pressure instruments provide the only reliable means for obtaining the -1.5 MPa water content of a sample." Reference:
   Quick and easy determination of the -15 bar (permanent wilt) water content of soils with the WP4C, G.S. Campbell
   https://library.metergroup.com/Sales%20and%20Support/METER%20Environment/Website%20Articles/determining-permanent-wilt-water-content-with-WP4C.pdf
3. Interpolations for PWP at 1500 kPa and standardized air-dry assume the moisture characteristic, between about -1 MPa (pF 4.01) and oven dry (-1000 MPa, pF 7.01), is linear in pF or logarithm of water potential. Reference:
   Quick and easy determination of the -15 bar (permanent wilt) water content of soils with the WP4C, G.S. Campbell. See WP4 worksheet for data prior to interpolation.
4. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (see EAL website: scu.edu.au/eal).
5. This report is not to be reproduced except in full.
6. This report was issued on 25/06/2024.

checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager

Construction Sciences

Construction Sciences Pty Ltd
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Laboratory: **Rockhampton Laboratory**
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SOIL PARTICLE DENSITY REPORT

Client:	ATC Williams	Report Number:	2128/R/86466-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures: AS1289.3.5.1

Sample Number	2128/S/170959	Sample Location	
Sampling Method	Tested As Received	Location	ATP008 BDS 0-01
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	8/06/2024		
Material Source	Insitu	Material Type	Investigation
Client Reference	Sample 1		

Soil Particle Density (Fine)		Soil Particle Density (Coarse)	
Percent of Fine Fraction (%)	-	Percent of Coarse Fraction (%)	-
Temperature of Test (C°)	22	Temperature of Test (C°)	-
Supplied Result Reference	-	Supplied Result Reference	-
Average Particle Density Fine (t/m³)	**2.41**	Average Particle Density Coarse (t/m³)	**-**

Soil Particle Density (t/m³) -

Remarks

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Tai Battisson
Form ID: W14Rep Rev 1

Construction Sciences

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Laboratory: **Rockhampton Laboratory**
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SOIL PARTICLE DENSITY REPORT

Client:	ATC Williams	Report Number:	2128/R/86466-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures: AS1289.3.5.1

Sample Number	2128/S/170960	Sample Location	
Sampling Method	Tested As Received	Location	ATP002 BDS 0.3-0.8
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	8/06/2024		
Material Source	Insitu	Material Type	Investigation
Client Reference	Sample 2		

Soil Particle Density (Fine)		Soil Particle Density (Coarse)	
Percent of Fine Fraction (%)	-	Percent of Coarse Fraction (%)	-
Temperature of Test (C°)	21	Temperature of Test (C°)	-
Supplied Result Reference	-	Supplied Result Reference	-
Average Particle Density Fine (t/m³)	**2.50**	Average Particle Density Coarse (t/m³)	**-**

Soil Particle Density (t/m³) -

Remarks

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Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Tai Battisson
Form ID: W14Rep Rev 1

Construction Sciences

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Email: Rockhampton@constructionsciences.net

SOIL PARTICLE DENSITY REPORT

Client:	ATC Williams	Report Number:	2128/R/86466-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 3 of 9

Test Procedures:	AS1289.3.5.1

Sample Number	2128/S/170961	Sample Location	
Sampling Method	Tested As Received	Location	ATP005 BDS 0.3-0.6
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	8/06/2024		
Material Source	Insitu	Material Type	Investigation
Client Reference	Sample 3		

Soil Particle Density (Fine)		Soil Particle Density (Coarse)	
Percent of Fine Fraction (%)	-	Percent of Coarse Fraction (%)	-
Temperature of Test (C°)	21	Temperature of Test (C°)	-
Supplied Result Reference	-	Supplied Result Reference	-
Average Particle Density Fine (t/m³)	**2.35**	Average Particle Density Coarse (t/m³)	**-**

Soil Particle Density (t/m³)	-

Remarks

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Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Tai Battisson
Form ID: W14Rep Rev 1

Construction Sciences

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Laboratory: **Rockhampton Laboratory**
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SOIL PARTICLE DENSITY REPORT

Client:	ATC Williams	Report Number:	2128/R/86466-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 4 of 9

Test Procedures:	AS1289.3.5.1

Sample Number	2128/S/170962	Sample Location	
Sampling Method	Tested As Received	Location	Composite (ATP010 BDS 1-1.5 ATP011 BDS 0.5-1.0
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	8/06/2024		
Material Source	Insitu	Material Type	Investigation
Client Reference	Sample 4		

Soil Particle Density (Fine)		Soil Particle Density (Coarse)	
Percent of Fine Fraction (%)	-	Percent of Coarse Fraction (%)	-
Temperature of Test (C°)	22	Temperature of Test (C°)	-
Supplied Result Reference	-	Supplied Result Reference	-
Average Particle Density Fine (t/m³)	**2.55**	Average Particle Density Coarse (t/m³)	**-**

Soil Particle Density (t/m³)	-

Remarks

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Corporate Site Number: 2128

Approved Signatory: Tai Battisson
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SOIL PARTICLE DENSITY REPORT

Client:	ATC Williams	Report Number:	2128/R/86466-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 5 of 9

Test Procedures:	AS1289.3.5.1

Sample Number	2128/S/170963	Sample Location	
Sampling Method	Tested As Received	Location	Composite (ATP006 BDS 0.9-1.4)
Date Sampled	23/04/2024		ATP007 BDS 0.3-0.7
Sampled By	Client/Subcontractor Supplied		ATP009 BDS
Date Tested	8/06/2024		
Material Source	Insitu	Material Type	Investigation
Client Reference	Sample 5		

Soil Particle Density (Fine)		Soil Particle Density (Coarse)	
Percent of Fine Fraction (%)	-	Percent of Coarse Fraction (%)	-
Temperature of Test (C°)	22	Temperature of Test (C°)	-
Supplied Result Reference	-	Supplied Result Reference	-
Average Particle Density Fine (t/m³)	**2.48**	Average Particle Density Coarse (t/m³)	**-**

Soil Particle Density (t/m³)	-

Remarks

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SOIL PARTICLE DENSITY REPORT

Client:	ATC Williams	Report Number:	2128/R/86466-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 6 of 9

Test Procedures:	AS1289.3.5.1

Sample Number	2128/S/170964	Sample Location	
Sampling Method	Tested As Received	Location	ATP016 BDS 0.5-1.0
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	8/06/2024		
Material Source	Insitu	Material Type	Investigation
Client Reference	Sample 6		

Soil Particle Density (Fine)		Soil Particle Density (Coarse)	
Percent of Fine Fraction (%)	-	Percent of Coarse Fraction (%)	-
Temperature of Test (C°)	22	Temperature of Test (C°)	-
Supplied Result Reference	-	Supplied Result Reference	-
Average Particle Density Fine (t/m³)	**2.51**	Average Particle Density Coarse (t/m³)	**-**

Soil Particle Density (t/m³)	-

Remarks

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SOIL PARTICLE DENSITY REPORT

Client:	ATC Williams	Report Number:	2128/R/86466-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 7 of 9

Test Procedures:	AS1289.3.5.1

Sample Number	2128/S/170965	Sample Location	
Sampling Method	Tested As Received	Location	Composite (ATP006 BDS 1.4-1.6)
Date Sampled	23/04/2024		ATP007 BDS 1.6-1.7
Sampled By	Client/Subcontractor Supplied		
Date Tested	16/06/2024		
Material Source	Insitu	Material Type	Investigation
Client Reference	Sample 7		

Soil Particle Density (Fine)		Soil Particle Density (Coarse)	
Percent of Fine Fraction (%)	-	Percent of Coarse Fraction (%)	-
Temperature of Test (C°)	22	Temperature of Test (C°)	-
Supplied Result Reference	-	Supplied Result Reference	-
Average Particle Density Fine (t/m³)	**2.52**	Average Particle Density Coarse (t/m³)	**-**

Soil Particle Density (t/m³)	-

Remarks

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SOIL PARTICLE DENSITY REPORT

Client:	ATC Williams	Report Number:	2128/R/86466-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 8 of 9

Test Procedures:	AS1289.3.5.1

Sample Number	2128/S/170966	Sample Location	
Sampling Method	Tested As Received	Location	Composite (ATP003 BDS 2-2.2)
Date Sampled	23/04/2024		ATP014 BDS 1.5-2.0
Sampled By	Client/Subcontractor Supplied		
Date Tested	8/06/2024		
Material Source	Insitu	Material Type	Investigation
Client Reference	Sample 8		

Soil Particle Density (Fine)		Soil Particle Density (Coarse)	
Percent of Fine Fraction (%)	-	Percent of Coarse Fraction (%)	-
Temperature of Test (C°)	22	Temperature of Test (C°)	-
Supplied Result Reference	-	Supplied Result Reference	-
Average Particle Density Fine (t/m³)	**2.44**	Average Particle Density Coarse (t/m³)	**-**

Soil Particle Density (t/m³)	-

Remarks

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SOIL PARTICLE DENSITY REPORT

Client:	ATC Williams	Report Number:	2128/R/86466-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 9 of 9

Test Procedures:	AS1289.3.5.1

Sample Number	2128/S/170967	Sample Location	
Sampling Method	Tested As Received	Location	Composite (ATP001 BDS 1.1-1.3) ATP005 BDS 1.5-2.0
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	8/06/2024		
Material Source	Insitu	Material Type	Investigation
Client Reference	Sample 9		

Soil Particle Density (Fine)		Soil Particle Density (Coarse)	
Percent of Fine Fraction (%)	-	Percent of Coarse Fraction (%)	-
Temperature of Test (C°)	21	Temperature of Test (C°)	-
Supplied Result Reference	-	Supplied Result Reference	-
Average Particle Density Fine (t/m³)	**2.50**	Average Particle Density Coarse (t/m³)	**-**

Soil Particle Density (t/m³)	-

Remarks

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SOIL PARTICLE DENSITY REPORT

Client:	ATC WILLIAMS PTY LTD	Report Number:	2128/R/86786-1
Client Address:	20 Edmonstone Street, Level3, Suite17, 14-20 Aerodrome Rd	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	2/07/2024 Page 1 of 1

Test Procedures:	AS1289.3.5.1

		Sample Location	
Sample Number	2128/S/170968		
Sampling Method	Tested As Received	Location	ATP009 BDS 1.6-2.1
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	2/07/2024		
Material Source	Insitu	Material Type	Investigation
Client Reference	Sample 10		

Soil Particle Density (Fine)		Soil Particle Density (Coarse)	
Percent of Fine Fraction (%)	-	Percent of Coarse Fraction (%)	-
Temperature of Test (C°)	21	Temperature of Test (C°)	-
Supplied Result Reference	-	Supplied Result Reference	-
Average Particle Density Fine (t/m³)	**2.41**	Average Particle Density Coarse (t/m³)	**-**

Soil Particle Density (t/m³) -

Remarks

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MOISTURE DENSITY RELATIONSHIP REPORT

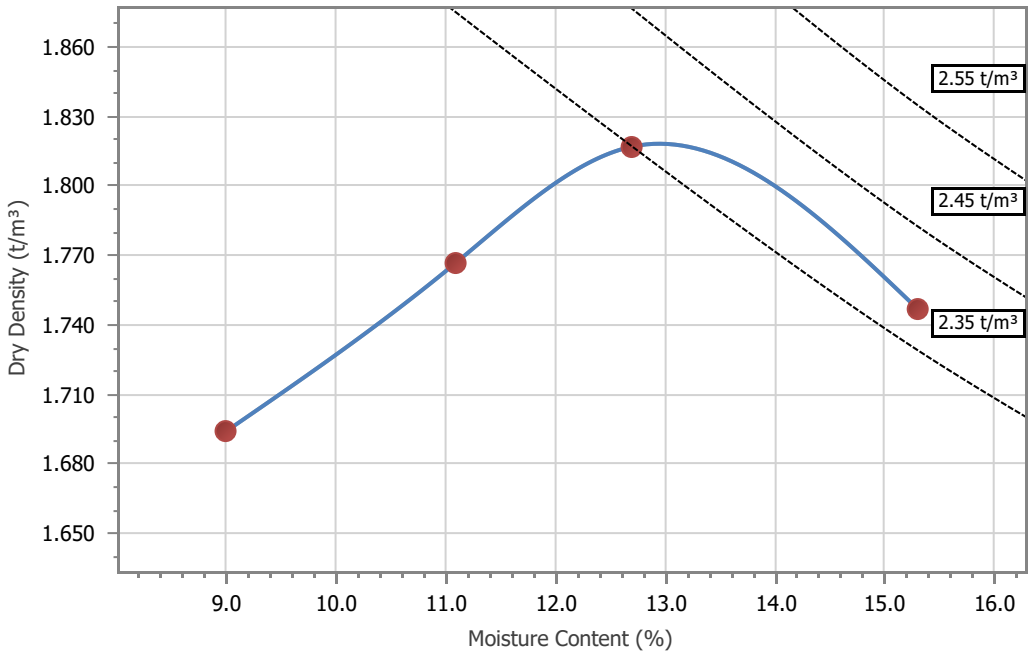
Client:	ATC Williams	Report Number:	2128/R/86440-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Location	ATP008 BDS 0-01
Sample Number	2128/S/170959		
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied	Prep Material > 53mm (%)	-
Date Tested	8/06/2024	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Investigation	Percent Oversize (%)	1
Liquid Limit Method	Estimation	Total Curing Time (hrs)	3.3
Material Description	Silty Clay		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
9.0	1.694
11.1	1.767
12.7	1.817
15.3	1.747

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	1.82	Optimum Moisture Content (%):	13.0

Remarks

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MOISTURE DENSITY RELATIONSHIP REPORT

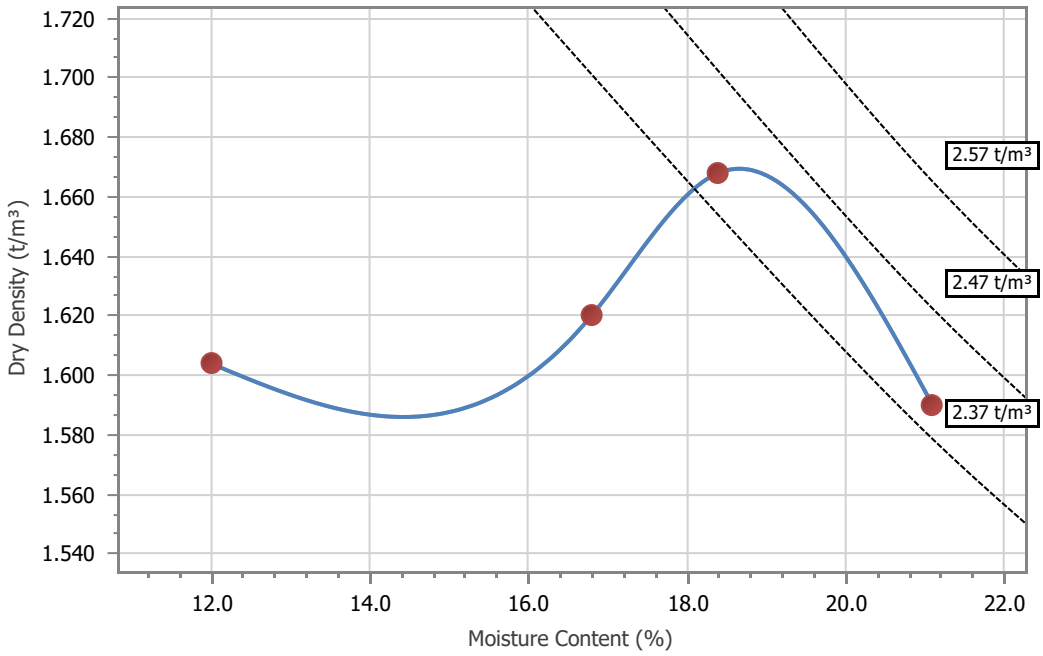
Client:	ATC Williams	Report Number:	2128/R/86440-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Location	ATP002 BDS 0.3-0.8
Sample Number	2128/S/170960		
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied	Prep Material > 53mm (%)	-
Date Tested	8/06/2024	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Investigation	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	3.0
Material Description	Grey Brown Silty CLAY		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
12.0	1.604
16.8	1.620
18.4	1.668
21.1	1.590

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.67**	**Optimum Moisture Content (%):**	**18.5**

Remarks

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MOISTURE DENSITY RELATIONSHIP REPORT

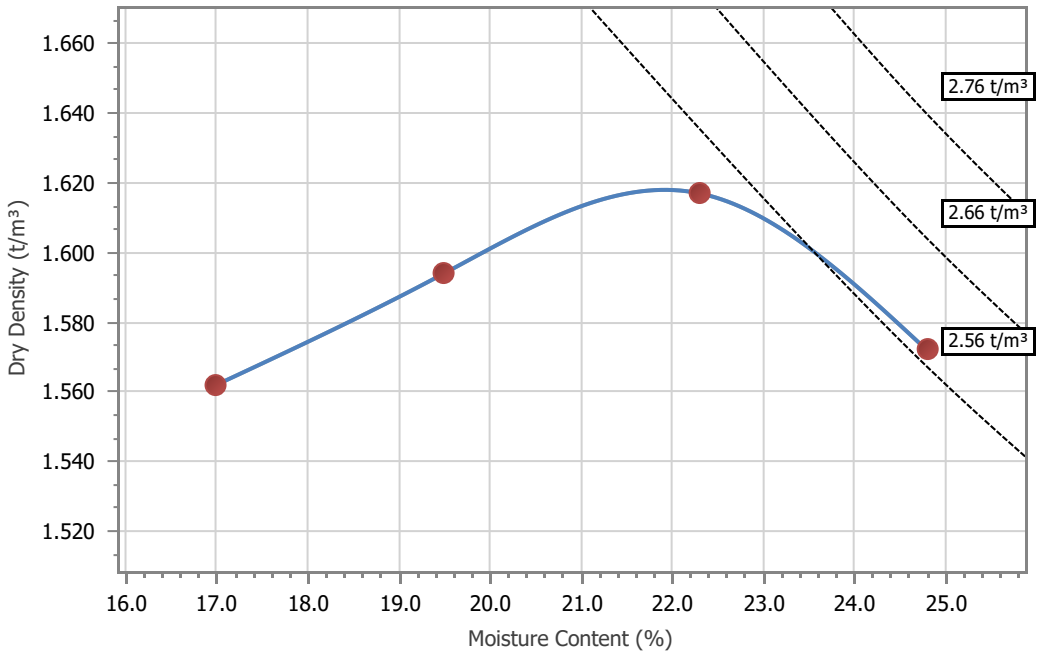
Client:	ATC Williams	Report Number:	2128/R/86440-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Location	ATP005 BDS 0.3-0.6
Sample Number	2128/S/170961		
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied	Prep Material > 53mm (%)	-
Date Tested	8/06/2024	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Investigation	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	5.5
Material Description	Grey Silty Clay		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
17.0	1.562
19.5	1.594
22.3	1.617
24.8	1.572

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.62**	**Optimum Moisture Content (%):**	**22.0**

Remarks

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MOISTURE DENSITY RELATIONSHIP REPORT

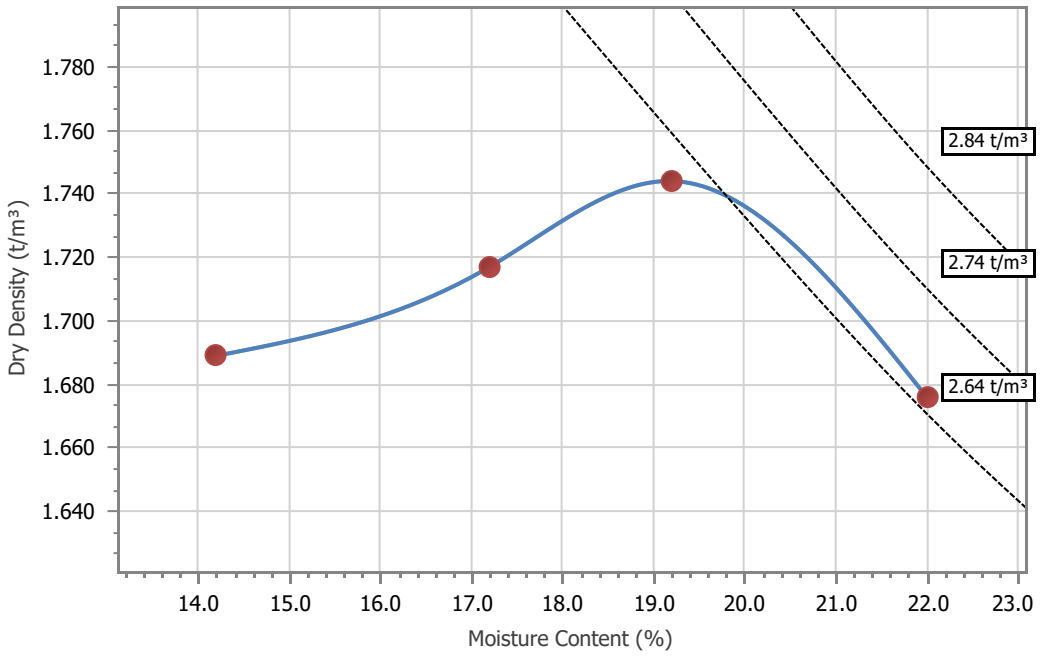
Client:	ATC Williams	Report Number:	2128/R/86440-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Location	Composite (ATP010 BDS 1-1.5 ATP011 BDS 0.5-1.0
Sample Number	2128/S/170962		
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied	Prep Material > 53mm (%)	-
Date Tested	8/06/2024	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Investigation	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	3.8
Material Description	Silty Clay		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
14.2	1.689
17.2	1.717
19.2	1.744
22.0	1.676

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.74**	**Optimum Moisture Content (%):**	**19.0**

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MOISTURE DENSITY RELATIONSHIP REPORT

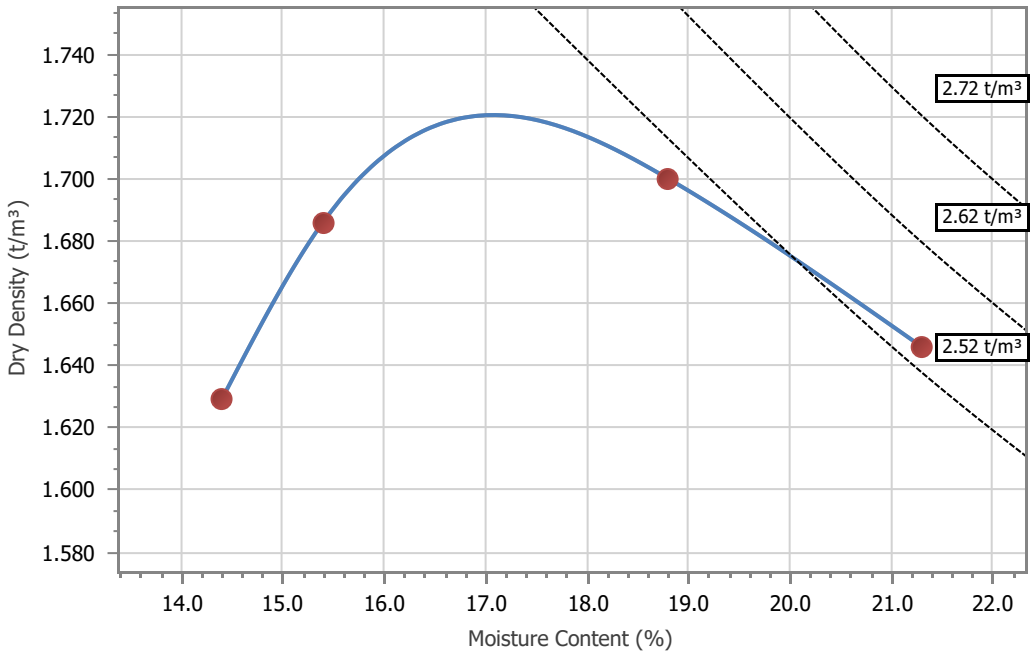
Client:	ATC Williams	Report Number:	2128/R/86440-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Location	Composite (ATP006 BDS 0.9-1.4)
Sample Number	2128/S/170963		ATP007 BDS 0.3-0.7
Sampling Method	Tested As Received		ATP009 BDS
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied	Prep Material > 53mm (%)	-
Date Tested	8/06/2024	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Investigation	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	4.0
Material Description	Silty Clay		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
14.4	1.629
15.4	1.686
18.8	1.700
21.3	1.646

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	1.72	Optimum Moisture Content (%):	17.0

Remarks

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MOISTURE DENSITY RELATIONSHIP REPORT

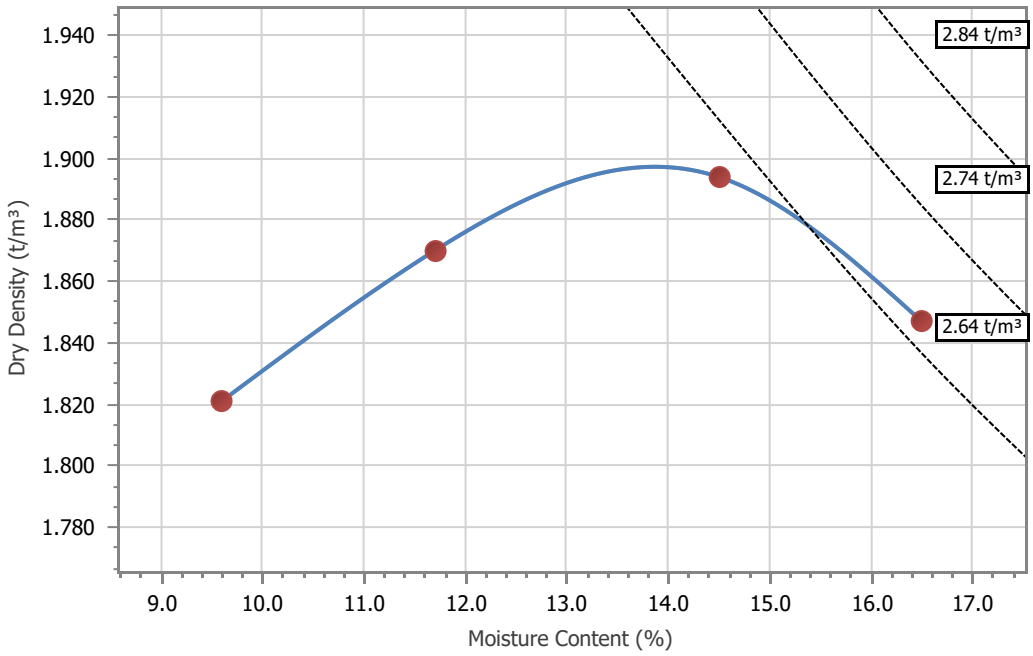
Client:	ATC Williams	Report Number:	2128/R/86440-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Location	ATP016 BDS 0.5-1.0
Sample Number	2128/S/170964		
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied	Prep Material > 53mm (%)	-
Date Tested	8/06/2024	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Investigation	Percent Oversize (%)	18
Liquid Limit Method	Estimation	Total Curing Time (hrs)	4.3
Material Description	Light BROWN Silty CLAY		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
9.6	1.821
11.7	1.870
14.5	1.894
16.5	1.847

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.90**	**Optimum Moisture Content (%):**	**14.0**

Remarks

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Tai Battisson
Form ID: W4Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
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Laboratory: Rockhampton Laboratory
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Email: Rockhampton@constructionsciences.net

MOISTURE DENSITY RELATIONSHIP REPORT

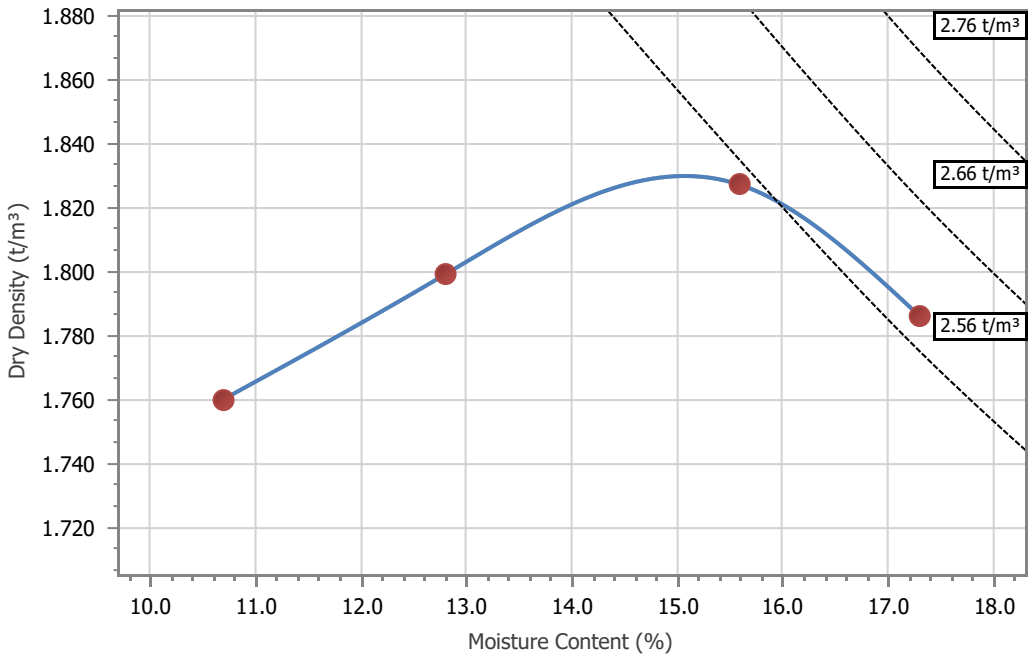
Client:	ATC Williams	Report Number:	2128/R/86440-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Location	Composite (ATP006 BDS 1.4-1.6) ATP007 BDS 1.6-1.7
Sample Number	2128/S/170965		
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied	Prep Material > 53mm (%)	-
Date Tested	8/06/2024	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Investigation	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	4.5
Material Description	Brown Grey Silty Clay		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
10.7	1.760
12.8	1.799
15.6	1.827
17.3	1.786

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.83**	**Optimum Moisture Content (%):**	**15.0**

Remarks

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MOISTURE DENSITY RELATIONSHIP REPORT

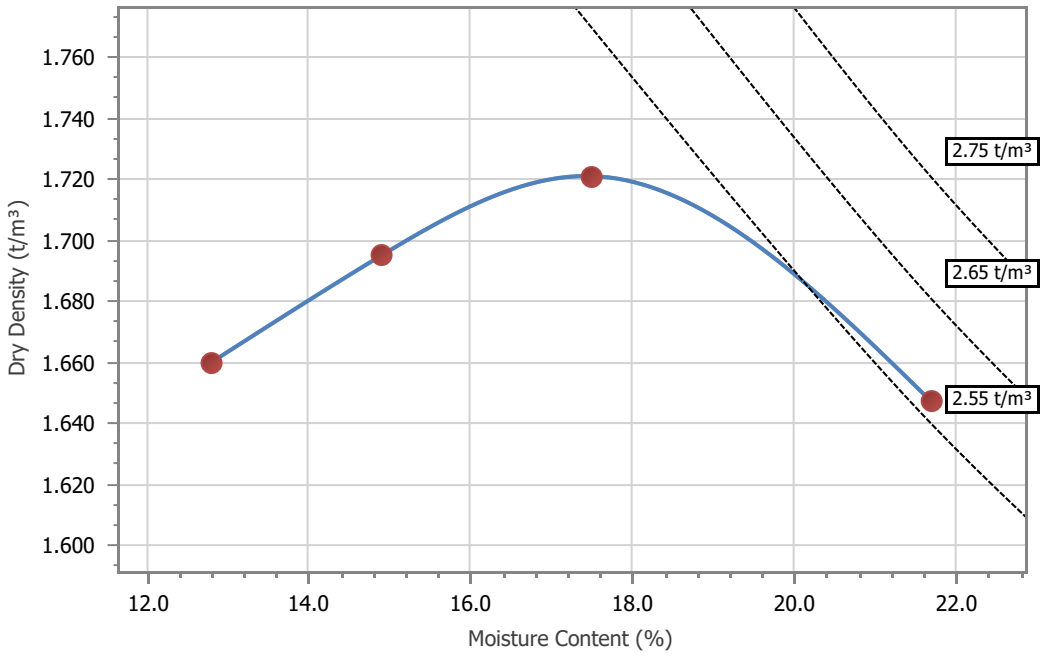
Client:	ATC Williams	Report Number:	2128/R/86440-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Location	Composite (ATP003 BDS 2-2.2)
Sample Number	2128/S/170966		ATP014 BDS 1.5-2.0
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied	Prep Material > 53mm (%)	-
Date Tested	8/06/2024	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Investigation	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	4.8
Material Description	Silty Clay		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
12.8	1.660
14.9	1.695
17.5	1.721
21.7	1.647

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.72**	**Optimum Moisture Content (%):**	**17.5**

Remarks

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MOISTURE DENSITY RELATIONSHIP REPORT

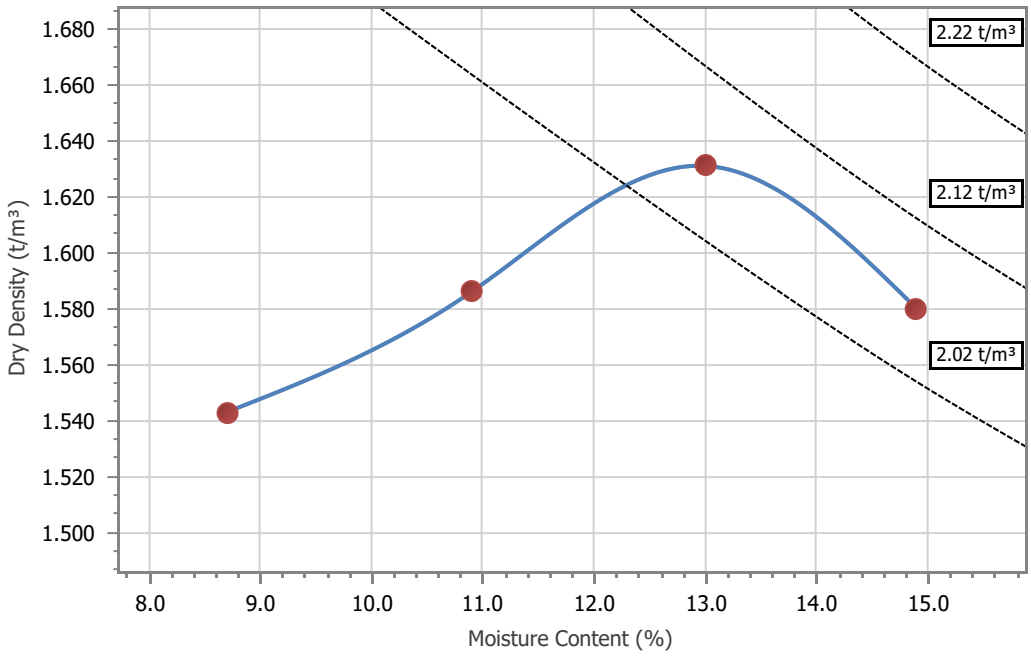
Client:	ATC Williams	Report Number:	2128/R/86440-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Location	Composite (ATP001 BDS 1.1-1.3) ATP005 BDS 1.5-2.0
Sample Number	2128/S/170967		
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied	Prep Material > 53mm (%)	-
Date Tested	8/06/2024	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Investigation	Percent Oversize (%)	16
Liquid Limit Method	Estimation	Total Curing Time (hrs)	5.0
Material Description	Silty Clay		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
8.7	1.543
10.9	1.586
13.0	1.631
14.9	1.580

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	1.63	Optimum Moisture Content (%):	13.0

Remarks

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MOISTURE DENSITY RELATIONSHIP REPORT

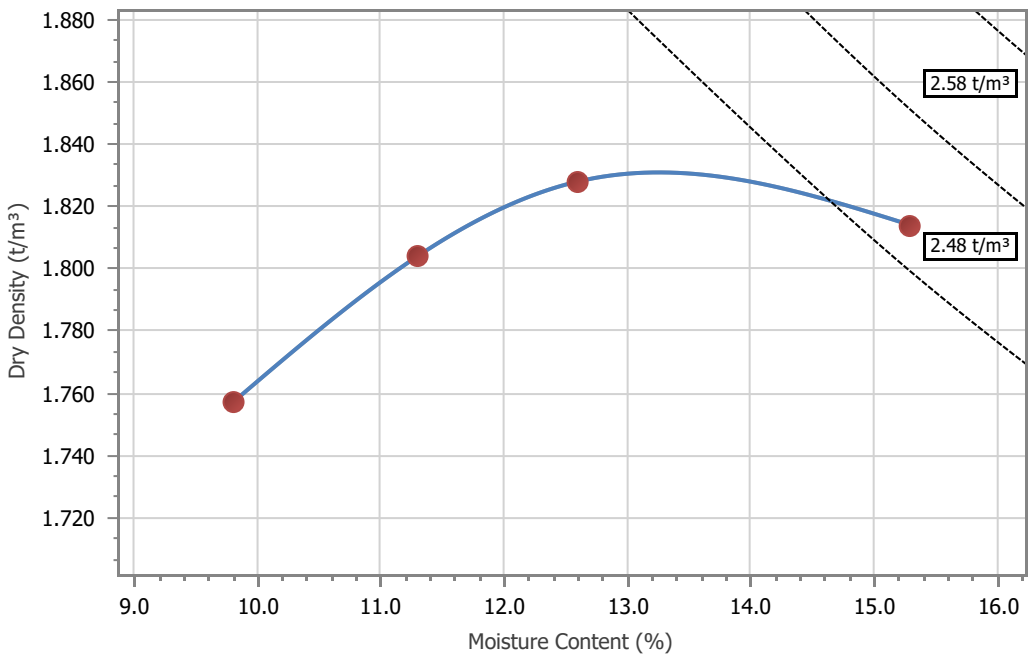
Client:	ATC WILLIAMS PTY LTD	Report Number:	2128/R/86865-1
Client Address:	20 Edmonstone Street, Level3, Suite17, 14-20 Aerodrome Rd	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	4/07/2024 Page 1 of 1

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Location	ATP009 BDS 1.6-2.1
Sample Number	2128/S/170968		
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied	Prep Material > 53mm (%)	-
Date Tested	2/07/2024	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Investigation	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	2.0
Material Description	Sandy gravel		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
9.8	1.757
11.3	1.804
12.6	1.828
15.3	1.814

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.83**	**Optimum Moisture Content (%):**	**13.5**

Remarks

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Form ID: W4Rep Rev 3

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EMERSON CLASS NUMBER REPORT

Client:	ATC Williams	Report Number:	2128/R/86441-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 1 of 3

Test Procedures:	AS1289.3.8.1

Sample Number	2128/S/170959	2128/S/170960	2128/S/170961	2128/S/170962
ID / Client ID	Sample 1	Sample 2	Sample 3	Sample 4
Lot Number	-	-	-	-
Date / Time Sampled	23/04/2024	23/04/2024	23/04/2024	23/04/2024
Date Tested	10/06/2024	8/06/2024	10/06/2024	8/06/2024
Material Source	Insitu	Insitu	Insitu	Insitu
Material Type	Investigation	Investigation	Investigation	Investigation
Sampling Method	Tested As Received	Tested As Received	Tested As Received	Tested As Received
Prep Material > 53mm (%)	-	-	-	-
Water Type	Potable	Distilled	Potable	Distilled
Water Temperature (°C)	25	23	25	23
Location	ATP008 BDS 0-01	ATP002 BDS 0.3-0.8	ATP005 BDS 0.3-0.6	Composite (ATP010 BDS 1-1.5 ATP011 BDS 0.5-1.0
Soil Description	Silty Clay	Grey Brown Silty CLAY	Grey Silty Clay	Silty Clay
Emerson Class Description	Slakes. Dispersion in soil/water suspension.	Slakes. Dispersion in soil/water suspension.	Slakes. Dispersion in soil/water suspension.	Slakes. Dispersion in soil/water suspension.
Emerson Class Number	**5**	**5**	**5**	**5**

Remarks

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Corporate Site Number: 2128

Approved Signatory: Tai Battisson
Form ID: W22Rep Rev 4

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EMERSON CLASS NUMBER REPORT

Client:	ATC Williams	Report Number:	2128/R/86441-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 2 of 3

Test Procedures:	AS1289.3.8.1

Sample Number	2128/S/170963	2128/S/170964	2128/S/170965	2128/S/170966
ID / Client ID	Sample 5	Sample 6	Sample 7	Sample 8
Lot Number	-	-	-	-
Date / Time Sampled	23/04/2024	23/04/2024	23/04/2024	23/04/2024
Date Tested	8/06/2024	10/06/2024	10/06/2024	10/06/2024
Material Source	Insitu	Insitu	Insitu	Insitu
Material Type	Investigation	Investigation	Investigation	Investigation
Sampling Method	Tested As Received	Tested As Received	Tested As Received	Tested As Received
Prep Material > 53mm (%)	-	-	-	-
Water Type	Distilled	Potable	Potable	Potable
Water Temperature (°C)	23	24	24	25
Location	Composite (ATP006 BDS 0.9-1.4) ATP007 BDS 0.3-0.7 ATP009 BDS	ATP016 BDS 0.5-1.0	Composite (ATP006 BDS 1.4-1.6) ATP007 BDS 1.6-1.7	Composite (ATP003 BDS 2-2.2) ATP014 BDS 1.5-2.0
Soil Description	Silty Clay	Light BROWN Silty CLAY	Brown Grey Silty Clay	Silty Clay
Emerson Class Description	Slakes. Dispersion in soil/water suspension.	Slakes. Flocculation in soil/water suspension.	Slakes. Flocculation in soil/water suspension.	Slakes. Dispersion in soil/water suspension.
Emerson Class Number	**5**	**6**	**6**	**5**

Remarks

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Corporate Site Number: 2128

Approved Signatory: Tai Battisson
Form ID: W22Rep Rev 4

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EMERSON CLASS NUMBER REPORT

Client:	ATC Williams	Report Number:	2128/R/86441-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures:	AS1289.3.8.1

Sample Number	2128/S/170967			
ID / Client ID	Sample 9			
Lot Number	-			
Date / Time Sampled	23/04/2024			
Date Tested	10/06/2024			
Material Source	Insitu			
Material Type	Investigation			
Sampling Method	Tested As Received			
Prep Material > 53mm (%)	-			
Water Type	Potable			
Water Temperature (°C)	24			
Location	Composite (ATP001 BDS 1.1-1.3) ATP005 BDS 1.5-2.0			
Soil Description	Silty Clay			
Emerson Class Description	Slakes Some dispersion.			
Emerson Class Number	**2**			

Remarks

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EMERSON CLASS NUMBER REPORT

Client:	ATC WILLIAMS PTY LTD	Report Number:	2128/R/86785-1
Client Address:	20 Edmonstone Street, Level3, Suite17, 14-20 Aerodrome Rd	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	2/07/2024 Page 1 of 1

Test Procedures:	AS1289.3.8.1

Sample Number	2128/S/170968			
ID / Client ID	Sample 10			
Lot Number	-			
Date / Time Sampled	23/04/2024			
Date Tested	27/06/2024			
Material Source	Insitu			
Material Type	Investigation			
Sampling Method	Tested As Received			
Prep Material > 53mm (%)	-			
Water Type	Distilled			
Water Temperature (°C)	21			
Location	ATP009 BDS 1.6-2.1			
Soil Description	Sandy gravel			
Emerson Class Description	Slakes Some dispersion.			
Emerson Class Number	**2**			

Remarks

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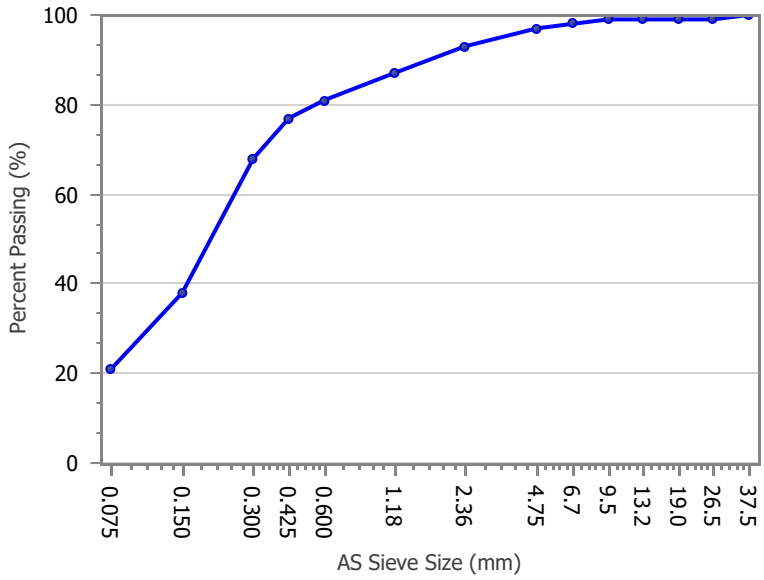
QUALITY OF MATERIALS REPORT

Client:	ATC Williams	Report Number:	2128/R/86464-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.3.6.1, AS1289.3.9.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.2		
Sample Number	2128/S/170959	Location	ATP008 BDS 0-01
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	13/06/2024	Material Source	Insitu
PSD Preparation	Washed	Material Type	Investigation
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	Silty Clay		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
37.5		**100**	
26.5		**99**	
19.0		**99**	
13.2		**99**	
9.5		**99**	
6.7		**98**	
4.75		**97**	
2.36		**93**	
1.18		**87**	
0.600		**81**	
0.425		**77**	
0.300		**68**	
0.150		**38**	
0.075		**21**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Cone Liquid Limit (%)		**26**		0.075/0.425 Fines Ratio		**0.27**	
Plastic Limit (%)		**16**		PI x 0.425 Ratio (%)		**772.3**	
Cone Plasticity Index (%)		**10**		LS x 0.425 Ratio (%)		**308.9**	
Linear Shrinkage (%)		**4.0**		Shrinkage Observations	-		

Remarks

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NATA

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Approved Signatory: Tai Battisson
Form ID: W85Rep Rev 3

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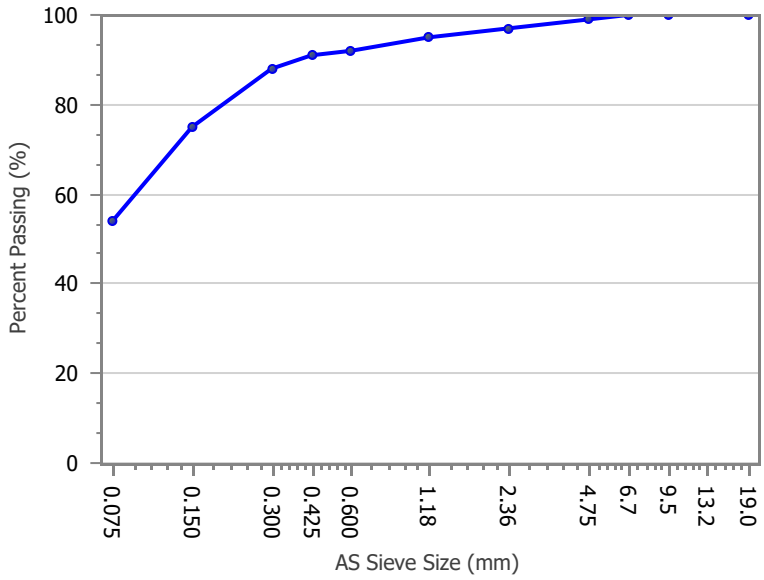
QUALITY OF MATERIALS REPORT

Client:	ATC Williams	Report Number:	2128/R/86464-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.3.6.1, AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	2128/S/170960	Location	ATP002 BDS 0.3-0.8
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	13/06/2024	Material Source	Insitu
PSD Preparation	Washed	Material Type	Investigation
Atterberg Preparation	Dry Sieved / Air Dried	Prep Material > 53.0mm (%)	
Material Description	Grey Brown Silty CLAY		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
9.5		**100**	
6.7		**100**	
4.75		**99**	
2.36		**97**	
1.18		**95**	
0.600		**92**	
0.425		**91**	
0.300		**88**	
0.150		**75**	
0.075		**54**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**53**		0.075/0.425 Fines Ratio		**0.59**	
Plastic Limit (%)		**19**		PI x 0.425 Ratio (%)		**3090.6**	
Plastic Index (%)		**34**		LS x 0.425 Ratio (%)		**1090.8**	
Linear Shrinkage (%)		**12.0**		Shrinkage Observations	Cracked		

Remarks

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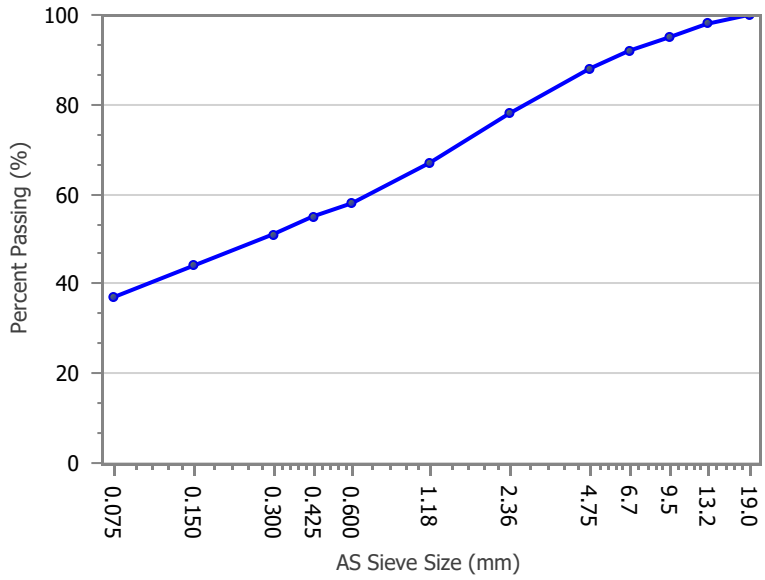
QUALITY OF MATERIALS REPORT

Client:	ATC Williams	Report Number:	2128/R/86464-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.3.6.1, AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	2128/S/170961	Location	ATP005 BDS 0.3-0.6
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	13/06/2024	Material Source	Insitu
PSD Preparation	Washed	Material Type	Investigation
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	Grey Silty Clay		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**98**	
9.5		**95**	
6.7		**92**	
4.75		**88**	
2.36		**78**	
1.18		**67**	
0.600		**58**	
0.425		**55**	
0.300		**51**	
0.150		**44**	
0.075		**37**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**36**		0.075/0.425 Fines Ratio		**0.68**	
Plastic Limit (%)		**22**		PI x 0.425 Ratio (%)		**764.4**	
Plastic Index (%)		**14**		LS x 0.425 Ratio (%)		**354.9**	
Linear Shrinkage (%)		**6.5**		Shrinkage Observations	-		

Remarks

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Tai Battisson
Form ID: W85Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
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Laboratory: **Rockhampton Laboratory**
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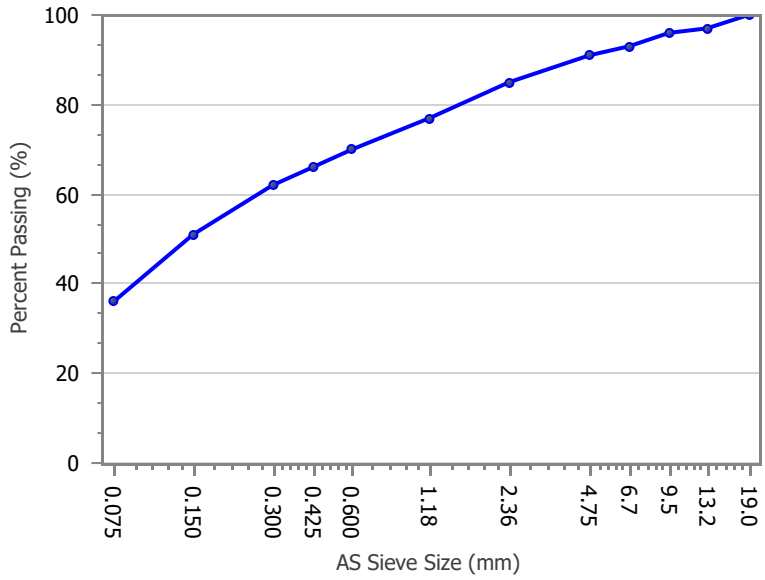
QUALITY OF MATERIALS REPORT

Client:	ATC Williams	Report Number:	2128/R/86464-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.3.6.1, AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	2128/S/170962	Location	Composite (ATP010 BDS 1-1.5
Sampling Method	Tested As Received		ATP011 BDS 0.5-1.0
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	12/06/2024	Material Source	Insitu
PSD Preparation	Washed	Material Type	Investigation
Atterberg Preparation	Dry Sieved / Air Dried	Prep Material > 53.0mm (%)	
Material Description	Silty Clay		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**97**	
9.5		**96**	
6.7		**93**	
4.75		**91**	
2.36		**85**	
1.18		**77**	
0.600		**70**	
0.425		**66**	
0.300		**62**	
0.150		**51**	
0.075		**36**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**36**		0.075/0.425 Fines Ratio		**0.55**	
Plastic Limit (%)		**22**		PI x 0.425 Ratio (%)		**921.2**	
Plastic Index (%)		**14**		LS x 0.425 Ratio (%)		**427.7**	
Linear Shrinkage (%)		**6.5**		Shrinkage Observations	-		

Remarks

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Approved Signatory: Tai Battisson
Form ID: W85Rep Rev 3

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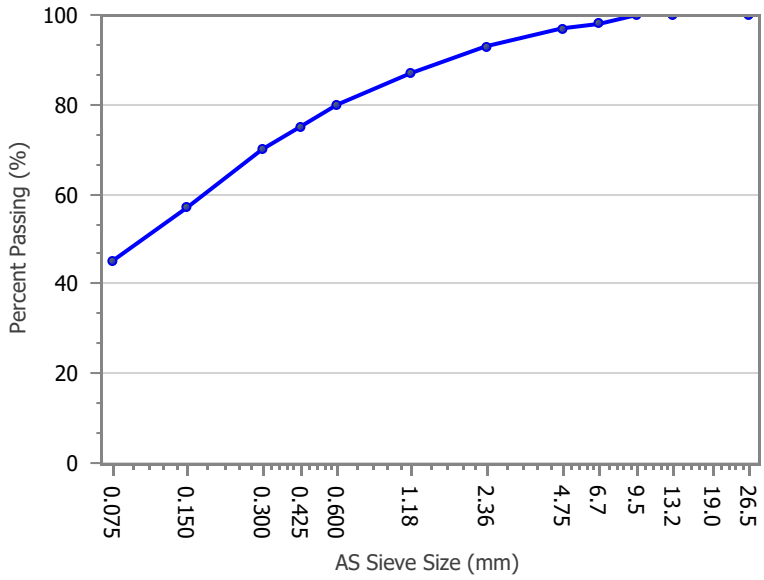
QUALITY OF MATERIALS REPORT

Client:	ATC Williams	Report Number:	2128/R/86464-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024

Test Procedures	AS1289.3.6.1, AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	2128/S/170963	Location	Composite (ATP006 BDS 0.9-1.4)
Sampling Method	Tested As Received		ATP007 BDS 0.3-0.7
Date Sampled	23/04/2024		ATP009 BDS
Sampled By	Client/Subcontractor Supplied		
Date Tested	12/06/2024	Material Source	Insitu
PSD Preparation	Washed	Material Type	Investigation
Atterberg Preparation	Dry Sieved / Air Dried	Prep Material > 53.0mm (%)	
Material Description	Silty Clay		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
26.5		**100**	
13.2		**100**	
9.5		**100**	
6.7		**98**	
4.75		**97**	
2.36		**93**	
1.18		**87**	
0.600		**80**	
0.425		**75**	
0.300		**70**	
0.150		**57**	
0.075		**45**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**42**		0.075/0.425 Fines Ratio		**0.60**	
Plastic Limit (%)		**19**		PI x 0.425 Ratio (%)		**1727.3**	
Plastic Index (%)		**23**		LS x 0.425 Ratio (%)		**675.9**	
Linear Shrinkage (%)		**9.0**		Shrinkage Observations	-		

Remarks

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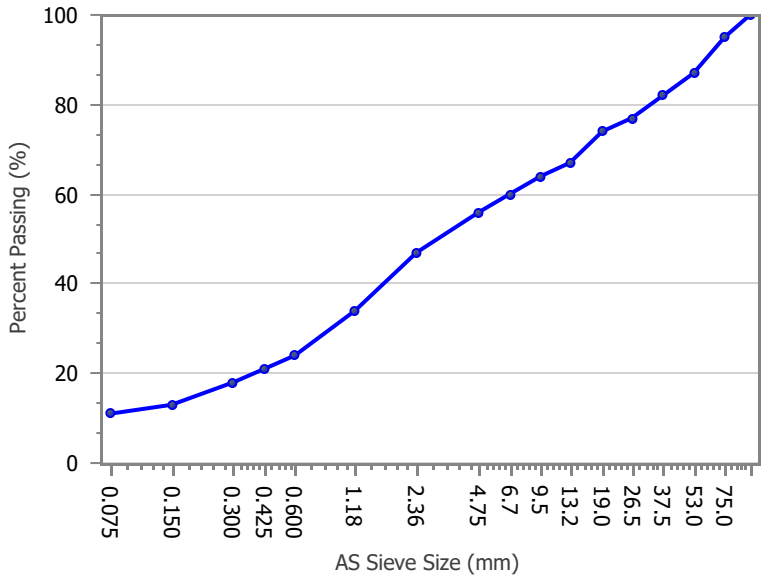
QUALITY OF MATERIALS REPORT

Client:	ATC Williams	Report Number:	2128/R/86464-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 6 of 9

Test Procedures	AS1289.3.6.1, AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	2128/S/170964	Location	ATP016 BDS 0.5-1.0
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	8/06/2024	Material Source	Insitu
PSD Preparation	Washed	Material Type	Investigation
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	Light BROWN Silty CLAY		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
100.0		**100**	
75.0		**95**	
53.0		**87**	
37.5		**82**	
26.5		**77**	
19.0		**74**	
13.2		**67**	
9.5		**64**	
6.7		**60**	
4.75		**56**	
2.36		**47**	
1.18		**34**	
0.600		**24**	
0.425		**21**	
0.300		**18**	
0.150		**13**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**27**		0.075/0.425 Fines Ratio		**0.51**	
Plastic Limit (%)		**23**		PI x 0.425 Ratio (%)		**83.1**	
Plastic Index (%)		**4**		LS x 0.425 Ratio (%)		**41.5**	
Linear Shrinkage (%)		**2.0**		Shrinkage Observations	-		

Remarks

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Approved Signatory: Tai Battisson
Form ID: W85Rep Rev 3

Construction Sciences

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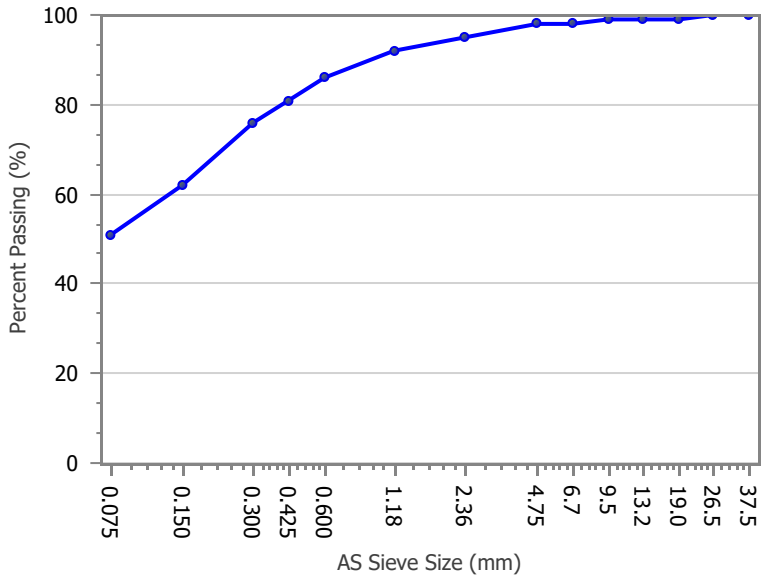
QUALITY OF MATERIALS REPORT

Client:	ATC Williams	Report Number:	2128/R/86464-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 7 of 9

Test Procedures	AS1289.3.6.1, AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	2128/S/170965	Location	Composite (ATP006 BDS 1.4-1.6)
Sampling Method	Tested As Received		ATP007 BDS 1.6-1.7
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	13/06/2024	Material Source	Insitu
PSD Preparation	Washed	Material Type	Investigation
Atterberg Preparation	Dry Sieved / Air Dried	Prep Material > 53.0mm (%)	
Material Description	Brown Grey Silty Clay		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
37.5		**100**	
26.5		**100**	
19.0		**99**	
13.2		**99**	
9.5		**99**	
6.7		**98**	
4.75		**98**	
2.36		**95**	
1.18		**92**	
0.600		**86**	
0.425		**81**	
0.300		**76**	
0.150		**62**	
0.075		**51**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**45**		0.075/0.425 Fines Ratio		**0.63**	
Plastic Limit (%)		**20**		PI x 0.425 Ratio (%)		**2033.2**	
Plastic Index (%)		**25**		LS x 0.425 Ratio (%)		**813.3**	
Linear Shrinkage (%)		**10.0**		Shrinkage Observations	-		

Remarks

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Form ID: W85Rep Rev 3

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Laboratory: **Rockhampton Laboratory**
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Email: Rockhampton@constructionsciences.net

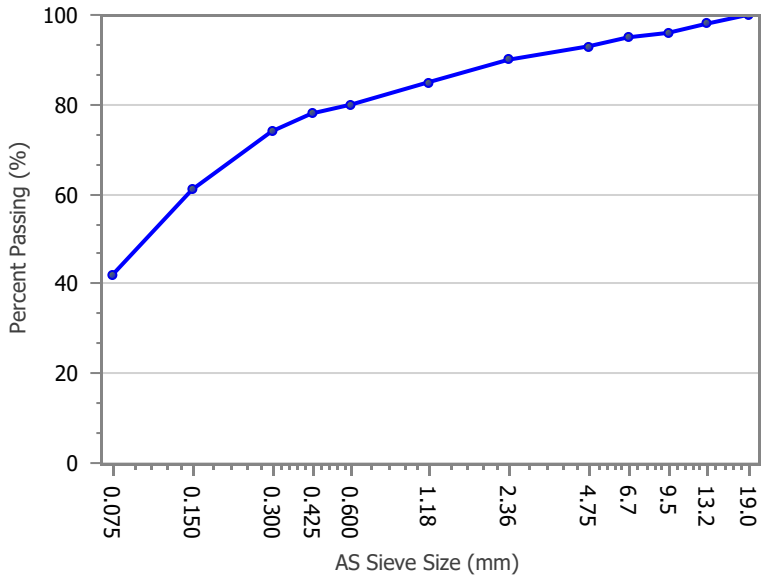
QUALITY OF MATERIALS REPORT

Client:	ATC Williams	Report Number:	2128/R/86464-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 8 of 9

Test Procedures	AS1289.3.6.1, AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	2128/S/170966	Location	Composite (ATP003 BDS 2-2.2) ATP014 BDS 1.5-2.0
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	12/06/2024	Material Source	Insitu
PSD Preparation	Washed	Material Type	Investigation
Atterberg Preparation	Dry Sieved / Air Dried	Prep Material > 53.0mm (%)	
Material Description	Silty Clay		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**98**	
9.5		**96**	
6.7		**95**	
4.75		**93**	
2.36		**90**	
1.18		**85**	
0.600		**80**	
0.425		**78**	
0.300		**74**	
0.150		**61**	
0.075		**42**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**41**		0.075/0.425 Fines Ratio		**0.53**	
Plastic Limit (%)		**15**		PI x 0.425 Ratio (%)		**2020.2**	
Plastic Index (%)		**26**		LS x 0.425 Ratio (%)		**971.2**	
Linear Shrinkage (%)		**12.5**		Shrinkage Observations	-		

Remarks

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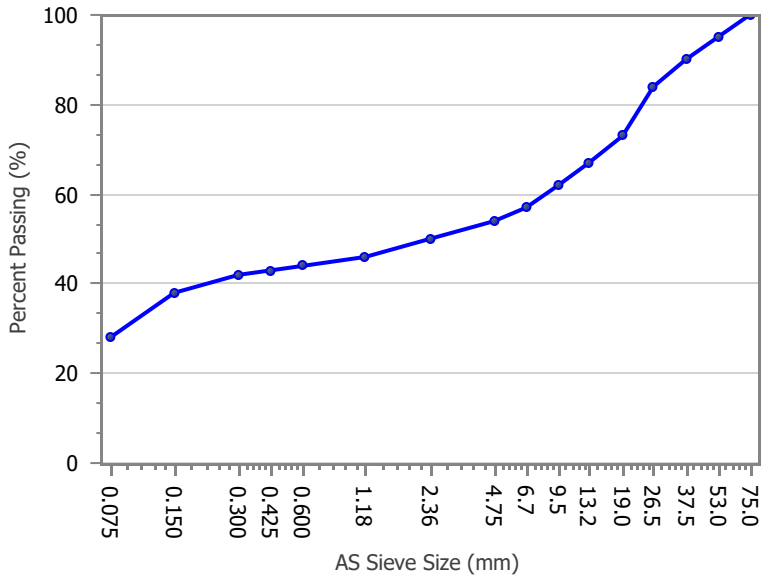
QUALITY OF MATERIALS REPORT

Client:	ATC Williams	Report Number:	2128/R/86464-1
Client Address:	,	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	17/06/2024 Page 9 of 9

Test Procedures	AS1289.3.6.1, AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	2128/S/170967	Location	Composite (ATP001 BDS 1.1-1.3)
Sampling Method	Tested As Received		ATP005 BDS 1.5-2.0
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	13/06/2024	Material Source	Insitu
PSD Preparation	Washed	Material Type	Investigation
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	Silty Clay		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
75.0		**100**	
53.0		**95**	
37.5		**90**	
26.5		**84**	
19.0		**73**	
13.2		**67**	
9.5		**62**	
6.7		**57**	
4.75		**54**	
2.36		**50**	
1.18		**46**	
0.600		**44**	
0.425		**43**	
0.300		**42**	
0.150		**38**	
0.075		**28**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**38**		0.075/0.425 Fines Ratio		**0.67**	
Plastic Limit (%)		**25**		PI x 0.425 Ratio (%)		**556.3**	
Plastic Index (%)		**13**		LS x 0.425 Ratio (%)		**299.5**	
Linear Shrinkage (%)		**7.0**		Shrinkage Observations	-		

Remarks

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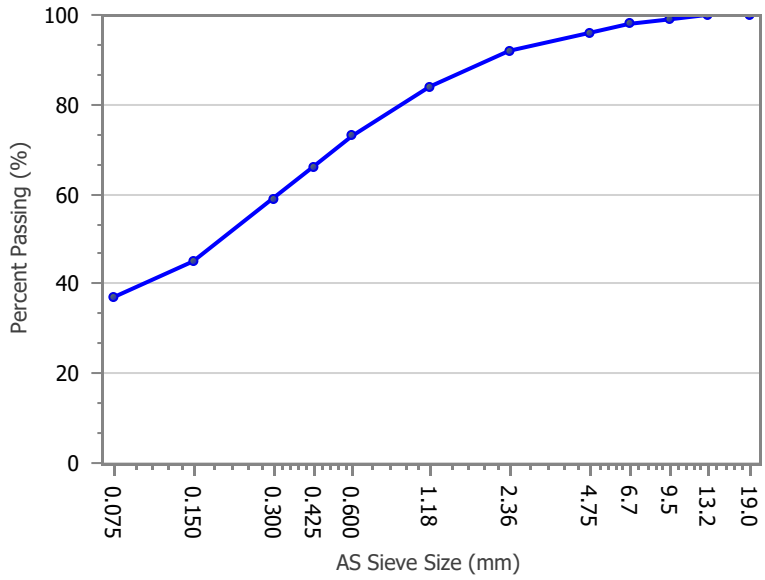
QUALITY OF MATERIALS REPORT

Client:	ATC WILLIAMS PTY LTD	Report Number:	2128/R/86784-1
Client Address:	20 Edmonstone Street, Level3, Suite17, 14-20 Aerodrome Rd	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	2/07/2024 Page 1 of 1

Test Procedures	AS1289.3.6.1, AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	2128/S/170968	Location	ATP009 BDS 1.6-2.1
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	2/07/2024	Material Source	Insitu
PSD Preparation	Washed	Material Type	Investigation
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	Sandy gravel		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**100**	
9.5		**99**	
6.7		**98**	
4.75		**96**	
2.36		**92**	
1.18		**84**	
0.600		**73**	
0.425		**66**	
0.300		**59**	
0.150		**45**	
0.075		**37**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**53**		0.075/0.425 Fines Ratio		**0.56**	
Plastic Limit (%)		**28**		PI x 0.425 Ratio (%)		**1647.5**	
Plastic Index (%)		**25**		LS x 0.425 Ratio (%)		**692.0**	
Linear Shrinkage (%)		**10.5**		Shrinkage Observations	Curling		

Remarks

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Form ID: W85Rep Rev 3

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Tai.Battisson@constructionsciences.net

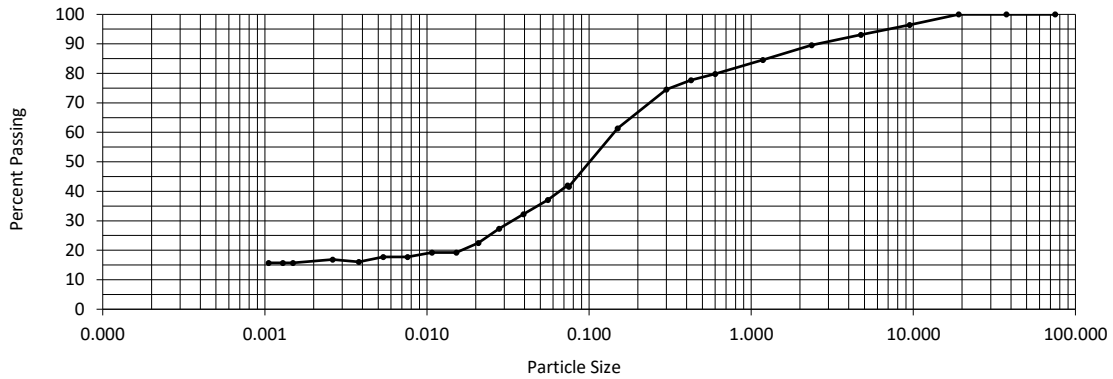
Report for

PARTICLE SIZE DISTRIBUTION (AS 1289 3.6.1 / 3.6.3)

Client:	ATC Williams Pty Ltd	**Report No:**	**2128/R/170966-1**
Client Address:	Mount Rawdon		
Project:	Mount Rawdon Operation Test Pit Program	**Test Request:**	2128/T/37774
Project Location:	Mount Rawdon		
Test Location:	Composite (ATP003 BDS 2-2.2) - ATP014 BDS 1.5-2.0		
Material Description:	Tested As Received		
Sampled By:	Client	**Sample Date:**	23/04/2024
Tested By:	Allister Naismith	**Test Date:**	15/06/2024
Sampling Method:	Tested As Received	**Sample No:**	2128/S/170966

Hydrometer Type:	ASTM E100 152H, Grams per litre
Dispersant Type:	Sodium Hexametaphosphate and Anhydrous Sodium Carbonate
Pre-treatment:	AS 1289.3.6.3 - 6.1(a)
Loss on Pre-treatment:	None

Particle Size Distribution



Soil Particle Density (AS1289.3.5.1) -2.36mm (t/m3)
2.443
Soil Particle Density Sample No.
2128/S/170966
Soil Particle Density Report No.
2128/S/170966

PSD - AS1289.3.6.1

Sieve Size (mm)	Percent Passing
75.0	100
37.5	100
19.0	100
9.5	96
4.75	93
2.36	90
1.18	85
0.600	80
0.425	78
0.300	75
0.150	61
0.075	42

PSD Hydrometer - AS1289.3.6.3

Sieve Size (µm)	Percent Passing
73.782	42.0
55.63	37.1
39.34	32.2
27.82	27.3
20.77	22.5
15.17	19.2
10.73	19.2
7.58	17.7
5.36	17.7
3.79	16.1
2.62	16.8
1.49	15.7
1.29	15.7
1.06	15.7

Corporate Site Number: 2128
Accreditation Number: 1986

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The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Name: T. Battisson
Function: Authorised Signatory
Date: 24/06/24

Construction Sciences
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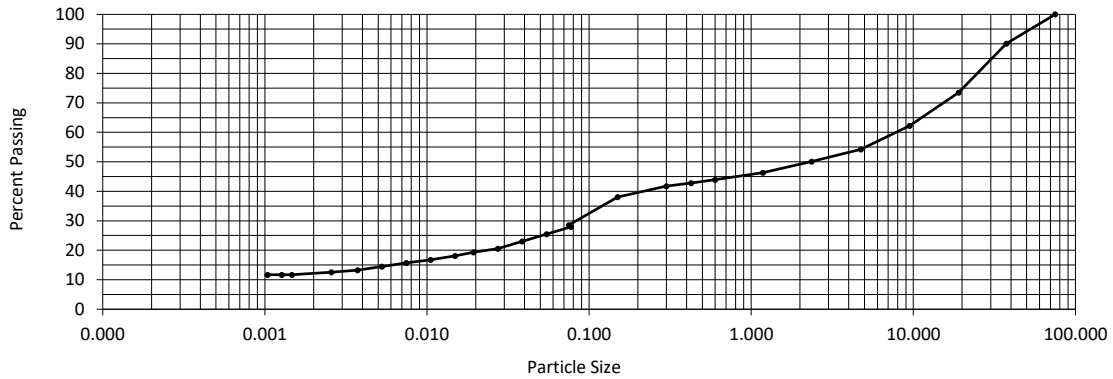
Report for

PARTICLE SIZE DISTRIBUTION (AS 1289 3.6.1 / 3.6.3)

Client:	ATC Williams Pty Ltd	**Report No:**	**2128/R/170967-1**
Client Address:	Mount Rawdon		
Project:	Mount Rawdon Operation Test Pit Program	**Test Request:**	2128/T/37774
Project Location:	Mount Rawdon		
Test Location:	Composite (ATP001 BDS 1.1-1.3) - ATP005 BDS 1.5-2.0		
Material Description:	Tested As Received		
Sampled By:	Client	**Sample Date:**	23/04/2024
Tested By:	Allister Naismith	**Test Date:**	15/06/2024
Sampling Method:	Tested As Received	**Sample No:**	2128/S/170967

Hydrometer Type:	ASTM E100 152H, Grams per litre
Dispersant Type:	Sodium Hexametaphosphate and Anhydrous Sodium Carbonate
Pre-treatment:	AS 1289.3.6.3 - 6.1(a)
Loss on Pre-treatment:	None

Particle Size Distribution



Soil Particle Density (AS1289.3.5.1) -2.36mm (t/m3)
2.498
Soil Particle Density Sample No.
2128/S/170967
Soil Particle Density Report No.
2128/S/170967-1

PSD - AS1289.3.6.1

Sieve Size (mm)	Percent Passing
75.0	100
37.5	90
19.0	73
9.5	62
4.75	54
2.36	50
1.18	46
0.600	44
0.425	43
0.300	42
0.150	38
0.075	29

PSD Hydrometer - AS1289.3.6.3

Sieve Size (µm)	Percent Passing
77.343	27.9
54.69	25.5
38.67	23.0
27.34	20.5
19.34	19.3
14.91	18.1
10.54	16.8
7.46	15.7
5.27	14.5
3.73	13.2
2.57	12.5
1.47	11.7
1.27	11.7
1.04	11.7

Corporate Site Number: 2128

Accreditation Number: 1986

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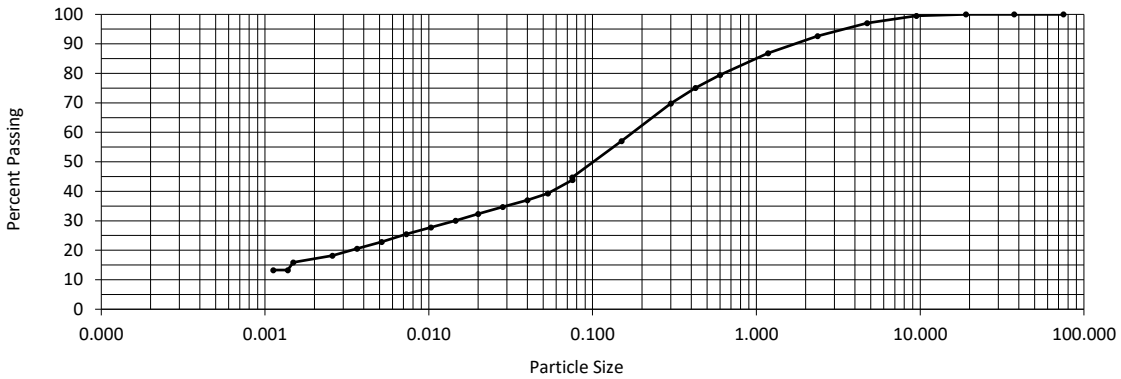
Report for

PARTICLE SIZE DISTRIBUTION (AS 1289 3.6.1 / 3.6.3)

Client:	ATC Williams Pty Ltd	**Report No:**	**2128/R/170963-1**
Client Address:	Mount Rawdon		
Project:	Mount Rawdon Operation Test Pit Sampling	**Test Request:**	2128/T/37774
Project Location:	Mount Rawdon		
Test Location:	Composite (ATP006 BDS 0.9-1.4) - ATP007 BDS 0.3-0.7 - ATP009 BDS		
Material Description:	Tested as Received		
Sampled By:	Client	**Sample Date:**	23/04/2024
Tested By:	Allister Naismith	**Test Date:**	17/06/2024
Sampling Method:	Tested as Received	**Sample No:**	2128/S/170963

Hydrometer Type:	ASTM E100 152H, Grams per litre
Dispersant Type:	Sodium Hexametaphosphate and Anhydrous Sodium Carbonate
Pre-treatment:	AS 1289.3.6.3 - 6.1(a)
Loss on Pre-treatment:	None

Particle Size Distribution



Soil Particle Density (AS1289.3.5.1) -2.36mm (t/m3)
2.476
Soil Particle Density Sample No.
2128/S/170963
Soil Particle Density Report No.
2128/R/170963-1

PSD - AS1289.3.6.1

Sieve Size (mm)	Percent Passing
75.0	100
37.5	100
19.0	100
9.5	99
4.75	97
2.36	93
1.18	87
0.600	79
0.425	75
0.300	70
0.150	57
0.075	45

PSD Hydrometer - AS1289.3.6.3

Sieve Size (µm)	Percent Passing
75.497	43.9
53.38	39.3
39.93	37.0
28.24	34.7
19.97	32.4
14.58	30.1
10.31	27.8
7.29	25.5
5.16	22.8
3.65	20.5
2.58	18.2
1.49	15.9
1.37	13.3
1.12	13.3

Corporate Site Number: 2128
Accreditation Number: 1986

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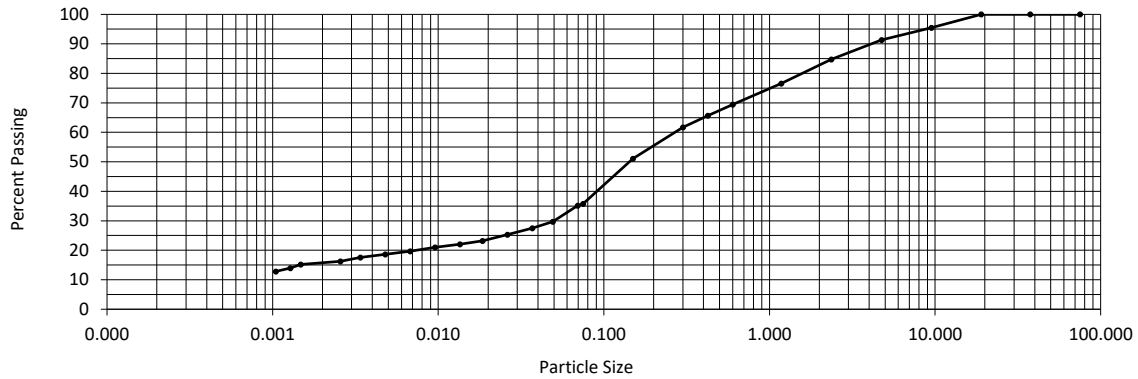
Report for

PARTICLE SIZE DISTRIBUTION (AS 1289 3.6.1 / 3.6.3)

Client:	ATC Williams Pty Ltd	**Report No:**	**2128/R/170962-1**
Client Address:	Mount Rawdon		
Project:	Mount Rawdon Operation Test Pit Sampling	**Test Request:**	2128/T/37774
Project Location:	Mount Rawdon		
Test Location:	Composite (ATP010 BDS 1-1.5) - ATP011 BDS 0.5-1.0		
Material Description:	Tested as Received		
Sampled By:	Client	**Sample Date:**	23/04/2024
Tested By:	Allister Naismith	**Test Date:**	13/06/2024
Sampling Method:	Tested as Received	**Sample No:**	2128/S/170962

Hydrometer Type:	ASTM E100 152H, Grams per litre
Dispersant Type:	Sodium Hexametaphosphate and Anhydrous Sodium Carbonate
Pre-treatment:	AS 1289.3.6.3 - 6.1(a)
Loss on Pre-treatment:	None

Particle Size Distribution



Soil Particle Density (AS1289.3.5.1) -2.36mm (t/m3)
2.548
Soil Particle Density Sample No.
2128/S/170962
Soil Particle Density Report No.
2128/R/170962-1

PSD - AS1289.3.6.1

Sieve Size (mm)	Percent Passing
75.0	100
37.5	100
19.0	100
9.5	95
4.75	91
2.36	85
1.18	77
0.600	69
0.425	66
0.300	62
0.150	51
0.075	36

PSD Hydrometer - AS1289.3.6.3

Sieve Size (µm)	Percent Passing
69.578	35.2
49.20	29.7
37.04	27.5
26.19	25.3
18.52	23.1
13.52	22.1
9.56	21.0
6.76	19.7
4.78	18.6
3.38	17.5
2.56	16.3
1.48	15.2
1.28	13.9
1.05	12.8

Corporate Site Number: 2128
Accreditation Number: 1986

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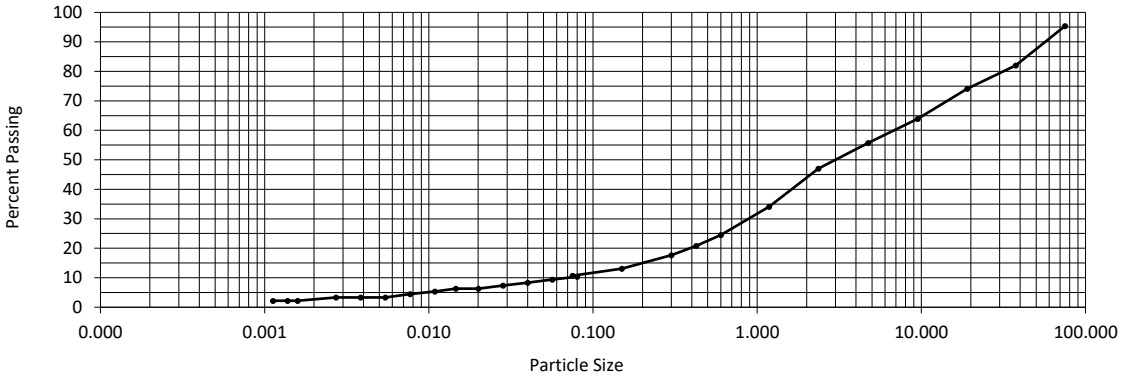
Report for

PARTICLE SIZE DISTRIBUTION (AS 1289 3.6.1 / 3.6.3)

Client:	ATC Williams Pty Ltd	**Report No:**	**2128/R/170694-1**
Client Address:	Mount Rawdon		
Project:	Mount Rawdon Operation Test Pit Sampling	**Test Request:**	2128/T/37774
Project Location:	Mount Rawdon		
Test Location:	ATP016 BDS 0.5-1.0		
Material Description:	Tested as Received		
Sampled By:	Client	**Sample Date:**	23/04/2024
Tested By:	Allister Naismith	**Test Date:**	17/06/2024
Sampling Method:	Tested as Received	**Sample No:**	2128/S/170964

Hydrometer Type:	ASTM E100 152H, Grams per litre
Dispersant Type:	Sodium Hexametaphosphate and Anhydrous Sodium Carbonate
Pre-treatment:	AS 1289.3.6.3 - 6.1(a)
Loss on Pre-treatment:	None

Particle Size Distribution



Soil Particle Density (AS1289.3.5.1) -2.36mm (t/m3)
2.509
Soil Particle Density Sample No.
2128/S/170964
Soil Particle Density Report No.
2128/R/170964-1

PSD - AS1289.3.6.1

Sieve Size (mm)	Percent Passing
75.0	95
37.5	82
19.0	74
9.5	64
4.75	56
2.36	47
1.18	34
0.600	25
0.425	21
0.300	18
0.150	13
0.075	11

PSD Hydrometer - AS1289.3.6.3

Sieve Size (µm)	Percent Passing
80.017	10.3
56.58	9.3
40.01	8.3
28.29	7.3
20.00	6.3
14.61	6.3
10.87	5.3
7.69	4.5
5.44	3.3
3.84	3.3
2.72	3.3
1.59	2.2
1.38	2.2
1.12	2.2

Corporate Site Number: 2128
Accreditation Number: 1986

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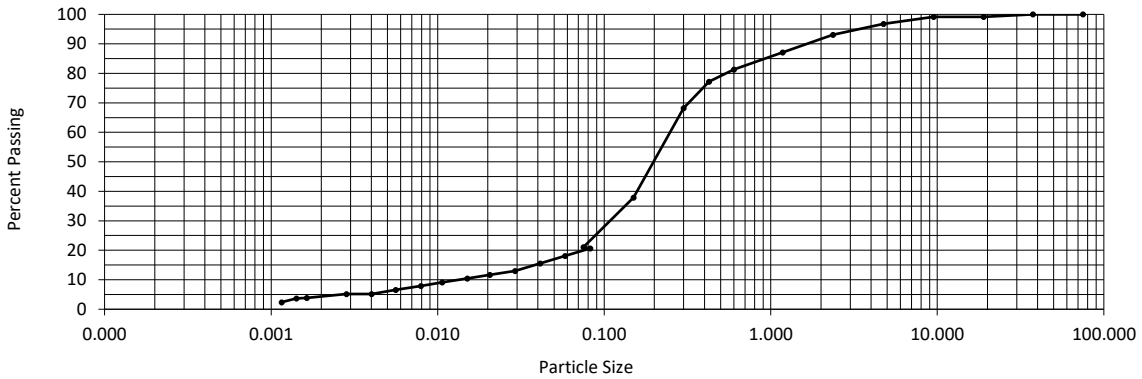
Report for

PARTICLE SIZE DISTRIBUTION (AS 1289 3.6.1 / 3.6.3)

Client:	ATC Williams Pty Ltd	**Report No:**	**2128/R/170959-1**
Client Address:	Mount Rawdon		
Project:	Mount Rawdon Operation Test Pit Sampling	**Test Request:**	2128/T/37774
Project Location:	Mount Rawdon		
Test Location:	ATP008 BDS 0-01		
Material Description:	Tested As Received		
Sampled By:	Client	**Sample Date:**	23/04/2024
Tested By:	Allister Naismith	**Test Date:**	17/06/2024
Sampling Method:	Tested As Received	**Sample No:**	2128/S/170959

Hydrometer Type:	ASTM E100 152H, Grams per litre
Dispersant Type:	Sodium Hexametaphosphate and Anhydrous Sodium Carbonate
Pre-treatment:	AS 1289.3.6.3 - 6.1(a)
Loss on Pre-treatment:	None

Particle Size Distribution



Soil Particle Density (AS1289.3.5.1) -2.36mm (t/m3)
2.41
Soil Particle Density Sample No.
2128/S/170959
Soil Particle Density Report No.
2128/R/170959-1

PSD - AS1289.3.6.1

Sieve Size (mm)	Percent Passing
75.0	100
37.5	100
19.0	99
9.5	99
4.75	97
2.36	93
1.18	87
0.600	81
0.425	77
0.300	68
0.150	38
0.075	21

PSD Hydrometer - AS1289.3.6.3

Sieve Size (µm)	Percent Passing
82.404	20.6
58.27	18.1
41.20	15.5
29.13	13.0
20.60	11.7
15.04	10.4
10.64	9.1
7.92	7.9
5.60	6.6
4.01	5.1
2.83	5.1
1.64	3.9
1.42	3.7
1.16	2.4

Corporate Site Number: 2128
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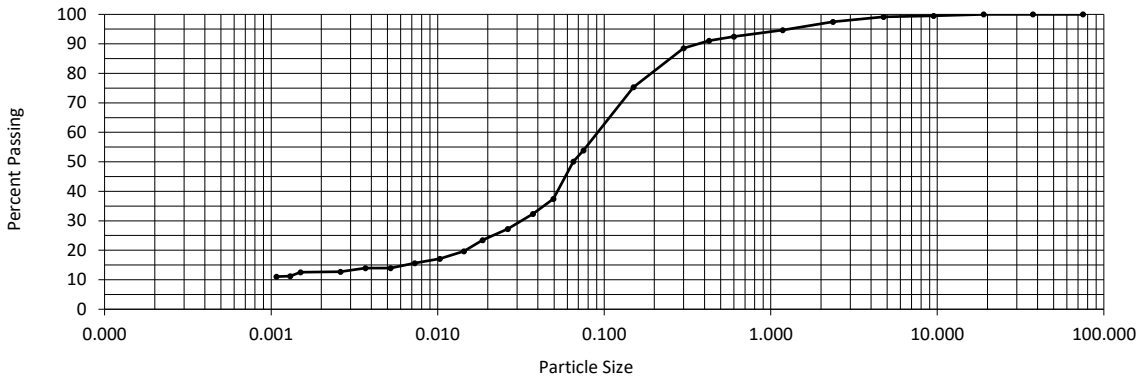
Report for

PARTICLE SIZE DISTRIBUTION (AS 1289 3.6.1 / 3.6.3)

Client:	ATC Williams Pty Ltd	**Report No:**	**2128/R/170960-1**
Client Address:	Mount Rawdon		
Project:	Mount Rawdon Operation Test Pit Sampling	**Test Request:**	2128/T/37774
Project Location:	Mount Rawdon		
Test Location:	ATP002 BDS 0.3-0.8		
Material Description:	Tested As Received		
Sampled By:	T.Battisson	**Sample Date:**	23/04/2024
Tested By:	Allister Naismith	**Test Date:**	15/06/2024
Sampling Method:	Tested As Received	**Sample No:**	2128/S/170960

Hydrometer Type:	ASTM E100 152H, Grams per litre
Dispersant Type:	Sodium Hexametaphosphate and Anhydrous Sodium Carbonate
Pre-treatment:	AS 1289.3.6.3 - 6.1(a)
Loss on Pre-treatment:	None

Particle Size Distribution



Soil Particle Density (AS1289.3.5.1) -2.36mm (t/m3)
2.501
Soil Particle Density Sample No.
2128/S/170960
Soil Particle Density Report No.
2128/R/170960-1

PSD - AS1289.3.6.1

Sieve Size (mm)	Percent Passing
75.0	100
37.5	100
19.0	100
9.5	100
4.75	99
2.36	98
1.18	95
0.600	93
0.425	91
0.300	89
0.150	75
0.075	54

PSD Hydrometer - AS1289.3.6.3

Sieve Size (µm)	Percent Passing
65.170	50.1
49.49	37.4
37.28	32.3
26.36	27.3
18.64	23.5
14.39	19.7
10.29	17.1
7.28	15.6
5.21	14.0
3.68	14.0
2.61	12.7
1.50	12.5
1.30	11.2
1.08	11.1

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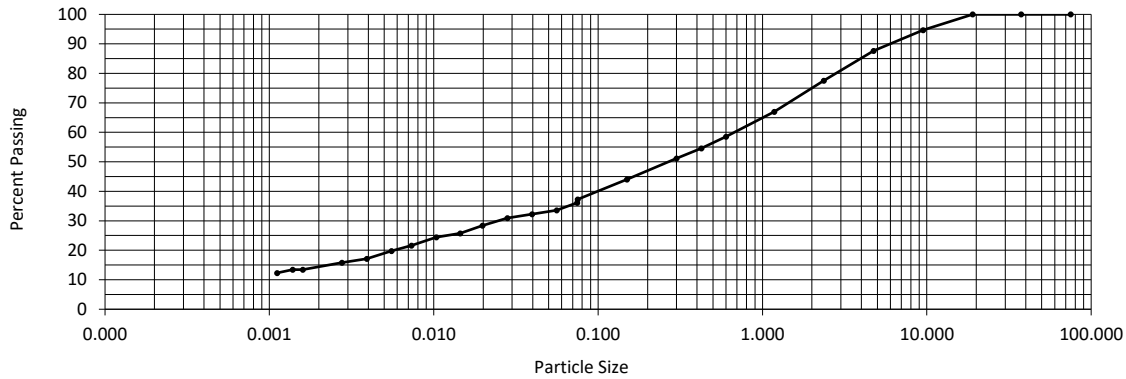
Report for

PARTICLE SIZE DISTRIBUTION (AS 1289 3.6.1 / 3.6.3)

Client:	ATC Williams Pty Ltd	**Report No:**	**2128/R/170961-1**
Client Address:	Mount Rawdon		
Project:	Mount Rawdon Operation Test Pit Sampling	**Test Request:**	2128/T/37774
Project Location:	Mount Rawdon		
Test Location:	ATP005 BDS 0.3-0.6		
Material Description:	Tested As Received		
Sampled By:	Client	**Sample Date:**	23/04/2024
Tested By:	Allister Naismith	**Test Date:**	17/06/2024
Sampling Method:	Tested As Received	**Sample No:**	2128/S/170961

Hydrometer Type:	ASTM E100 152H, Grams per litre
Dispersant Type:	Sodium Hexametaphosphate and Anhydrous Sodium Carbonate
Pre-treatment:	AS 1289.3.6.3 - 6.1(a)
Loss on Pre-treatment:	None

Particle Size Distribution



Soil Particle Density (AS1289.3.5.1) -2.36mm (t/m3)
2.346
Soil Particle Density Sample No.
2128/S/170961
Soil Particle Density Report No.
2128/R/170961-1

PSD - AS1289.3.6.1

Sieve Size (mm)	Percent Passing
75.0	100
37.5	100
19.0	100
9.5	95
4.75	88
2.36	78
1.18	67
0.600	59
0.425	55
0.300	51
0.150	44
0.075	37

PSD Hydrometer - AS1289.3.6.3

Sieve Size (µm)	Percent Passing
74.526	36.1
56.04	33.5
39.62	32.2
28.02	30.9
19.81	28.3
14.47	25.7
10.35	24.4
7.32	21.6
5.53	19.7
3.91	17.1
2.77	15.8
1.60	13.4
1.38	13.4
1.12	12.3

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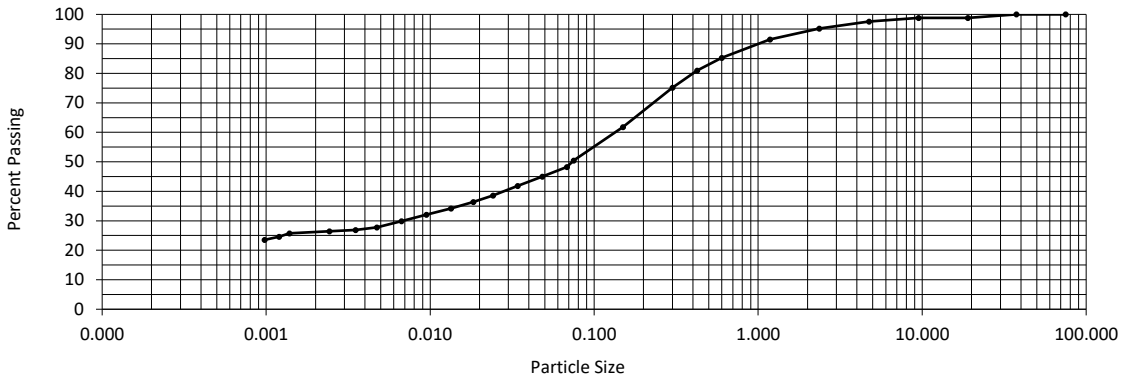
Report for

PARTICLE SIZE DISTRIBUTION (AS 1289 3.6.1 / 3.6.3)

Client:	ATC Williams Pty Ltd	**Report No:**	**2128/R/170965-1**
Client Address:	Yarwun, Qld		
Project:	Mount Rawdon Operation Test Pit Sampling	**Test Request:**	2128/T/37774
Project Location:	Mount Rawdon		
Test Location:	Composite (ATP006 BDS 1.4-1.6) - ATP007 BDS 1.6-1.7		
Material Description:	Tested As Received		
Sampled By:	Client	**Sample Date:**	23/04/2024
Tested By:	Allister Naismith	**Test Date:**	17/06/2024
Sampling Method:	Tested As Received	**Sample No:**	2128/S/170965

Hydrometer Type:	ASTM E100 152H, Grams per litre
Dispersant Type:	Sodium Hexametaphosphate and Anhydrous Sodium Carbonate
Pre-treatment:	AS 1289.3.6.3 - 6.1(a)
Loss on Pre-treatment:	None

Particle Size Distribution



Soil Particle Density (AS1289.3.5.1) -2.36mm (t/m3)
2.516
Soil Particle Density Sample No.
2128/S/170965
Soil Particle Density Report No.
2128/R/170965-1

PSD - AS1289.3.6.1

Sieve Size (mm)	Percent Passing
75.0	100
37.5	100
19.0	99
9.5	99
4.75	98
2.36	95
1.18	92
0.600	85
0.425	81
0.300	75
0.150	62
0.075	50

PSD Hydrometer - AS1289.3.6.3

Sieve Size (µm)	Percent Passing
68.260	48.3
48.27	45.0
34.13	41.8
24.13	38.5
18.33	36.4
13.39	34.2
9.47	32.1
6.69	29.9
4.73	27.7
3.51	26.9
2.42	26.4
1.38	25.7
1.20	24.6
0.98	23.5

Corporate Site Number: 2128
Accreditation Number: 1986

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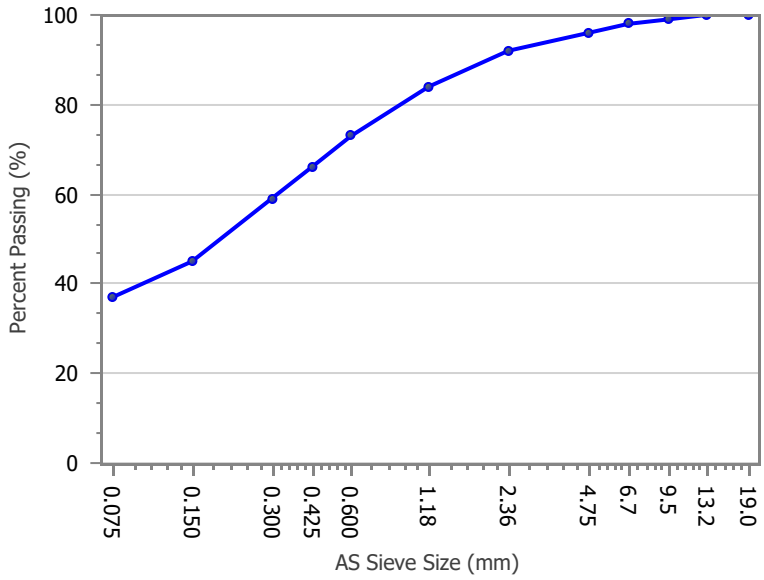
QUALITY OF MATERIALS REPORT

Client:	ATC WILLIAMS PTY LTD	Report Number:	2128/R/86784-1
Client Address:	20 Edmonstone Street, Level3, Suite17, 14-20 Aerodrome Rd	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	2/07/2024 Page 1 of 1

Test Procedures	AS1289.3.6.1, AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	2128/S/170968	Location	ATP009 BDS 1.6-2.1
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	2/07/2024	Material Source	Insitu
PSD Preparation	Washed	Material Type	Investigation
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	Sandy gravel		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**100**	
9.5		**99**	
6.7		**98**	
4.75		**96**	
2.36		**92**	
1.18		**84**	
0.600		**73**	
0.425		**66**	
0.300		**59**	
0.150		**45**	
0.075		**37**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**53**		0.075/0.425 Fines Ratio		**0.56**	
Plastic Limit (%)		**28**		PI x 0.425 Ratio (%)		**1647.5**	
Plastic Index (%)		**25**		LS x 0.425 Ratio (%)		**692.0**	
Linear Shrinkage (%)		**10.5**		Shrinkage Observations	Curling		

Remarks

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Tai Battisson
Form ID: W85Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
7 Lawson Street,
Parkhurst QLD 4702

Laboratory: **Rockhampton Laboratory**
Phone: 07 4886 2100
Fax: 07 4926 1286
Email: Rockhampton@constructionsciences.net

EMERSON CLASS NUMBER REPORT

Client:	ATC WILLIAMS PTY LTD	Report Number:	2128/R/86785-1
Client Address:	20 Edmonstone Street, Level3, Suite17, 14-20 Aerodrome Rd	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	2/07/2024 Page 1 of 1

Test Procedures:	AS1289.3.8.1

Sample Number	2128/S/170968			
ID / Client ID	Sample 10			
Lot Number	-			
Date / Time Sampled	23/04/2024			
Date Tested	27/06/2024			
Material Source	Insitu			
Material Type	Investigation			
Sampling Method	Tested As Received			
Prep Material > 53mm (%)	-			
Water Type	Distilled			
Water Temperature (°C)	21			
Location	ATP009 BDS 1.6-2.1			
Soil Description	Sandy gravel			
Emerson Class Description	Slakes Some dispersion.			
Emerson Class Number	**2**			

Remarks

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Tai Battisson
Form ID: W22Rep Rev 4

Construction Sciences

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Parkhurst QLD 4702

Laboratory: **Rockhampton Laboratory**
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Email: Rockhampton@constructionsciences.net

SOIL PARTICLE DENSITY REPORT

Client:	ATC WILLIAMS PTY LTD	Report Number:	2128/R/86786-1
Client Address:	20 Edmonstone Street, Level3, Suite17, 14-20 Aerodrome Rd	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	2/07/2024 Page 1 of 1

Test Procedures:	AS1289.3.5.1

		Sample Location	
Sample Number	2128/S/170968		
Sampling Method	Tested As Received	Location	ATP009 BDS 1.6-2.1
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied		
Date Tested	2/07/2024		
Material Source	Insitu	Material Type	Investigation
Client Reference	Sample 10		

Soil Particle Density (Fine)		Soil Particle Density (Coarse)	
Percent of Fine Fraction (%)	-	Percent of Coarse Fraction (%)	-
Temperature of Test (C°)	21	Temperature of Test (C°)	-
Supplied Result Reference	-	Supplied Result Reference	-
Average Particle Density Fine (t/m³)	**2.41**	Average Particle Density Coarse (t/m³)	**-**

Soil Particle Density (t/m³) -

Remarks

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Tai Battisson
Form ID: W14Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
7 Lawson Street,
Parkhurst QLD 4702

Laboratory: **Rockhampton Laboratory**
Phone: 07 4886 2100
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Email: Rockhampton@constructionsciences.net

MOISTURE DENSITY RELATIONSHIP REPORT

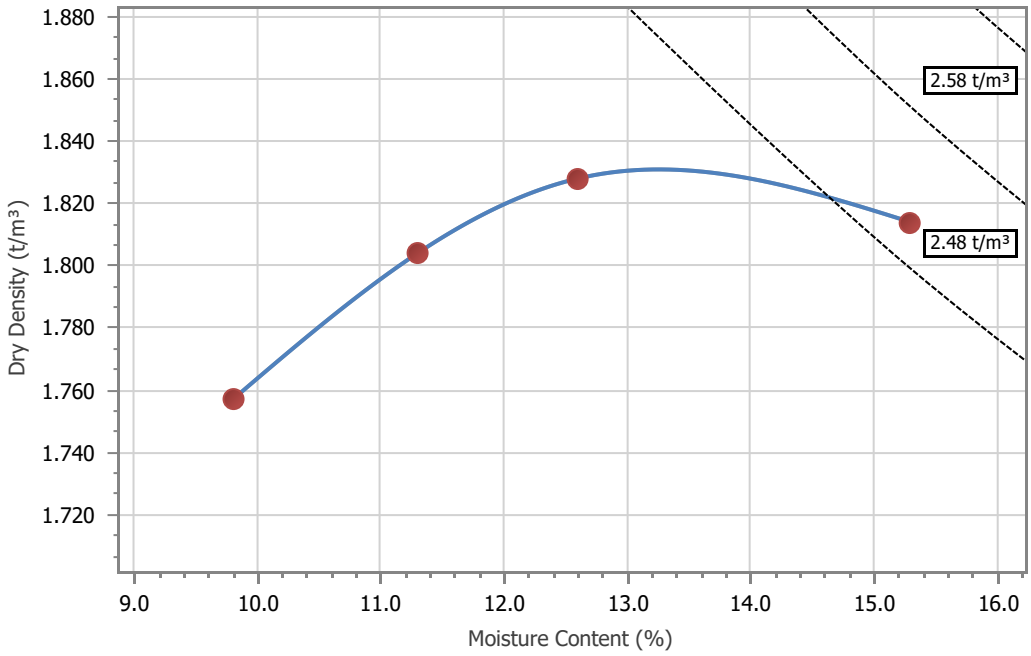
Client:	ATC WILLIAMS PTY LTD	Report Number:	2128/R/86865-1
Client Address:	20 Edmonstone Street, Level3, Suite17, 14-20 Aerodrome Rd	Project Number:	2128/P/1538
Project:	Mount Rawdon Operation Test Pit Sampling Program	Lot Number:	
Location:	Mount Rawdon Mine	Internal Test Request:	2128/T/37774
Component:	Mount Rawdon Operation Test Pit	Client Reference/s:	Test Pit Investigation
Area Description:	Mount Rawdon	Report Date / Page:	4/07/2024 Page 1 of 1

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Location	ATP009 BDS 1.6-2.1
Sample Number	2128/S/170968		
Sampling Method	Tested As Received		
Date Sampled	23/04/2024		
Sampled By	Client/Subcontractor Supplied	Prep Material > 53mm (%)	-
Date Tested	2/07/2024	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Investigation	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	2.0
Material Description	Sandy gravel		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
9.8	1.757
11.3	1.804
12.6	1.828
15.3	1.814

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	1.83	Optimum Moisture Content (%):	13.5

Remarks

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 2128

Approved Signatory: Tai Battisson
Form ID: W4Rep Rev 3

Construction Sciences
Rockhampton Laboratory
101 High Street North Rockhampton Qld. 4701
Phone : (07) 4928 0044
Fax: (07) 4926 1286

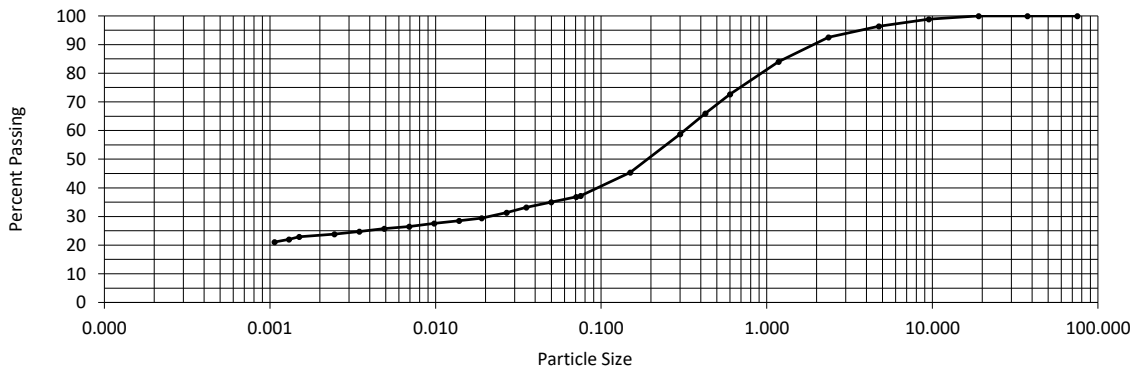
Report for

PARTICLE SIZE DISTRIBUTION (AS 1289 3.6.1 / 3.6.3)

Client:	ATC Williams Pty Ltd	**Report No:**	**2128/R/170968-1**
Client Address:	Yarwun, Qld		
Project:	Mount Rawdon Operation Test Pit Sampling	**Test Request:**	2128/T/37774
Project Location:	Mount Rawdon		
Test Location:	ATP009 BDS 1.6-2.1		
Material Description:	Tested As Received		
Sampled By:	Client	**Sample Date:**	23/04/2024
Tested By:	Allister Naismith	**Test Date:**	17/06/2024
Sampling Method:	Tested As Received	**Sample No:**	2128/S/170968

Hydrometer Type:	ASTM E100 152H, Grams per litre
Dispersant Type:	Sodium Hexametaphosphate and Anhydrous Sodium Carbonate
Pre-treatment:	AS 1289.3.6.3 - 6.1(a)
Loss on Pre-treatment:	None

Particle Size Distribution



Soil Particle Density (AS1289.3.5.1) -2.36mm (t/m3)
2.411
Soil Particle Density Sample No.
2128/S/170968
Soil Particle Density Report No.
2128/R/170968-1

PSD - AS1289.3.6.1

Sieve Size (mm)	Percent Passing
75.0	100
37.5	100
19.0	100
9.5	99
4.75	96
2.36	93
1.18	84
0.600	73
0.425	66
0.300	59
0.150	45
0.075	37

PSD Hydrometer - AS1289.3.6.3

Sieve Size (µm)	Percent Passing
70.554	36.9
49.89	35.0
35.28	33.2
26.80	31.3
18.95	29.4
13.84	28.5
9.79	27.6
6.92	26.5
4.89	25.7
3.46	24.8
2.45	23.9
1.50	22.9
1.30	22.0
1.06	21.1

Corporate Site Number: **2128**
Accreditation Number: **1986**

NATA
WORLD RECOGNISED ACCREDITATION

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Name: T. Battisson
Function: Authorised Signatory
Date: 02/07/24

Construction Sciences
Rockhampton Laboratory
101 High Street North Rockhampton Qld. 4701
Phone : (07) 4928 0044
Fax: (07) 4926 1286

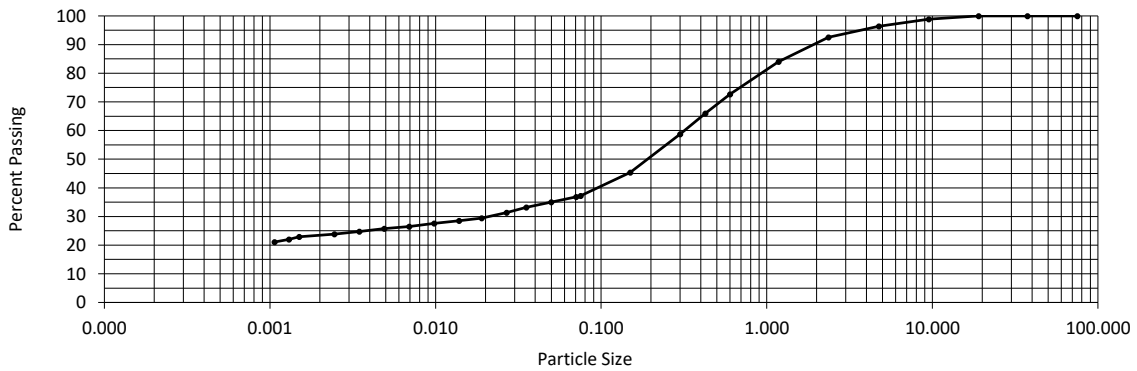
Report for

PARTICLE SIZE DISTRIBUTION (AS 1289 3.6.1 / 3.6.3)

Client:	ATC Williams Pty Ltd	**Report No:**	**2128/R/170968-1**
Client Address:	Yarwun, Qld		
Project:	Mount Rawdon Operation Test Pit Sampling	**Test Request:**	2128/T/37774
Project Location:	Mount Rawdon		
Test Location:	ATP009 BDS 1.6-2.1		
Material Description:	Tested As Received		
Sampled By:	Client	**Sample Date:**	23/04/2024
Tested By:	Allister Naismith	**Test Date:**	17/06/2024
Sampling Method:	Tested As Received	**Sample No:**	2128/S/170968

Hydrometer Type:	ASTM E100 152H, Grams per litre
Dispersant Type:	Sodium Hexametaphosphate and Anhydrous Sodium Carbonate
Pre-treatment:	AS 1289.3.6.3 - 6.1(a)
Loss on Pre-treatment:	None

Particle Size Distribution



Soil Particle Density (AS1289.3.5.1) -2.36mm (t/m3)
2.411
Soil Particle Density Sample No.
2128/S/170968
Soil Particle Density Report No.
2128/R/170968-1

PSD - AS1289.3.6.1

Sieve Size (mm)	Percent Passing
75.0	100
37.5	100
19.0	100
9.5	99
4.75	96
2.36	93
1.18	84
0.600	73
0.425	66
0.300	59
0.150	45
0.075	37

PSD Hydrometer - AS1289.3.6.3

Sieve Size (µm)	Percent Passing
70.554	36.9
49.89	35.0
35.28	33.2
26.80	31.3
18.95	29.4
13.84	28.5
9.79	27.6
6.92	26.5
4.89	25.7
3.46	24.8
2.45	23.9
1.50	22.9
1.30	22.0
1.06	21.1

Corporate Site Number: **2128**
Accreditation Number: **1986**

NATA
WORLD RECOGNISED ACCREDITATION

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Name: T. Battisson
Function: Authorised Signatory
Date: 02/07/24

Particle Size Distribution Results

TEST IN ACCORDANCE WITH AS 1289

☑ Method 3.6.1 ☑ Method 3.6.3

☑ Oven Drying Method 2.1.1

Client:	Evolution Mining Limited	**NATA Report No.:**	**R64424**
Address:	Mount Perry QLD 4671	**Job No.:**	111359.100
		Register No.:	59924
Project:	Mount Rawdon TSF Field Cover System Trials	**Location:**	QLD

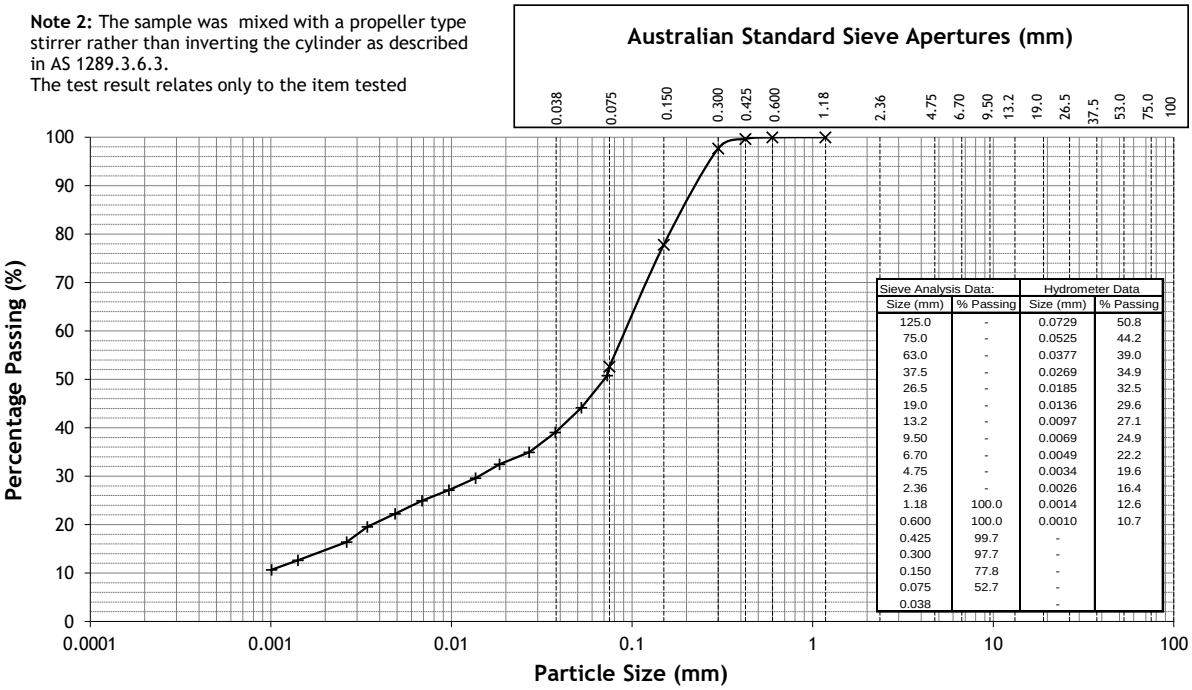
Sample Description: TSF-FN-1	Borehole No: ☐	Test Pit Depth: ☐

Dispersion Method used: Mechanical Stirrer for 1 minute **Hydrometer Type Used:** ASTM 152H

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1 Clause 6.5.4 ☑ Sample provided by the Client

Note 1: The sample was oven-dried during sample preparation and not air-dried as stated in AS 1289.3.6.3

Note 2: The sample was mixed with a propeller type stirrer rather than inverting the cylinder as described in AS 1289.3.6.3.
The test result relates only to the item tested



Sieve Analysis Data:		Hydrometer Data	
Size (mm)	% Passing	Size (mm)	% Passing
125.0	-	0.0729	50.8
75.0	-	0.0525	44.2
63.0	-	0.0377	39.0
37.5	-	0.0269	34.9
26.5	-	0.0185	32.5
19.0	-	0.0136	29.6
13.2	-	0.0097	27.1
9.50	-	0.0069	24.9
6.70	-	0.0049	22.2
4.75	-	0.0034	19.6
2.36	-	0.0026	16.4
1.18	100.0	0.0014	12.6
0.600	100.0	0.0010	10.7
0.425	99.7	-	
0.300	97.7	-	
0.150	77.8	-	
0.075	52.7	-	
0.038		-	

CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

0.002 0.006 0.02 0.06 0.2 0.6 2 6 20 60

NATA ACCREDITED LABORATORY NUMBER: 3372

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Date Tested:24-26/06/2024

Name of Signatory: Luke Renkin Date Reported:28/06/2024

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Form RSN 004.16 (PSD)
Date of Issue: June 2024

Particle Size Distribution Results

TEST IN ACCORDANCE WITH AS 1289

☑ Method 3.6.1 ☑ Method 3.6.3

☑ Oven Drying Method 2.1.1

Client:	Evolution Mining Limited	**NATA Report No.:**	**R64524**
Address:	Mount Perry QLD 4671	**Job No.:**	111359.100
		Register No.:	60024
Project:	Mount Rawdon TSF Field Cover System Trials	**Location:**	QLD

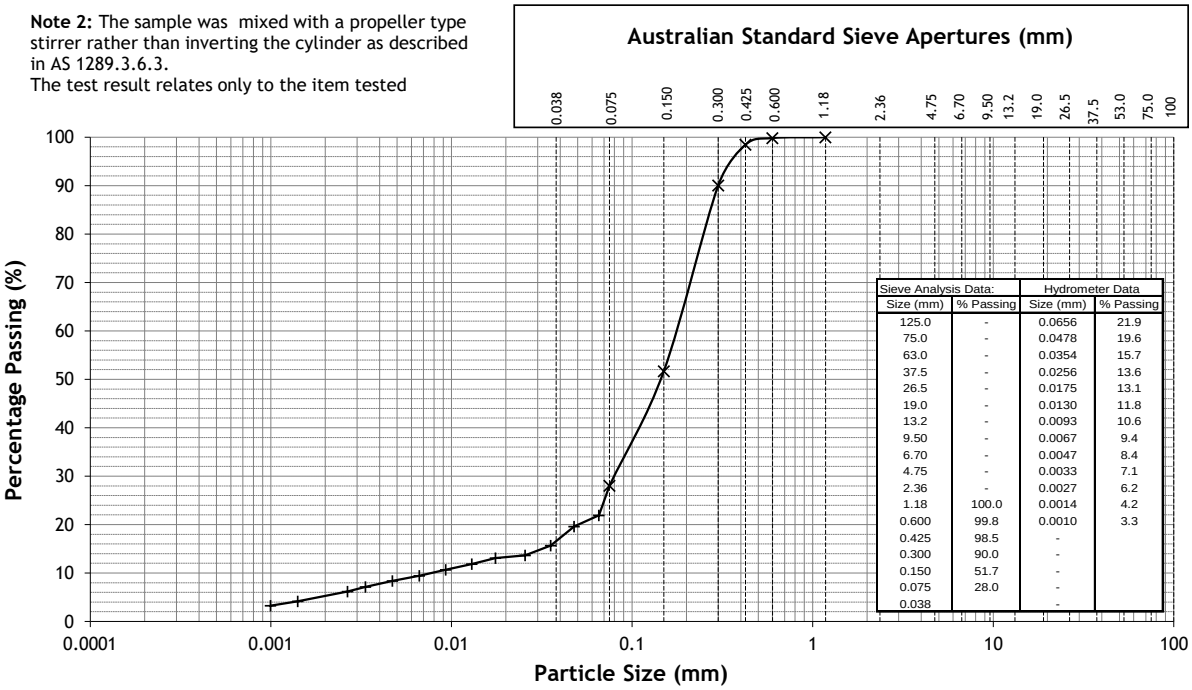
Sample Description: TSF-CRS-1	Borehole No: ☐	Test Pit Depth: ☐

Dispersion Method used: Mechanical Stirrer for 1 minute **Hydrometer Type Used:** ASTM 152H

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1 Clause 6.5.4 ☑ Sample provided by the Client

Note 1: The sample was oven-dried during sample preparation and not air-dried as stated in AS 1289.3.6.3

Note 2: The sample was mixed with a propeller type stirrer rather than inverting the cylinder as described in AS 1289.3.6.3.
The test result relates only to the item tested



Sieve Analysis Data: Size (mm)	% Passing	Hydrometer Data Size (mm)	% Passing
125.0	-	0.0656	21.9
75.0	-	0.0478	19.6
63.0	-	0.0354	15.7
37.5	-	0.0256	13.6
26.5	-	0.0175	13.1
19.0	-	0.0130	11.8
13.2	-	0.0093	10.6
9.50	-	0.0067	9.4
6.70	-	0.0047	8.4
4.75	-	0.0033	7.1
2.36	-	0.0027	6.2
1.18	100.0	0.0014	4.2
0.600	99.8	0.0010	3.3
0.425	98.5	-	
0.300	90.0	-	
0.150	51.7	-	
0.075	28.0	-	
0.038		-	

CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

0.002 0.006 0.02 0.06 0.2 0.6 2 6 20 60

NATA ACCREDITED LABORATORY NUMBER: 3372

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Date Tested:24-26/06/2024

Name of Signatory: Luke Renkin Date Reported:28/06/2024

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Form RSN 004.16 (PSD)
Date of Issue: June 2024

Determination of the Soil Particle Density of a Soil

TEST IN ACCORDANCE WITH AS 1289.3.5.1

Client: Evolution Mining Pty Ltd..... **Laboratory Report No.:R64324**.

Address: PO Box 1168, Bundaberg QLD 4670..... **Job No.:** 111359.100.....

.....

Project: Mount Rawdon TSF Field Cover System Trial..... **Location:** QLD.....

Register Number	Sample Description	Test Temperature (°C)	% of Sample >2.36 mm	Particle Density (g/cm³)
59924	TSF-FN-1	19.5	None	2.73 #
60024	TSF CRS-1	19.3	None	2.74 #

Notes:

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1

☒ Sample provided by the client

* = apparent average soil particle density – particle size less than 2.36 mm

X = apparent average soil particle density – particle size greater than 2.36 mm

= soil particle density of the total sample

The test results relate only to the items tested.

NATA ACCREDITED LABORATORY NUMBER: 3372

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory ..... Date Tested: 21/06/2024

Name of Signatory *Luke Renkin* Date Reported: 28/06/2024

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Form RSN 003.7
Date of Issue: July 2020

Classification (Atterberg Limits)

TEST IN ACCORDANCE WITH AS 1289 – CONE PENETROMETER

Client: Evolution Mining Pty Ltd..... **Laboratory Report No.: R64224**

Address: PO Box 1168, Bundaberg QLD 4670..... **Job No.:** 111359.100.....

.....

Project: Mount Rawdon TSF Field Cover System Trial..... **Location:** QLD.....

Register Number	Sample Description	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Sample Curled (CU) Crumbled (CR) Cracked (CK)
59924	TSF-FN-1	23	18	5	-	-
60024	TSF CRS-1	26	NP	-	-	-

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1, Clause

☒ Sample provided by the client

The test results relate only to the items tested.

Test Methods:

☐ Liquid Limit AS 1289.3.9.1 (Standard - Penetrometer Method)
☒ Liquid Limit AS 1289.3.9.2 (One Point – Penetrometer Method)
☒ Plastic Limit AS 1289.3.2.1
☒ Plasticity Index AS 1289.3.3.2 (Cone Plasticity Index)
☐ Linear Shrinkage AS 1289.3.4.1
☒ Moisture Content AS 1289.2.1.1

Sample Preparation:

☐ Natural Moisture ☒ Air Dried ☐ Oven Dried ☐ Unknown
☐ Wet Sieved ☒ Dry Sieved ☐ Unsieved

NATA ACCREDITED LABORATORY NUMBER: 3372

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory ..... Date Tested: 17-20/06/2024

Name of Signatory: Luke Renkin Date Reported: 28/06/2024

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Form RSN 002.9 (Atterbergs-Soils)
Date of Issue: July 2020

Minimum and Maximum Dry Density of a Cohesionless Material

TEST IN ACCORDANCE WITH AS 1289.5.5.1

Client: Evolution Mining Limited ..... **NATA Report No.: R72424** .....

Address: Mount Perry, QLD 4671 ..... **Job No.:** 111359.100 .....

.....

Project: Mt Rawdon Operation TSF Field Cover System Trials ..... **Location:** QLD .....

Register Number	Sample Description	Type of Material Size of Mould	Minimum Dry Density ρd min (t/m^3)	Maximum Dry Density ρd max (t/m^3)
60024	TSF-CRS-1	Tailing-One Litre	1.28	1.92 *

Notes:

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1

☒ Sample provided by the client

* Modification of the standard test method: Due to the high fines content of this sample, cyclic vibrating and consolidation stages were required to achieve maximum dry density.

The test results relate only to the items tested.

NATA ACCREDITED LABORATORY NUMBER: 3372

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory ..... Date Tested: 23-26/07/2024 .....

Name of Signatory Luke Renkin Date Reported: 26/07/2024

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Form RSN 015.3
Date of Issue: June 2024

Permeability – Constant Head Method

TEST IN ACCORDANCE WITH IN-HOUSE PROCEDURE 7.1.1

SAMPLE PREPARATION IN ACCORDANCE WITH

☐ **AS 1289.5.1.1** ☒ **CONSOLIDATED**

Client: Evolution Mining Pty Ltd ..... **NATA Report No.: R72524** .....

Address: PO Box 1168, Bundaberg QLD 4670 ..... **Job No.:** 111359.100 .....

.....

Project: Mount Rawdon TSF Field Cover System Trial ..... **Location:** QLD .....

Sample Register No.	59924	60024
Sample Description	TSF-FN-1	TSF-CRS-1

Sample as Prepared

Initial Moisture Content (%)	15.2	12.2
Dry Density (t/m^3)	1.78	1.82

Test Conditions

Surcharge (kPa)	13.2	12.6
Sample Height (mm)	60	60
Void Ratio (e)	0.54	0.50
Water Used	Melbourne Tap	Melbourne Tap
Conductivity of Water (µS/cm)	70	70
Hydraulic Gradient	13.9	5.3

Test Results

Permeability @ 20ºC (m/s)	2.60×10^{-8}	1.06×10^{-7}
Final Moisture Content (%)	16.9	18.4

Test Notes:

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1

☒ Sample provided by the client

The test results relate only to the items tested.

NATA ACCREDITED LABORATORY NUMBER: 3372

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory ..... Date Tested: 24-25/07/2024

Name of Signatory Luke Renkin Date Reported: 26/07/2024

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Form RSN 013.10
Date of Issue: June 2024

Soil Dry Density/Moisture Content Relation

TEST IN ACCORDANCE WITH AS 1289

☑ Method 5.1.1 (STANDARD)

☐ Method 5.2.1 (MODIFIED)

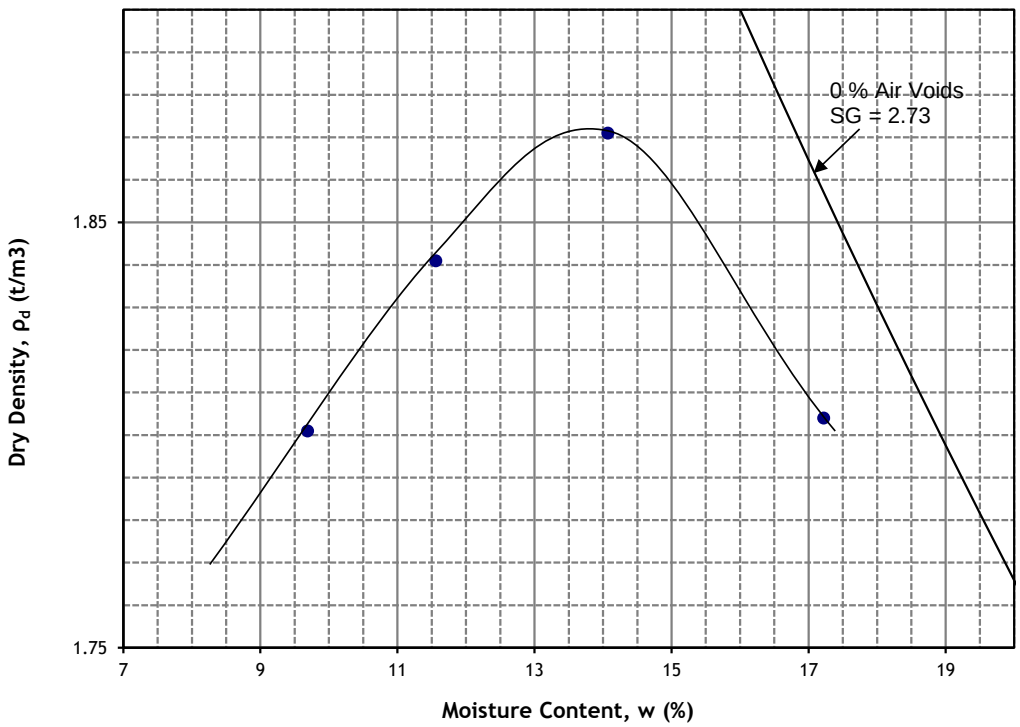
Moisture Content in accordance with AS 1289.2.1.1

Client:	Evolution Mining Limited	**NATA Report No.:**	**R72324**
Address:	PO Box 1168, Bundaberg QLD 4670	**Job No.:**	111359.100
		Register No.:	59924
Project:	Mount Rawdon Operations TSF Field Cover System Trials	**Location:**	QLD

Sample Description: TSF-FN-1	Borehole No: ☐	Test Pit Depth: ☐

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1 Clause 6.5.4

☑ Sample provided by the Client



Maximum Dry Density 1.87 t/m^3 Optimum Moisture Content 14.0 %

NATA ACCREDITED LABORATORY NUMBER: 3372

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Date Tested: 22-23/07/2024

Name of Signatory: Luke Renkin Date Reported: 26/07/2024

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