

Resource Feasibility Assessment

Proposed Bluestone Hardrock Quarry - Springvale Road, Elderslie, NSW &
Blind Creek Road, Glendon Brook, NSW

Final Report

P2410628JR01V04

April 2026

Prepared for Bluestone Hardrock Pty Ltd

environmental science & engineering

Project Details

Report Title	Resource Feasibility Assessment: Proposed Bluestone Hardrock Quarry - Springvale Road, Elderslie, NSW & Blind Creek Road, Glendon Brook, NSW
Client	Bluestone Hardrock Pty Ltd
Document	P2410628JR01V04
Director	Dr. Daniel Martens
Manager	Jeff Fulton / Ben McGiffin
Principal Author	Dr. Wasiul Bari

Document History

Issue	Issue Date	Status	Description / Comment	Author	Reviewer	Approved
1	9/09/2025	Draft	For client review	WB	RE	BM
2	30/10/2025	Draft	For client review	WB	RE	BM
2	18/12/2025	Draft	For review	WB	RE	BM
3	01/04/2026	Final	For development application	WB	RE	BM
4	30/04/2026	Final	For development application	WB	RE	BM

© Copyright Martens & Associates Pty Ltd
Suite 201, 20 George St, Hornsby, NSW 2077, Australia
ACN 070 240 890 ABN 85 070 240 890
P +61-2-9476-9999 | mail@martens.com.au | www.martens.com.au

Copyright Statement

Martens & Associates Pty Ltd (Publisher) is the owner of the copyright subsisting in this publication. Other than as permitted by the Copyright Act and as outlined in the Terms of Engagement, no part of this report may be reprinted or reproduced or used in any form, copied or transmitted, by any electronic, mechanical, or by other means, now known or hereafter invented (including microcopying, photocopying, recording, recording tape or through electronic information storage and retrieval systems or otherwise), without the prior written permission of Martens & Associates Pty Ltd. Legal action will be taken against any breach of its copyright. This report is available only as book form unless specifically distributed by Martens & Associates in electronic form. No part of it is authorised to be copied, sold, distributed or offered in any other form.

Contents

Project Details	2
Document History.....	2
Copyright Statement	2
Tables	5
Abbreviations	6
Executive Summary	7
1 Introduction	8
1.1 Overview	8
1.2 Assessment Objectives	8
1.3 Other Assessments	8
1.4 Project Details	9
1.4.1 Key Project Aspects	9
1.4.2 Indicative Staging	11
2 Site Background Information.....	12
2.1 Site Details.....	12
2.2 Location and Topographical Setting	12
2.3 Geological Setting and History	13
3 Site Assessment.....	14
3.1 Summary of Works Undertaken.....	14
3.2 Site Mapping	15
3.2.1 Walkover	15
3.2.2 Mapping Interpretation	15
3.3 Intrusive Field Investigation	16
3.4 Subsurface Materials	17
3.5 Hydrogeological Conditions	18
3.5.1 NSW Department of Primary Industries Bore Search	18
3.5.2 Borehole Observations.....	18
3.5.3 Groundwater Level Measurements.....	18
3.5.4 Conclusion	19
3.6 Conceptual Geological Model	19
4 Laboratory Testing.....	21
4.1 Overview	21
4.2 Testing Regime.....	21
4.3 Test Results	23
4.3.1 Petrographic Analysis Results	23
4.3.2 Wet / Dry Strength Variation	24
4.3.3 Laboratory Point Load strength index and UCS Testing	26

4.3.4	Particle Shape by Proportional Caliper	26
4.3.5	Fractured Faces of Coarse Aggregate	27
4.3.6	Particle Size Distribution.....	27
4.3.7	Acid Soluble Sulphate and Acid Soluble Chloride	28
4.3.8	Sugar in Aggregate	29
4.3.9	Polished Aggregate Friction Value (PAFV)	29
4.3.10	Particle Dry Density and Water Absorption.....	30
4.3.11	Sodium Sulphate Soundness	30
4.3.12	Alkali Reactivity	31
4.3.13	Methylene Blue Adsorption Value (MBVA).....	32
4.3.14	Tests Not Covered Within This Report	32
4.4	Conclusion	33
5	Resource Assessment	36
5.1	Unit Volumes, Weights and Cut Depth	36
5.2	Key Issues Impacting Resource Feasibility	36
5.3	Market Suitability.....	37
6	Conclusions and Recommendations	39
6.1	Conclusions	39
7	Limitations	40
8	References	41
	Appendix A – Maps and Figures.....	43
	Appendix B – Idealised Geotechnical Sections	48
	Appendix C – Borehole and Monitoring Well Logs.....	54
	Appendix D – Rock Core Photographs	85
	Appendix E – Petrographic Analysis Results	124
	Appendix F – Laboratory Test Certificates	154
	Appendix G – Comments on RMS3051: Traffic Category	185
	Appendix H – Important Information About Your Report.....	187
	Appendix I – Notes About This Report.....	190

Tables

Table 1: Key aspects of the Project.	9
Table 2: Summary of Site details.	12
Table 3: Mapped geological deformation events, associated structures and interpretation.	16
Table 4: Summary of groundwater monitoring results and dip measurements.	18
Table 5: Sample testing overview.	21
Table 6: Sample testing overview (continued).	22
Table 7: Wet / Dry Strength Variation test results compared to typical RMS requirements.	25
Table 8: RMS3051 and AS2758.1 specifications.	25
Table 9: Classification of laboratory tested samples in accordance with RMS3051 and AS2758.1.	26
Table 10: Point load strength index and UCS.	26
Table 11: Particle shape by proportional caliper test results compared to RMS3051 and AS2758.1 requirements.	27
Table 12: Fractured faces of coarse aggregate test results compared to RMS3051 requirements.	27
Table 13: Particle size distribution results compared to RMS3051 requirements.	28
Table 14: Acid soluble sulphate test results compared to RMS3051 requirements.	29
Table 15: Sugar in aggregate test results compared to AS2758.1 requirements.	29
Table 16: PAFV compared to RMS 3152 requirements.	30
Table 17: Particle dry density and water absorption test results compared to TfNSW specifications.	30
Table 18: Sodium sulphate soundness test results compared to AS2758.1 requirements.	31
Table 19: AS2758.1 specifications.	31
Table 20: Alkali reactivity test results compared to AS2758.1 requirements.	31
Table 21: MBVA test results compared to TfNSW Specification D&C R126 requirements.	32
Table 22: List of tests and anticipated results, not covered within this report as per typical RMS3051 and AS22758.1 requirements.	32
Table 23: Discussion and summary for failed / marginal test results.	33
Table 24: Unit volumes and weights.	36
Table 25: General market retail price guide.	38

Abbreviations

BH	Borehole
CBR	California Bearing Ratio
DP	Deposited Plan
DPIEW	NSW Department of Planning, Industries and Environment – Water
DPHI	NSW Department of Planning Housing and Infrastructure
ha	Hectare
LGA	Local Government Area
m	Metre
MA	Martens & Associates Pty Ltd
MBVA	Methylene Blue adsorption value
MW	Monitoring Well
NATA	National Association of Testing Authorities
NEFB	New England Fold Belt
mAHD	Metres, Australian height datum
mbgl	Metres below ground level
PAFV	Polished aggregate friction value
PSD	Particle size distribution
SSDA	State Significant Development Application
TIN	Triangulated irregular network
UCS	Unconfined Compressive Strength

Executive Summary

This resource feasibility assessment report has been prepared by Martens and Associates (**MA**) on behalf of Bluestone Hardrock Pty Ltd to support a State Significant Development Application (**SSDA**), SSD-76210271 to the NSW Department of Planning Housing and Infrastructure (**DPHI**) for the proposed Bluestone Hard Rock Quarry (**'the Quarry'**) at Springvale Road, Elderslie, NSW and Blind Creek Road, Glendon Brook, NSW (**'the Site'**).

The purpose of the assessment is to assess the suitability of the resource as concrete aggregate, asphalt, rip rap, road base and rail ballast in the context of hard rock quarry markets and to estimate the volume of usable resource at the Site.

In order to fulfill the assessment objectives, a scope of drilling comprising eight cored boreholes (BH101 to BH108) was undertaken within the proposed extraction pit footprint to develop a conceptual geological model was developed for the Site.

To assess encountered rock characteristics and rock property, a wide range of laboratory testing was performed on collected rock core samples. Based on the laboratory test results are presented a volume analysis of the hard rock deposits was undertaken. A total of an approximately 50 million tonnes of suitable material is expected to be available to hard rock quarry markets.

Investigation findings indicate that high quality resource is available at the Site to at least 105 mbgl or to 110 mAHD. The proposed hard rock quarry is considered feasible, subject to a detailed financial viability assessment.

1 Introduction

1.1 Overview

Martens and Associates (**MA**) was engaged by Bluestone Hardrock Pty Ltd to carry out a resource feasibility assessment to support the Environmental Impact Statement (EIS) relating to a State Significant Development Application SSD-76210271 to the NSW Department of Planning Housing and Infrastructure (DPHI) for the proposed Bluerock Quarry (**'the Quarry'**) at Springvale Road, Elderslie, NSW and Blind Creek Road, Glendon Brook, NSW (**'the Site'**). The Site comprises a group of adjoining lots to the northeast of Springvale Road. The Site location is shown on Map 01, Appendix A.

This resource feasibility assessment was undertaken in general accordance with the agreed scope of work outlined in MA's proposal P2410628BC02V01, dated 4 April 2024.

1.2 Assessment Objectives

The objectives of this assessment include:

1. Assess ground conditions and develop a conceptual geological model for the Site.
2. Assess likely groundwater levels and potential implications on quarry development.
3. Review laboratory test results against relevant standards / guidelines to assess the suitability of the Site materials as a resource.
4. Provide appropriate comment on suitability of the resource (concrete aggregate, asphalt, rip rap, road base and rail ballast) in the context of hard rock quarry markets.
5. Carry out a volume analysis of the hard rock deposits potentially available at the Site.
6. Highlight key issues impacting the resource feasibility assessment.
7. Outline recommendations for additional assessments, where necessary.

1.3 Other Assessments

The following assessments were undertaken by MA in conjunction with the Resource Feasibility Assessment to support the EIS:

1. A geotechnical and pit staging assessment. Results of the assessment are presented in MA's report referenced P2410628JR03V03, dated April 2026 (MA, 2026a).
2. A hydrogeological impact assessment. Results are presented in MA's report referenced P2410628JR06V02, dated April 2026 (MA, 2026b).

Reference has been made to the findings of the above assessments, where necessary.

1.4 Project Details

1.4.1 Key Project Aspects

The Project is a quarry for the extraction of hard rock and gravel to supply aggregate and conglomerate suitable for road base and concrete batching in the local region. The Project site is within the locality of Elderslie and Glendon Brook, approximately 10 km northwest of the community of East Branxton, NSW.

The key aspects of the Project are provided in Table 1.

Table 1: Key aspects of the Project.

Project Element	Summary of the Project
Proposed Development	Hard rock quarry
Resource Extraction Method	Traditional drilling and blasting.
Resource	Quarry extraction of high-quality Tuff and Agglomerate from a reduced level (RL) of 215 mAHD down to 110 mAHD.
Project Site Area	186 ha
Disturbance Areas	Total disturbance area is approximately 63.4 ha. Individual disturbance area at different locations is as follows: • 37.8 ha - Pit Area. • 4.3 ha - Stockpile and Laydown Area. • 16.2 ha - Processing Area. • 0.5 ha - Weighbridge and Office Area. • 1.3 ha - Haul Road 1. • 3.3 ha - Haul Road 2.
Annual Production	Up to 1,000,000 tonnes.
Quarry Life	Up to 30 Years (under this application).
Potential Resource Life	Up to 50 years.
Hours of Operation	- Extraction and processing operations: • Monday to Friday: 7:00am to 5:00pm. • Saturday: 8:00am to 1:00pm. - Internal product transfers to stockpiles: • Monday to Friday: 7:00am to 5:00pm. • Saturday: 8:00am to 1:00pm. - Haulage from the development site: • 6:30am to 4:00pm Monday to Friday. • No haulage on Saturday, Sunday or a Public Holiday. - Drilling and Blasting activities: • Blasting between 9:00am to 5:00pm Monday to Friday only. On average one (1) blast per week, carried out by an external contractor. - Maintenance activities: • 6:00am to 6:00pm (Monday to Saturday).

Project Element	Summary of the Project
	- No work on Sundays and Public Holidays. 6. Construction hours: 7:00am to 5:00pm (Monday to Saturday). 8:00am to 3:00pm (Saturday). - No work on Sundays and Public Holidays.
Operational Workforce	At full operation, up to 15 full-time staff, with further support from the local and regional construction industry and associated haulage contractors.
Product Transport	- Road haulage of product via semi-trailer / truck and dog trailer. - On average 110 laden trucks per day in order to meet peak production. - Maximum of 30 laden trucks per hour at peak rates. - Maximum daily extraction rate of 7,000 tonnes per day.
Transport Route	- The road transport route from the Site extends over approximately 13km from the Site entrance to the Hunter Expressway interchange at Branxton. The road transport route incorporates Springvale Road, Stanhope Road, Elderslie Road and the New England Highway. Elderslie Road was previously used by the Great Greta Coal Mine to haul coal. - The road transport route includes use of the Elderslie Bridge which crosses the Hunter River. The bridge is located 600m south of the intersection of Elderslie Road and Stanhope Road and has a mass restriction of 50 tonnes.
Water Management	Erosion and sediment control devices such as catch drains, road drainage, dirty water dams and clean water dams.
Utilities	- Power supply from existing electricity network and diesel generators. - Water supply sourced from onsite dams, surface water runoff, and rainwater tanks. Potable water imported as needed.
Operational Activities and Areas	- Site office and employee facilities. - Car parking. - Existing site access from Springvale Road via Haul Road 1 (sealed) to Weighbridge and Office Area. - Use of Haul Road 1 and Haul Road 2. - Workshop and fuel storage – to be initially located at the Weighbridge and Office Area. - Fuel and supply deliveries. - Equipment storage. - Waste management. - Equipment parking areas. - Processing Area including crusher and screening plant. - Raw material stockpiles. - Product stockpiles and truck loading areas. - Truck parking. - Weighbridge. - Environmental management measures including road watering, site rehabilitation, etc. - Use of ancillary plant and equipment.

Project Element	Summary of the Project
Rehabilitation	Rehabilitation will initially be limited to areas of immediate disturbance such as road batters, access road construction and sediment dams. Progressive rehabilitation of the quarry benches will occur as they become available, with the majority of the rehabilitation taking place at the completion of resource extraction when the quarry floor, stockpile areas, and portions of the infrastructure areas will be rehabilitated.

1.4.2 Indicative Staging

This section provides a detailed description of the scope of works for which approval is sought and the basis on which the EIS has been undertaken. The Project will be completed in four stages, which will involve:

- **Stage 1 (Year 0 – Year 4):**
 - Construction of Haul Road 1 (approximately 750 m long) from Springvale Road to the Processing Area including:
 - The sealing of the haul road to the Weighbridge and Office Area.
 - Construction of creek crossings, sediment basins and water storage dams.
 - Construction of terraced platforms for the material plant processing at the end of Haul Road 1 to the southeast of the pit area over an area of approximately 10 ha.
 - The extracted materials from this area will be used for construction of roads and infrastructure for the project. Any surplus materials will be stockpiled within a designated area for later sales. The quantity of this material was not included in our volume calculation.
- **Stage 2 (Year 4 – Year 5):** Construction of Haul Road 2 from the Processing Area to the Pit Area, passing the proposed Stockpile and Laydown Area. Haul Road 2 will extend approximately 750 m into the extraction pit area to create access to the northern end of the pit to allow extraction in that area of the pit.
- **Stage 3 (Year 5 – Year 30):**
 - Establishment of a quarry extraction pit over an area of approximately 33.7 ha in the northern portion of the Site and extraction of hard rock up to 135 mAHD with potential additional future extraction up to 110 mAHD.
- **Stage 4 (Year 30 – Year 35):** Pit closure and rehabilitation. The operational area of the quarry, including the pit area, will be progressively rehabilitated during operation and following the end of the quarry operational period (i.e. Stage 3).

The main quarry components and their relative location within the Site are shown on Map 01, Appendix A.

2 Site Background Information

2.1 Site Details

A summary of general site details is provided in Table 2.

Table 2: Summary of Site details.

Item	Description / Comment
Legal Property Description ('the Site')	The proposed quarry site will comprise the following four properties: • Lot 65 DP 752473, Blind Creek Road, Glendon Brook. • Lot 904 DP 1061259, Blind Creek Road, Elderslie. • Lot 903 DP 1061259, Blind Creek Road, Elderslie. • Lot 5 DP 1102521, 253 Springvale Road, Elderslie.
Local Government Area (LGA)	Singleton Shire Council (Council)
Site Area	The four properties (i.e. lots) associated with the proposed quarry site cover an area of approximately 186 ha.
Site Access (refer to Map 01, Appendix A)	The proposed single point access to the Site for light and heavy vehicles is located at the northern end of Springvale Road, which is an unmarked 2-lane sealed no-through road of variable width and maintained by Council. The site entrance is approximately 2.1 km north of the Stanhope Road and Springvale Road intersection, with the Stanhope Road and Elderslie Road intersection located a further 2 km to the south-west in the vicinity of the Hunter River.
Current Land Use	Currently, the development area predominately comprises mature woodland with small, cleared areas for cattle grazing and informal vehicle access track extending from the toe to the crest of the ridge. Scattered dams exist across the Site.
Proposed Land Use	Hard rock quarry extraction and processing.
Neighbouring Environment	The Site is surrounded by agricultural land (primarily cattle grazing) to the north, west and south, with National Park land to the east.
Vegetation	The Site is covered predominately in dense bush. Some areas were cleared for cattle grazing, firebreaks and an informal vehicle access.

2.2 Location and Topographical Setting

The development area of the Quarry is situated along two northwest – southeast striking ridgelines and saddles with elevations ranging between approximately 55 mAHD near the toe of a west facing ridgeline slope in the southeastern portion and 220 mAHD on a ridge crest in the northwestern portion of the Site (refer Map 02, Appendix A). The Site is characterised by steeper west facing ridgeline slope of grades approximately 60 %. The eastern faces of the ridgeline and southern portion of the Site is characterised by gentle to moderate slopes of grades between approximately 10 % and 30 % towards the east. Site topography, inclusive of the proposed Quarry footprint, is presented on Map 02, Appendix A.

2.3 Geological Setting and History

The Site is located within the southern part of the New England Fold Belt (**NEFB**). The NEFB extends approximately 1,500 km, from northern QLD to NSW, where it is bordered to the south and southwest by the Sydney Basin. The southern province of the NEFB has undergone significant deformation since its deposition during the Late Devonian – Carboniferous (~330-350 Ma) eras. The dominant geological features are a series of oroclines (sharp bends) (Rosenbaum et al, 2012). The Tamworth Belt, which was formed as part of an accretionary wedge and forearc basin, is located within the southern portion of these oroclines. The Tamworth Belt is characterized by arc related basin fill that has been folded into a series of elongated, typically dome like features of double-plunging anticlines and synclines (Korsch, 1977). The Tamworth Belt has subsequently been split into numerous terranes defined by major faults: Emu Creek, Rouchel, Gresford, Myall and Hastings Blocks (Roberts et al, 1991). The Site is situated within the southwestern portion of the allochronous Gresford Block, in close proximity to the Hunter – Mookie thrust fault that resulted in major east - west compression and shortening of the region.

The Site and the areas bounding the Site are underlain primarily by the following geological units of Middle Mississippian (346.7 - 330.9 Ma) era (MinView, 2025):

- Grey andesitic and the red rhyodacitic ignimbrite (pyroclastic rock) of the Breckin Ignimbrite Member (Cgimb) associated with the Mowbray Formation of the Gilmore Volcanic Group.
- Blue-grey, red-mottled welded andesitic ignimbrite with minor interbeds of beige to grey dacitic ignimbrite (pyroclastic rock) associated with the Martins Creek Ignimbrite Member (Curim) of the Isismurra Formation.
- Red to purple lithic sandstone; red, purple, or green siltstone; pebble conglomerate (agglomerate) with interbedded rhyolitic and rhyodacitic ignimbrite (siliciclastic sedimentary rock) associated with the Newtown Formation (Cgin) of the Gilmore Volcanics Group.

The outcrop zones of the geological units are shown on Map 04, Appendix A.

3 Site Assessment

3.1 Summary of Works Undertaken

Our scope of works comprising a walkover inspection and intrusive investigations including installation of groundwater monitoring wells were devised to characterise the quarry's geotechnical conditions, determine permanent groundwater conditions at the site and to recover subsurface rock samples for laboratory testing. A summary of works undertaken at the Site is presented below:

1. Site walkover inspection to review local geology, topography, soil exposures, surface hydrology, drainage and relevant site features including surface mapping.
2. Topographic and surface mapping lineament analysis.
3. Drilling of eight boreholes by rock hammering to inferred top of rock followed by HQ rock coring.
4. Installation of five groundwater monitoring wells and data loggers for long term groundwater level monitoring.
5. Collected rock samples were tested for:
 - A. Petrographic analysis.
 - B. Wet / dry strength variation (T215).
 - C. Acid soluble sulphate content (T219).
 - D. Sugar in aggregates.
 - E. Sodium sulphate soundness.
 - F. Polished aggregate friction test (PAFV value).
 - G. Coarse particle density & water absorption.
 - H. Alkali reactivity (T363).
 - I. Methylene Blue value (T659).
 - J. Particle shape distribution (T106).
 - K. Particle shape by proportional calliper (T213).
 - L. Fractured faces of coarse aggregate (T239).

3.2 Site Mapping

3.2.1 Walkover

Site walkover inspections and site mapping were undertaken on 19 September 2017 and 30 May 2025. Key observations during our site mapping are summarised below:

- Rock outcrops were scattered, generally limited to cuttings, with minor exposures along peaks and crests. Rock 'floaters' in a soil matrix were abundant on slope faces.
- Two distinguishable rock units (tuff and agglomerate) were identified from exposures across the Site.
- Distinctly weathered and faulted agglomerate was exposed by an access road cutting into the mid – upper slopes in Lots 65 (DP 752473) and 904 (DP 1061259). Exposed thickness was typically up to 1.5 m, overlain with approximately 1.0 m of soil.
- Contact between agglomerate and tuff was encountered in Lots 5 (DP 1102521) and 903 (DP 1061259) along an inferred west – southwest / east – northeast direction.
- Evidence of small historical landslides was observed in close proximity to the southwest and to the east of the proposed pit, particularly in the vicinity of natural drainage channel (refer Figure 3, Appendix A).

3.2.2 Mapping Interpretation

Based on the findings of our desktop review and field mapping, three prevalent geological deformation events and associated faulting and jointing appear to affect the Site as described in Table 3.

Table 3: Mapped geological deformation events, associated structures and interpretation.

Deformation Event ¹	Regional Direction	Mapped Strike (°) of Structures ²	Measured Dip(s) (°) of Structures ²	Field Description
D1	E – W compression (thrusting)	340 310 330 330	78 (W) 60 (SW) 60 (SW) 20 (NE)	Splayed steep faulting and jointing dipping to the west – southwest and shallow jointing dipping to the northeast, propagating from thrusting of Tamworth Belt during the Hunter – Mookie reverse thrust event. Where measurable, spacing between joints in order of 15 cm to 50 cm.
D2	N – S expansion	072 100 088	41 (S) ³ N/A 48 (S) ³	Large fault zones cross-cutting north – south trending geology.
Late Stage	NW – SE expansion	030	12 (SE)	Pervasive cross cutting joints with spacing between 15 cm to 20 cm.

Notes:

¹ Preliminary deformation event name, nomenclature may not be comparable to works outside of this study.

² Refer to Figure 3, Appendix A for mapped locations.

³ Low confidence value from lack of repeatable measurable structures in outcrop.

Results from the field mapping investigations were combined with topographic maps into a preliminary lineament analysis to generate a sitespecific geological map and model to aid subsurface investigations (Figure 3, Appendix A).

Key assumptions, based on available data, to generate Figure 3 include:

- Inferred geological boundary positions between Mowbray Formation, Isismurra Formation and Newtown Formation.
- Potential transition from tuff to agglomerate within the Site from between approximately 148.5 mAHD in the western portion and 67.0 mAHD in the southeastern portion of Site.
- Average dip of 10° towards the northeast adopted as geological formation contact based on field mapping of rock defects, thought to be associated with the D1 compressional event.
- The thickness of rock units do not account for potential variation due to faulting and thrusting across the site.

3.3 Intrusive Field Investigation

Scope of subsurface investigation works included:

- Drilling of eight boreholes (BH101 to BH108) to characterise subsurface conditions within the footprint of the proposed extraction pit, along the northwest trending ridgeline. Out of the eight boreholes, BH101 to BH104 was

undertaken by MA and drilling of BH105 to BH108 was completed by the client with cores stored onsite in Elderslie. One geotechnical engineer from MA had inspected, logged and sampled the cores prior to preparation of this report. Details of encountered subsurface conditions are provided on borehole logs, Appendix C.

- Installation of 5 monitoring wells in MW01 (BH102), MW02 (BH103), MW03 (BH104), MW04 (BH107) and MW05 (BH106) for groundwater level monitoring. Details of monitoring well construction are provided in Appendix C.
- Installation of water level and barometric pressure loggers in monitoring wells for continuous groundwater monitoring.
- Laboratory testing of sixteen rock core samples to assess suitability for use as concrete aggregate, asphalt aggregate, rip rap, road base and/or rail ballast.

Intrusive investigation locations are shown in Map 03, Appendix A.

3.4 Subsurface Materials

Site observations and intrusive investigations identified three general subsurface units as described below:

Unit 1: Soil

Soil profiles within the investigation area were shallow, extending generally to between 0.2 m and 2.4 mbgl. A deeper soil profile of up to 7.7 mbgl was encountered in BH103, although some of this profile may have included layers of extremely weathered agglomerate. Anecdotal evidence indicates BH103 likely to be located in an area that has previously experienced shearing. This could have contributed to the deeper soil profile.

Typically, shallow to moderate deep soils are expected across the majority of site (i.e. thickness < 1.5 m). This material will be stripped and stockpiled for potential sale or reuse during the rehabilitation of the quarry.

Unit 2: Tuff

Tuff was encountered in BH102 to BH106 to a maximum (investigation termination) depth of approximately 64.11 mbgl (BH105) and in BH101, BH107 and BH108 up to between approximately 11 mbgl (BH101) and 32.7 mbgl (BH108). Unit 2 comprise two distinct subunits:

Unit 2A: Very hard, grey and red crystal rich andesite tuff with light grey, white and greyish black phenocrysts.

Unit 2B: Generally very hard, blue-grey, red-mottled with beige to grey crystal-lithic rhyodacite tuff with very light grey to white phenocrysts.

We note that Minview? describes Unit 2 as ignimbrite, which is a specific type of welded tuff. However, considering the wide variation in mineral composition of the tested rock samples, we have adopted the broader term Tuff for Unit 2.

Unit 3: Agglomerate

Weathered agglomerate was encountered below Unit 2 in BH101, BH107 and BH108 up to investigation termination depths of between 20.1 mbgl (BH101) and 69 mbgl (BH108). This mainly comprises mixed varying-coloured gravels and cobbles cemented in a grey, purple and green aphanitic matrix. Where weathering and / or faulting has occurred within this layer, the matrix has altered to silty clay and clay, resulting in zones with reduced rock strength.

Refer Appendix C for borehole and monitoring well logs. Explanatory notes are presented in Appendix I. For rock core photos, refer to Appendix D. Intrusive investigation locations are shown in Map 03, Appendix A.

3.5 Hydrogeological Conditions

3.5.1 NSW Department of Primary Industries Bore Search

A review of NSW Department of Planning, Industry and Environment – Water (**DPIEW**) groundwater bore database did not identify groundwater bores within 2000 m of the Site.

3.5.2 Borehole Observations

Groundwater inflow was not encountered during drilling of boreholes up to a maximum of 7.7 mbgl. Groundwater conditions below this depth could not be observed due to the introduction of drilling fluids during HQ3 rock coring.

3.5.3 Groundwater Level Measurements

Five groundwater monitoring wells were installed, and data loggers were positioned in each well for continuous groundwater monitoring. Groundwater monitoring with data loggers is ongoing at the time of preparing this report. Standing groundwater levels in the groundwater monitoring wells were measured on various dates using a dip meter. A summary of dipped standing groundwater level readings in MW01 to MW05, are provided in Table 4. Refer to the hydrogeological impact assessment report (MA, 2026b) for further information on groundwater monitoring results and findings of the detailed groundwater assessment.

Table 4: Summary of groundwater monitoring results and dip measurements.

Bore ID	Surface Elevation (mAHD) ¹	Standing Water Level (mbgl / mAHD)					
		20/01/2025	7/04/2025	8/01/2025	9/04/2025	14/05/2025	17/07/2025
MW01 / BH102	119.96	22.60 / 97.36	22.64 / 97.32	22.50 / 97.46	23.04 / 96.92	22.90 / 97.06	22.31 / 97.65
MW02	168.89	33.65 /	33.55 /	33.95 /	NA ²	33.76 /	Dry

Bore	Surface	Standing Water Level (mbgl / mAHD)					
/ BH103		135.24	133.34	132.94		133.13	
MW03 / BH104	218.06	33.94 / 184.12	33.90 / 184.16	33.92 / 184.14	33.87 / 184.19	33.83 / 184.23	33.90 / 184.16
MW04 / BH107	173.14	NA ²	NA ²	NA ²	43.95 / 129.19	43.07 / 130.07	43.17 / 129.97
MW05 / BH106	140.54	NA ²	17.00 / 123.54	17.20 / 123.34	17.11 / 123.43	17.05 / 123.49	16.09 / 124.45

Notes:

¹ Surface elevation from DWC, 2025.

² Not Applicable.

3.5.4 Conclusion

Based on our observation and dipped groundwater level measurements as well as engineering judgement, we conclude that:

- Groundwater levels across the Site typically vary between 184.2 mAHD (in the western portion) and 97.6 mAHD (in the southern portion).
- Proposed rock extraction up to approximately 135.0 mAHD is expected to intercept the permanent groundwater table across the Site.
- A groundwater assessment and construction dewatering management report will be required to support a Water Supply Works (WSW) approval from WaterNSW in accordance with the Water Management Act (2000).

3.6 Conceptual Geological Model

Based on site investigations and interpretations as well as engineering judgement, it is considered feasible that the primary resource unit is likely to extend to significant depth (and therefore thickness). The following material unit depths have been assigned for resource feasibility assessment:

- Unit 1 (Soil): From ground surface to an average 1.5 mbgl, above Unit 2 and / or Unit 3.
- Unit 2 (Tuff): From topographic elevation of between approximately 220 mAHD and 162 mAHD up to between approximately 136 mAHD and the 50 years extraction period base level of the pit (i.e. 110 mAHD). Typically, top 10 m of this unit is likely to be highly to moderately weathered while the remaining thickness in the bottom portion of the pit is expected to be slightly weathered to fresh. We have inferred that the volume of the moderately weathered tuff is approximately 10% of the total volume of tuff (i.e. Unit 2).

- Unit 3 (Agglomerate): From topographic elevation of between approximately 162 mAHD and 125 mAHD to 110 mAHD (i.e. the 50 years extraction period base level of the pit). Similar to Unit 2, in general, top 10 m of Unit 3 is observed to be highly to moderately weathered while the remaining thickness in the bottom portion is expected to be moderately to slightly weathered. We have inferred that the volume of the moderately to highly weathered agglomerate is approximately 10% of the total volume of Unit 3.

The above depth assumptions are to be refined based on observations of the rock profile during quarry operation. Idealised geological sections are presented in Drawing Nos. PS03-C600 to PS03-C603, included as Appendix B.

4 Laboratory Testing

4.1 Overview

To assess encountered rock characteristics, one slightly weathered surface sample and three slightly weathered borehole samples were collected and submitted to Geochempet Services, under chain of custody conditions, for rock classification via petrographic analysis. Laboratory reports of petrographic analysis are provided in Appendix E.

A further a surface sample and eleven distinctly weathered and slightly weathered to fresh rock core samples were submitted to Resource Laboratories, a National Association of Testing Authorities, Australia (**NATA**) accredited laboratory, for rock property testing (particle size distribution, wet and dry strength and wet and dry strength variation, particle shape by proportional caliper, fractured faces of coarse aggregate, acid soluble sulphate, uniaxial compressive strength, point load strength index, sugar in aggregates, sodium sulfate soundness, polished aggregate friction test, coarse particle density & water absorption, alkali reactivity and methylene blue value). Laboratory test certificates are provided in Appendix F.

4.2 Testing Regime

Samples were selected to enable rock characterisation and define rock properties across both distinct lithologies, and rock conditions encountered. An overview of the testing regime is provided in Table 5 and Table 6. Tests were selected as typically required by TfNSW or former Roads and Maritime Services (RMS) for road pavements (e.g. RMS QA Specification 3051, Edition 6, Revision 5) and for use as coarse concrete aggregates in accordance with AS2758.1 (2014) *Aggregates and rock for engineering purposes: Concrete aggregates*.

Table 5: Sample testing overview.

Sample ID (Unit and Sample Location)	Laboratory Test							
	Petrographic ¹	AS1141.22 ²	T105 ³	T106 ⁴	AS1141.13 / T213 ⁵	T215 ⁶	AS1012.20.1 / T219 ⁷	T239 ⁸
BH108/31.0- 31.1 (Unit 2 – Tuff)	X	-	-	-	-	-	-	-
BH105/33.07- 33.24 (Unit 2 – Tuff)	X	-	-	-	-	-	-	-
10628/Surfac e/01 (Unit 2 – Tuff, near BH102)	-	-	-	-	X	-	-	-
BH105/30.0- 40.0 (Unit 2 – Tuff)	-	X	-	-	-	-	X	-

Sample ID	Laboratory Test							
BH106/0.72-10.0 (Unit 2 – Tuff)	-	X	-	-	-	-	X	-
6007/surface/0/R/1 (Unit 2 – Tuff, near BH102)	X	-	X	-	-	X	X	-
6007/BH101/R/3-3.18 (Unit 3 – Agglomerate)	X	-	-	-	-	-	-	-
6007/Agglomerate (Unit 3 – Agglomerate, near BH101)	-	X	X	X	X	-	X	X
6007/BH103+ BH104/18-22.0m (Unit 2 – Tuff, combined core from BH103 and BH104)	-	X	X	X	X	-	X	X

Notes:

¹ Petrographic analysis for methods C295 (Petrographic Assessment of Aggregates for Concrete), AS2758.1 (Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B)) and HB 79 (Alkali Aggregate Reaction – Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia).

² AS1141.22 Wet / Dry Strength Variation (Single).

³ RMS T105: Preparation of Samples for Testing.

⁴ RMS T106: Coarse Particle Size Distribution of Road Construction Materials.

⁵ AS1141.13 / RMS T213: Particle Shape by Proportional Caliper.

⁶ RMS T215: Wet / Dry Strength Variation.

⁷ AS1012.20.1: Acid Soluble Sulfate and chloride / RMS T219: Acid Soluble Sulfate.

⁸ RMS T239: Fractured Faces of Coarse Aggregate.

Table 6: Sample testing overview (continued).

Sample ID	Laboratory Test							
	UCS ¹	PLT ²	AS1141.35 ³	AS1141.6.1 ⁴	AS1141.41 ⁵ & AS1141.42 ⁶	AS1141.24 ⁷	T363 ⁸	T659 ⁹
BH105/34.18 – 34.35 (Unit 2 – Tuff)	X	-	-	-	-	-	-	-
BH105/39.70 – 40.00 (Unit 2 – Tuff)	X	-	-	-	-	-	-	-

Sample ID	Laboratory Test							
BH106/2.52 – 2.82 (Unit 2 – Tuff)	X	-	-	-	-	-	-	-
BH108/37.49 – 37.70 (Unit 3 – Agglomerate)	X	-	-	-	-	-	-	-
BH106/5.58-5.78 (Unit 2 – Tuff)	-	X	-	-	-	-	-	-
BH106/7.00-7.15 (Unit 2 – Tuff)	-	X	-	-	-	-	-	-
BH106/9.28-9.39 (Unit 2 – Tuff)	-	X	-	-	-	-	-	-
10628/Surface/01 (Unit 2 – Tuff, near BH102)	-	-	-	-	X	-	-	-
BH105/30.0-40.0 (Unit 2 – Tuff)			X	X		X	X	X
BH106/0.72-10.0 (Unit 2 – Tuff)			X	X		X	X	X

Notes:

¹ Uniaxial Compressive Strength (UCS).

² Point Load Strength Index Test (PLT).

³ AS1141.35: Sugar in Aggregate.

⁴ AS1141.6.1: Coarse Particle Density & Water Absorption.

⁵ AS1141.41: Preparation of Samples for Testing.

⁶ AS1141.42: Polished Aggregate Friction Value (PAFV).

⁷ AS1141.42: Sodium Sulphate Soundness.

⁸ RMS T363: Accelerated Mortar Bar Test for the Assessment of Alkali-Reactivity of Aggregate.

⁹ RMS T659: Methylene Blue Adsorption Value of Road Construction Material.

4.3 Test Results

4.3.1 Petrographic Analysis Results

1. Sample 10628/BH108/31.0-31.1: Crystal-lithic Rhyodacite Tuff (Unit 2)

Petrographic laboratory reports identified sample 10628/BH108/31.0-31.1 as crystal-lithic rhyodacite tuff. For engineering purposes, the sample can be summarised as 65 % hard durable materials, moderately strong and is predicted to be moderately durable and mild or slow deleterious alkali-silica reactivity concrete.

Due to the aforementioned characteristics, the sample is predicted to be suitable for use as a source of concrete aggregate, roadbase and rail ballast as well as asphaltic aggregate.

2. Sample 10628/BH105/33.07-33.24: Crystal Rich Andesite Tuff (Unit 2)

Petrographic laboratory reports identified sample 10628/BH105/33.07-33.24 as crystal rich andesite tuff. For engineering purposes, the sample can be summarised as hard, strong and is predicted to be durable and mild or slow deleterious alkali-silica reactivity concrete.

Due to the aforementioned characteristics, the sample is predicted to be suitable for use as a source of concrete aggregate, roadbase and rail ballast as well as asphaltic aggregate.

3. Sample 6007/surface/0/R/1: Latite Tuff (Unit 2)

Petrographic laboratory reports identified sample 6007/surface/0/R/1 as latite tuff. For engineering purposes the sample can be summarised as hard, strong and is predicted to be durable and innocuous in relation to alkali-silica reactivity in concrete.

Due to the aforementioned characteristics, the sample is predicted to be suitable for use as a source of concrete aggregate as well as asphaltic aggregate, rail ballast and rip rap.

4. Sample 6007/BH101/R/3-3.18: Latite Agglomerate (Unit 3)

Petrographic laboratory reports identified sample 6007/BH101/R/3-3.18 as latite agglomerate. For engineering purposes the sample can be summarised as essentially hard and strong and is predicted to be essentially durable, however, fracture veins may cause the rock to fail into smaller pieces. The sample is also predicted to be innocuous in relation to alkali – silica reactivity in concrete.

Due to the aforementioned characteristics, the sample is predicted to be suitable for use as a source of concrete aggregate and road base.

4.3.2 Wet / Dry Strength Variation

Wet test results are outlined in Table 7. Typical RMS3051 and AS2758.1 specifications are outlined in Table 8 with sample classification in accordance to RMS3051 and AS2758.1 presented in Table 9.

Table 7: Wet / Dry Strength Variation test results compared to typical RMS requirements.

Sample & Unit ID	Test Method ¹	Results			
		Significant Breakdown	Wet Strength (kN)	Dry Strength (kN)	Wet Dry Strength Variation (%)
10628/BH105/30.0-40.0 (Unit 2 – Tuff)	AS1141.22	Yes	284	289	2
10628/BH106/0.72-10.0 (Unit 2 – Tuff)	AS1141.22	Yes	94	200	53
6007/surface/0/R/1 (Unit 2 – Tuff)	T215	No	230	248	7
6007/Agglomerate (Unit 3 – Agglomerate)	AS1141.22	Yes	63	115	45
6007/BH103+ BH104/18-22.0m (Unit 2 – Tuff)	AS1141.22	Yes	145	203	29

Notes:

¹ RMS requires testing to T215. AS1141.22 was conducted where not enough sample available.

Table 8: RMS3051 and AS2758.1 specifications.

Standard	Specification		Classification
	Wet Strength (kN)	Wet Dry Strength Variation (%)	
RMS3051	> 100	< 35	DBG20 (HD) – Traffic Category A ¹
	> 70	< 35	DGB20 - Traffic Categories B, C and D ¹ DGS20 - Traffic Categories A and B ¹ DGS40 - Traffic Categories A and B ¹
	> 50	< 40	DGS20 – Traffic Categories C and D ¹ DGS40 – Traffic Categories C and D ¹
AS2758.1 ²	50	45	A1, A2 ²
	80	35	B1, B2 ²
	100	25	C ²

Notes:

¹ RMS3051 classification from Table 3051.3, RMS3051 (2014). AS2758.1 classification from Table 3, AS2758.1 (2014). Refer to Appendix G for traffic category description.

² Concrete Exposure Classification from Table 3 AS2758.1 (2014).

Table 9: Classification of laboratory tested samples in accordance with RMS3051 and AS2758.1.

Sample & Unit ID	RMS3051 Traffic Category Classification ¹	Concrete Exposure Classification ²
10628/BH105/30.0-40.0 (Unit 2 – Tuff)	DBG20 (HD) – Traffic Category A	C
10628/BH106/0.72-10.0 (Unit 2 – Tuff)	NR ³	NR ³
6007/surface/0/R/1 (Unit 2 – Tuff)	DBG20 (HD) – Traffic Category A	C
6007/Agglomerate (Unit 3 – Agglomerate)	NR ³	A1, A2
6007/BH103+ BH104/18.0-22.0m (Unit 2 – Tuff)	DBG20 (HD) – Traffic Category A	B1, B2

Notes:

¹ RMS3051 classification from Table 3051.3, RMS3051 (2014). Refer to Appendix G for traffic category description.

² AS2758.1 classification from Table 3, (AS2758.1, 2014).

³ No Rating; Sample failed to meet specification.

4.3.3 Laboratory Point Load strength index and UCS Testing

Laboratory point load strength index and UCS test results are summarised in Table 10. Rock core photos are provided in Figures 4 to 27, Appendix D, for reference.

Table 10: Point load strength index and UCS.

BH	Depth (mbgl)	Rock Type	Point Load Strength Index $I_{s(50)}$ (MPa)		UCS (MPa)	Rock Strength Classification ²
			Diametral	Axial		
BH105	34.18 – 34.35	TUFF	NA	NA	290	Extremely high
	39.70 – 40.00	TUFF	NA	NA	260	Extremely high
BH106	2.52 – 2.82	TUFF	NA	NA	56.0	High
	5.58 – 5.78	TUFF	1.3	0.78	15.6 – 26.0 ¹	Medium to high
	7.00 – 7.16	TUFF	1.9	0.22 ³	38.0 ¹	High
	9.28 – 9.39	TUFF	4.3	5.7	86.0 – 114.0 ¹	Very high
BH108	37.49 – 37.70	AGGLOMERATE	NA	NA	5.8	Medium

Notes:

¹ Unconfined compressive strength (axial) of intact material, assuming $UCS = 20 \times I_{s(50)}$.

² Strength classification based on AS1726 (2017).

4.3.4 Particle Shape by Proportional Caliper

Particle shape by proportional caliper, compared to typical RMS and AS2758.1 requirements, are outlined in Table 11.

Table 11: Particle shape by proportional caliper test results compared to RMS3051 and AS2758.1 requirements.

Sample & Unit ID	Results				RMS and AS2758.1 Specification ^{1, 2}
	Flat Particles (%)	Flat and Elongated Particles (%)	Elongated Particles (%)	Total Misshapen Particles (%)	Total Misshapen Particles (%)
10628/Surface/01	19	0	6	25	< 35
6007/Agglomerate (Unit 3 – Agglomerate)	21.2	10.2	0.3	32	
6007/BH103+ BH104/18-22.0m (Unit 2 – Tuff)	22.6	11.2	2.6	36 ³	

Notes:

¹ RMS QA Specification 3051: Granular Base and Subbase Materials for Surfaced Road Pavements (2014).

² AS2758.1 requires testing at a 3:1 caliper ratio. However, AS2758.1 allows, at the option of the purchaser, for misshapen particles to be determined using a 2:1 ratio with a < 35% total misshapen particle limit.

³ Further testing would be required to improve unit characterisation and ensure compliance to RMS3051.

4.3.5 Fractured Faces of Coarse Aggregate

Fractured faces of coarse aggregate obtained after crushing of the rock samples, compared to RMS3051 requirements, are outlined in Table 12.

Table 12: Fractured faces of coarse aggregate test results compared to RMS3051 requirements.

Sample & Unit ID	Results			RMS Specification ¹
	Particles with No Fractured Faces (%)	Particles with At Least One Fractured Faces (%)	Particles with Two or More Fractured Faces (%)	Particles with Two or More Fractured Faces (%)
6007/Agglomerate (Unit 3 – Agglomerate)	0	100	100	Minimum 85
6007/BH103+ BH104/18-22.0m (Unit 2 – Tuff)	0	100	100	

Notes:

¹ For Class 1 DGB20 in accordance with RMS3051.

4.3.6 Particle Size Distribution

Particle size distribution results compared to RMS3051 requirements are outlined in Table 13.

Table 13: Particle size distribution results compared to RMS3051 requirements.

Passing AS Sieve Size (mm)	Sample (% by mass passing)		RMS Specification ¹ (% by mass passing)	
	6007/Agglomerate (Unit 3 – Agglomerate)	6007/BH103+BH104/18.0-22.0m (Unit 2 – Tuff)	DGB20 (HD) & DGB20	DGS40
26.5	100	100	100	100
19.0	91	84	95 – 100	95 – 100
13.2	66	53	78 – 92	70 – 90
9.50	45	34	63 – 83	58 – 80
4.75	33	24	44 – 64	43 – 65
2.36	25	17	33 – 49	30 – 55
425 (µm)	17	11	14 - 23	10 – 30
75 (µm)	NT ²	NT ²	7 – 14	4 – 17

Notes:

¹ RMS QA Specification 3051: Granular Base and Subbase Materials for Surfaced Road Pavements (2014).

² Portion not tested.

4.3.7 Acid Soluble Sulphate and Acid Soluble Chloride

Acid soluble sulphate and Acid soluble chloride test results, compared to RMS and AS2758.1 requirements, are outlined in Table 14.

Table 14: Acid soluble sulphate test results compared to RMS3051 requirements.

Sample & Unit ID	Acid Soluble Sulphate (%)		Acid Soluble Chloride (%)	
	Test Results	RMS3051 Specification ¹	Test Results	AS 2758.1 Specification ²
10628/ BH105 /30.0-40.0 (Unit 2 – Tuff)	0.007	< 0.3	0.004	< 0.03
10628/ BH106 /0.72-10.0 (Unit 2 – Tuff)	0.007		0.004	
6007/ surface /0/R/1 (Unit 2 – Tuff)	0.021		NT ³	
6007/ Agglomerate (Unit 3 – Agglomerate)	0.034		NT ³	
6007/ BH103+ BH104 / 18.0-22.0m (Unit 2 – Tuff)	0.014		NT ³	

Notes:

¹ RMS QA Specification 3051: Granular Base and Subbase Materials for Surfaced Road Pavements (2014).

² AS2758.1 classification from Section 14.3.2, AS2758.1 (2014).

³ Not tested.

4.3.8 Sugar in Aggregate

Sugar was found to be absent in tested rock aggregate as summarised in Table 15.

Table 15: Sugar in aggregate test results compared to AS2758.1 requirements.

Sample & Unit ID	Sugar in Aggregate	
	Test Results	AS 2758.1 Specification ¹
10628/BH105/30.0-40.0 (Unit 2 – Tuff)	Absent	Free of any sugar
10628/BH106/0.72-10.0 (Unit 2 – Tuff)	Absent	

Notes:

¹ AS2758.1 classification from Section 14.2, AS2758.1 (2014).

4.3.9 Polished Aggregate Friction Value (PAFV)

Polished aggregate friction values for tested aggregate compared to typical RMS3152 requirements, are outlined in Table 16.

Table 16: PAFV compared to RMS 3152 requirements.

Sample & Unit ID	PAFV	
	Test Results	RMS Specification ¹
10628/Surface/01	52	≥ 48
10628/BH105/30.0-40.0 (Unit 2 – Tuff)	47	

Notes:

¹ RMS QA Specification 3152: Aggregates for Asphalt, Edition 2, Revision 4, June 2020 (RMS, 2020).

4.3.10 Particle Dry Density and Water Absorption

Particle dry density and water absorption values of tested aggregate compared to typical Transport for NSW (**TfNSW**) D&C R81 requirements, are outlined in Table 17.

Table 17: Particle dry density and water absorption test results compared to TfNSW specifications.

Sample & Unit ID	Particle Dry Density (t/m ³)	RMS Specification ¹ (t/m ³)	Water Absorption (%)	TfNSW Specification ¹ (%)
10628/BH105/30.0-40.0 (Unit 2 – Tuff)	2.59	2.1	1.1	2.5
10628/BH106/0.72-10.0 (Unit 2 – Tuff)	2.42		3.6	

Notes:

¹ Transport for NSW (TfNSW) Specification D&C R81: No Fines Concrete Subbase, Edition 2, Revision 2, February 2021 (TfNSW, 2021).

4.3.11 Sodium Sulphate Soundness

Sodium sulphate soundness in accordance with AS2758.1 requirements is outlined in Table 18 with sodium sulphate soundness classification in accordance with AS2758.1 presented in Table 19.

Table 18: Sodium sulphate soundness test results compared to AS2758.1 requirements.

Sample & Unit ID	Sodium Sulphate Soundness	
	Test Results (%)	Concrete Exposure Classification ¹
10628/BH105/30.0-40.0 (Unit 2 – Tuff)	0.1 ²	A1, A2, B1, B2 and C
10628/BH106/0.72-10.0 (Unit 2 – Tuff)	7.8 ³	A1, A2, B1 and B2

Notes:

¹ AS2758.1 classification from Table 5 of AS2758.1 (2014).

² Aggregate is suitable for all concrete exposure classification.

³ Aggregate not suitable for 'C' classification.

Table 19: AS2758.1 specifications.

Sodium Sulphate Soundness	
Concrete Exposure Classification	Maximum Weighted Average Loss (%)
A1, A2	12
B1, B2	9
C	6

Notes:

¹ Concrete Exposure Classification reproduced from Table 5 of AS2758.1 (2014).

4.3.12 Alkali Reactivity

Aggregate alkali reactivity test results, compared to AS2758.1 requirements, are outlined in Table 20.

Table 20: Alkali reactivity test results compared to AS2758.1 requirements.

Sample & Unit ID	Mortar Bar Expansion (%)		Aggregate Reactivity Classification ¹
	10 Days	21 Days	
10628/BH105/30.0-40.0 (Unit 2 – Tuff)	0.076	0.158	Slowly reactive ²
10628/BH106/0.72-10.0 (Unit 2 – Tuff)	0.004	0.012	Non-reactive

Notes:

¹ Based on Table T363/A of RMS TS 02800.39:0.0 - Test Method T363: Accelerated Mortar Bar Test for the Assessment of Alkali-Reactivity of Aggregate, January 2012 (RMS, 2012).

² To use in concrete, aggregate shall comply with Clause 2.8 of AS 1379-2007.

4.3.13 Methylene Blue Adsorption Value (MBVA)

Methylene blue adsorption value (**MBVA**) test results, compared to compared to typical TfNSW requirements, are outlined in Table 21.

Table 21: MBVA test results compared to TfNSW Specification D&C R126 requirements.

Sample & Unit ID	Average MBA Value (mg/g)	TfNSW Specification ¹
10628/BH105/30.0-40.0 (Unit 2 – Tuff)	4	≤ 10
10628/BH106/0.72-10.0 (Unit 2 – Tuff)	10	

Notes:

¹ Table R126.2 TfNSW Specification D&C R126: High Modulus Asphalt (EME2), Edition 1, Revision 3, September 2020 (TfNSW, 2020).

4.3.14 Tests Not Covered Within This Report

Tests listed in Table 22 are typically required to characterise aggregates and assess compliance with RMS3051 and / or AS2758.1 specifications. However, these tests were omitted during preliminary resource investigation for the following reasons:

- Petrographic analysis results, with specific reference to:
 - i. The origin of the material (igneous)
 - ii. Expected engineering characteristics
- Condition of encountered rock during field investigations.
- Previous experience.

Table 22: List of tests and anticipated results, not covered within this report as per typical RMS3051 and AS2758.1 requirements.

Test	Specification	Requirement	Evidence	Expected Outcome ¹
Permeability (AS1289.6.7.2)	RMS3051	Max: 5×10^{-8}	Petrographic report	Pass for all aggregate
Plasticity (RMS T109) ²	RMS3051: DGB20(HD) – Traffic Category A DGB20 – Traffic Category B and C	Plasticity Index Min: 2 Max: 6	Origin and visual assessment of condition of encountered material Previous experience	Non-plastic for all aggregate
Dry Compressive	RMS3051: DGB20(HD) and	Min: 1.7 MPa	Condition of encountered rock	Pass for tuff

Test	Specification	Requirement	Evidence	Expected Outcome ¹
Strength (RMS T114) ²	DGB20 – All Traffic Categories		Petrographic report	
Light Particles (AS1141.31)	AS2758.1	< 1% of material particles with a density of < 2.0 t/m ³	Origin and visual assessment of condition of encountered material	Pass for tuff

Notes:

¹ Assumes aggregate is fresh and free from structural defects.

² RMS T114 specification required if plasticity index is less than 2.

4.4 Conclusion

Limited laboratory tests generally indicate that:

- All samples tested pass under relevant RMS / TfNSW / Australian Standard specification for acid soluble sulphates, fractured faces, sugar in aggregate, PAFV and MBV.
- Slightly weathered to fresh tuff is classified as class C for concrete aggregates (AS2758.1) and likely DBG20 (HD) – Traffic Category A (very heavy traffic) or DGB20 – Traffic Category B (heavy traffic).
- High to moderate structurally impacted tuff in its current form may not suitable for use as road base material or in concrete. However, provided engineer mix design is taken into account for misshapen particles and significant breakdown of material, the structurally impacted tuff may be classified as class B1, B2 for concrete aggregates (AS2758.1).
- Majority portion of agglomerate in its current form may not suitable for use as road base material or in concrete. However, provided engineer mix design is taken into account for significant breakdown of material, the agglomerate may be classified as class A1, A2 for concrete aggregates (AS2758.1).

We note that limited rock samples were tested, and the samples selected for testing were typically of poorer quality to verify a range of suitability conditions / requirements for the sake of conservatism. Further laboratory testing as listed in Table 22 would be required, dependent upon the purchaser's requirements and client's decision for the quarry to act as wholesale or retail. A discussion and summary of the test results that failed to meet specifications along with the impact on the proposed development is presented in Table 23.

Table 23: Discussion and summary for failed / marginal test results.

Test Method	Sample(s) that Failed Specification Requirements	Discussion	Expected Developmental Impact
Wet / Dry	6007/Agglomerate	Agglomerate by nature is variable in	Considering the wet

Test Method	Sample(s) that Failed Specification Requirements	Discussion	Expected Developmental Impact
Strength Variation (AS1141.22 & T215)	& 10628/BH106/0.72-10.0 (Unit 2 – Tuff)	composition due to the presence of large gravels and cobbles in a finer matrix. The fine matrix when impacted by structures (jointing or faulting) or water can alter to clay, reducing the rock engineering properties (particularly strength). Typically agglomerate containing a larger percentage of matrix material will have greater susceptibility to fail the strength requirements. Whilst the sample tested failed to meet the wet strength and wet / dry variation requirements of RMS 3051, discrete bands may exist within the unit (e.g. as seen in BH108 from 60.0 m – 68.0 m that may pass specifications. Further testing across the agglomerate resource area is recommended, to characterise unit consistency.	strength and wet / dry variation of slightly weathered tuff (284 kN and 2 %) and distinctly weathered and partially structurally defected tuff (145 kN and 29%), it may be possible to blend the agglomerate / weathered tuff with fresh tuff to meet specifications. Testing of a blended batch would be required to determine if the blended batch would fail due to continued significant breakdown.
Coarse Particle Size Distribution (T106)	6007/Agglomerate 6007/BH103+ BH104/18-22.0m	Crushing of the rock samples produced well graded tuff and poorly graded agglomerate aggregates. Although both samples failed to meet the required particle size distribution curve for RMS 3051 and AS2758.1, the crush produced proportionally larger aggregates that can be re-crushed at a smaller nominal aggregate size and / or blended with previous crushing, which may lead to the required particle size distribution.	Aggregate will likely require additional crushes across a range of nominal aggregate spacing to meet RMS 3051 and AS2758.1 PSD criteria. Additionally, purchasers may require PSD that differs from AS2758.1 and / or RMS 3051 requirements.
Particle Shape by Proportional Caliper (T213)	6007/BH103+ BH104/18-22.0m	Sample 6007/BH103+BH104/18-22.0m was selected for analysis due to the presence of multiple structural defects resulting in poor rock quality designation (RQD). The material was blended from the same depth interval below ground surface across two boreholes within potentially the primary quarry zone to meet sample weight requirements for testing. The test result indicates an approximate representation of the characteristics of structurally impacted tuff. Fresh tuff, free from structural defects, is likely to contain improved particle shape results (i.e. less misshapen particles).	The test results marginally fail RMS 3051 and AS2758.1 (2014: section 8.3.3) specifications (36%, compared to 35%). Where moderate rock defects are encountered, the rock could potentially pass requirements for fractured faces or may require blending with fresh tuff. Fresh and non-defected tuff is expected to pass both RMS 3051 and AS2758.1 particle shape requirements.
Water Absorption	10628/BH106/0.72-10.0	10628/BH106/0.72-10.0 was selected for analysis due to the presence of	The test results marginally fail

Test Method	Sample(s) that Failed Specification Requirements	Discussion	Expected Developmental Impact
(AS1141.6.1)	(Unit 2 – Tuff)	multiple structural defects resulting in poor RQD. The test result indicates an approximate representation of the characteristics of structurally impacted tuff. Fresh and non-defected tuff (e.g. 10628/BH105/30.0-40.0), free from structural defects showed significantly improved water absorption results (i.e. 1.1%).	AS1141.6.1 specifications (3.6%, compared to 2.5%). Where moderate rock defects are encountered, the rock could potentially pass requirements for water absorption or may require blending with fresh tuff.
Sodium Sulphate Soundness (AS2758.1)	10628/BH106/0.72-10.0 (Unit 2 – Tuff)	10628/BH106/0.72-10.0 was selected for analysis due to weathering and structural defect. The test result (i.e. 7.8%) indicates an approximate representation of the characteristics of structurally impacted tuff. Fresh and non-defected tuff (e.g. 10628/BH105/30.0-40.0), free from structural defects showed significantly improved sodium sulphate soundness results (i.e. 0.1).	The test results marginally fail AS2758.1 specifications (7.8%, compared to 6%) for an exposure classification of C). However, the material possesses a B1 and B2 exposure classification. Where moderate rock defects are encountered, the rock could potentially pass requirements for water absorption or may require blending with fresh tuff.

5 Resource Assessment

5.1 Unit Volumes, Weights and Cut Depth

Unit volumes of extractable rock were calculated using triangulated irregular network (TIN) software modelling to represent surface and underlying unit morphology. A boundary buffer of 50 m was applied to the pit design. A pit batter configuration with batter height, bench width and batter angle of 15 m, 5 m and 8° were adopted, respectively, based on the findings from MA, 2026a. Quarry excavation techniques in very high strength rock typically involve benching for drill and blast and batters will likely be designed against encountered geology and defects. The TIN model calculated rock volumes from 2012 LIDAR surface topography to a predefined base excavation level of 110 mAHD (i.e. up to 50 year extraction period base level of the pit). Based on the conceptual geological model as discussed in Section 3.6 (refer to Appendix B for idealised geological sections), the Pit was separated into three distinct zones, namely soil, tuff and agglomerate. Estimated volumes of material units and extractable rock are provided in Table 24.

Table 24: Unit volumes and weights.

Unit	Calculated Total Unit Volume (m ³) ¹	Representative Bulk Density (t/m ³) ²	Calculated Total Weight (t) for Unit
Unit 1 (Soil)	606,000	1.6	969,600
Unit 2 (Tuff)	15,349,400	2.6 ³	39,908,440
Unit 3 (Agglomerate)	6,107,100	2.3 ³	14,046,330

Notes:

¹ Calculated from TIN to TIN modelling using 2012 LIDAR survey data, geological field mapping and available borehole information. Additional intrusive testing would be required to improve approximations.

² Estimated bulk density of in-situ material (i.e. no bulking factor applied).

³ Density may differ across unit.

Bands of alternating geology may exist within the designated units (i.e. bands of agglomerate within tuff or vice versa). Additional intrusive testing would be required to improve resource approximations and geological unit relationships. Notwithstanding this, the volumes presented are considered suitable for preliminary feasibility assessment purposes. We recommend refining of unit coverage areas, in particular the agglomerate and tuff contact in the northeastern portion of the extraction pit and saddle.

5.2 Key Issues Impacting Resource Feasibility

Key issues which may impact resource feasibility include:

1. Creeks and associated creek buffers.

2. Extent and volume of impacted rock from structural defects (faults and jointing).
3. Inferred contacts of geological formations and lithologies.

Excavatability implications based on Look (2014) and site testing results are summarised below:

1. Medium strength material - considered likely to require a moderately hard to very hard ripping effort and at minimum a D8 digger.
2. High strength material - considered likely to require an extremely hard ripping effort and at minimum a D9 to D11 digger or possibly blasting.
3. Very high strength material - likely to require blasting.

5.3 Market Suitability

A range of general market prices for road base aggregates is listed below. Prices were obtained from available online rates and direct contact and discussions with quarry material companies (e.g. Boral). Results are summarised in Table 25.

For estimation of preliminary resource prices, we have made the following assumptions:

- Weight of structurally impacted tuff is 10% of the estimated cumulative tuff weight.
- 75 % of the structurally impacted tuff can be used as aggregate.
- Weight of structurally impacted agglomerate is 10 % of the estimated cumulative agglomerate weight.
- 20 % of the structurally impacted agglomerate can be used as aggregate.
- Crushing process will produce 17% and 25 % of dust for tuff and agglomerate, respectively.

Table 25: General market retail price guide.

Resource	Retail Market Price (\$/t) ¹	Calculated Total Weight (t) for Unit ²	Bluestone Preliminary Resource Price ³
Soil ⁴	NA	NA	NA
Tuff ⁵	\$38 - \$40 ⁷ (AS2758.1)	32,296,000	\$1,227,245,000 – \$1,291,836,000
	\$25 - \$30 (RMS 3051)		\$807,398,000 – \$968,877,000
Blended Tuff and Agglomerate ⁵	\$25 - \$30 (RMS 3051)	43,022,000 ⁸	\$1,075,542,000 – \$1,290,650,000
Crusher Dust ⁶	\$18 - \$30	6,615,000 ⁹	\$119,067,000 – \$198,445,000

Notes:

¹ Prices are for use as a guide only and based on product passing RMS 3051 requirements for DGB20 and AS2758.1 exposure classification B1, B2 and C. Market price is subject to change and will vary based on location and quality of product. Delivered wholesale prices would be less than the retail mark-up.

² Calculated based on values from Table 24 and assumptions in Section 5.3. Results are considered preliminary and further investigation would be required to refine volume and weight estimations. Does not include loss of material from blasting and crushing.

³ Values rounded to nearest \$1,000.

⁴ No price is provided for soil. Soil may be required to be stored and used for quarry rehabilitation.

⁵ PSD results indicate a crusher dust production of 17% for tuff and 25% for agglomerate during aggregate crushing processes. The relevant percentages have been removed from the calculated total weight.

⁶ Particle sizes less than 5 mm graded through to particle sizes finer than 75 µm, produced from crushing processes (also referred to as fine aggregate in AS2758.1 (2014)).

⁷ Price based on online rates and discussions with quarry material companies. Price is subject to aggregate size and batch certification to AS2758.1 pre dispatch. Uncertified batches and / or lock in contract supply will likely reduce market price.

⁸ Estimated total combined (i.e. tuff + agglomerate) weight of usable aggregate based on values from Table 24 and assumptions in Section 5.3, which excludes crushed dust and unusable percentage of weathered rock. Further assessment and blending analysis would be required to determine appropriate volume, weight and suitability for market purposes, which may be less than the values indicated.

⁹ Calculated total weight based on percentage of crusher dust produced from crushing of tuff only.

6 Conclusions and Recommendations

6.1 Conclusions

Investigation of site subsurface materials identified three material units, soil (Unit 1), a tuff layer (Unit 2), and an agglomerate layer (Unit 3). Unit 1 was typically shallow across the Site (less than 1.0 m), although the soil profile may be thicker (up to 6.7 m in BH103). Unit 2 was encountered in BH102 to BH106 to a maximum (investigation termination) depth of approximately 64.11 mbgl (BH105) and in BH101, BH107 and BH108 up to between approximately 11 mbgl (BH101) and 32.7 mbgl (BH108). Unit 3 was encountered below Unit 2 in BH101, BH107 and BH108 up to investigation termination depth of 69.0 mbgl (BH108).

Laboratory testing conducted on Unit 1 is not included in this report as it did not form part of the assessment scope. Soil may be required to be stockpiled and used for future quarry rehabilitation purposes or as bunds to reduce noise from quarry operations. The suitability of soil for this purpose is discussed in MA, 2026a.

Unit 2 is inferred to extend up to between approximately 136 mAHD and the base level of the pit (i.e. likely beyond 110 mAHD) across the Pit area. Fresh tuff is deemed suitable for use as road base and concrete aggregate, provided mix design measures are applied to take account of particle size distribution. In areas where Unit 2 has been moderately impacted by structural defects (faulting, shear zones, veining and joints), the rock may still be suitable for use in concrete and road base with additional mix design measures to account for increased misshaped particles and significant rock breakdown.

Majority portion of Unit 3 is not suitable for use as road base due to its low wet strength and wet / dry strength variation. This unit may be blended with Unit 2 to increase the overall wet strength and decrease the wet / dry strength variation to pass RMS 3051 requirements. Unit 3 material may still be used in concrete aggregate with an exposure classification of A1, A2 provided engineering mix design practices can reduce significant rock breakdown.

7 Limitations

Martens and Associates (MA) operates in the business of providing civil, geotechnical and environmental consulting services. MA is not a financial advisor, forecaster or accountant and therefore does not make any representations or promises and cannot give any guarantee, warranty or undertaking as to any profit projection, revenue or performance of your business.

For the purpose of this report, MA has assumed all relevant material information and documents have been provided by the Client.

Except to the extent that liability under the law cannot be disclaimed, MA does not accept any liability, whether in contract, tort or otherwise whatsoever, whether or not it has been negligent, for any loss or damage including, without limitation, loss of profit and profit projection, which may arise directly or indirectly from use or reliance of any opinion, advice, recommendation, representation or information expressively or impliedly published in or in relation to this report, notwithstanding any error or omission.

MA reserves the right to make any changes or improvements to this report at any time.

Occasionally subsurface conditions in areas of the Site not investigated may be found to be different from those expected. This can also occur with groundwater conditions, especially after climatic changes. Should, during site works soil, water or rock conditions be found to be significantly different to those detailed in this report, works shall cease immediately and the new conditions should be addressed by Martens & Associates to determine implications before recommencement.

For further limitations of this report, refer to the Important Information About Your Report provided in Appendix H.

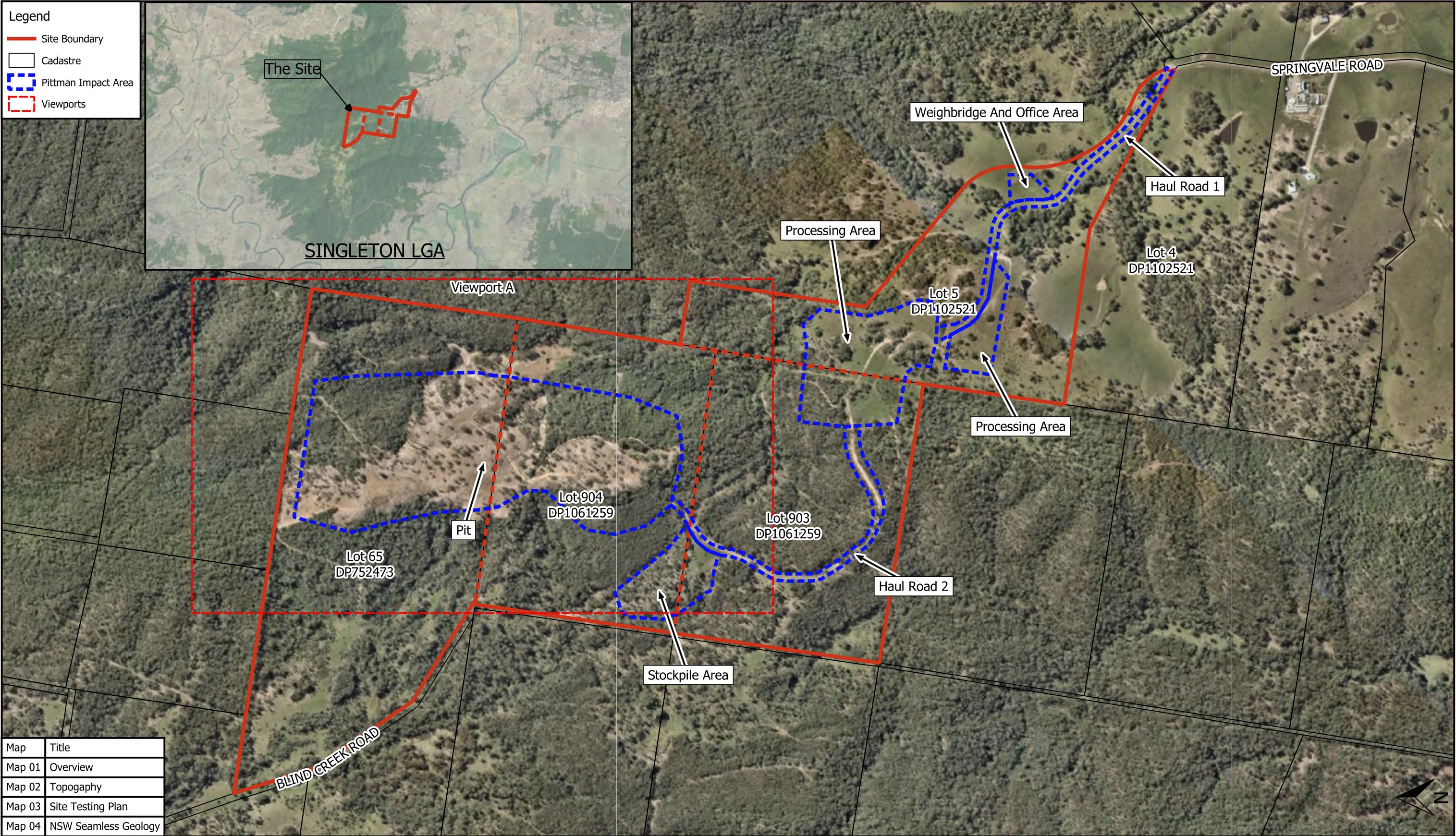
8 References

- De Witt Consulting (2025) *Plan Showing Lidar Contours*, Project No. 8748, Drawing Ref. 8748-CONTOURS-28.01, Revision B, dated 28 January 2025 (DWC, 2025).
- Korsch R. J. (1977) A framework for the Palaeozoic geology of the southern part of the New England Geosyncline. *Journal of the Geological Society of Australia*, 24(5-6), 339-355.
- Look, B. (2014) *Handbook of Geotechnical Investigation and Design Tables*, Taylor and Francis Group, London, UK, p 203 – 205 (Look, 2014).
- MinView, Geological Survey New South Wales, <https://minview.geoscience.nsw.gov.au/>, accessed on 17 September 2025 (MinView, 2025).
- Martens and Associates Pty Ltd (2025) *Resource Feasibility Assessment Planset*, Project No. P24110628, Planset No. PS03, Drawing Nos. PS03-A000 and PS03-C600 to PS03-C603, Revision A, dated 24 October 2025 (MA, 2025).
- Martens and Associates Pty Ltd (2026) *Geotechnical and Pit Staging Assessment – Proposed Bluestone Hardrock Quarry - Springvale Road, Elderslie, NSW & Blind Creek Road, Glendon Brook, NSW*, document reference P2410628JR03V03, dated April 2026 (MA, 2026a).
- Martens and Associates Pty Ltd (2026) *Hydrogeological Impact Assessment – Proposed Bluestone Hardrock Quarry - Springvale Road, Elderslie, NSW & Blind Creek Road, Glendon Brook, NSW*, document reference P2410628JR06V02, dated April 2026 (MA, 2026b).
- NSW DPI Office of Water, Real Time data, Groundwater database, accessed on September 2024, <https://realtimedata.waternsw.com.au/water.stm>
- Roads and Maritime Services (2020) QA Specification 3152: Aggregates for Asphalt, Edition 2, Revision 4, June 2020 (RMS, 2020).
- Roads and Maritime Services (2014) QA Specification 3051, Edition 6, Revision 5, *Granular Base and Subbase Materials for Surfaced Road Pavements*, RMS IC-QA-3051 (RMS, 2014).
- Roberts, J., B. A. Engel, and J. Chapman, *Geology of the Camberwell 9133, Dungong 9233 and Buladelah 9333 1:100 000 Sheets (Hunter – Myall Region)* New South Wales., Geological Survey New South Wales, Sydney, 1991.
- Rosenbaum, G., Li, P., & Rubatto, D. (2012) The contorted New England Orogen (eastern Australia): New evidence from U-Pb geochronology of early Permian granitoids. *Tectonics*, 31(1).
- Standards Australia Limited (2017) AS 1726:2017, *Geotechnical site investigations*, SAI Global Limited.

Standards Australia Limited (2014) AS2758.1:2014, *Aggregates and rock for engineering purposes: Concrete Aggregates*, SAI Global Limited.

Transport for NSW (TfNSW) Specification D&C R81: No Fines Concrete Subbase, Edition 2, Revision 2, February 2021 (TfNSW, 2021).

Appendix A – Maps and Figures



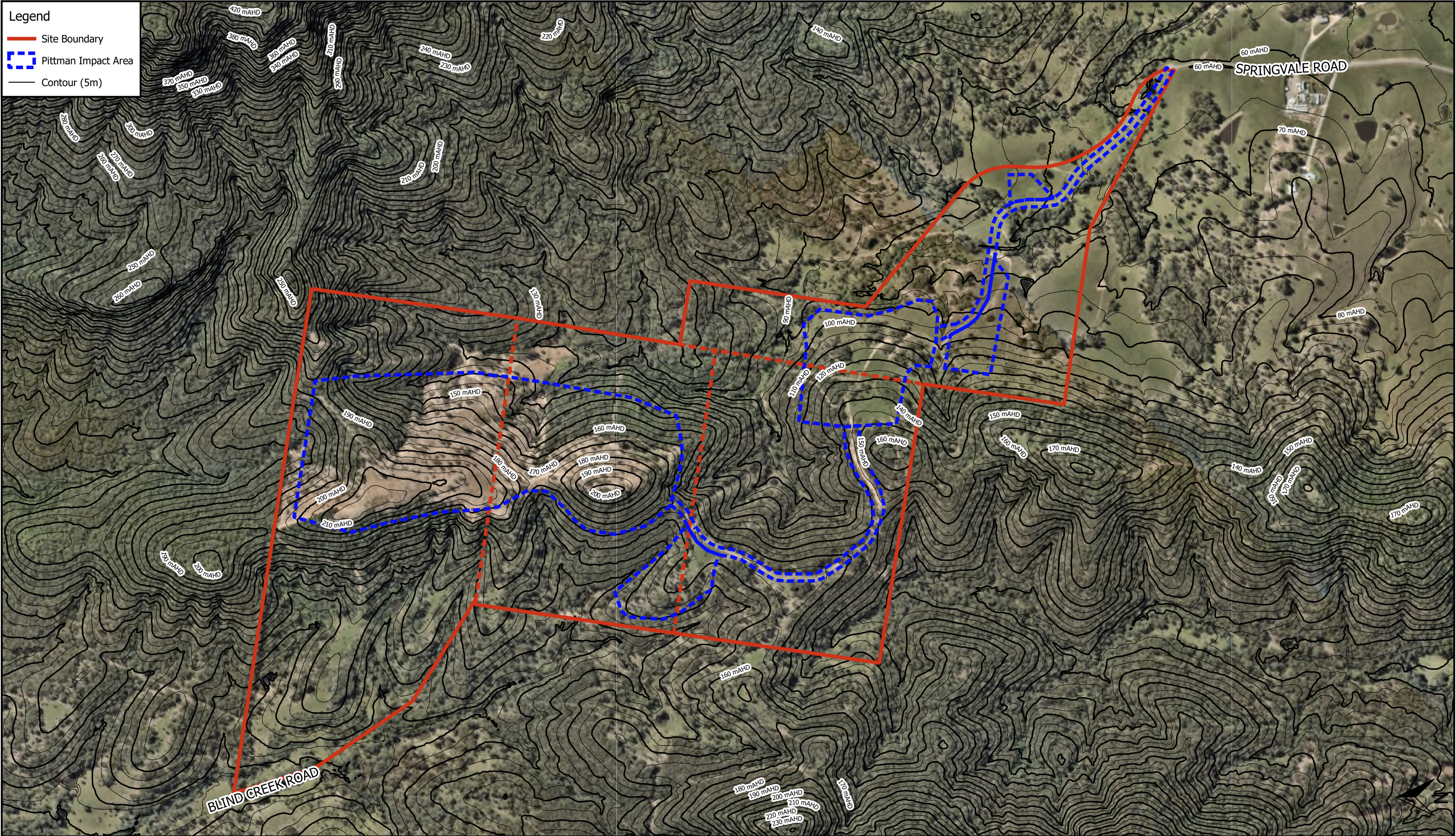
Map	Title
Map 01	Overview
Map 02	Topography
Map 03	Site Testing Plan
Map 04	NSW Seamless Geology

0 100 200 300 400 500 m

1:10000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).



0 100 200 300 400 500 m

1:10000 @ A3

Viewport

- Notes:
- Aerial from Nearmap (2025).
 - Site Boundary from NSW Spatial Services Clip and Ship (2025).
 - Contours from ELVIS Lidar (2012).

Map Title / Figure:

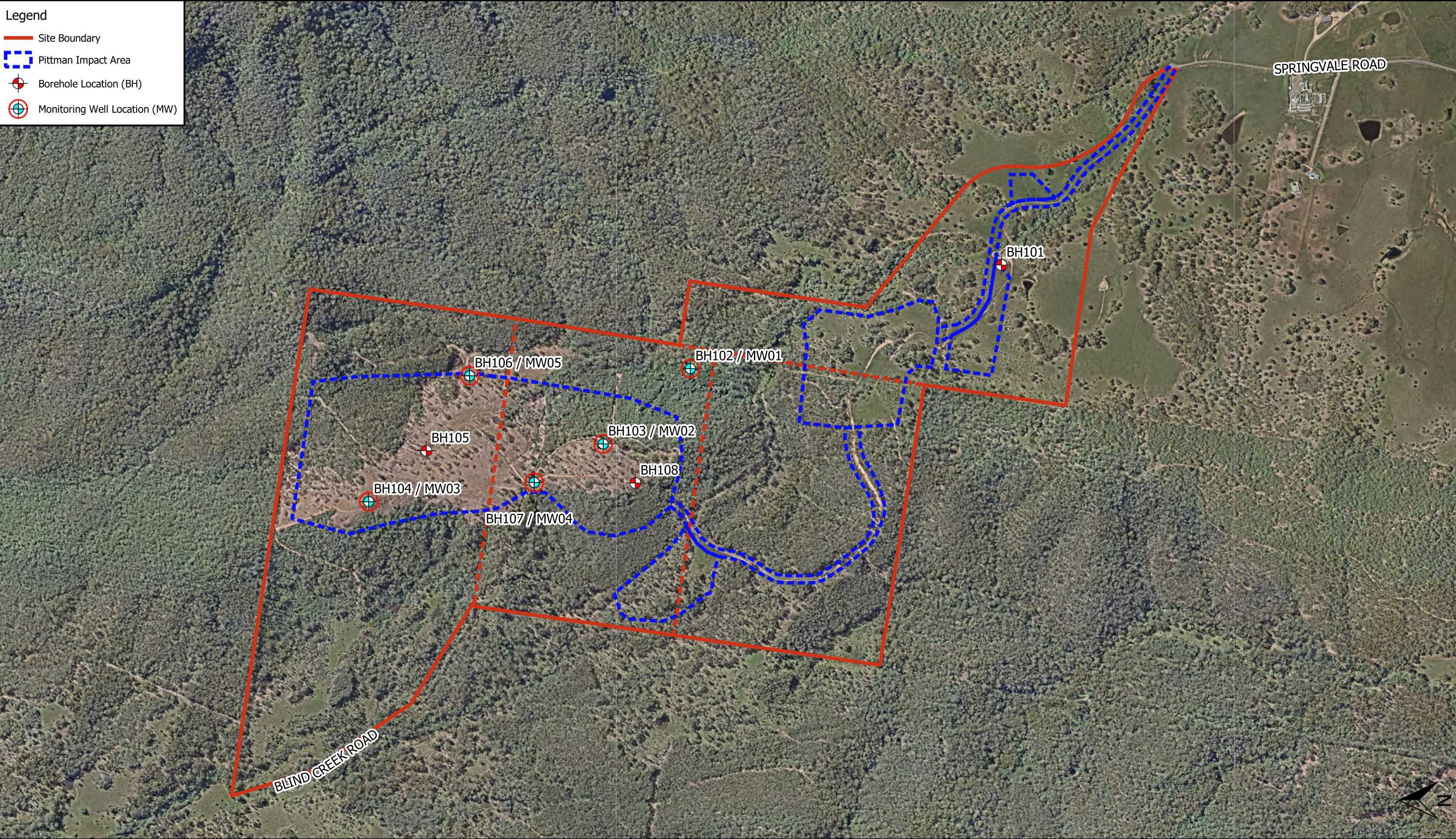
Topography

Map 02
Springvale Road, Elderslie, NSW
Bluestone Hardrock Quarry
Resource Feasibility Assessment
Bluestone Hardrock Pty Ltd
23/10/2025

Map
Site
Project
Sub-Project
Client
Date

Legend

- Site Boundary
- Pittman Impact Area
- Borehole Location (BH)
- Monitoring Well Location (MW)



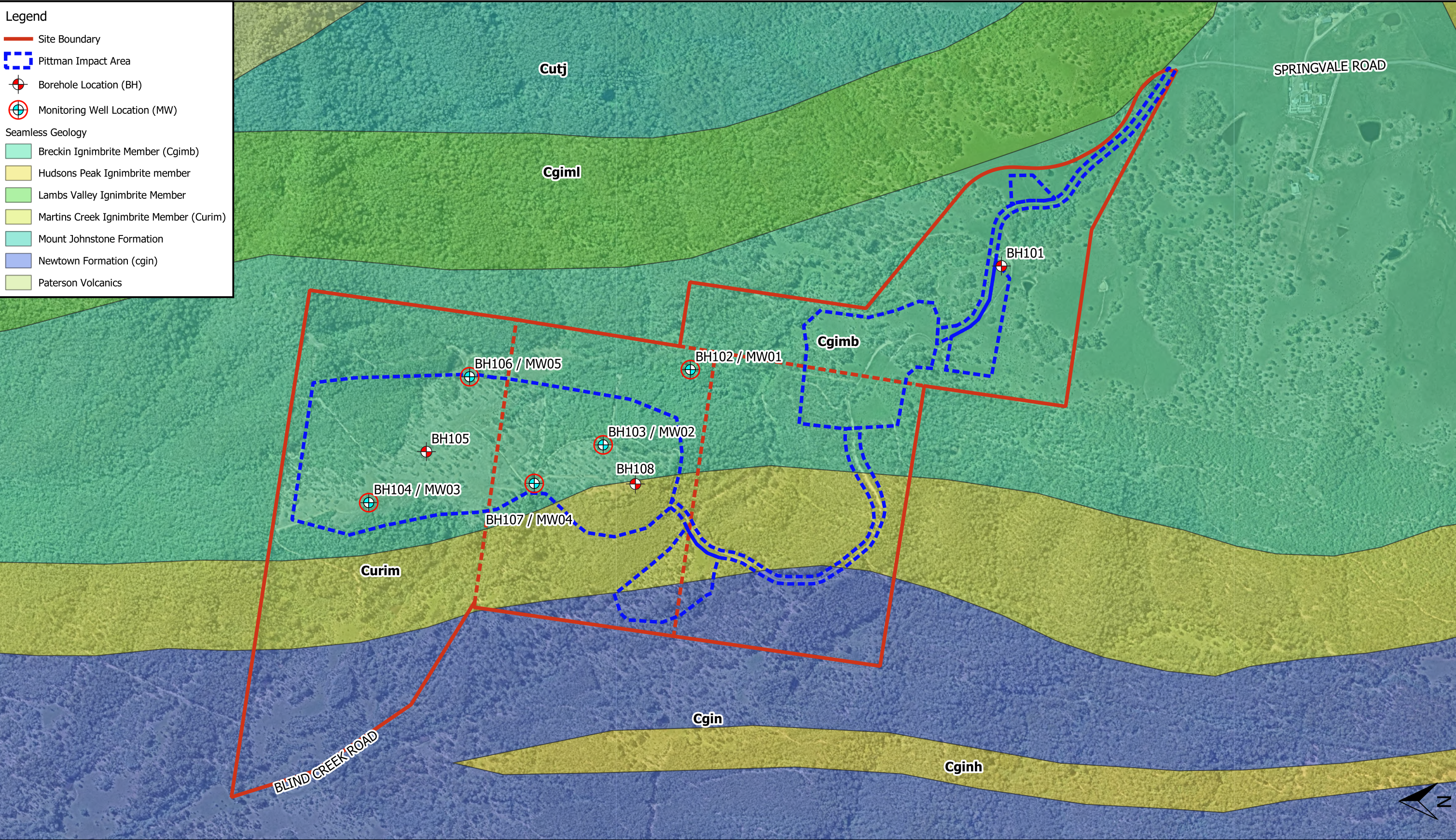
1:10000 @ A3

Viewport

- Notes:
- Aerial from Nearmap (2025).
 - Site Boundary from NSW Spatial Services Clip and Ship (2025).
 - Contours from ELVIS Lidar (2012).

Map Title / Figure:
Site Testing Plan

Map 03		Map
Springvale Road, Elderslie, NSW		Site
Bluestone Hardrock Quarry		Project
Resource Feasibility Assessment		Sub-Project
Bluestone Hardrock Pty Ltd		Client
23/10/2025		Date



0 100 200 300 400 500 m

1:10000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Geology from Seamless (2025).

Map Title / Figure:
NSW Seamless Geology

Map 04	Map
Springvale Road, Elderslie, NSW	Site
Bluestone Hardrock Quarry	Project
Resource Feasibility Assessment	Sub-Project
Bluestone Hardrock Pty Ltd	Client
23/10/2025	Date

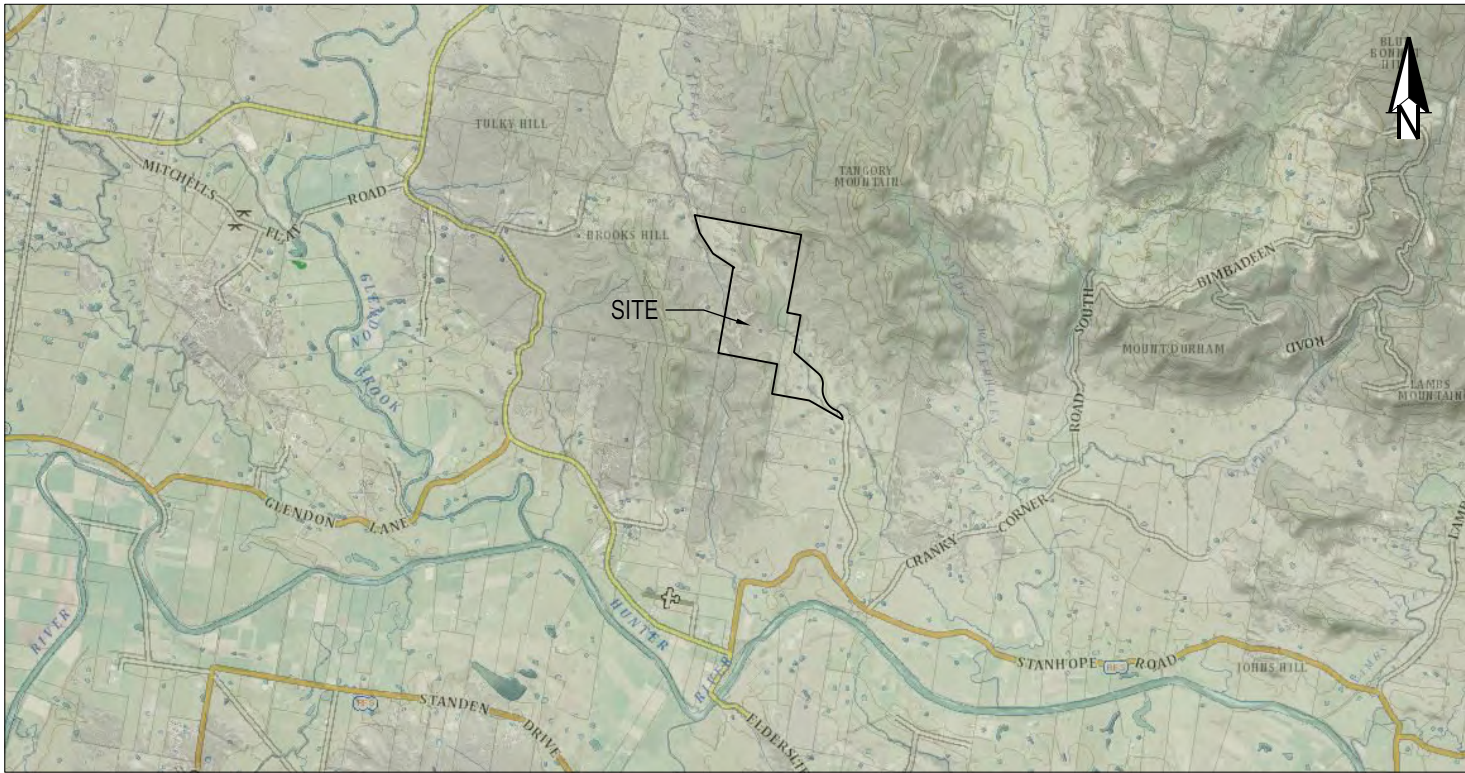
Appendix B – Idealised Geotechnical Sections

PROJECT: BLUSTONE HARDROCK QUARRY

PLANSET: RESOURCE FEASIBILITY ASSESSMENT

CLIENT: BLUESTONE HARDROCK PTY LTD

DRAWING LIST		
DWG NO.	REV	DWG TITLE
GENERAL		
PS03-A000	B	COVER SHEET
GRADING		
PS03-C600	B	GRADING SITE SECTION A AND TYPICAL BENCHING DETAIL
PS03-C601	B	GRADING SITE SECTION B
PS03-C602	B	GRADING SITE SECTION C (SHEET 1)
PS03-C603	B	GRADING SITE SECTION C (SHEET 2)



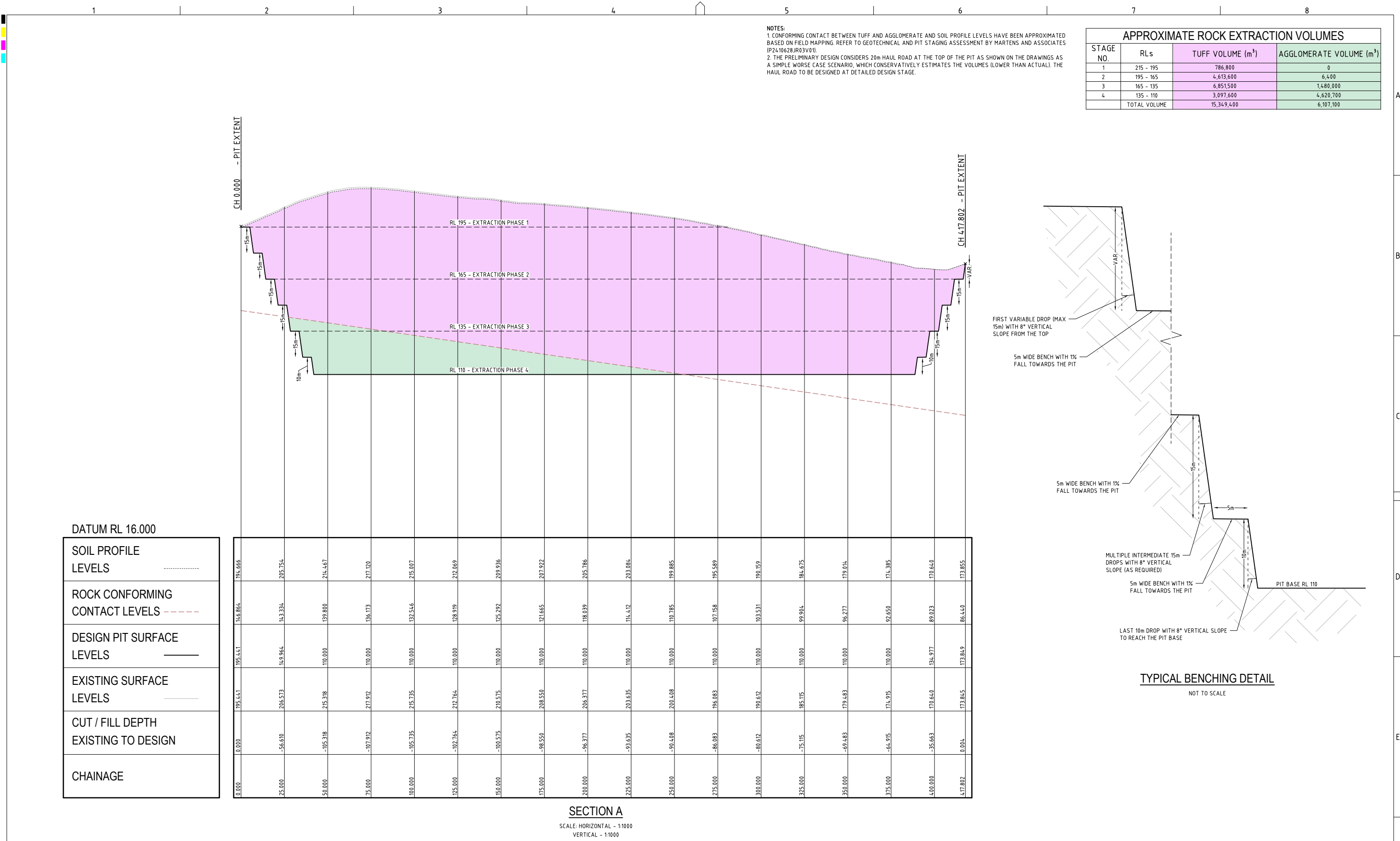
LOCALITY PLAN
NOT TO SCALE

LGA: SINGLETON COUNCIL

LOT5, SPRINGVALE ROAD, ELDERSLIE & BLIND CREEK ROAD, GLENDON BROOK, NSW

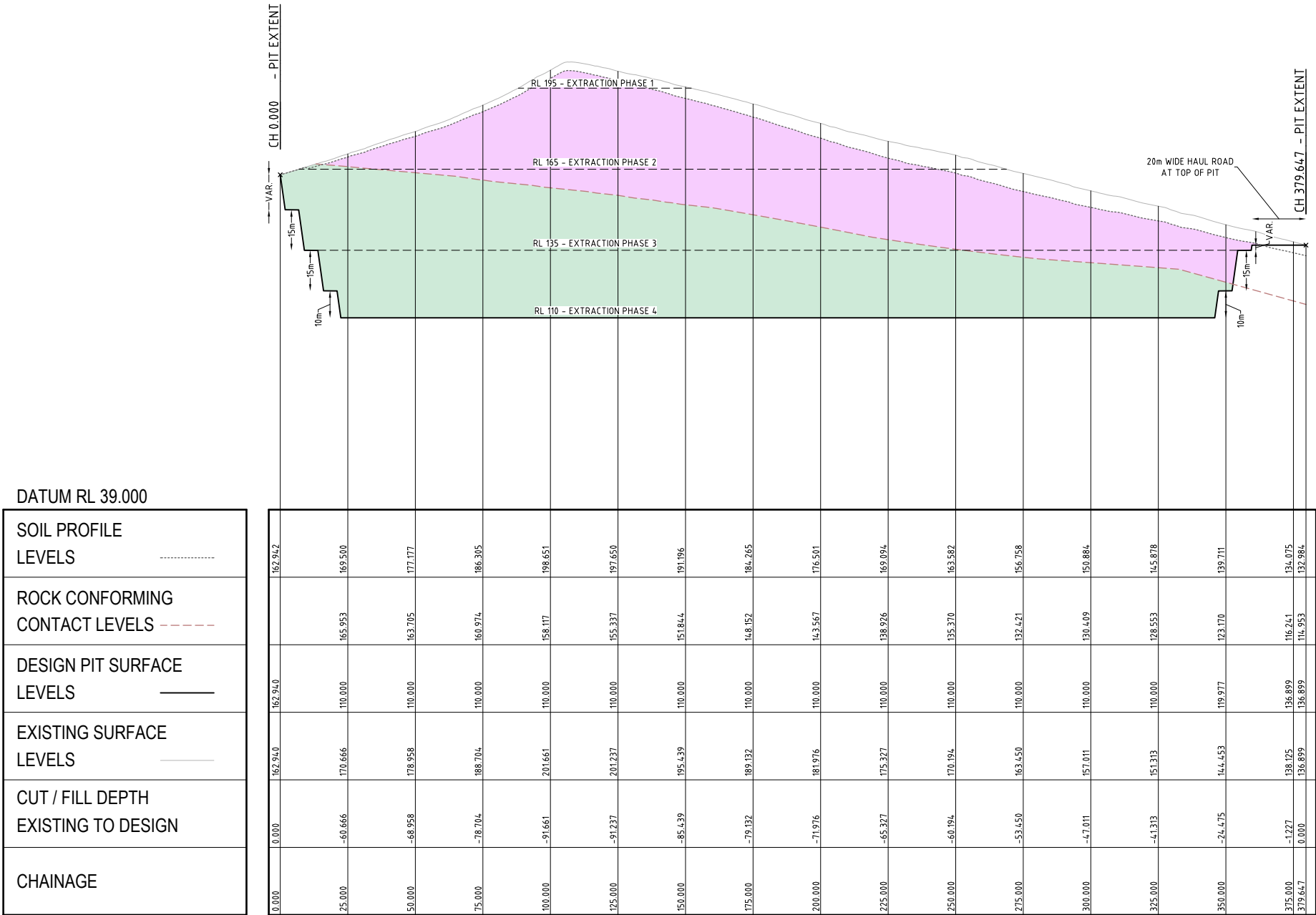
REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE	GRID	DATUM	PROJECT MANAGER	CLIENT	 Consulting Engineers Environment Water Geotechnical Civil Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 Email: mail@martens.com.au Internet: www.martens.com.au	DRAWING TITLE				
B	MINOR AMENDMENTS	08/12/2025	NP	RL	BM	BM				BM	BLUESTONE HARDROCK PTY LTD		COVER SHEET				
A	INITIAL RELEASE	24/10/2025	SSH	RL	BM	BM		DISCLAIMER & COPYRIGHT This plan must not be used for construction unless signed as approved by principal certifying authority. All measurements in millimetres unless otherwise specified. This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd. (C) Copyright Martens & Associates Pty Ltd			PROJECT NAME/PLANSET TITLE BLUSTONE HARDROCK QUARRY RESOURCE FEASIBILITY ASSESSMENT LOT 5, SPRINGVALE ROAD, ELDERSLIE & BLIND CREEK ROAD, GLENDON BROOK, NSW						
A1 / A3 LANDSCAPE (A3LC_v02.0.0)												DRAWING ID: P2410628-PS03-R02-A000 <					

SSDA



APPROXIMATE ROCK EXTRACTION VOLUMES			
STAGE NO.	RLs	TUFF VOLUME (m³)	AGGLOMERATE VOLUME (m³)
1	215 - 195	786,800	0
2	195 - 165	4,613,600	6,400
3	165 - 135	6,851,500	1,480,000
4	135 - 110	3,097,600	4,620,700
TOTAL VOLUME		15,349,400	6,107,100

NOTES:
1. CONFORMING CONTACT BETWEEN TUFF AND AGGLOMERATE AND SOIL PROFILE LEVELS HAVE BEEN APPROXIMATED BASED ON FIELD MAPPING. REFER TO GEOTECHNICAL AND PIT STAGING ASSESSMENT BY MARTENS AND ASSOCIATES (P2410628)R03V01.
2. THE PRELIMINARY DESIGN CONSIDERS 20m HAUL ROAD AT THE TOP OF THE PIT AS SHOWN ON THE DRAWINGS AS A SIMPLE WORSE CASE SCENARIO, WHICH CONSERVATIVELY ESTIMATES THE VOLUMES (LOWER THAN ACTUAL). THE HAUL ROAD TO BE DESIGNED AT DETAILED DESIGN STAGE.



SECTION B

SCALE: HORIZONTAL - 1:1000
VERTICAL - 1:1000

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENTS	08/12/2025	NP	RL	BM	BM
A	INITIAL RELEASE	24/10/2025	SSH	RL	BM	BM



GRID	DATUM	PROJECT MANAGER	CLIENT
	mAHD	BM	BLUESTONE HARDROCK PTY LTD
PROJECT NAME/PLANSSET TITLE			
BLUSTONE HARDROCK QUARRY			
RESOURCE FEASIBILITY ASSESSMENT			
LOT 5, SPRINGVALE ROAD, ELDERSLIE & BLIND CREEK ROAD, GLENDON BROOK, NSW			
DISCLAIMER & COPYRIGHT			
This plan must not be used for construction unless signed as approved by principal certifying authority.			
All measurements in millimetres unless otherwise specified.			
This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd			
(C) Copyright Martens & Associates Pty Ltd			

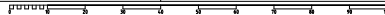


Consulting Engineers
Environment
Water
Geotechnical
Civil

Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8787
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE				
GRADING SITE SECTION B				
PROJECT NO.	PLANSSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P2410628	PS03	R02	PS03-C601	B

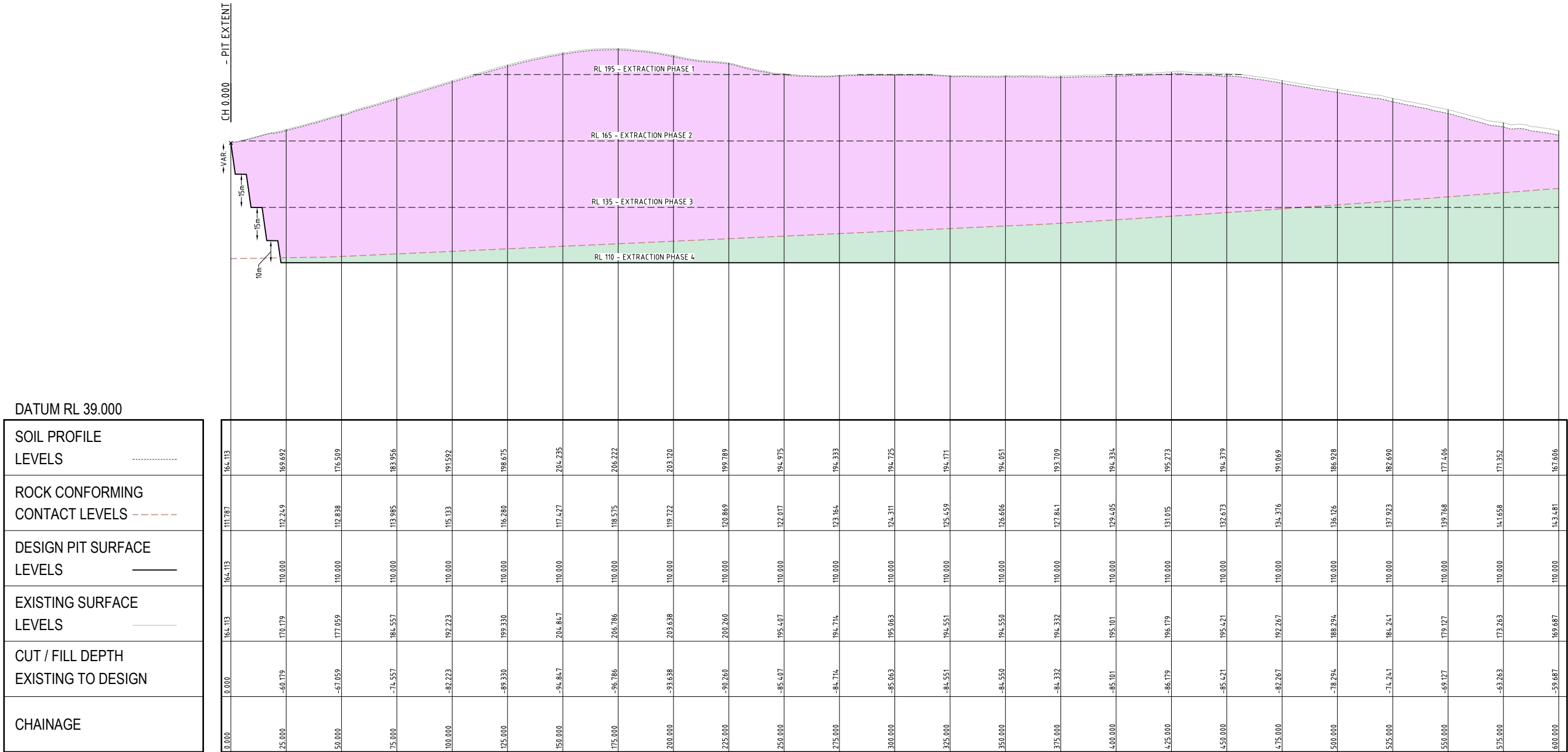
DRAWING ID: P2410628-PS03-R02-C601



SSDA

APPROXIMATE ROCK EXTRACTION VOLUMES			
STAGE NO.	RLs	TUFF VOLUME (m³)	AGGLOMERATE VOLUME (m³)
1	215 - 195	786,800	0
2	195 - 165	4,613,600	6,400
3	165 - 135	6,851,500	1,480,000
4	135 - 110	3,097,600	4,620,700
TOTAL VOLUME		15,349,400	6,107,100

NOTES:
1. CONFORMING CONTACT BETWEEN TUFF AND AGGLOMERATE AND SOIL PROFILE LEVELS HAVE BEEN APPROXIMATED BASED ON FIELD MAPPING. REFER TO GEOTECHNICAL AND PIT STAGING ASSESSMENT BY MARTENS AND ASSOCIATES (P2410628)R03V01.
2. THE PRELIMINARY DESIGN CONSIDERS 20m HAUL ROAD AT THE TOP OF THE PIT AS SHOWN ON THE DRAWINGS AS A SIMPLE WORSE CASE SCENARIO, WHICH CONSERVATIVELY ESTIMATES THE VOLUMES (LOWER THAN ACTUAL). THE HAUL ROAD TO BE DESIGNED AT DETAILED DESIGN STAGE.

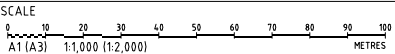


SECTION C

SCALE: HORIZONTAL - 1:1000
VERTICAL - 1:1000

CONTINUE TO THE NEXT SHEET

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENTS	08/12/2025	NP	RL	BM	BM
A	INITIAL RELEASE	24/10/2025	SSH	RL	BM	BM



GRID	DATUM	PROJECT MANAGER	CLIENT
	mAHD	BM	BLUESTONE HARDROCK PTY LTD
DISCLAIMER & COPYRIGHT			
This plan must not be used for construction unless signed as approved by principal certifying authority.			
All measurements in millimetres unless otherwise specified.			
This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd.			
(C) Copyright Martens & Associates Pty Ltd			

PROJECT NAME/PLANSET TITLE
BLUSTONE HARDROCK QUARRY
RESOURCE FEASIBILITY ASSESSMENT
LOT 5, SPRINGVALE ROAD, ELDERSLIE & BLIND CREEK ROAD, GLENDON BROOK, NSW



Consulting Engineers

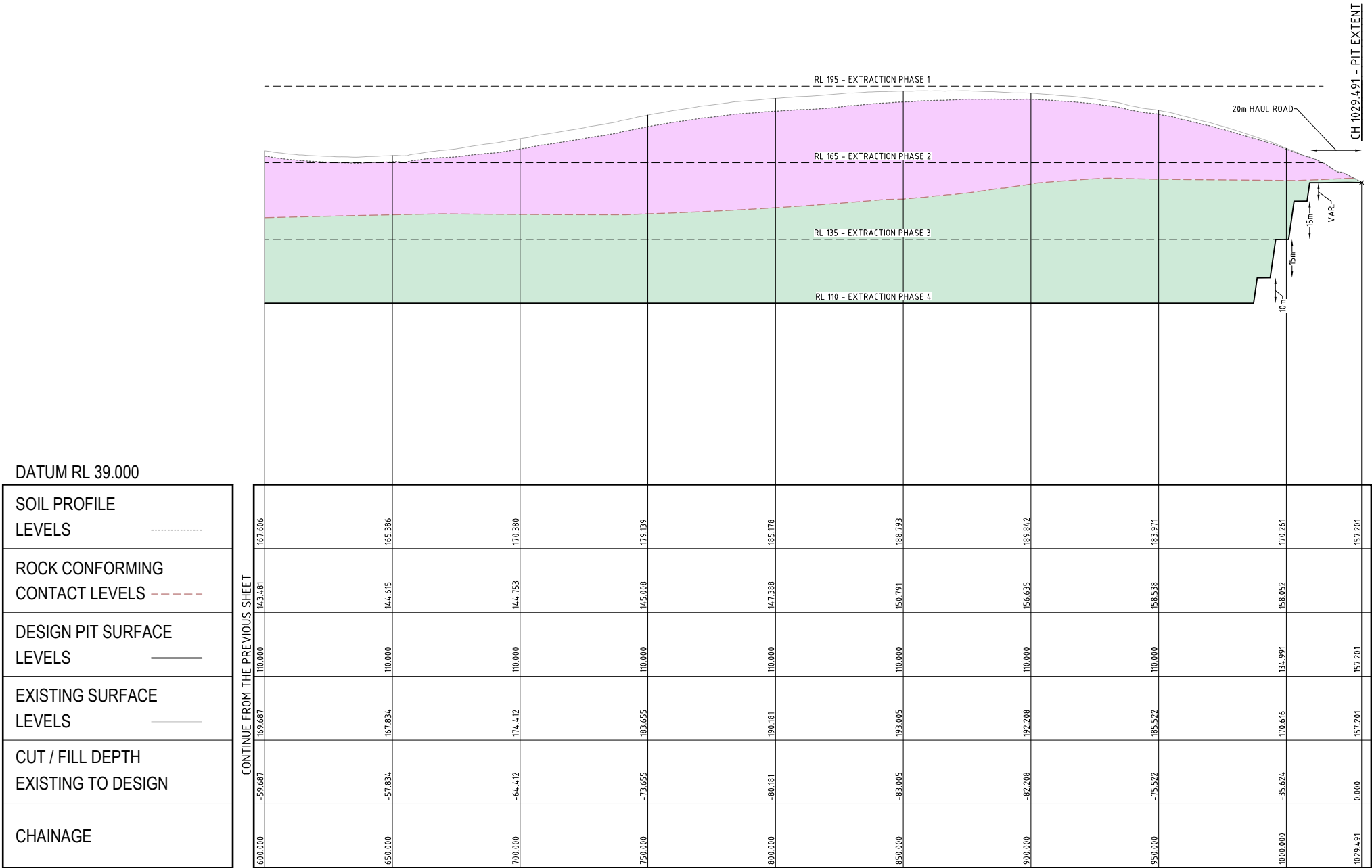
Environment
Water
Geotechnical
Civil

Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE				
GRADING SITE SECTION C (SHEET 1)				
PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P2410628	PS03	R02	PS03-C602	B

APPROXIMATE ROCK EXTRACTION VOLUMES			
STAGE NO.	RLs	TUFF VOLUME (m³)	AGGLOMERATE VOLUME (m³)
1	215 - 195	786,800	0
2	195 - 165	4,613,600	6,400
3	165 - 135	6,851,500	1,480,000
4	135 - 110	3,097,600	4,620,700
TOTAL VOLUME		15,349,400	6,107,100

NOTES:
1. CONFORMING CONTACT BETWEEN TUFF AND AGGLOMERATE AND SOIL PROFILE LEVELS HAVE BEEN APPROXIMATED BASED ON FIELD MAPPING. REFER TO GEOTECHNICAL AND PIT STAGING ASSESSMENT BY MARTENS AND ASSOCIATES (P2410628)R03V01.
2. THE PRELIMINARY DESIGN CONSIDERS 20m HAUL ROAD AT THE TOP OF THE PIT AS SHOWN ON THE DRAWINGS AS A SIMPLE WORSE CASE SCENARIO, WHICH CONSERVATIVELY ESTIMATES THE VOLUMES (LOWER THAN ACTUAL). THE HAUL ROAD TO BE DESIGNED AT DETAILED DESIGN STAGE.



SECTION C

SCALE: HORIZONTAL - 1:1000
VERTICAL - 1:1000

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENTS	08/12/2025	NP	RL	BM	BM
A	INITIAL RELEASE	24/10/2025	SSH	RL	BM	BM



GRID	DATUM	PROJECT MANAGER	CLIENT
	mAHD	BM	BLUESTONE HARDROCK PTY LTD
PROJECT NAME/PLANSET TITLE			
BLUSTONE HARDROCK QUARRY			
RESOURCE FEASIBILITY ASSESSMENT			
LOT 5, SPRINGVALE ROAD, ELDERSLIE & BLIND CREEK ROAD, GLENDON BROOK, NSW			
DISCLAIMER & COPYRIGHT			
This plan must not be used for construction unless signed as approved by principal certifying authority.			
All measurements in millimetres unless otherwise specified.			
This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd.			
(C) Copyright Martens & Associates Pty Ltd			



Consulting Engineers
Environment
Water
Geotechnical
Civil

Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE				
GRADING SITE SECTION C (SHEET 2)				
PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P2410628	PS03	R02	PS03-C603	B

DRAWING ID: P2410628-PS03-R02-C603

SSDA

Appendix C – Borehole and Monitoring Well Logs

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE PT170607BH101-BH104_MW02-MW04 V01.GPJ <<DrawingFile>> 09/09/2025 10:24 10.02.00.04 Dangel Lab and In Situ Tool - DGD | Lic: Martens 2.00 2016-11-13 Proj: Martens 2.00 2016-11-13

CLIENT	Pittman Building Pty Ltd			COMMENCED	18/10/2017	COMPLETED	26/10/2017	REF BH101					
PROJECT	Preliminary Resource Feasibility Assessment			LOGGED	AM	CHECKED	RE	Sheet 1 OF 2					
SITE	Blind Creek Road, Elsderslie, NSW			GEOLOGY	Agglomerate	VEGETATION	Grass	PROJECT NO. P1706007					
EQUIPMENT	4WD truck-mounted hydraulic drill rig			LONGITUDE		RL SURFACE	77.22 m	DATUM	AHD				
EXCAVATION DIMENSIONS	ø100 mm x 20.11 m depth			LATITUDE		ASPECT	Southeast	SLOPE	2%				
Drilling			Sampling		Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T		Not Observed		77.22 1.00				CL	CLAY, low plasticity, brown.				RESIDUAL SOIL
			2						Continued as Cored Borehole				
			4										
			6										
			8										
			10							D			
			12										
			14										
			16										
			18										
			20										
			22										
			24										
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS													
 (C) Copyright Martens & Associates Pty. Ltd.						MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au				Engineering Log - BOREHOLE			

[illegible]

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE PT170607BH101-9H104 MW02-MW04 V01.GPJ <<DrawingFile>> 09/09/2025 10:24 10.02.00.04 D:\git\Martens 2.00\2016-11-13\Pjt\Martens 2.00\2016-11-13

CLIENT	Pittman Building Pty Ltd			COMMENCED	11/10/2017	COMPLETED	17/10/2017	REF BH102					
PROJECT	Preliminary Resource Feasibility Assessment			LOGGED	AM	CHECKED	RE	Sheet 1 OF 3					
SITE	Blind Creek Road, Elsderslie, NSW			GEOLOGY	Latite Tuff	VEGETATION	Grass	PROJECT NO. P1706007					
EQUIPMENT	4WD truck-mounted hydraulic drill rig			LONGITUDE		RL SURFACE	119.96 m	DATUM	AHD				
EXCAVATION DIMENSIONS	ø100 mm x 40.06 m depth			LATITUDE		ASPECT	West	SLOPE	<10%				
Drilling		Sampling		Field Material Description									
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T				119.96 0.80				CL	CLAY, low plasticity, brown.				RESIDUAL SOIL
									Continued as Cored Borehole				
			2										
			4										
			6										
			8										
			10										
			12										
			14										
			16										
			18										
			20										
			22										
			24										
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS													
 (C) Copyright Martens & Associates Pty. Ltd.						MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au				Engineering Log - BOREHOLE			

CLIENT	Pittman Building Pty Ltd				COMMENCED	11/10/2017		COMPLETED	17/10/2017		REF BH102	
PROJECT	Preliminary Resource Feasibility Assessment				LOGGED	AM		CHECKED	RE		Sheet 2 OF 3	
SITE	Blind Creek Road, Elsderslie, NSW				GEOLOGY	Latite Tuff		VEGETATION	Grass		PROJECT NO. P1706007	
EQUIPMENT		4WD truck-mounted hydraulic drill rig			LONGITUDE			RL SURFACE	119.96 m		DATUM	AHD
EXCAVATION DIMENSIONS		ø100 mm x 40.06 m depth			LATITUDE			ASPECT	West		SLOPE	<10%
Drilling					Field Material Description					Defect Information		
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is(50) MPa	DEFECT DESCRIPTION & Additional Observations		AVERAGE DEFECT SPACING (mm)
					0.80		Continuation from non-cored borehole					
					119.16		TUFF, fine grained, aphanitic, dark grey.	SW / FR		0.85: JT, 40°, SN, Pl, Ro 0.90-1.28: JT, 90°, VNR, UN, Ro 1.13: HB 1.28: DB 1.47: JT, 2°, CN, Pl, Ro 1.60-3.60: JT Set 5, 40°, SN, Pl, Ro, JT at 1.6m - Carbonate infill, closed. 2.17: HB 2.30: DB 2.44-2.59: JT Set 2, 70° 2.60: JT, 70°, CN, Pl, Ro 2.76: JT, 30°, Clay CT, Pl, Ro 2.90: JT, 15°, VNR, UN, Ro 3.00-3.10: JT, 0°, SN, Pl, Ro 3.10-3.55: JT, 90° 3.10-3.60: JT Set 2, 40°, SN, Pl, Ro 3.10-3.60: JT Set 2, 80 - 90° 3.66-3.80: JT Set 2, 5°, CT, Pl, Ro 3.83: JT, 50°, CT, Pl, Ro 3.90-4.10: JT, 85°, VNR, Pl, Ro 4.10: DB 4.20: JT, 35°, VNR, Pl, Ro 4.50: JT, 5°, Clay CT, Pl, Ro 4.80: HB 4.92: HB 5.04: HB 5.09: HB 5.10: JT, 15°, SN, Pl, Ro 5.20: JT, 5°, SN, Pl, Ro 5.20-5.85: JT Set 3, 85°, Clay CT, Pl, Ro 5.50-6.00: SZ 6.28-6.55: JT Set 3, 5°, SN, Pl, Ro 6.45-6.75: JT90, VNR, Pl, Ro 6.75: DB 6.75-6.82: JT85, VNR, Pl, Ro 6.82-7.49: JT Set 7, 2 - 5°, SN, Pl, Ro 7.60: DB 7.74: DB 7.74-8.74: JT Set 11, 2 - 5°, SN, Pl, Ro 8.50-8.86: JT, 85 - 90°, Clay CT, Pl, Ro 8.86: DB 9.15-9.76: JT, 85°, VNR, Pl, Ro 9.25-9.92: JT Set 7, 5 - 10°, SN, Pl, Ro 9.90-10.55: JT, 85°, VNR, Pl, Ro 10.05-11.10: JT Set 13, 2 - 5°, SN, Pl, Ro 10.20-10.70: JTSet 3, 50°, CN, Pl, Ro 10.88: JT, 35°, SN, Pl, Ro 11.35: DB 11.76-12.78: JT Set 5, 5°, SN, Pl, Ro 13.14: JT, 60°, SN, ST, Ro 13.53-15.50: JT Set 13, 2 - 5°, SN, Pl, Ro 13.80-13.83: VN Set 2, 30°, Carbonate, Pl 14.22: DB 14.65-14.83: JT, 90°, VNR, Pl, Ro 15.66: DB 15.75: HB 16.05: HB 16.23: HB 16.46: HB 16.65-16.75: JT Set 2, 5°, SN, Pl, Ro 16.86: HB 17.17: HB 17.54-17.60: DB 17.71: JT, 10°, SN, Pl, Ro 17.94: JT, 2°, SN, Pl, Ro 18.05: DB 18.17: DB 18.24-18.60: JT Set 3, 25°, CN, Pl, Ro 18.67-18.76: DB 18.88-19.52: JT Set 3, 5°, SN, Pl, Ro 19.24: HB 19.60: HB 19.71-20.30: DB 20.41: HB 20.48: HB 20.70: HB 20.84: DB 20.90: HB 21.23: HB 21.41: HB 21.46: HB 21.57: HB 21.70-22.61: JT Set 3, 5 - 10°, CN, Pl, Ro 21.75-22.00: JT, 80°, Carbonate 22.15-22.20: JT, 90°, VNR, Pl, Ro		
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS												
 (C) Copyright Martens & Associates Pty. Ltd.					MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au					Engineering Log - BOREHOLE		

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P170607BH101-9H104_MW02-MW04 V01.GPJ <<DrawingFile>> 09/09/2025 10:24 10.02.00.04 Dargel Lab and In Situ Tool - DGD | Ltr. Martens 2.00 2016-11-13 Pjt. Martens 2.00 2016-11-13

CLIENT	Pittman Building Pty Ltd			COMMENCED	26/10/2017	COMPLETED	01/11/2017	REF BH103					
PROJECT	Preliminary Resource Feasibility Assessment			LOGGED	AM	CHECKED	RE	Sheet 1 OF 3					
SITE	Blind Creek Road, Elsderslie, NSW			GEOLOGY	Latite Tuff	VEGETATION		PROJECT NO. P1706007					
EQUIPMENT	4WD truck-mounted hydraulic drill rig			LONGITUDE		RL SURFACE	168.89 m	DATUM	AHD				
EXCAVATION DIMENSIONS	ø100 mm x 36.06 m depth			LATITUDE		ASPECT	East	SLOPE	2%				
Drilling			Sampling		Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/IT				168.89				CL	CLAY, low plasticity, black.				RESIDUAL SOIL
			2										
			4										
			6										
			6.70										
			162.19					GC	Gravelly CLAY, low plasticity, black.				WEATHERED ROCK
			7.70										
			8						Continued as Cored Borehole				
			10										
			12										
			14										
			16										
			18										
			20										
			22										
			24										
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS													
 (C) Copyright Martens & Associates Pty. Ltd.						MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au				Engineering Log - BOREHOLE			

CLIENT		Pittman Building Pty Ltd			COMMENCED		26/10/2017		COMPLETED		01/11/2017		REF BH103																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
PROJECT		Preliminary Resource Feasibility Assessment			LOGGED		AM		CHECKED		RE		Sheet 2 OF 3 PROJECT NO. P1706007																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
SITE		Blind Creek Road, Elsderslie, NSW			GEOLOGY		Latite Tuff		VEGETATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
EQUIPMENT			4WD truck-mounted hydraulic drill rig			LONGITUDE			RL SURFACE			168.89 m		DATUM		AHD																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
EXCAVATION DIMENSIONS			ø100 mm x 36.06 m depth			LATITUDE			ASPECT			East		SLOPE		2%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
Drilling																	Field Material Description																	Defect Information																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
METHOD		WATER		TOR		ROD (SCR)		DEPTH (metres)		DEPTH RL		GRAPHIC LOG		ROCK / SOIL MATERIAL DESCRIPTION										WEATHERING		INFERRED STRENGTH Is ₍₅₀₎ MPa										DEFECT DESCRIPTION & Additional Observations										AVERAGE DEFECT SPACING (mm)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

CLIENT	Pittman Building Pty Ltd			COMMENCED	26/10/2017		COMPLETED	01/11/2017		REF BH103			
PROJECT	Preliminary Resource Feasibility Assessment			LOGGED	AM		CHECKED	RE		Sheet 3 OF 3			
SITE	Blind Creek Road, Elsderslie, NSW			GEOLOGY	Latite Tuff		VEGETATION			PROJECT NO. P1706007			
EQUIPMENT		4WD truck-mounted hydraulic drill rig			LONGITUDE			RL SURFACE	168.89 m		DATUM	AHD	
EXCAVATION DIMENSIONS		ø100 mm x 36.06 m depth			LATITUDE			ASPECT	East		SLOPE	2%	
Drilling				Field Material Description					Defect Information				
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is(50) MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)		
HQ3	15/12/17	100	25 (100)	26			TUFF, fine grained, aphanitic,brown.	MW		24.65: JT, 15°, VNR, ST, Ro			
		100	15 (100)							24.80: DB			
		100	80 (100)							25.00-26.80: JTSet 19, 5 - 15°, SN-VN, PI, Ro			
		100	80 (97)							25.60-26.00: JT, 90°, VNR, PI, Ro			
		100	40 (100)							26.40-26.60: JT, 90°, VNR, PI, Ro			
		100	0 (65)							26.60-26.80: JT, 90°, closed			
		100	86 (100)							27.19: DB			
		100	98 (98)							27.55: HB			
		100	81 (100)							27.89: HB			
		100	86 (100)							28.05: JT, 2°, SN, PI, Ro			
		100	86 (100)	36	36.06 132.83		Hole Terminated at 36.06 m (Target depth reached)	FR - SW		28.17: DB			
		100	86 (100)							28.28: JTSet 3, 5°, CN, PI, Ro			
		100	86 (100)							28.75-29.42: JTSet 3, 5 - 10°, CN-SN, PI, Ro			
		100	86 (100)							29.62: HB			
		100	86 (100)							30.07: HB			
		100	86 (100)							30.23: DB			
		100	86 (100)							30.42: JTSet 3, 15°, SN-VN, PI, Ro			
		100	86 (100)							30.46: JTSet 3, 15°, SN-VN, PI, Ro			
		100	86 (100)							30.63-30.66: VN, 5°, Carbonate			
		100	86 (100)							30.75: VN, 60°, Carbonate			
		100	86 (100)	36	36.06 132.83		Hole Terminated at 36.06 m (Target depth reached)	FR - SW		31.00-31.35: JTSet 3, 15°, SN-VN, PI, Ro			
		100	86 (100)							31.10: DB			
		100	86 (100)							31.35: DB			
		100	86 (100)							31.60-31.75: HB			
		100	86 (100)							31.80: JT, Carbonate FILLED, PI, closed			
		100	86 (100)							31.90: HB			
		100	86 (100)							32.00: HB			
		100	86 (100)							32.10-32.20: JTSet 2, 2°, CN, PI, Ro			
		100	86 (100)							32.30-32.37: JTSet 3, 10 - 15°, SN, PI, Ro			
		100	86 (100)							32.45: DB			
		100	86 (100)	36	36.06 132.83		Hole Terminated at 36.06 m (Target depth reached)	FR - SW		32.70: HB			
		100	86 (100)							32.80: HB			
		100	86 (100)							33.05: HB			
		100	86 (100)							33.12: JT, 5°, SN, PI, Ro			
		100	86 (100)							33.29: HB			
		100	86 (100)							33.35: JT, 70°, CN, Ro			
		100	86 (100)							33.57: JTSet 3, 10 - 15°, CN-SN, PI, Ro			
		100	86 (100)							33.64: JTSet 3, 10 - 15°, CN-SN, PI, Ro			
		100	86 (100)							33.75: JTSet 3, 10 - 15°, CN-SN, PI, Ro			
		100	86 (100)							33.90-34.00: DB			
		100	86 (100)	36	36.06 132.83		Hole Terminated at 36.06 m (Target depth reached)	FR - SW		34.15: JT, 15°, CN, PI, Ro			
		100	86 (100)							34.55: JT, 5°, VNR, PI, Ro			
		100	86 (100)							34.82: JT, 60°, VNR, PI, Ro			
		100	86 (100)							34.84: JT, 15°, SN, PI, Ro			
		100	86 (100)							35.07: HB			
		100	86 (100)							35.50: JT, 30°, VNR, PI, Ro			
		100	86 (100)							35.58: DB			
		100	86 (100)							35.90: JT, 5°, CN, PI, Ro			
		100	86 (100)										
		100	86 (100)										
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS													
						MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au						Engineering Log - BOREHOLE	

MARTENS 2.00 LIB GLB Log MARTENS CORED BOREHOLE P1706007BH101-BH104, MW02-MW04 V01.GPJ <<DrawingFile>> 09/09/2025 10:26 10/02/00/04 Dattel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Proj: Martens 2.00 2016-11-13

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE PT170607BH104.MW02.MW04.V01.GPJ <<DrawingFile>> 09/09/2025 10:24 10.02.00.04 D:\git\Martens 2.00\2016-11-13\Pjt\Martens 2.00\2016-11-13

CLIENT	Pittman Building Pty Ltd			COMMENCED	18/10/2017	COMPLETED	26/10/2017	REF BH104					
PROJECT	Preliminary Resource Feasibility Assessment			LOGGED	AM	CHECKED	RE	Sheet 1 OF 3					
SITE	Blind Creek Road, Elsderslie, NSW			GEOLOGY	Latite Tuff	VEGETATION	Grass	PROJECT NO. P1706007					
EQUIPMENT	4WD truck-mounted hydraulic drill rig			LONGITUDE		RL SURFACE	218.06 m	DATUM	AHD				
EXCAVATION DIMENSIONS	ø100 mm x 35.00 m depth			LATITUDE		ASPECT	East	SLOPE	2-5%				
Drilling			Sampling		Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T				218.06 0.80				CL	CLAY, low plasticity, brown.				RESIDUAL SOIL
									Continued as Cored Borehole				
			2										
			4										
			6										
			8										
			10										
			12										
			14										
			16										
			18										
			20										
			22										
			24										
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS													
 (C) Copyright Martens & Associates Pty. Ltd.						MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au				Engineering Log - BOREHOLE			

MARTENS 2.00 LIB GLB Log MARTENS CORED BOREHOLE P1706007BH101-BH104, MW02-MW04 V01.GPJ <<DrawingFile>> 09/09/2025 10:26 10.02.00.04 Dargal Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Pj: Martens 2.00 2016-11-13

CLIENT	Pittman Building Pty Ltd			COMMENCED	18/10/2017		COMPLETED	26/10/2017		REF BH104				
PROJECT	Preliminary Resource Feasibility Assessment			LOGGED	AM		CHECKED	RE		Sheet 2 OF 3				
SITE	Blind Creek Road, Elsderslie, NSW			GEOLOGY	Latite Tuff		VEGETATION	Grass		PROJECT NO. P1706007				
EQUIPMENT		4WD truck-mounted hydraulic drill rig		LONGITUDE			RL SURFACE	218.06 m		DATUM	AHD			
EXCAVATION DIMENSIONS		Ø100 mm x 35.00 m depth		LATITUDE			ASPECT	East		SLOPE	2-5%			
Drilling				Field Material Description				Defect Information						
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is(50) MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)			
								EL 0.03 VL 0.1 J 0.3 M 1 H 3 V 10 Et			10 30 100 300 1000 3000			
				0.80	217.26		Continuation from non-cored borehole							
HQ3		100	0 (80)	2	217.26		TUFF, fine grained, aphanitic, dark grey, brown.	HW		0.80-5.45: SZ, Shear zone comprising closely spaced joints (set 19) at 5° - 20° and closely - moderately wide spaced joints (set 8) at 70° - 85°. 1.55: DB				
		100	0 (90)				HW	2.35: DB						
		100	0 (100)	MW			2.70: DB							
		100	0 (95)	4			3.35: DB							
		100	0 (95)				4.70: DB							
		100	79 (100)	6			SW	5.35: DB 5.50-5.90: JTSet 3, 2°, CN, PI, Ro						
		100	0 (70)	8			MW	6.40-6.90: JTSet 2, 50°, VNR, PI, Ro 6.68: JT, 5°, VNR, PI, Ro 7.07-7.28: VNSet 3, 2 - 15°, Carbonate 7.13: JT, 5°, SN, PI, Ro 7.20: JT, 70°, VNR, IR, Ro 7.50-7.60: DB 7.67: JT, 2°, VNR, UN, Ro 7.80: JT, 70°						
		100	7 (100)	SW			7.80-9.00: SZ, Shear zone comprising very closely - closely spaced joints (set12) at 2°-10°, moderately wide spaced joints (set 2) at 80°-90° and closed joints (set 6) at 45°. 8.20: DB 9.70: DB 10.00-10.07: JTSet 3, 80°, VNR, PI, Sm							
		100	30 (97)	10			MW	11.30: JT, 5°, SN, ST, Ro						
		100	73 (95)	12			SW	11.90: JT, 50°, SN, PI, Ro 12.15: HB 12.40: JT, 20°, SN, IR, Ro 12.60: JT, 30°, VNR, PI, Sm 12.70: DB 12.80: HB						
		100	63 (90)	14			MW	13.00-13.40: Shear zone comprising extremely closely spaced joints (set 5) at 80°. 13.50-13.80: JTSet 4, 5°, SN, UN, Ro 13.90: JT, 20°, SN, PI, Ro 14.33: JT, 50°, VNR, PI, Ro 14.46: JT, 5°, VNR, PI, Ro 14.81: HB 14.90: JT, 5°, SN, UN, Ro 15.00: JT, 20°, SN, PI, Ro 15.30: JT, 20°, VNR, PI, Ro 15.68: HB 15.80: HB 16.45: DB 16.45-17.60: SZ						
		100	66 (100)	16			SW	17.60: DB 17.60-17.70: JTSet 3, 40°, Carbonate 18.10: JT, 10°, SN, PI, Ro 18.20: VN, Carbonate 18.45: JT, 10°, SN, UN, Ro 18.65-18.70: JTSet 2, 5°, CN, UN, Ro 18.91: VN, 50°, Carbonate 19.00: DB 19.18-19.40: VNSet 2, 5°, Carbonate 19.60: HB 19.70: JT, 5°, SN, PI, Ro 20.00-23.90: JTSet 14, 45 - 60°, Carbonate 20.35-21.10: JTSet 5, 5 - 10°, CN, PI, Ro 20.45-20.75: JTSet 2, 80°, SN, PI, Ro 21.25: DB 21.50-21.85: JTSet 3, 70°, SN, PI, Ro 22.08: JT, 5°, CN, PI, Ro 22.35: VN, 15°, Carbonate 22.50: JT, 15°, CN, PI, Ro 22.60: HB 22.75: JT, 5°, SN, PI, Ro 23.00-23.10: JT, 85°, SN, PI, Ro 23.05: JT, 65°, SN, PI, Ro 23.12: JT, 10°, VNR, PI, Ro 23.21: JT, 10°, SN, UN, Ro 23.48-24.00: SZ, Shear zone comprising extremely to very						
		100	0 (95)	18			MW							
		100	79 (93)	20			SW - FR							
		100	70 (89)	22										
		100	53 (100)	24										
		100	0 (30)				24.00		Dark grey.					
		100	88 (100)				194.06							
		100												
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS														
 (C) Copyright Martens & Associates Pty. Ltd.						MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au			Engineering Log - BOREHOLE					

CLIENT	Pittman Building Pty Ltd				COMMENCED	18/10/2017		COMPLETED	26/10/2017		REF BH104					
PROJECT	Preliminary Resource Feasibility Assessment				LOGGED	AM		CHECKED	RE		Sheet 3 OF 3 PROJECT NO. P1706007					
SITE	Blind Creek Road, Elsderslie, NSW				GEOLOGY	Latite Tuff		VEGETATION	Grass							
EQUIPMENT		4WD truck-mounted hydraulic drill rig			LONGITUDE			RL SURFACE	218.06 m		DATUM	AHD				
EXCAVATION DIMENSIONS		ø100 mm x 35.00 m depth			LATITUDE			ASPECT	East		SLOPE	2-5%				
Drilling					Field Material Description					Defect Information						
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH IS ₍₅₀₎ MPa	DEFECT DESCRIPTION & Additional Observations		AVERAGE DEFECT SPACING (mm)				
HQ3	15/12/17	100	98 (100)	26			TUFF, fine grained, aphanitic, dark grey, brown.	SW - FR		close joints (set 5) at 80°-90°. 24.24: JT, 5°, CN, PI, Ro 24.42: HB 24.69: DB 25.40-25.46: DB 25.62: VN, Carbonate 25.62-25.65: JTSet 3, 5°, SN, UN, Ro 25.73: JT, 50°, SN, PI, Ro 26.18: HB 26.24: JT, 5°, SN, PI, Ro 26.35-26.44: JTSet 3, 10 - 20°, CN, UN, Ro 26.63: JT, 2°, CN, PI, Ro 26.76-26.77: JTSet 2, 2°, VNR, UN, Ro 26.84: JT, 10°, VNR, PI, Ro 27.12: JT, 5°, CN, PI, Ro 27.30: DB 27.40: JT, 10°, SN, PI, Ro 27.60: JT, 40°, CN, PI, Ro 27.75: HB 27.89: HB 27.95: DB 28.20: HB 28.40-28.60: JTSet 2, 5 - 20°, CN, ST, Ro 28.90: HB 29.07: DB 29.16: HB 29.35-29.45: JTSet 2, 10°, CN, ST, Ro 29.40: HB 29.50-29.68: DB 29.88: DB 30.17: HB 30.30: JT, 10°, CN, PI, Ro 30.50-30.54: JTSet 2, 10 - 15°, SN, UN, Ro 30.95: JT, 5°, SN, PI, Ro 31.12: HB 31.22: HB 31.28: JT, 15°, SN, PI, Ro 31.40: JT, 20°, Carbonate CT, PI, Ro 31.60: JT, 5°, CN, UN, Ro 31.70: DB 31.88: HB 32.15: JT, 5°, SN, CU, Ro 32.45: JT, 2°, CN, PI, Ro 32.65: JT, 5°, SN, PI, Ro 32.79: HB 32.89: HB 33.04: DB 33.13: DB 33.20: DB 33.35: JT, 5°, SN, PI, Ro 33.50: JT, 2 - 40°, CN, ST, Ro 33.68: JT, 2°, CN, UN, Ro 33.85-34.00: DB 34.62: JT, 5°, CN, PI, Ro 34.92: JT, 5°, SN, UN, Ro						
		100	71 (100)													
		100	100 (100)													
		100	92 (96)													
		100	95 (95)													
		100	89 (89)													
		100	97 (100)													
		100	89 (100)													
		100	93 (100)													
		100	87 (91)													
				35.00			Hole Terminated at 35.00 m (Target depth reached)									
				183.06												
				36												
				38												
				40												
				42												
				44												
				46												
				48												
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																
Martens (C) Copyright Martens & Associates Pty. Ltd.									MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au				Engineering Log - BOREHOLE			

CLIENT	Pittman Building Pty Ltd	COMMENCED	11/10/2017	COMPLETED	17/10/2017	REF MW01 Sheet 1 OF 1 PROJECT NO. P1706007	
PROJECT	Preliminary Resource Feasibility Assessment	LOGGED	AM	CHECKED	RE		
SITE	Blind Creek Road, Elsderslie, NSW	GEOLOGY	Latite Tuff	VEGETATION	Grass		
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE		RL SURFACE	119.96 m	DATUM	AHD
EXCAVATION DIMENSIONS	40.06 m depth	LATITUDE		ASPECT	West	SLOPE	<10%

Drilling					Sampling			Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	PIEZOMETER DETAILS	
				0.80				CL	CLAY, low plasticity, brown.				ID MW01 Static Water Level	
				119.16					TUFF, fine grained, aphanitic, dark grey.					
			5											
			10											
			15											
			20											
			25											
			30											
			35											
			40	40.06										
									Hole Terminated at 40.06 m (Target depth reached)					

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P170607BH101-9H104 MW02-MW04 V01.GPJ <<DrawingFile>> 09/09/2025 10:25 10.02.00.04 Dargel Lab and In Situ Tool - DGD | Lic: Martens 2.00 2016-11-13

CLIENT	Pittman Building Pty Ltd			COMMENCED	26/10/2017	COMPLETED	01/11/2017	REF MW02					
PROJECT	Preliminary Resource Feasibility Assessment			LOGGED	AM	CHECKED	RE	Sheet 1 OF 1					
SITE	Blind Creek Road, Elsderslie, NSW			GEOLOGY	Latite Tuff	VEGETATION		PROJECT NO. P1706007					
EQUIPMENT		4WD truck-mounted hydraulic drill rig			LONGITUDE		RL SURFACE	168.89 m	DATUM	AHD			
EXCAVATION DIMENSIONS		36.06 m depth			LATITUDE		ASPECT	East	SLOPE	2%			
Drilling				Sampling		Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS Static Water Level	
				168.89				CL	CLAY, low plasticity, black.			MW02	
			5									Grout	
				6.70									
				162.19				GC	Gravelly CLAY, low plasticity, black.				
				7.70									
				161.19					TUFF, fine grained, aphanitic, brown.			Bentonite	
			10										
			15										
				19.00									
				149.89					dark grey, brown.				
			20										
			25										
			30									Sand Screen	
			35										
				36.06									
			40						Hole Terminated at 36.06 m (Target depth reached)				
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS													
 (C) Copyright Martens & Associates Pty. Ltd.						MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au						Engineering Log - BOREHOLE	

CLIENT	Pitman Building Services Pty Ltd		COMMENCED				COMPLETED				REF BH105			
PROJECT	Resource Feasibility Assessment		LOGGED		AK		CHECKED				Sheet 2 OF 5			
SITE	Bluestone Hardrock Quarry, Elderslie, NSW		GEOLOGY				VEGETATION				PROJECT NO. P2410628			
EQUIPMENT				LONGITUDE				RL SURFACE		186.67 m		DATUM	AHD	
EXCAVATION DIMENSIONS		64.11 m depth		LATITUDE				ASPECT				SLOPE		
Drilling				Field Material Description						Defect Information				
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is ₍₅₀₎ MPa	DEFECT DESCRIPTION & Additional Observations		AVERAGE DEFECT SPACING (mm)		
					0.20 186.47		Start of Cored Borehole @ 0.20 m borehole							
NMLC		100	54 (100)	2			TUFF; aphantic, dark grey.	SW - FR		0.45: JT, 30 - 40°, SN, PI, Ro 0.48: JT, 60 - 70°, SN, PI, Ro 0.58: JT, 60 - 70°, SN, UN, Ro 0.65: JT, 20°, SN, UN, Ro 0.72: JT, 60 - 70°, SN, UN, Ro 0.76: DB 0.92: JT, 10 - 20°, SN, PI, Ro 0.95: JT, 80 - 90°, SN, PI, Ro 1.20: JT, 5 - 10°, SN, UN, Ro 1.26: JT, 5 - 10°, SN, UN, Ro 1.32: JT, 10°, SN, PI, Ro 1.32-1.39: HB, [DB- EOR] 1.46: JT, 0 - 40°, CU, Healed 1.49: JT, 5 - 10°, SN, ST, Ro 1.62: HB 1.75: HB 1.83: HB 1.92: HB 2.00: HB 2.13-2.64: JT Set 4, 5 - 10°, SN, PI, Ro 2.28-2.37: JT Set 2, 70 - 80°, SN, PI, Ro 2.30-2.74: JT Set 4, 10 - 20°, SN, PI, Ro 2.91: JT, 5 - 10°, SN, UN, Ro 2.92: JT, 5 - 10°, SN, PI, Ro 2.95-3.00: HB 3.05-3.48: JT Set 3, 70 - 80°, SN, PI, Ro 3.09-3.87: JT Set 4, 5 - 20°, SN, UN, Ro 3.39: HB 3.98-4.10: JT Set 3, 20 - 30°, SN, PI, Ro 4.23: HB 4.30-4.71: JT Set 2, 20 - 40°, SN, PI, Ro 4.37: HB, [DB- EOR] 4.45: JT, 5 - 10°, SN, PI, Ro 4.57-4.84: JTSet 2, 40 - 60°, SN, PI, Ro 4.85-5.16: JT, 80°, SN, PI, Ro 5.00: HB 5.08: JT, 0 - 5°, SN, UN, Ro 5.17: JT, 0 - 40°, CU, Healed 5.28: JT, 10 - 20°, PI, Closed 5.32: JT, 60 - 70°, PI, Closed 5.38: JT, 60 - 70°, SN, UN, Ro 5.51: JT, 10 - 20°, SN, PI, Ro 5.56: JT, 20 - 30°, SN, PI, Ro 5.63: JT, 10 - 20°, SN, UN, Ro 5.64: JT, 70 - 80°, SN, PI, Ro 5.74: JT, 20 - 30°, SN, UN, Ro 5.80: JT, 70 - 80°, SN, PI, Ro 5.84-6.23: JT, 70 - 80°, SN, PI, Ro 6.00: HB 6.07: HB 6.24: JT, 5 - 10°, SN, PI, Ro 6.33: HB 6.42: HB 6.62-6.63: JT Set 2, 0 - 2°, SN, PI, Ro 6.65: JT, 30 - 40°, SN, PI, Ro 6.83: HB 7.00: HB 7.05: JT, 70 - 80°, SN, PI, Ro 7.09: JT, 10 - 20°, SN, PI, Ro 7.09-7.87: Set 6 7.42: JT, 80°, SN, PI, Ro 7.75: HB, [EOR] 8.00: HB 8.09-9.28: JT Set 6, 10 - 30°, SN, PI, Ro 8.23: JT, 20 - 30°, SN, PI, Ro 8.32: JT, 5 - 10°, CT, PI, Ro 8.36: JT, 10 - 20°, SN, UN, Ro 8.47: HB 8.54: HB 8.90: JT, 40°, SN, PI, Ro 9.83: JT, 5 - 10°, SN, UN, Ro 9.87: JT, 40°, SN, PI, Ro 10.00: HB 10.08: JT, 10 - 20°, SN, PI, Ro 10.19-10.23: JT Set 3, 5 - 10°, SN, PI, Ro 10.33-10.36: JT Set 2, 40 - 50°, SN, PI, Ro 10.45-10.61: JT Set 3, 30 - 40°, SN, PI, Ro 10.83: HB 11.00: HB 11.12: DB, [EOR] 11.43: HB 11.94: JT, 10 - 20°, SN, PI, Ro 12.00: HB 12.07: HB 12.18: JT, 40 - 50°, SN, PI, Ro, [EOR] 12.54: JT, 20 - 30°, CN, PI, Ro				
		100	91 (100)						FR					
			100	80 (100)	4									
			100	89 (100)										
			100	84 (100)	8									
			100	100 (100)										
			100	92 (100)	12									
			100	90 (100)										
			100	91 (100)	16									
			100	72 (100)										
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS														
				MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au				Engineering Log - BOREHOLE						

MARTENS 2.00 LIB GLB Log MARTENS CORED BOREHOLE P24102BHH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 Datigel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Pjt: Martens 2.00 2016-11-13

CLIENT		Pitman Building Services Pty Ltd		COMMENCED				COMPLETED				REF BH105			
PROJECT		Resource Feasibility Assessment		LOGGED		AK		CHECKED				Sheet 3 OF 5			
SITE		Bluestone Hardrock Quarry, Elderslie, NSW		GEOLOGY				VEGETATION				PROJECT NO. P2410628			
EQUIPMENT						LONGITUDE				RL SURFACE		186.67 m			
EXCAVATION DIMENSIONS			64.11 m depth			LATITUDE				ASPECT		SLOPE			
Drilling			Field Material Description						Defect Information						
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is ₍₅₀₎ MPa	DEFECT DESCRIPTION & Additional Observations			AVERAGE DEFECT SPACING (mm)		
NMLC		100	72 (100)		22		TUFF; aphanitic, dark grey.	SW - FR		12.72: JT, 40 - 50°, SN, UN, Ro 12.73-12.81: JT Set 2, 10 - 20°, CN, PI, Ro 12.85: JT, 30 - 40°, CN, PI, Ro 13.00: JT, 20 - 30°, CN, PI, Ro 13.13-14.53: JT Set 2, 10 - 20°, SN, PI, Ro 13.16-13.31: JT Set 2, 30 - 40°, SN-CN, PI, Ro 14.00: HB 14.47: JT, 10 - 20°, PI, Closed 14.80: DB, [EOR] 15.00: HB 15.03: JT, 30 - 40°, SN, PI, Ro 15.33-15.89: JT Set 5, 10 - 20°, SN, PI, Ro 15.98: JT, 90°, SN, UN, Ro 16.00: HB 16.48: HB 16.65-16.85: JT Set 2, 10°, SN, PI, Ro 17.00: HB 17.03: JT, 5 - 10°, SN, PI, Ro 17.08-17.21: JT Set 4, 40 - 50°, VNR, PI, Ro 17.33: JT, 70 - 80°, SN, PI, Ro 17.38: [EOR] 17.38-17.86: JT Set 5, 10 - 30°, SN, PI, Ro 17.72-17.95: JT Set 2, 50 - 70°, SN, PI, Ro 17.98-19.70: JT Set 11, 10 - 20°, SN, PI, Ro 18.22: HB 18.39: HB 19.33: JT, 80 - 90°, SN, UN, Ro 19.40: [EOR] 19.60: JT, 40 - 50°, PI, Closed 19.67: JT, 40 - 50°, SN, PI, Ro 19.74: HB 19.82-20.23: JT 20.00: HB 20.10: JT, 2 - 5°, SN, PI, Ro 20.57: HB 20.93: JT, 30 - 40°, SN, PI, Ro 21.00: HB 21.09-21.28: JT Set 4, 10 - 20°, SN, PI, Ro 21.17-21.73: JT Set 3, 20 - 30°, SN, PI, Ro 21.37-21.85: JTSet 5, 5 - 10°, SN, PI, Ro 21.62: JT, 60 - 70°, SN, PI, Ro 21.83: JT, 60 - 70°, SN, PI, Ro 21.93: JT, 20 - 30°, SN, UN, Ro 21.97: JT, 30 - 40°, SN, UN, Ro 22.12-22.50: JT Set 3, 20 - 30°, SN, PI, Ro 22.14-22.68: JT Set 5, 10 - 20°, SN, PI, Ro 22.25: JT, 70 - 80°, SN, PI, Ro 22.37: JT, 40 - 50°, SN, PI, Ro 22.81: JT, 0 - 2°, SN, PI, Ro 22.84: JT, 70 - 80°, SN, PI, Ro 22.88-22.98: JT Set 3, 30 - 40°, PI, Closed 23.00: HB 23.06: HB 23.11-23.93: JT Set 4, 30 - 40°, VNR, PI, Ro 23.25: HB 23.53-23.87: JT Set 4, 20 - 30°, SN, PI, Ro 23.98-24.85: JT Set 8, 10 - 20°, SN, PI, Ro, 40 - 370mm spcaing 24.00-24.08: JT Set 3, 20 - 30°, SN, PI, Ro, 40mm spacing 24.15: JT, 30 - 40°, VNR, PI, Ro 24.22: JT, 5 - 30°, CU, Healed 24.26: JT, 30 - 40°, SN, PI, Ro 25.00: JT, 40 - 50°, SN, PI, Ro 25.11: JT, 2 - 5°, SN, UN, Ro 25.13: JT, 30 - 40°, SN, UN, Ro 25.17: JT, 10 - 20°, SN, UN, Ro 25.19: JT, 5 - 10°, SN, UN, Ro 25.29: JT, 80 - 90°, SN, UN, Ro 25.32-25.35: CS, 30mm Gravelly SAND 25.41-25.48: JT Set 2, 20 - 80°, SN, UN, Ro 25.53-26.00: JT Set 5, 10°, CN-SN, PI, Ro 25.74: JT, 20 - 30°, SN, PI, Ro 26.07: JT, 5 - 10°, SN, UN, Ro 26.19: JT, 30 - 40°, SN, PI, Ro 26.21-26.79: JT Set 6, 5 - 10°, SN, PI, Ro 26.22: JT, 40 - 50°, CN, PI, Ro 26.45-26.83: JT Set 3, 5 - 20°, SN, PI, Ro 26.53-31.50: JT Set 5, 20 - 30°, VNR, PI, Ro 27.00: HB 27.06: HB 27.15: HB 27.53-38.32: JT Set 31, 5 - 20°, SN-CN, PI, Ro 28.00: HB 28.19: HB 28.82: HB 29.00: HB 29.27: HB 29.78: HB					
		100	71 (99)		24			FR							
		100	82 (100)		26										
		100	100 (100)		28										
		100	100 (100)		30										
		100	100 (100)		32										
		100	100 (100)		34										
		100	100 (100)		36										
		100	100 (100)		38										
		100	100												
	EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS														
	 (C) Copyright Martens & Associates Pty. Ltd. MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au Engineering Log - BOREHOLE														

MARTENS 2.00 LIB.GLB Log MARTENS CORED BOREHOLE P241028BH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 DattelLab and In Situ Tool -DGD [Lib: Martens 2.00 2016-11-13 Pjt: Martens 2.00 2016-11-13

CLIENT	Pitman Building Services Pty Ltd				COMMENCED		COMPLETED		REF BH105		
PROJECT	Resource Feasibility Assessment				LOGGED	AK	CHECKED		Sheet 4 OF 5		
SITE	Bluestone Hardrock Quarry, Elderslie, NSW				GEOLOGY		VEGETATION		PROJECT NO. P2410628		
EQUIPMENT						LONGITUDE		RL SURFACE	186.67 m	DATUM	AHD
EXCAVATION DIMENSIONS		64.11 m depth				LATITUDE		ASPECT		SLOPE	
Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is ₍₅₀₎ MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)
NMLC			(100)				TUFF; aphanitic, dark grey.	FR	EL 0.03 VL 0.1 J 0.3 M 1 H 3 VH 10 EH	29.82: HB	10 30 100 300 1000 3000
		100	100 (100)	42						30.00: HB	
										30.05: HB	
										30.12: HB	
										30.82: HB	
										31.29: HB	
										31.63: HB	
										31.69: HB	
										31.80: DB, [EOR]	
										31.95: HB	
										32.00: HB	
										32.11: HB	
										32.31: HB	
										32.71: HB	
										32.82: JT, 60 - 70°, VNR, Pl, Ro	
										33.00: HB	
		100	100 (100)	44						34.18: HB	
										35.00: HB	
										35.67: HB	
						36.00: HB					
						37.00: HB					
						38.84: JT, 10 - 20°, SN, UN, Ro					
						39.00: JT, 5 - 10°, SN, UN, Ro					
						39.70: JT, 20 - 30°, SN, Pl, Ro					
						40.00: HB					
						40.24-55.14: JT Set 24, 5 - 15°, CN-SN, Pl, Ro					
						41.00: HB					
						41.24: HB					
						41.44: HB, [EOR]					
						42.76: HB					
						43.00: HB					
						43.77: JT, 40 - 50°, SN, Pl, Ro, [EOR]					
						44.00: HB					
						45.00: HB					
						46.00: HB					
						47.00: HB					
						47.37: DB, [EOR]					
						47.89: HB					
						48.00: HB					
						48.75: HB					
						49.00: HB					
						49.05: HB					
						49.49: HB					
						50.00: HB					
						50.14: HB					
						50.16: HB					
						50.62: DB					
						50.83: JT, 50 - 60°, SN, CU, Ro					
						51.00: HB					
						51.86: HB					
						52.00: HB					
						52.07: DB					
						53.00: HB					
						53.12: JT, 30 - 40°, SN, Pl, Ro					
						53.29: JT, 30 - 40°, VNR, Pl, Ro					
						53.36: DB					
						54.00: HB					
						54.28: HB					
						55.00: HB					
						56.00: HB					
						56.55: JT, 50 - 60°, SN, Pl, Ro					
						57.00: HB					
						57.78: HB					
						58.00: HB					
						58.08: HB					
						58.60: JT, 50 - 60°, SN, Pl, Ro					
						59.00: HB					
						59.15: HB					
						59.33-59.60: JT Set 4, 5 - 10°, CN, Pl, Ro					
						59.62: HB					
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS											
 MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au								Engineering Log - BOREHOLE			

MARTENS 2.00 LIB.GLB Log MARTENS CORED BOREHOLE P241002BHH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 Datagel Ltd and In Situ Tool -DGD [Lib: Martens 2.00 2016-11-13 Pjt: Martens 2.00 2016-11-13

CLIENT	Pitman Building Services Pty Ltd		COMMENCED		COMPLETED		REF BH105				
PROJECT	Resource Feasibility Assessment		LOGGED	AK	CHECKED		Sheet 5 OF 5				
SITE	Bluestone Hardrock Quarry, Elderslie, NSW		GEOLOGY		VEGETATION		PROJECT NO. P2410628				
EQUIPMENT			LONGITUDE		RL SURFACE	186.67 m	DATUM	AHD			
EXCAVATION DIMENSIONS		64.11 m depth	LATITUDE		ASPECT		SLOPE				
Drilling			Field Material Description			Defect Information					
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is(50) MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)
NMLC		100	90 (100)				TUFF; aphantic, dark grey.	FR	EL 0.03 VL 0.1 J 0.3 M 1 H 3 VH 10 EH	60.00: HB 60.04: DB 60.21-62.86: JT Set 7, 10 - 15°, Pl, Ro 61.00: HB 61.15: HB 61.84: HB 61.90: JT, 50 - 60°, VNR, Pl, Ro 62.00: HB 62.32: HB 63.03: HB 63.04: HB 63.19: HB 63.25: JT, 5 - 10°, Pl, Healed 63.38: JT, 70 - 80°, SN, Pl, Ro 63.92: JT, 80 - 98°, SN, Pl, Ro 64.00: HB	10 30 100 300 1000 3000
		100	75 (100)	62	64.11 122.56		Hole Terminated at 64.11 m				
				66							
				68							
				70							
				72							
				74							
				76							
				78							
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS											
 (C) Copyright Martens & Associates Pty. Ltd.						MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au			Engineering Log - BOREHOLE		

MARTENS 2.00 LIB.GLB Log MARTENS CORED BOREHOLE P24102BHH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 Datagel Ltd and In Situ Tool - DGD [Lib: Martens 2.00 2016-11-13 Proj: Martens 2.00 2016-11-13

CLIENT		Pitman Building Services Pty Ltd				COMMENCED				COMPLETED				REF BH106			
PROJECT		Resource Feasibility Assessment				LOGGED		AK		CHECKED				Sheet 2 OF 3			
SITE		Bluestone Hardrock Quarry, Elderslie, NSW				GEOLOGY				VEGETATION				PROJECT NO. P2410628			
EQUIPMENT							LONGITUDE				RL SURFACE		140.54 m		DATUM AHD		
EXCAVATION DIMENSIONS			30.00 m depth				LATITUDE				ASPECT				SLOPE		
Drilling						Field Material Description						Defect Information					
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is(50) MPa	DEFECT DESCRIPTION & Additional Observations					AVERAGE DEFECT SPACING (mm)		
					0.72		Start of Cored Borehole at 0.72 borehole										
NMLC		100	70 (99)	2	139.82	C C											

MARTENS 2.00 LIB GLB Log MARTENS CORED BOREHOLE P241002BH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 Datagel Ltd and In Situ Tool -DGD | Lib: Martens 2.00 2016-11-13 Pjt: Martens 2.00 2016-11-13

CLIENT		Pitman Building Services Pty Ltd		COMMENCED				COMPLETED				REF BH106		
PROJECT		Resource Feasibility Assessment		LOGGED		AK		CHECKED				Sheet 3 OF 3		
SITE		Bluestone Hardrock Quarry, Elderslie, NSW		GEOLOGY				VEGETATION				PROJECT NO. P2410628		
EQUIPMENT						LONGITUDE				RL SURFACE		140.54 m		
EXCAVATION DIMENSIONS			30.00 m depth			LATITUDE				ASPECT				
Drilling			Field Material Description						Defect Information					
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is ₍₅₀₎ MPa	DEFECT DESCRIPTION & Additional Observations			AVERAGE DEFECT SPACING (mm)	
NMLC		100	95 (100)				TUFF; aphanitic, brown and drak grey.	SW		14.17: HB 14.84: HB 15.00: DB, [EOR] 15.08: HB 15.44-15.86: JT Set 2, 20 - 30°, SN, PI, Ro 15.67: JT, 50 - 60°, SN, PI, Ro 16.00: JT, 20 - 30°, SN, PI, Ro 16.13: HB 16.17: DB, [EOR] 16.22-16.26: JT Set 2, 50 - 60°, SN, PI, Ro 16.32: JT, 40 - 50°, SN, PI, Ro 16.57: HB 16.61: JT, 50 - 60°, SN, PI, Ro 16.73: JT, 60 - 90°, UN, Closed 16.81: DS, 50 mm; Silty CLAY 17.00: HB 17.11: HB 17.13: JT Set 4, 30 - 40°, SN, PI, Ro 17.17: JT, 20 - 30°, SN, PI, Ro 17.78-18.12: IS, 60 - 80°, Gravelly CLAY 18.52: JT, 50 - 70°, PI, Closed 18.63: HB 18.79: HB 19.00: HB 19.07-19.91: JT Set 4, 10 - 20°, SN, PI, Ro 19.23: DB 19.57-19.59: JT Set 2, 5 - 10°, SN, PI, Ro 19.76: JT, 50 - 60°, PI, Closed 20.00: HB 20.41-24.69: JT Set 6, 10 - 20°, SN, PI, Ro 20.63: DB, [EOR] 20.94: HB 21.00: HB 21.13: HB 21.52: HB 21.66: JT, 30 - 40°, SN, PI, Ro 22.00: HB 22.03: HB 22.13: HB 22.14: DB, [EOR] 23.00: HB 23.83: HB 24.00: HB 25.00: HB				
		100	100 (100)	22										
		100	100 (100)	24										
		100	80 (100)	26										
		100	86 (100)	28										
				30	30.00 110.54									
				32										
				34										
				36										
				38										
Hole Terminated at 30.00 m									25.19: DB, [EOR] 25.43-26.00: JT Set 5, 10 - 20°, SN, PI, Ro 25.46-25.81: JT Set 4, 60 - 80°, SN, PI, Ro 26.00-26.13: JT Set 3, 20 - 30°, SN, UN, Ro 26.15-26.44: JT, 80 - 90°, SN, PI, Ro 26.16-26.36: JT Set 3, 10 - 20°, SN, PI, Ro 26.17-26.33: JT Set 4, 20 - 30°, SN - VNR, PI, Ro 26.48-27.43: JTSet 4, 20 - 30°, SN, PI, Ro 26.53-27.50: JT Set 3, 20 - 30°, SN, PI, Ro 27.00: HB 27.60: JT, 20 - 30°, PI, Closed 27.67: JT, 10 - 20°, SN, PI, Ro 27.82: JT, 10 - 20°, SN, UN, Ro 27.92: JT, 20 - 30°, SN, UN, Ro 27.98: JT, 30 - 40°, SN, UN, Ro 28.04: JT, 80 - 90°, SN, PI, Ro 28.08: JT, 10 - 20°, SN, PI, Ro 28.32: HB 28.38: JT, 20 - 30°, PI, Closed 28.44: HB 28.63: JT, 20 - 30°, SN, PI, Ro 29.00: HB 29.09: HB 29.11: JT, 20 - 30°, SN, UN, Ro 29.13: JT, 30 - 40°, SN, PI, Ro 29.21: JT, 20 - 30°, VNR, PI, Ro					
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS														
 MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au									Engineering Log - BOREHOLE					

MARTENS 2.00 LIB GLB Log MARTENS CORED BOREHOLE P24102BH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 Datigel Lab and In Situ Tool -DGD [Lib: Martens 2.00 2016-11-13 Proj: Martens 2.00 2016-11-13

CLIENT	Pitman Building Services Pty Ltd				COMMENCED		COMPLETED		REF BH107				
PROJECT	Resource Feasibility Assessment				LOGGED	AK	CHECKED		Sheet 2 OF 5				
SITE	Bluestone Hardrock Quarry, Elderslie, NSW				GEOLOGY		VEGETATION		PROJECT NO. P2410628				
EQUIPMENT						LONGITUDE		RL SURFACE	173.14 m	DATUM	AHD		
EXCAVATION DIMENSIONS		63.51 m depth				LATITUDE		ASPECT		SLOPE			
Drilling						Field Material Description				Defect Information			
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is ₍₅₀₎ MPa	DEFECT DESCRIPTION & Additional Observations		AVERAGE DEFECT SPACING (mm)	
				2	2.40		Start of cased borehole at 2.40 borehole						
HQ3		100	10 (40)		170.74		TUFF; aphantic, brown and dark grey.	MW - HW		2.52-3.08: JT Set 6, SN, UN, Ro			
				4						3.36: JT, 70 - 80°, SN, CU, Ro 3.43: JT, 10 - 20°, SN, PI, Ro 3.49: JT, 5 - 10°, SN, PI, Ro 3.60: JT, 40 - 50°, SN, UN, Ro 3.70: JT, 70 - 80°, SN, PI, Ro 3.91: JT, 30 - 40°, SN, UN, Ro 4.00: JT, 10 - 20°, SN, PI, Ro 4.07-4.45: JT Set 2, 50 - 60°, SN, PI, Ro 4.08-4.92: JT Set 11, 10 - 20°, SN, PI, Ro 4.56: JT, 5 - 20°, SN, CU, Ro 4.73: JT, 70 - 80°, SN, PI, Ro 4.93: JT, 20 - 30°, SN, UN, Ro 5.64: JT, 10 - 20°, SN, PI, Ro 6.38: JT, 40 - 50°, SN, PI, Ro 6.40-6.88: JT, 70 - 90°, SN, UN, Ro 6.60-6.70: JT Set 2, 50 - 60°, SN, PI, Ro 7.20: JT, 10 - 20°, SN, PI, Ro 7.29: JT, 10 - 20°, SN, PI, Ro 7.40-7.72: JT Set 2, 20 - 30°, SN, PI, Ro 7.77-7.82: JT Set 2, 5 - 10°, SN, PI, Ro 8.07-8.42: JT Set 4, 10 - 20°, SN, PI, Ro 8.25-8.61: JT Set 5, 10 - 20°, SN, PI, Ro			
		97	15 (60)							8.92-9.20: JT, 70 - 80°, SN, PI, Ro			
				6						9.36: JT, 10 - 20°, SN, UN, Ro 9.47: JT, 20 - 30°, SN, PI, Ro 9.55: JT, 80 - 90°, SN, UN, Ro			
		100	0 (0)							10.63: DB 10.71: JT, 10 - 20°, SN, PI, Ro			
		100	10 (30)							11.37-11.93: JT Set 10, 10 - 20°, CN, UN, Ro 11.42: DB 11.56-11.67: JT Set 2			
		75	10 (50)							12.56-13.66: JT Set 18, 5 - 10°, CN - SN, UN, Ro			
		33	0 (0)							13.70-14.70: DZ			
				12						14.73-14.76: JT Set 2, 40 - 50°, SN, UN, Ro 14.83-14.90: FZ, 5 - 40°, 70mm. 14.96-15.35: JT Set 5, 5 - 10°, SN, UN, Ro 15.30: DB 15.37-15.52: FZ, 5 - 40°, 150mm. 15.67-15.95: FZ, 10 - 60°, 280mm. 16.00: HB 16.06: HB 16.10: DB 16.20-16.32: JT Set 3, 5 - 20°, SN, UN, Ro 16.41-17.16: FZ, 5 - 40°, 750mm. 17.26-17.76: JT Set 8, 5 - 15°, SN, UN, Ro 17.50: JT, 70 - 80°, SN, UN, Ro 17.76-17.95: JT, 80 - 90°, SN, UN, Ro 18.00-18.50: FZ, 5 - 30°, 500mm.			
		55	0 (45)							18.60-19.00: JT Set 4, 5 - 15°, SN, UN, Ro			
				14						19.04-19.16: JT Set 2, 20 - 40°, SN, CU, Ro 19.31-19.55: JT Set 2, 5 - 10°, SN, UN, Ro 19.45: HB			
		100	10 (90)										
		88	10 (60)										
		100	10 (70)										
				16									
		98	10 (70)										
				18									
		100	10 (70)										
		100	20										
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS													
 (C) Copyright Martens & Associates Pty. Ltd.								MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au				Engineering Log - BOREHOLE	

MARTENS 2.00 LIB.GLB Log MARTENS CORED BOREHOLE P241028BH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 Datigel Ltd and In Situ Tool -DGD [Lib: Martens 2.00 2016-11-13 Pjt: Martens 2.00 2016-11-13

CLIENT		Pitman Building Services Pty Ltd			COMMENCED				COMPLETED				REF BH107				
PROJECT		Resource Feasibility Assessment			LOGGED		AK		CHECKED				Sheet 3 OF 5				
SITE		Bluestone Hardrock Quarry, Elderslie, NSW			GEOLOGY				VEGETATION				PROJECT NO. P2410628				
EQUIPMENT						LONGITUDE				RL SURFACE		173.14 m		DATUM AHD			
EXCAVATION DIMENSIONS			63.51 m depth			LATITUDE				ASPECT				SLOPE			
Drilling						Field Material Description						Defect Information					
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is(50) MPa	DEFECT DESCRIPTION & Additional Observations				AVERAGE DEFECT SPACING (mm)			
HQ3		100	(80) 20 (80)				TUFF; aphanitic, brown and dark grey.	MW		19.62: DB 19.65-19.74: CS, 90mm. 19.79-19.89: JT Set 3, 10 - 30°, SN, UN, Ro 19.94: JT, 30 - 40°, SN, PI, Ro 19.95-20.10: CZ, 150mm. 20.15: JT, 10 - 90°, SN, ST, Ro 20.18-22.52: JT Set 23, 5 - 20°, SN, PI, Ro							
		100	40 (90)	22	22.30 150.84		AGGLOMERATE; pink, brown and grey.	HW		22.70-24.39: FZ, 5 - 80°, 1690mm.							
		100	90 (90)	26						24.49: DB 24.58-26.89: JT Set 20, 5 - 15°, SN, UN, Ro 25.00: HB 26.00: HB							
		70	60 (60)	28						27.00: HB 27.22: DB 27.31-27.50: JT Set 5, 5 - 10°, SN, UN, Ro 27.57-27.65: CS, 80mm. 28.10-28.15: CS, 50mm. 28.23: JT, 5 - 15°, SN, UN, Ro 28.32-28.40: JT Set 2, 5 - 15°, SN, UN, Ro 28.69-29.00: FZ, 310mm.							
		100	80 (90)	30						29.45-29.65: JT Set 4, CN, UN, Ro 29.72-29.80: CS, 80mm. 29.85: DB 30.00: HB 30.15: JT, 5 - 10°, SN, UN, Ro 30.25: DB 30.29-30.85: JT Set 10, 5 - 45°, SN, UN, Ro 31.00: HB 31.00-31.40: CZ, 400mm. 31.40: DB 31.49: JT, 10 - 20°, SN, UN, Ro 31.57: DB 31.65-31.74: CS, 90mm. 31.82-32.30: JT Set 4, 5 - 20°, SN, UN, Ro 32.45-32.58: FZ, 10 - 50°, 130mm. 32.67-33.30: JT Set 5, 5 - 20°, SN, UN, Ro 33.00-33.08: HB							
		100	50 (90)							33.45: DB 33.56-33.80: JT Set 4, 5 - 15°, SN, UN, Ro 33.80-34.54: FZ, 5 - 50°, 740mm.							
		100	30 (80)	34						34.68: JT, 2 - 5°, SN, PI, Ro 34.79: JT, 20 - 30°, SN, PI, Ro 34.92: JT2, 5°, CN, PI, Ro 35.00: HB 35.03-35.20: CS, 170mm. 35.34-35.38: CS, 40mm. 35.53: JT, 2 - 5°, CN, UN, Ro 35.64-36.15: FZ, 2 - 40°, 510mm. 36.22: JT, 5 - 20°, SN, CU, Ro 36.34: JT, 5 - 20°, SN, CU, Ro 36.42-36.46: CS, 40mm. 36.53: HB 36.64-36.67: CS, 40mm. 36.87: JT, 5 - 30°, SN, CU, Ro 37.00: HB 37.09-37.14: CS, 50mm. 37.17: JT, 5 - 30°, SN, CU, Ro 37.62-37.92: CZ, 300mm. 38.00: HB 38.08-38.23: FZ, 40 - 70°, 150mm. 38.23-38.70: JT, 80 - 90°, SN, UN, Ro, closed then open. 38.78-39.00: CZ, 220mm. 39.06: HB							
		100	60 (90)	36													
		75	30 (50)	38													
		100	60 (90)														
	EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																
 MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au										Engineering Log - BOREHOLE							

MARTENS 2.00 LIB.GLB Log MARTENS CORED BOREHOLE P241022BH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 Datagel Ltd and In Situ Tool -DGD [Lib: Martens 2.00 2016-11-13 Pjt: Martens 2.00 2016-11-13

CLIENT		Pitman Building Services Pty Ltd			COMMENCED				COMPLETED				REF BH107						
PROJECT		Resource Feasibility Assessment			LOGGED		AK		CHECKED				Sheet 4 OF 5						
SITE		Bluestone Hardrock Quarry, Elderslie, NSW			GEOLOGY				VEGETATION				PROJECT NO. P2410628						
EQUIPMENT						LONGITUDE				RL SURFACE		173.14 m		DATUM	AHD				
EXCAVATION DIMENSIONS			63.51 m depth			LATITUDE				ASPECT				SLOPE					
Drilling					Field Material Description					Defect Information									
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is ₍₅₀₎ MPa	DEFECT DESCRIPTION & Additional Observations				AVERAGE DEFECT SPACING (mm)					
HQ3		100	60 (90)				AGGLOMERATE; pink, brown and grey.	MW • HW	EL 0.03 VL 0.1 J 0.3 M 1 H 3 VH 10 EH	39.10: DB 39.33: JT, 5 - 30°, CN, UN, Ro 39.45-40.06: FZ, 5 - 40°, 610mm. 40.15-40.83: JT Set 5, 5 - 20°, SN, UN, Ro 41.00: HB 41.27: JT, 2 - 5°, SN, UN, Ro 41.55-45.90: FZ, 5 - 20°, 4350mm, comprising multiple joints and seams.				10 30 100 300 1000 3000					
		87	30 (60)	42							46.00: JT, 5 - 10°, SN, UN, Ro 46.12: JT, 5 - 10°, SN, UN, Ro 46.32: JT, 20 - 30°, SN, UN, Ro 46.48: JT, 5 - 10°, SN, UN, Ro 46.65-47.10: DZ, 450mm.								
		100	30 (80)	46							47.26-47.36: JT, 70 - 80°, SN, UN, Ro 47.42: JT, 5 - 10°, SN, UN, Ro 47.60: JT, 5 - 10°, SN, UN, Ro 47.69: JT, 10 - 20°, SN, UN, Ro 47.76: JT, 10 - 20°, SN, UN, Ro 47.89: DB 48.00: HB 48.00-48.12: FZ, 5 - 40°, 120mm. 48.25-50.00: JT Set 14, 5 - 20°, SN, UN, Ro								
		100	75 (90)	48							50.18-50.23: DZ, 50mm.								
		100	50 (80)	50							50.53: JT, 20 - 30°, CN, CU, Ro 50.75-52.15: JT Set 15, 5 - 20°, SN, UN, Ro								
		80	30 (60)	52							52.23-52.70: FZ, 5 - 90°, 470mm.								
		100	0 (60)	54							52.79: JT, 40 - 50°, SN, UN, Ro 52.89: DB 53.00: JT, 20 - 30°, SN, UN, Ro 53.17: HB 53.28: JT, 5 - 15°, SN, CU, Ro 53.51: JT, 20 - 40°, SN, UN, Ro 53.60-57.42: FZ, 2 - 90°, 3820mm, comprising multiple joints and seams.								
		100	40 (80)	56							57.64: JT, 2 - 5°, SN, UN, Ro 57.85: JT, 2 - 10°, SN, UN, Ro 57.93: JT, 2 - 5°, SN, UN, Ro 58.00: HB 58.09-58.12: DS, 30mm. 58.25: JT, 40 - 50°, SN, UN, Ro 58.35: JT, 2 - 5°, SN, UN, Ro 58.50-59.73: JT Set 9, 5 - 20°, SN, UN, Ro								
		100	60 (90)	58															
	EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																		
 (C) Copyright Martens & Associates Pty. Ltd.										MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au					Engineering Log - BOREHOLE				

CLIENT		Pitman Building Services Pty Ltd				COMMENCED				COMPLETED				REF BH107			
PROJECT		Resource Feasibility Assessment				LOGGED		AK		CHECKED				Sheet 5 OF 5			
SITE		Bluestone Hardrock Quarry, Elderslie, NSW				GEOLOGY				VEGETATION				PROJECT NO. P2410628			
EQUIPMENT						LONGITUDE				RL SURFACE		173.14 m		DATUM AHD			
EXCAVATION DIMENSIONS		63.51 m depth				LATITUDE				ASPECT				SLOPE			
Drilling						Field Material Description						Defect Information					
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is(50) MPa	DEFECT DESCRIPTION & Additional Observations				AVERAGE DEFECT SPACING (mm)			
HQ3		100	60 (90)	62	63.51 109.63		AGGLOMERATE; pink, brown and grey.	MW HW		59.91-60.33: FZ, 2 - 45°, 420mm.							
		100	50 (80)							60.54-61.19: JT Set 6, 2 - 20°, SN, UN, Ro							
										61.26-61.40: CZ, 140mm.							
										61.91: JT, 5 - 10°, SN, UN, Ro							
										62.00: HB							
										62.20: JT, 5 - 10°, SN, UN, Ro							
										62.30: JT, 10 - 20°, SN, UN, Ro							
										62.35-62.90: CZ, 550mm.							
										63.00: HB							
										63.15-63.35: CZ, 20mm.							
				64			Hole Terminated at 63.51 m										
				66													
				68													
				70													
				72													
				74													
				76													
				78													
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																	
						MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au						Engineering Log - BOREHOLE					

MARTENS 2.00 LIB.GLB Log MARTENS CORED BOREHOLE P241022BH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 Datigel Ltd and In Situ Tool -DGD [Lib: Martens 2.00 2016-11-13 Proj: Martens 2.00 2016-11-13

CLIENT	Pitman Building Services Pty Ltd				COMMENCED		COMPLETED		REF BH108			
PROJECT	Resource Feasibility Assessment				LOGGED	AK	CHECKED		Sheet 2 OF 5			
SITE	Bluestone Hardrock Quarry, Elderslie, NSW				GEOLOGY		VEGETATION		PROJECT NO. P2410628			
EQUIPMENT						LONGITUDE		RL SURFACE	192.87 m	DATUM	AHD	
EXCAVATION DIMENSIONS		69.00 m depth				LATITUDE		ASPECT		SLOPE		
Drilling						Field Material Description				Defect Information		
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is ₍₅₀₎ MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)	
NMLC							Continuation from non-cored borehole					
					2.40		Start Cored Borehole @ 2.40 m					
			100	40 (70)	190.47		TUFF; aphantic, brown and dark grey.	MW		3.00-3.76: FZ, 5 - 90°, 760mm.		
			100	35 (75)						3.98: DS, 20mm. 4.10: DB 4.30-4.60: FZ, 5 - 45°, 300mm. 4.76: HB 5.00: HB 5.02: HB 5.10: HB 5.12-5.46: JT Set 3, 5 - 15°, SN, UN, Ro 5.16-5.47: JT Set 2, 50 - 60°, SN, UN, Ro 5.55: JT, 80 - 90°, closed. 5.61-5.90: FZ, 45 - 50°, 290mm. 6.00: HB 6.24-6.90: JT Set 8, 5 - 20°, SN, UN, Ro 7.00: HB 7.00-7.36: JT Set 5, 5 - 20°, SN, UN, Ro 7.55-7.93: JT Set 5, 5 - 20°, SN, UN, Ro		
			100	30 (75)						8.00: HB 8.08: JT, 40 - 50°, CN, UN, Ro 8.15: JT, 2 - 5°, SN, UN, Ro 8.37-8.59: JT Set 2, 60 - 70°, SN, UN, Ro 8.67: DB 8.79: JT, 70 - 80°, SN, UN, Ro 8.87-17.00: FZ, 5 - 90°, 8130mm, comprised of joints.		
			100	10 (50)								
			100	15 (85)								
			100	15 (90)								
			100	35 (90)								
			100	20 (70)								
		100	60 (90)									
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS												
 MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au								Engineering Log - BOREHOLE				

MARTENS 2.00 LIB.GLB Log MARTENS CORED BOREHOLE P241002BH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 Dattel/Lab and In Situ Tool -DGD [Lib: Martens 2.00 2016-11-13 Pjt: Martens 2.00 2016-11-13

CLIENT	Pitman Building Services Pty Ltd				COMMENCED		COMPLETED		REF BH108				
PROJECT	Resource Feasibility Assessment				LOGGED	AK	CHECKED		Sheet 3 OF 5				
SITE	Bluestone Hardrock Quarry, Elderslie, NSW				GEOLOGY		VEGETATION		PROJECT NO. P2410628				
EQUIPMENT						LONGITUDE		RL SURFACE	192.87 m	DATUM	AHD		
EXCAVATION DIMENSIONS		69.00 m depth				LATITUDE		ASPECT		SLOPE			
Drilling						Field Material Description				Defect Information			
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is ₍₅₀₎ MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)		
NMLC		100	60 (90)	22			TUFF; aphanitic, brown and dark grey.	MW		19.21-20.62: JT Set 14, 5 - 20°, SN, UN, Ro			
										20.62-21.31: FZ, 5 - 20°, 690mm.			
		100	30 (60)	24						21.37-21.89: JT Set 9, 5 - 15°, SN, UN, Ro			
										21.94-22.28: FZ, 5 - 40°, 340mm.			
		100	60 (90)	26						22.44: JT, 5 - 10°, SN, UN, Ro 22.66: JT, 5 - 10°, SN, UN, Ro 22.80: JT, 2 - 10°, SN, UN, Ro 22.89: JT, 60 - 70°, SN, UN, Ro 22.91-23.00: CS, 90mm. 23.05: JT, 10 - 20°, SN, UN, Ro 23.18-24.16: JT Set 12, 2 - 10°, SN, UN, Ro			
										24.63: JT, 90°, SN, UN, Ro			
										25.00: HB 25.05-25.71: JT Set 4, 20 - 30°, SN, UN, Ro 25.12-25.59: JT Set 4, 5 - 10°, SN, UN, Ro 25.71-29.00: FZ, 5 - 90°, 3290mm, comprised of joints.			
		100	75 (100)	30						29.04-29.14: JT Set 2, 10 - 20°, SN, UN, Ro 29.27: JT, 40 - 50°, SN, UN, Ro 29.36: JT, 2 - 5°, SN, UN, Ro 29.67: JT, 5 - 30°, SN, UN, Ro 29.73: DB 30.00: HB 30.15: JT, 90°, SN, PI, Ro 30.27: JT, 10 - 20°, SN, UN, Ro 30.36: JT, 5 - 10°, SN, UN, Ro 30.51: JT, 40 - 60°, SN, UN, Ro 30.67-30.83: JT Set 2, 5 - 15°, SN, UN, Ro 31.00: HB 31.32: JT, 40 - 50°, SN, PI, Ro 31.46-32.77: JT Set 14, 5 - 20°, SN, UN, Ro			
		100	85 (90)	32	32.10 160.77		AGGLOMERATE; pink, brown and grey.			33.19-33.24: CS, 50mm. 33.37-34.25: JT Set 8, 5 - 15°, SN, UN, Ro			
										34.39-34.45: CS, 60mm. 34.63-35.53: JT Set 5, 5 - 15°, SN, UN, Ro			
		100	85 (85)	36						35.65: JT, 50 - 70°, CN, CU, Ro 35.72: JT, 5 - 10°, SN, UN, Ro 35.86-36.00: DZ, 140mm. 36.14-37.67: JT Set 14, 5 - 15°, SN, UN, Ro			
									37.89-38.00: DZ, 110mm. 38.29-38.47: DZ, 180mm. 38.65: JT, 80 - 90°, SN, UN, Ro 38.77-39.46: JT Set 7, 5 - 15°, SN, UN, Ro 38.87-40.66: FZ, 5 - 45°, 790mm.				
	100	60 (75)	38						39.57-39.65: CS, 80mm.				
	100	85											
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS													
 (C) Copyright Martens & Associates Pty. Ltd.								MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au				Engineering Log - BOREHOLE	

MARTENS 2.00 LIB.GLB Log MARTENS CORED BOREHOLE P241022BH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 Datagel Ltd and In Situ Tool -DGD [Lib: Martens 2.00 2016-11-13 Pjt: Martens 2.00 2016-11-13

CLIENT	Pitman Building Services Pty Ltd		COMMENCED				COMPLETED				REF BH108		
PROJECT	Resource Feasibility Assessment		LOGGED		AK		CHECKED				Sheet 4 OF 5		
SITE	Bluestone Hardrock Quarry, Elderslie, NSW		GEOLOGY				VEGETATION				PROJECT NO. P2410628		
EQUIPMENT				LONGITUDE				RL SURFACE		192.87 m		DATUM	AHD
EXCAVATION DIMENSIONS		69.00 m depth		LATITUDE				ASPECT				SLOPE	
Drilling				Field Material Description						Defect Information			
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is ₍₅₀₎ MPa	DEFECT DESCRIPTION & Additional Observations			AVERAGE DEFECT SPACING (mm)
NMLC			(90)				AGGLOMERATE; pink, brown and grey.	MW		40.71-41.23: JT Set 10, 5 - 15°, SN, UN, Ro			
		100	85 (90)	42	41.37-41.65: DZ, 280mm.								
					41.77-42.00: FZ, 5 - 45°, 230mm.								
					42.14-43.10: JT Set 6, 5 - 10°, SN, UN, Ro								
		100	85 (90)	44	43.25-43.61: DZ, 360mm.								
					43.92: HB								
					44.00: HB								
					44.24-44.34: DS, 90mm.								
					44.47-45.32: JT Set 9, 5 - 20°, CN, UN, Ro								
		100	85 (100)	46	45.35-45.55: DZ, 200mm.								
				45.57-45.92: JT Set 2, 40 - 50°, CN, UN, Ro									
				45.76: JT, 5 - 10°, CN, UN, Ro									
				46.00: HB									
				46.19-46.46: DZ, 270mm.									
				46.79-48.30: JT Set 8, 5 - 15°, SN, UN, Ro									
				48.38-48.43: DS, 50mm.									
	100	60 (80)	48	48.70-48.82: DZ, 120mm.									
				48.90: JT, 70 - 90°, CN, CU, Ro									
				49.00: HB									
				49.22-49.31: DS, 90mm.									
				49.57-50.19: JT Set 7, 5 - 40°, SN, UN, Ro									
				50.20-52.46: FZ, 5 - 40°, 2260mm, comprising multiple joints, seams and zones.									
	100	75 (100)	52	52.65: JT, 5 - 10°, CN, UN, Ro									
				52.89-53.02: DZ, 130mm.									
				53.14-53.18: DS, 40mm.									
				53.25-53.28: DS, 30mm.									
				53.37-53.40: DS, 40mm.									
				53.55-53.57: DS, 20mm.									
	100	40 (80)	54	53.66-53.71: DS, 50mm.									
				53.79: JT, 2 - 5°, CN, UN, Ro									
				54.00: HB									
				54.00-54.17: DZ, 170mm.									
		</											

NMLC

MARTENS 2.00 LIB.GLB Log MARTENS CORED BOREHOLE P241002BHH105-108V01.GPJ <<DrawingFile>> 09/09/2025 13:40 10.02.00.04 Datagel Ltd and In Situ Tool -DGD [Lib: Martens 2.00 2016-11-13 Pjt: Martens 2.00 2016-11-13

CLIENT	Pitman Building Services Pty Ltd		COMMENCED		COMPLETED		REF BH108				
PROJECT	Resource Feasibility Assessment		LOGGED	AK	CHECKED		Sheet 5 OF 5				
SITE	Bluestone Hardrock Quarry, Elderslie, NSW		GEOLOGY		VEGETATION		PROJECT NO. P2410628				
EQUIPMENT			LONGITUDE		RL SURFACE	192.87 m	DATUM	AHD			
EXCAVATION DIMENSIONS		69.00 m depth	LATITUDE		ASPECT		SLOPE				
Drilling			Field Material Description			Defect Information					
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is(50) MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)
NMLC		100	100 (100)				AGGLOMERATE; pink, brown and grey.	MW		60.15-62.25: JT Set 11, 5 - 15°, SN, UN, Ro	
		100	100 (100)	62				62.32-62.71: DZ, 390mm.			62.90-63.42: DZ, 510mm.
		100	75 (75)	64						63.79-67.90: JT Set 17, 5 - 30°, SN, UN, Ro	
				66							
				68							
				69.00	123.87		Hole Terminated at 69.00 m			68.56-69.00: FZ, 5 - 70°, 440mm.	
				70							
				72							
				74							
				76							
				78							
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS											
						MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au			Engineering Log - BOREHOLE		

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P241062BH105-108V01.GPJ <<DrawingFile>> 06/09/2025 13:39 10/02/00.04 D:\git\Tool - DGD\ [Lib: Martens 2.00 2016-11-13 Proj: Martens 2.00 2016-11-13]

CLIENT	Pitman Building Services Pty Ltd		COMMENCED		COMPLETED		REF BH106 / MW05												
PROJECT	Resource Feasibility Assessment		LOGGED	AK	CHECKED		Sheet 1 OF 1												
SITE	Bluestone Hardrock Quarry, Elderslie, NSW		GEOLOGY		VEGETATION		PROJECT NO. P2410628												
EQUIPMENT			LONGITUDE		RL SURFACE	140.54 m	DATUM	AHD											
EXCAVATION DIMENSIONS	30.00 m depth		LATITUDE		ASPECT		SLOPE												
Drilling		Sampling		Field Material Description															
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	PIEZOMETER DETAILS						
				0.72					Start Non-Cored Borehole @ 0.72 m				ID MW05	Static Water Level					
				139.82					TUFF; aphantic, brown and drak grey.										
				5															
				10										Grout					
				15															
				20															
				25										Screen					
				30										Sand					
				30.00					Hole Terminated at 30.00 m										
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																			
 (C) Copyright Martens & Associates Pty. Ltd.										MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au					Engineering Log - BOREHOLE				

Appendix D – Rock Core Photographs

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH101 (Dry) Lot 5 DP 1102521, Elderslie, NSW	Drawing No:
Approved:	JF		BH101
Date:	5.12.2017		Job No: P2410628JR01V04
Scale	As above with vertical exaggeration.		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH101 (Wet) Lot 5 DP 1102521, Elderslie, NSW	Drawing No:
Approved:	JF		BH101
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration.		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd		ABN 85 070 240 890	Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH102: 0.8 m – 24.0 m (Dry) Lot 904 DP 1061259, Elderslie, NSW		Drawing No:
Approved:	JF			BH102
Date:	5.12.2017			Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration.			

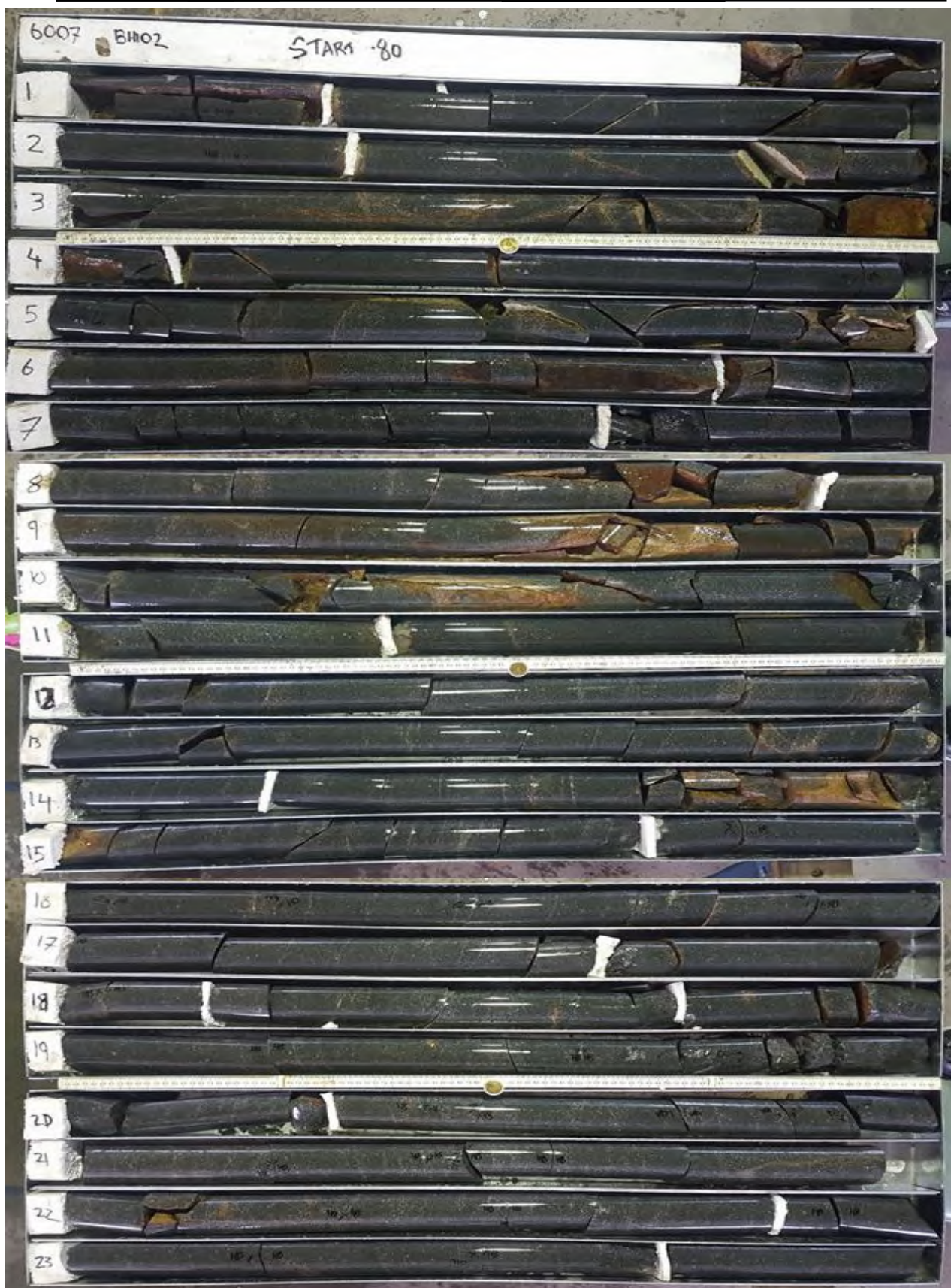
0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH102: 24.0 m – 40.06 m (Dry) Lot 904 DP 1061259, Elderslie, NSW	Drawing No:
Approved:	JF		BH102
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration.		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

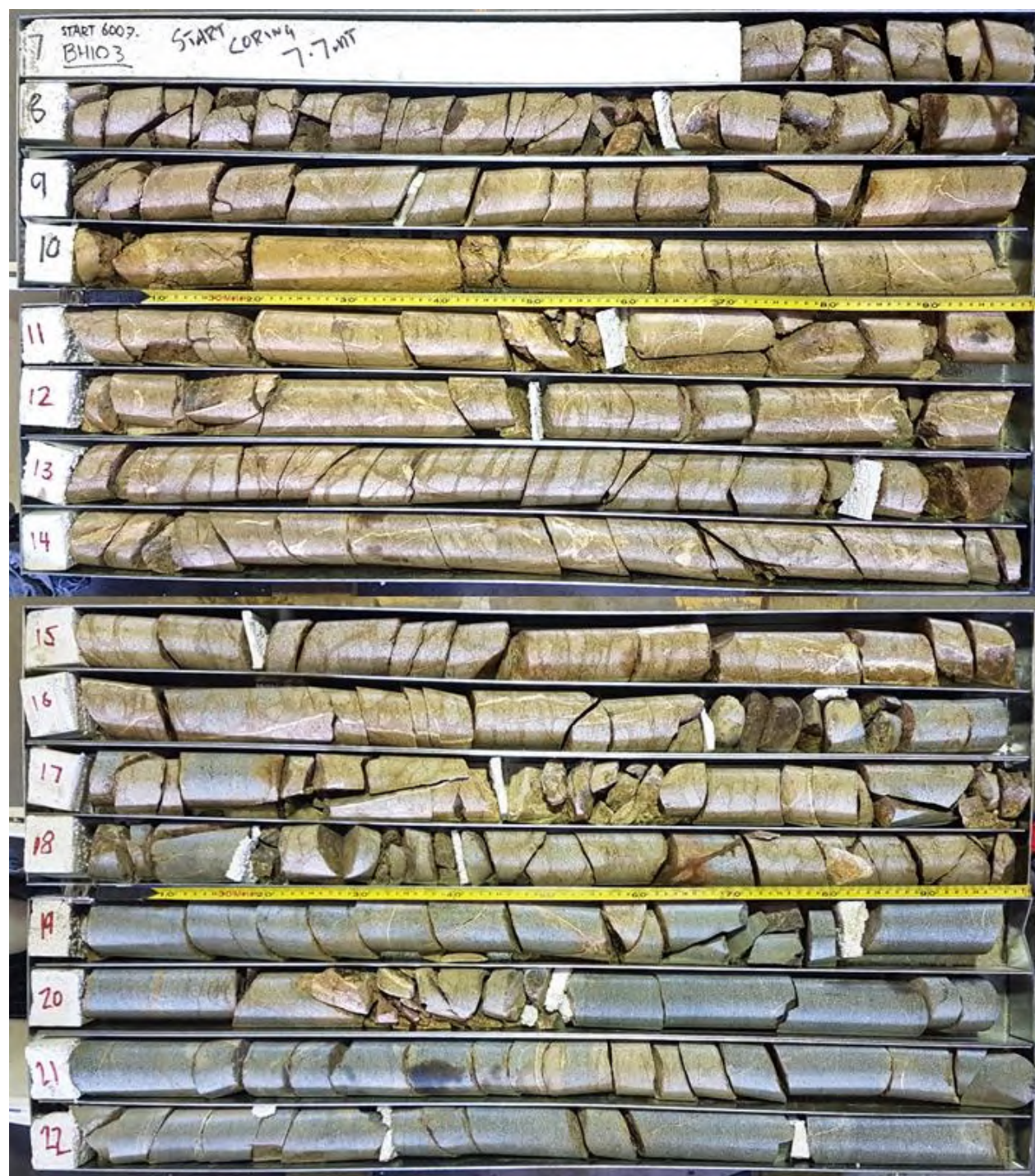
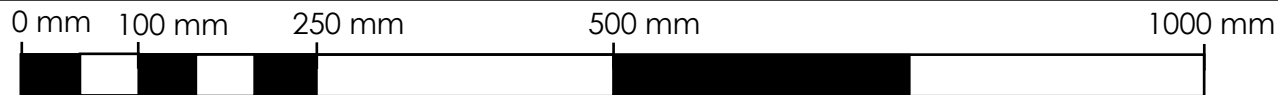
Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH102: 0.8 m – 24.0 m (Wet) Lot 904 DP 1061259, Elderslie, NSW	Drawing No:
Approved:	JF		BH102
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration.		

0 mm 100 mm 250 mm 500 mm 1000 mm

martens



Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH102: 24.0 m – 40.06 m (Wet) Lot 904 DP 1061259, Elderslie, NSW	Drawing No:
Approved:	JF		BH102
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration.		



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH103: 7.7 m – 23.0 m (Dry) Lot 904 DP 1061259, Elderslie, NSW	Drawing No:
Approved:	JF		BH103
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration.		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH103: 23.0 m – 36.06 m (Dry) Lot 904 DP 1061259, Elderslie, NSW	Drawing No:
Approved:	JF		BH103
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration.		

0 mm 100 mm 250 mm 500 mm 1000 mm

martens



Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH103: 7.7 m – 23.0 m (Wet) Lot 904 DP 1061259, Elderslie, NSW	Drawing No:
Approved:	JF		BH103
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration.		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH103: 23.0 m – 36.06 m (Wet) Lot 904 DP 1061259, Elderslie, NSW	Drawing No:
Approved:	JF		BH103
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

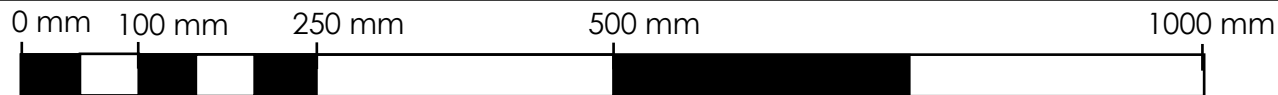
Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH104: 0.8 m – 16.0 m (Dry) Lot 65 DP 752473, Elderslie, NSW	Drawing No:
Approved:	JF		BH104
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration.		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH104: 16.0 m – 35.0 m (Dry) Lot 65 DP 752473, Elderslie, NSW	Drawing No:
Approved:	JF		BH104
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaaceration.		



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH104: 0.8 m – 16.0 m (Wet) Lot 65 DP 752473, Elderslie, NSW	Drawing No:
Approved:	JF		BH104
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration.		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AM	Photo of Rock Core BH104: 16.0 m – 35.0 m (Wet) Lot 65 DP 752473, Elderslie, NSW	Drawing No:
Approved:	JF		BH104
Date:	5.12.2017		Job No: P2410628JR01V04
Scale:	As above with vertical exaggeration.		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890

Environment | Water | Wastewater | Geotechnical | Civil | Management

Drawn:	AK
Approved:	RE
Date:	04.09.2025
Scale:	Not to Scale

Photo of Rock Core
BH105 (dry) 0.25 m to 25 m
Resource Evaluation Assessment

Drawing No:
FIGURE 18
File No: P2410628JR01V04

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890

Environment | Water | Wastewater | Geotechnical | Civil | Management

Drawn:	AK
Approved:	RE
Date:	04.09.2025
Scale:	Not to Scale

Photo of Rock Core
BH105 (dry) 25 m to 50 m
Resource Evaluation Assessment

Drawing No:
FIGURE 19
File No: P2410628JR01V04

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890

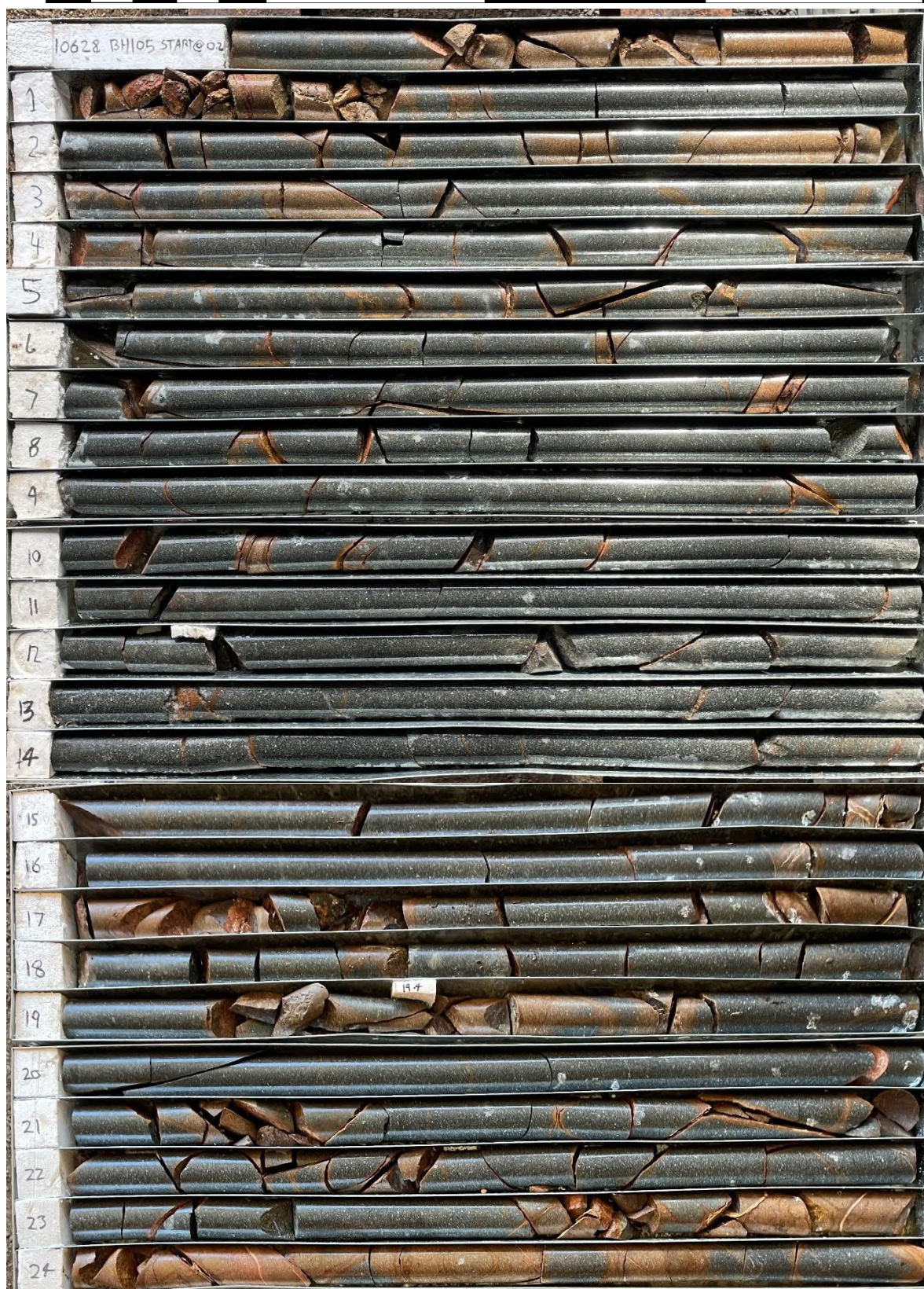
Environment | Water | Wastewater | Geotechnical | Civil | Management

Drawn:	AK
Approved:	RE
Date:	04.09.2025
Scale:	Not to Scale

Photo of Rock Core
BH105 (dry) 50 m to 64.11 m
Resource Evaluation Assessment

Drawing No:
FIGURE 20
File No: P2410628JR01V04

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890

Environment | Water | Wastewater | Geotechnical | Civil | Management

Drawn:	AK
Approved:	RE
Date:	04.09.2025
Scale:	Not to Scale

Photo of Rock Core
BH105 (wet) 0.25 m to 25 m
Resource Evaluation Assessment

Drawing No:
FIGURE 21
File No: P2410628JR01V04

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH105 (wet) 25 m to 50 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 22
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

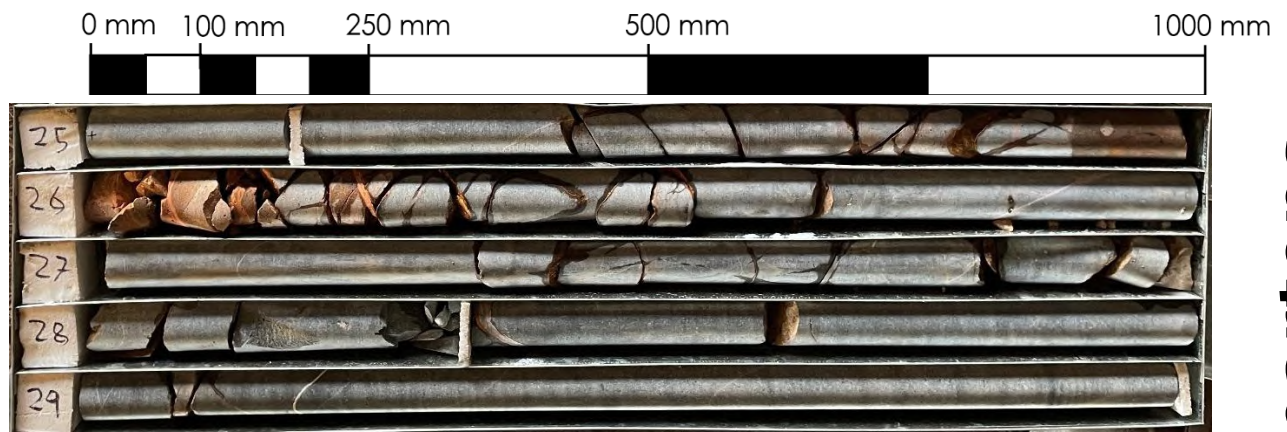
Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH105 (wet) 50 m to 64.11 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 23
Date:	04.03.2025		File No: P2410628JR01V04
Scale:	Not to Scale		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH106 (dry) 0.72 m to 25 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 24
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		



martens

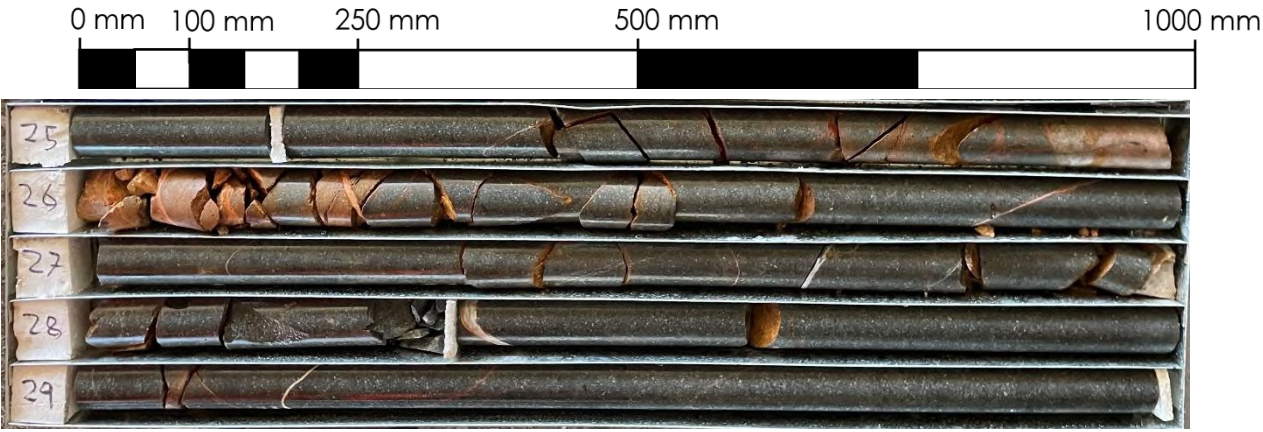
Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH106 (dry) 25 m to 30 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 25
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH106 (wet) 0.72 m to 25 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 26
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH106 (wet) 25 m to 30 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 27
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		

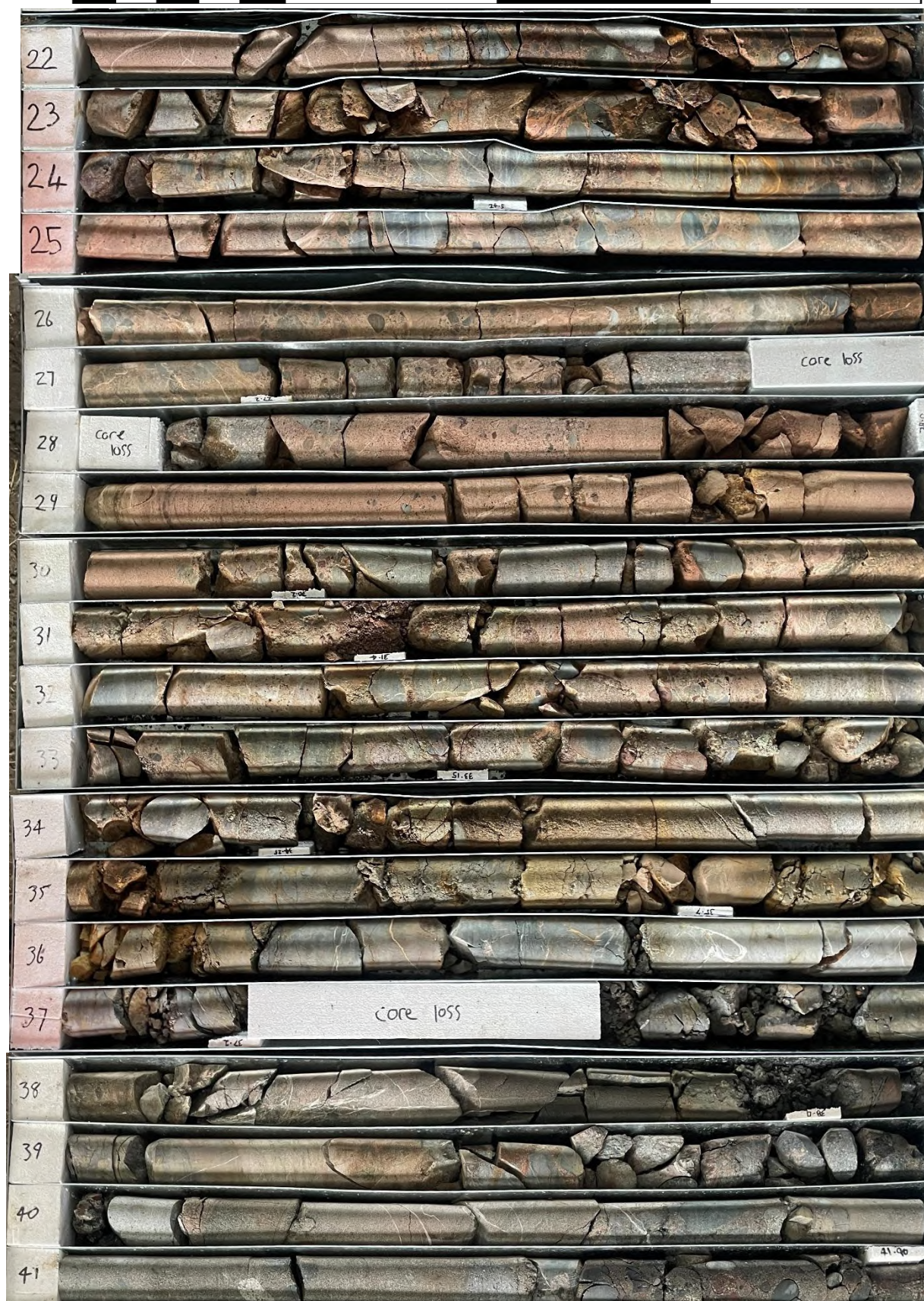
0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd		ABN 85 070 240 890	Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH107 (dry) 2.4 m to 22 m Resource Evaluation Assessment	Drawing No:	
Approved:	RE		FIGURE 28	
Date:	04.09.2025		File No: P2410628JR01V04	
Scale:	Not to Scale			

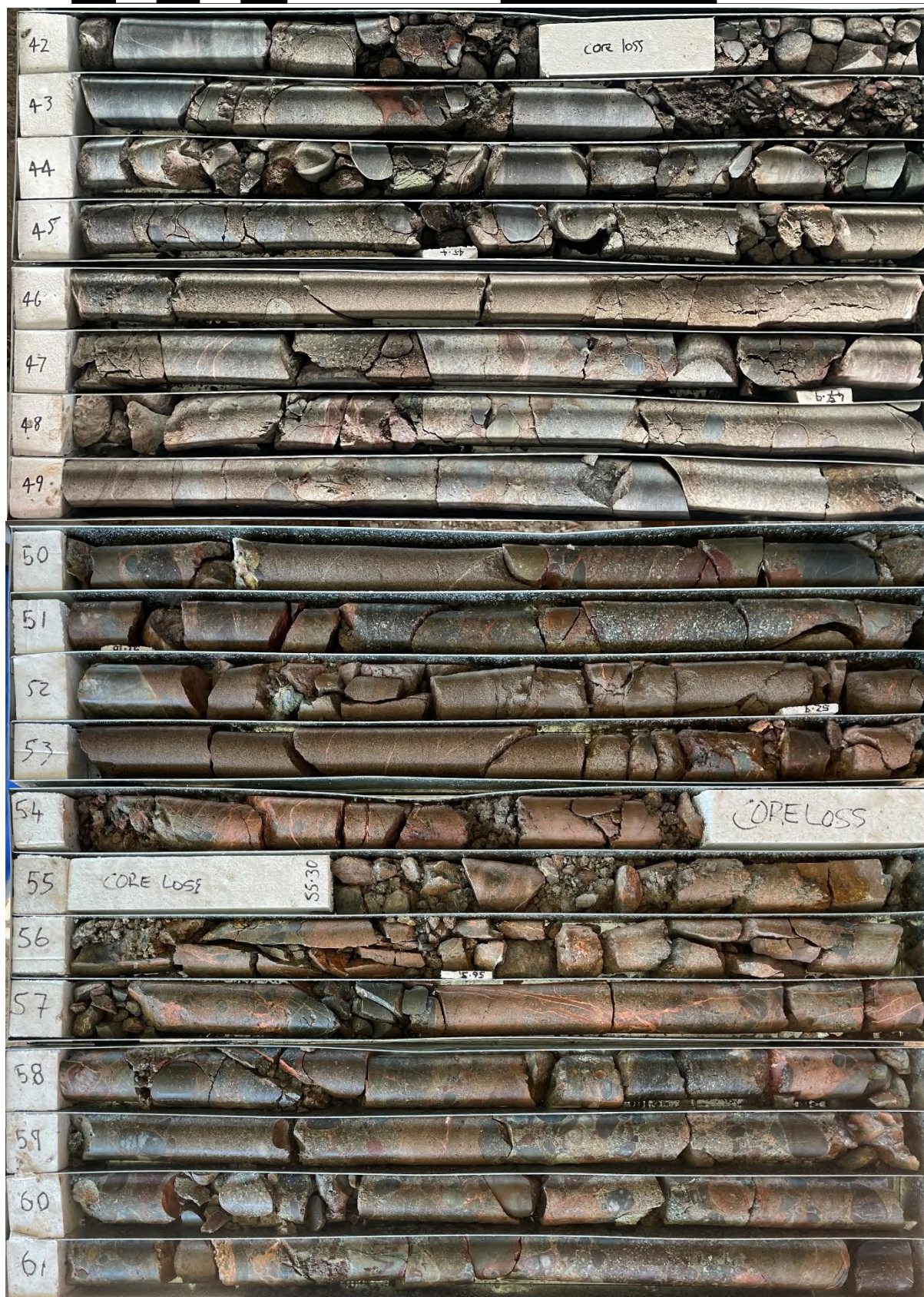
0 mm 100 mm 250 mm 500 mm 1000 mm



martens

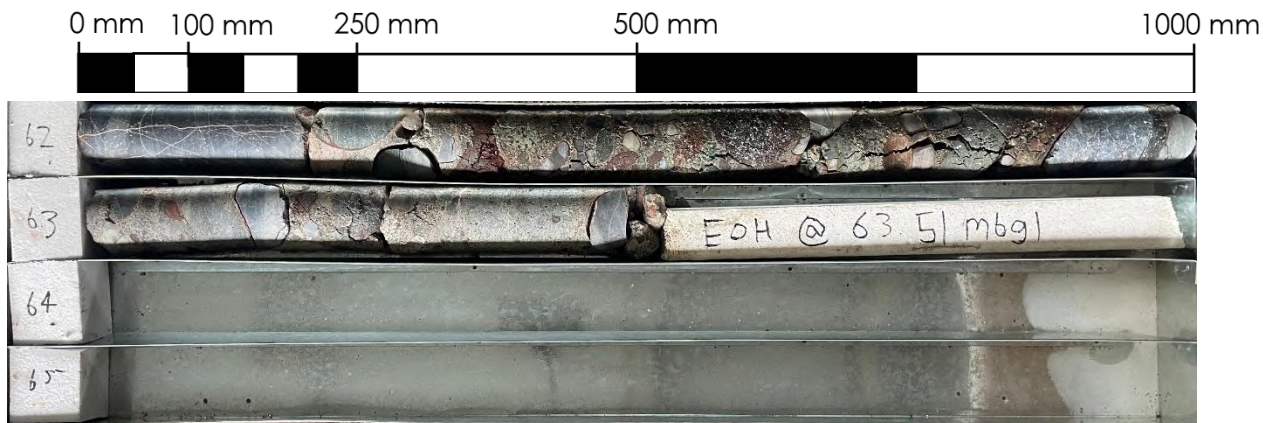
Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH107 (dry) 22 m to 42 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 29
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH107 (dry) 42 m to 62 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 30
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH107 (dry) 62 m to 63.51 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 31
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH107 (wet) 2.4 m to 22 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 32
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

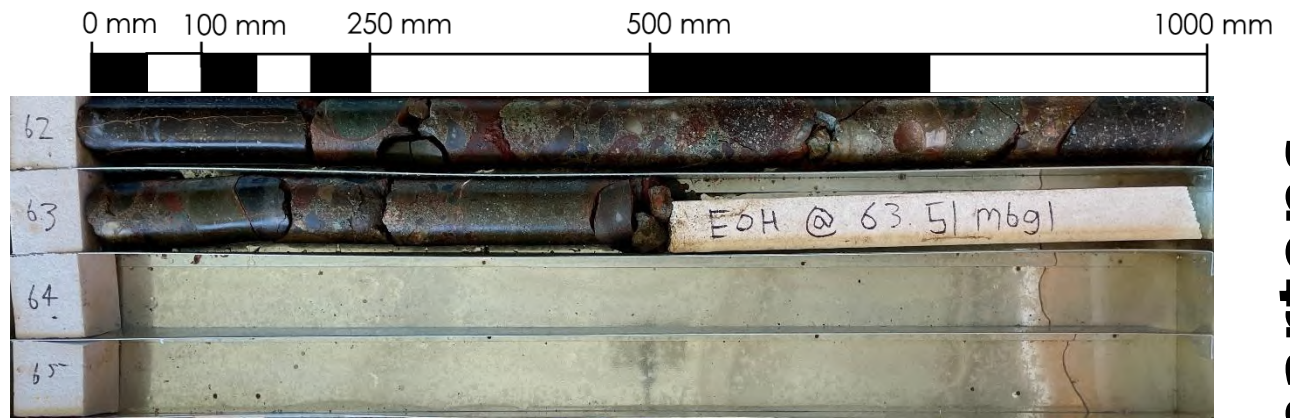
Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH107 (wet) 22 m to 42 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 33
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH107 (dry) 42 m to 62 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 34
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH107 (wet) 62 m to 63.51 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 35
Date:	04.09.2025		
Scale:	Not to Scale		File No: P2410628JR01V04

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH108 (dry) 1.35 m to 26 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 36
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH108 (dry) 26 m to 50 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 37
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		



martens

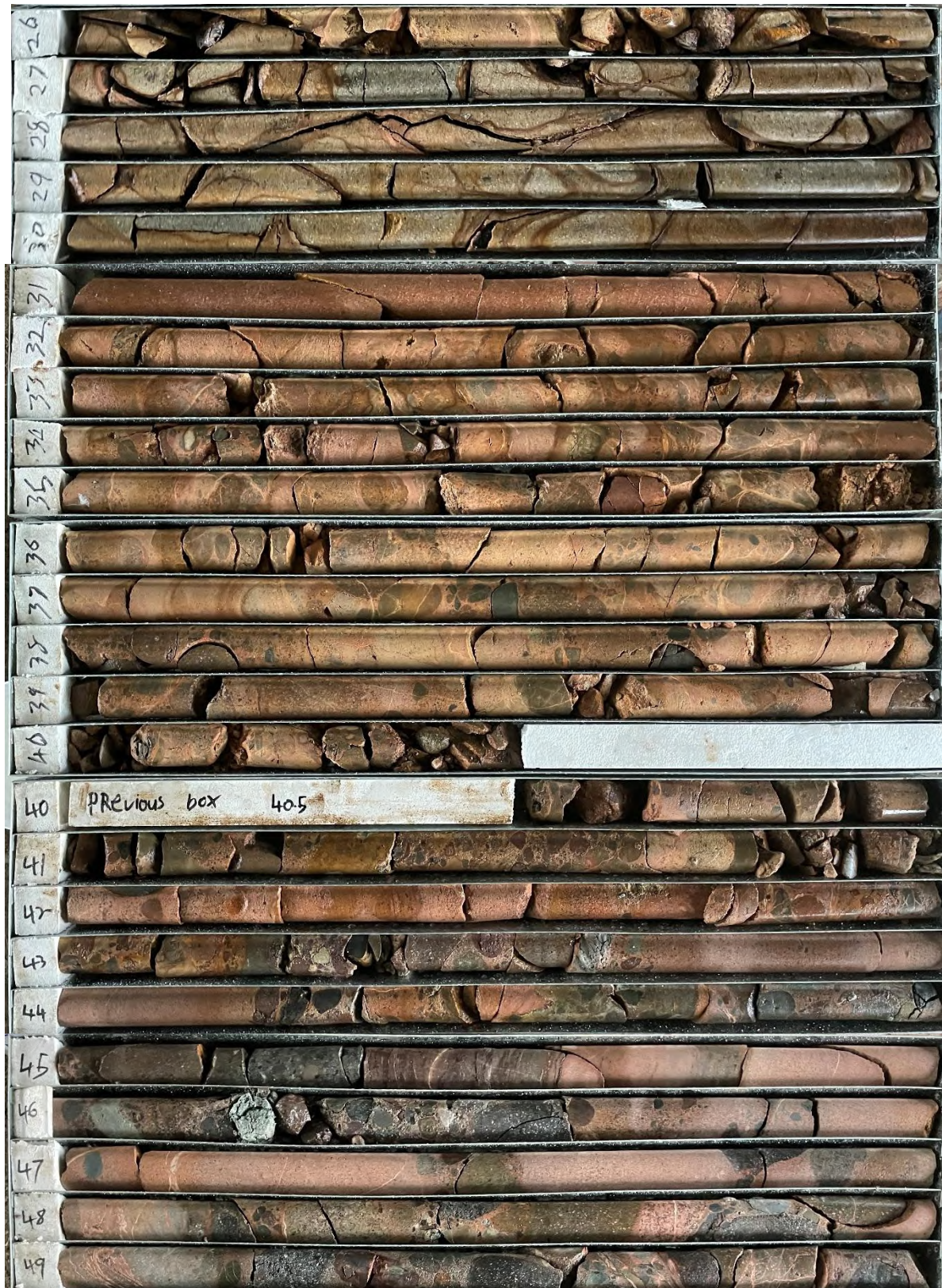
Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH108 (dry) 50 m to 69 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 38
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		



martens

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH108 (wet) 1.35 m to 26 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 39
Date:	04.09.2025		File No: P2410628JR01V04
Scale:	Not to Scale		

0 mm 100 mm 250 mm 500 mm 1000 mm



martens

Martens & Associates Pty Ltd ABN 85 070 240 890

Environment | Water | Wastewater | Geotechnical | Civil | Management

Drawn: AK

Approved: RE

Date: 04.09.2025

Scale: Not to Scale

Photo of Rock Core
BH108 (wet) 26 m to 50 m
Resource Evaluation Assessment

Drawing No:

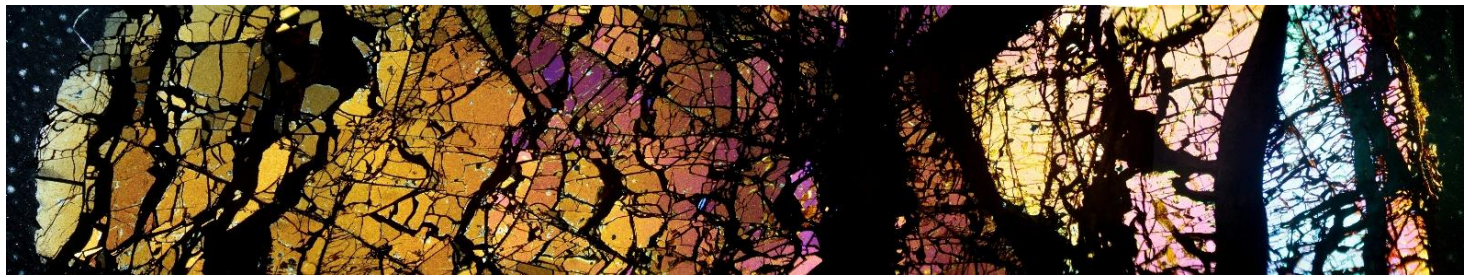
FIGURE 40

File No: P2410628JR01V04



Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management	
Drawn:	AK	Photo of Rock Core BH108 (wet) 50 m to 69 m Resource Evaluation Assessment	Drawing No:
Approved:	RE		FIGURE 41
Date:	04.09.2025		
Scale:	Not to Scale		File No: P2410628JR01V04

Appendix E – Petrographic Analysis Results

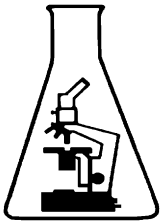


Geochempet Services

ABN 980 6945 3445

PETROLOGICAL and GEOCHEMICAL CONSULTANTS

Principals: K.E. Spring B.Sc. (Hons), MAppSc and H.M. Spring B.Sc.



5/14 Redcliffe Gardens Drive
Clontarf, QLD 4019

Telephone: (07) 3284 0020

Email: info@geochempet.com
www.geochempet.com

PETROGRAPHIC REPORT ON A CRUSHED AGGREGATE SAMPLE (6007/surface/0/R/1) FROM A POTENTIAL HARD ROCK QUARRY

prepared for

**MARTENS & ASSOCIATES
HORNSBY, NSW**

Order Number:
Invoice Number: 0000
Client Ref: Andrew Mesthos

Issued by

K. E. Spring B.Sc.(Hons), MAppSc
1 September 2017

September, 2017

Ma170901

Page 1 of 5

The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

GEOCHEMPET SERVICES BRISBANE

<u>Sample ID:</u>	6007/surface/0/R/1	<u>Date Sampled:</u>	07/07/17
<u>Material:</u>	Crushed aggregate/rock	<u>Date Received:</u>	09/08/17
<u>Sample Location:</u>	Blind Creek Road, Elderslie	<u>Job No.:</u>	P139
<u>Project Name:</u>	P1706007 - Blind Creek Road, Elderslie		
<u>Project:</u>	Resource preliminary investigation		
<u>Work Requested</u>	Petrographic analysis in relation to suitability for use as concrete aggregate, asphaltic aggregate, rail ballast and rip rap; petrographic assessment of potential for alkali-silica reactivity		
<u>Methods</u>	Account taken of ASTM C295 Standard Guide for <i>Petrographic Assessment of Aggregates for Concrete</i> , the AS2758.1 – 2014 <i>Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B)</i> , the AS1141 Standard Guide for the <i>Method for sampling and testing aggregates</i> , of the content of the 2015 joint publication of the Cement and Concrete Association of Australia and Standards Australia, (HB 79-2015) entitled <i>Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia</i>		
<u>Identification</u>	Latite tuff		

Description

The supplied sample consisted of robust, hard, and angular to sub-angular fragments of rock with a dust coating. When washed, the dust coatings were easily removed and the fragments are seen to consist of reddish and medium dark grey variations, both unweathered and slightly weathered, still robust, latite tuff, displaying numerous phenoclasts of mainly light grey plagioclase and hornblende dispersed through a now very finely crystalline feldspathic matrix variably pigmented by hematite staining.

GEOCHEMPET SERVICES BRISBANE



Plate 1: Photograph of supplied crushed aggregate sample.

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of 9 randomly selected rock fragments. An approximate mineralogical composition of the aggregate, expressed in volume percent and based on a count of 100 widely spaced points falling within the sectioned fragments, is:

Durable Minerals

30%	feldspar phenoclasts
1%	hornblende as phenoclasts
3%	opaque oxide as phenoclasts
1%	clinopyroxene as phenoclasts
28%	finely microcrystalline feldspars and quartz as devitrification products after former vitric shards and micro-spherulites (3% microcrystalline quartz)
20%	coarser microcrystalline feldspars
3%	coarser microcrystalline quartz
1%	hematite
trace	zircon

GEOCHEMPET SERVICES BRISBANE

Weak &/or Deleterious Minerals

2%	sericite/illite
8%	chlorite
2%	smectite clay
1%	limonite/goethite

In thin section, the rock plainly displays textures of mildly flow-banded, tuffaceous style, involving many smoothly corroded, subhedral and broken phenoclasts (about 0.1 to 2 mm in size) dispersed through a now mosaic devitrified matrix (<0.01 mm to about 0.1 in grainsize) containing some ghosted vitric shards and micro-spherulites.

The most abundant phenoclasts are poorly twinned, zoned, prismatic plagioclase, with slight to moderately alteration to sericite. There are prismatic phenocrysts of fresh brown hornblende showing rim alteration (opacite rim alteration). The hornblende rim alteration appears to be related to devolatilisation of hydrated minerals as response to decompression during magma ascent. Additional phenocrysts are former mafic silicates which are now completely altered to greenish-brown smectite clay or hematite. Other minor phenocrysts include K-feldspar, clear clinopyroxene and opaque oxide (magnetite and/or ilmenite).

The formerly vitroclastic matrix between the phenoclasts now consists of a microcrystalline mosaic of mainly feldspars, but some hidden quartz (in ghosted vitric shards and micro-spherulites) which are impregnated by fine hematite, chlorite, limonite/goethite and traces of illite/sericite and a few accessory grains of zircon.

Comments and Interpretations

This supplied crushed aggregate sample (labelled 6007/surface/0/R/1) from a potential hard rock source at Blind Creek Road, Elderslie is considered to represent latite tuff, an intermediate volcanic rock. It formed initially by a pyroclastic, ashflow mechanism, rather than as simple lava. Subsequent diagenesis (i.e. modifications induced by burial and the passage of time) and/or hydrothermal action (i.e. modifications by passage of hot fluids) has devitrified the rock and altered it. The rock is slightly altered to sericite, smectite and chlorite clays, mostly affecting the phenocrysts and patches of the groundmass.

For engineering purposes, the rock in the supplied aggregate sample may be summarised as:

- **latite tuff**, an intermediate volcanic igneous rock type
- now finely recrystallized
- non-porous
- unweathered and slightly weathered
- carrying about 13% of soft or weak minerals
- **hard**
- **strong**

The rock is predicted to be **durable**.

The rock is predicted to be **innocuous in relation to alkali-silica reactivity in concrete**. Free silica amounts to only about 6% of which 3% is in the form of quartz which are neither excessively fine

GEOCHEMPET SERVICES BRISBANE

nor substantially strained, but the rock may contain some difficult to recognise finely microcrystalline quartz (about 3%) in the matrix which may be misidentified as feldspar.

Tuff of the type represented by the supplied sample is predicted to be **suitable for use as concrete aggregate, asphaltic aggregate, rail ballast and rip rap.**

Free Silica Content

About 6%. Quantitative X-ray diffraction analysis would be required to offer a conclusive determination for quartz content.

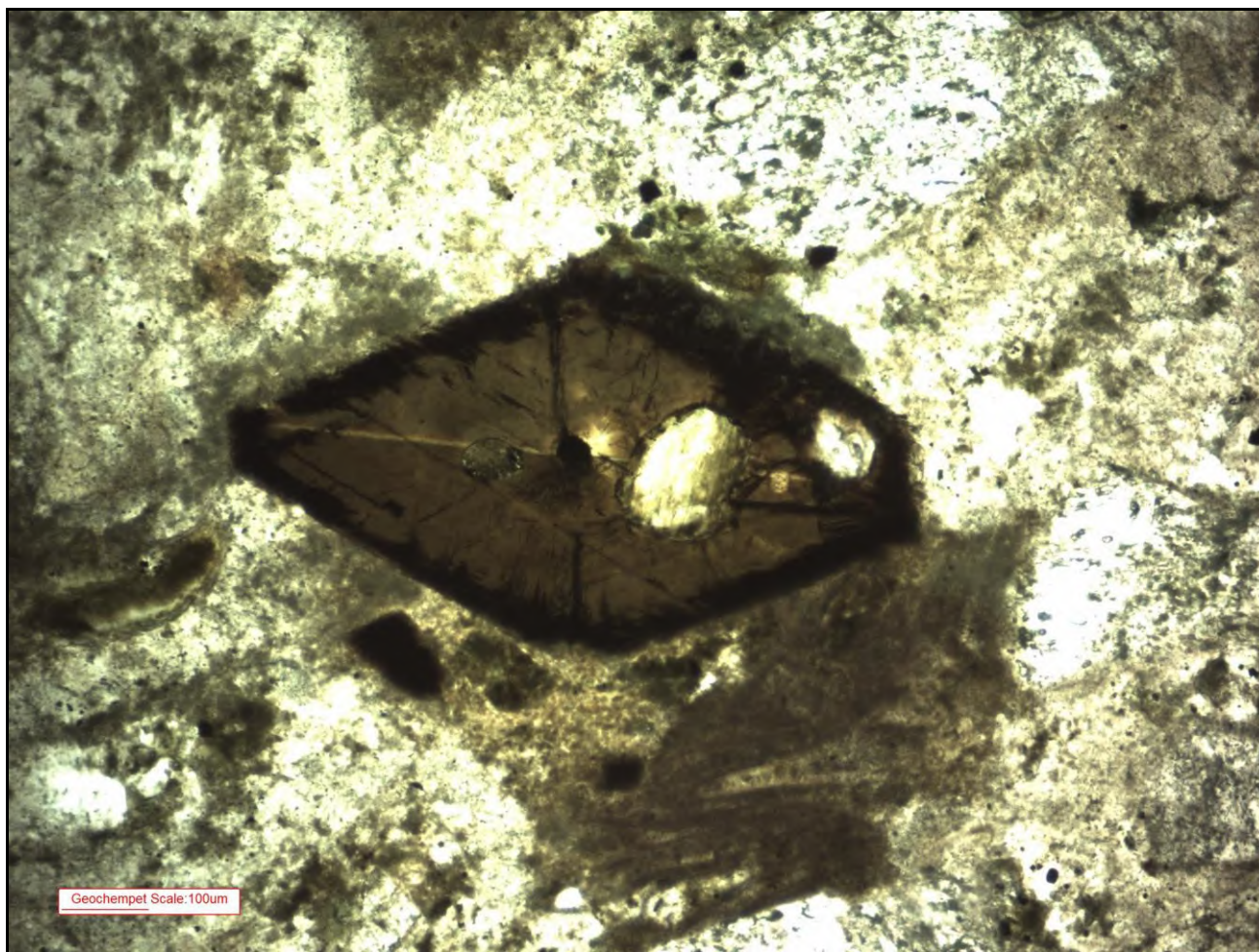
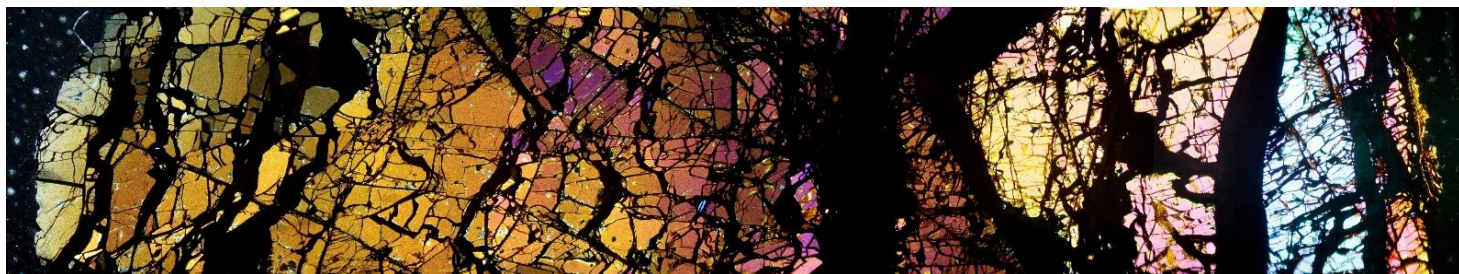


Plate 2: Micrograph taken at medium magnification in transmitted plane polarised light. The image shows a fragment with finely crystalline quartzofeldspathic groundmass (ghosted former glassy shards are still preserved) with a hornblende phenocryst outline by an opacite rim.

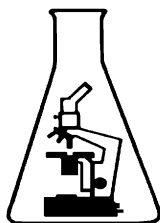


Geochempet Services

ABN 980 6945 3445

PETROLOGICAL and GEOCHEMICAL CONSULTANTS

Principals: K.E. Spring B.Sc. (Hons), MAppSc and H.M. Spring B.Sc.



5/14 Redcliffe Gardens Drive
Clontarf, QLD 4019

Telephone: (07) 3284 0020
Email: info@geochempet.com
www.geochempet.com

PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (6007) FROM POTENTIAL QUARRY AT ELDESLIE, NSW

prepared for

**MARTENS & ASSOCIATES
HORNSBY, NSW**

Purchase Order: P1706007COC03V01
Invoice Number: 00007927
Client Ref: Andrew Mesthos

Issued by

K. E. Spring B.Sc.(Hons), MAppSc
22 November 2017

NOVEMBER, 2017

Ma171101

Page 1 of 5

The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services

GEOCHEMPET SERVICES, BRISBANE

Sample Number: 6007 **Date Sampled:** 30/10/17
Borehole Details: BH101/R/3-3.18 m **Date Received:** 03/11/17
Location: Potential quarry at Eldeslie, NSW
Work Requested Petrographic analysis in relation to suitability for use as road base, concrete aggregate; petrographic assessment of potential for alkali-silica reactivity
Methods Account taken of ASTM C295 Standard Guide for *Petrographic Assessment of Aggregates for Concrete*, the AS2758.1 – 2014 *Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B)* and of the content of the 2015 joint publication of the Cement and Concrete Association of Australia and Standards Australia, (HB 79-2015) entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*
Identification Latite Agglomerate

Description

The supplied sample consists of a 60 mm diameter drill core which displays apparently hard, robust, variously medium grey and light red, intermediate volcanic rock containing sub-rounded medium-grey clasts (speckled white) from a fraction of a millimetre up to 30 mm and less commonly to at least 60 mm in size dispersed through an interstitial hematite-stained (composed of fine, reddish hematite and pinkish, calcite) and brecciated matrix.



Plate 1. Photograph of supplied drill core sample.

GEOCHEMPET SERVICES, BRISBANE

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of the drill core specimen. An approximate average composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

Primary Minerals

68%	feldspar (plagioclase and subordinate K-feldspar)
<1%	clinopyroxene
4%	opaque oxide (magnetite and/or ilmenite)
1%	quartz
<1%	apatite

Secondary Minerals

6%	zeolite
10%	hematite
3%	epidote
2%	calcite
5%	green to brown smectite clay
1%	sericite

Microscopically, the rock is seen to be finely amygdaloidal, abundantly porphyritic to glomeroporphyritic, hypidiomorphic, inter-granular, finely holocrystalline textures of volcanic style reddened by hematite pigmentation. Phenocrysts range in size from about 0.2 to 1.5 mm. Groundmass grains are about 0.05 to 0.1 mm in size. Amygdules are crudely spherical and range up to 0.5 mm in diameter).

The phenocrysts are lath-shaped to tabular, twinned grains of relatively fresh (with argillized and hematitized inclusions) plagioclase feldspar which is sometimes slightly epidotized and sericitized. Other micro-phenocrysts comprise equant grains of fresh or slightly haematized opaque oxide (magnetite and/or ilmenite). The groundmass consists of laths and anhedral grains of feldspar (apparently plagioclase and subordinate K-feldspar), interstitial stumpy prisms of former clinopyroxene (now smectitized), equant grains of opaque oxide, occasional finely acicular prisms of apatite (now hematitized), along with disseminated, interstitial, small patches (mainly 0.05 to 0.7 mm size) of green to brown smectite clay and vughs of reddened zeolite crystals. Small crudely spherical to elongate amygdules are filled with radial aggregates of smectite clay as well as calcite. Minor and local hematitic concentrations along with pervasive hematitic pigmentation in incipiently glassy areas of the groundmass are observed.

The brecciated interstitial matrix contains mainly of calcite, zeolite and hematite associated with some carbonate veining in a network of straight fractures.

GEOCHEMPET SERVICES, BRISBANE

Comments and Interpretations

The supplied drill core sample (labelled 6007) taken from BH101/R/3-3.18 m depth from potential quarry site at Eldeslie is interpreted to consist of latite agglomerate probably from the top or bottom of a lava flow. The alteration is probably the result of hydrothermal effects.

For engineering purposes, the rock represented in the supplied drill core sample may be summarised as:

- **latite agglomerate** (an intermediate volcanic rock)
- finely amygdaloidal
- unweathered
- hematite-pigmentation
- heavily altered
- secondary mineral content is about 27%, including 13% of robust, benign minerals hematite and epidote.
- carries about 2% moderately robust carbonate – calcite
- soft, weak mineral content is about 12% consisting of 6% zeolite and 5% smectite clay which are expansive water sensitive minerals along with 1% sericite
- **essentially hard**
- **essentially strong**

The rock is predicted to be **essentially durable**, fracture veins filled by zeolites may cause the rock to fail into smaller pieces.

Rock equivalent to the supplied sample is predicted to be **innocuous in relation to alkali-silica reactivity in concrete**: it apparently carries about 1% free silica which is neither sufficiently strained or fine enough to be deleterious.

Thus, latite agglomerate of the type represented in supplied drill core sample is predicted to be **suitable for use as a source of road base and concrete aggregate**.

Free Silica Content

Estimated to be 1%.

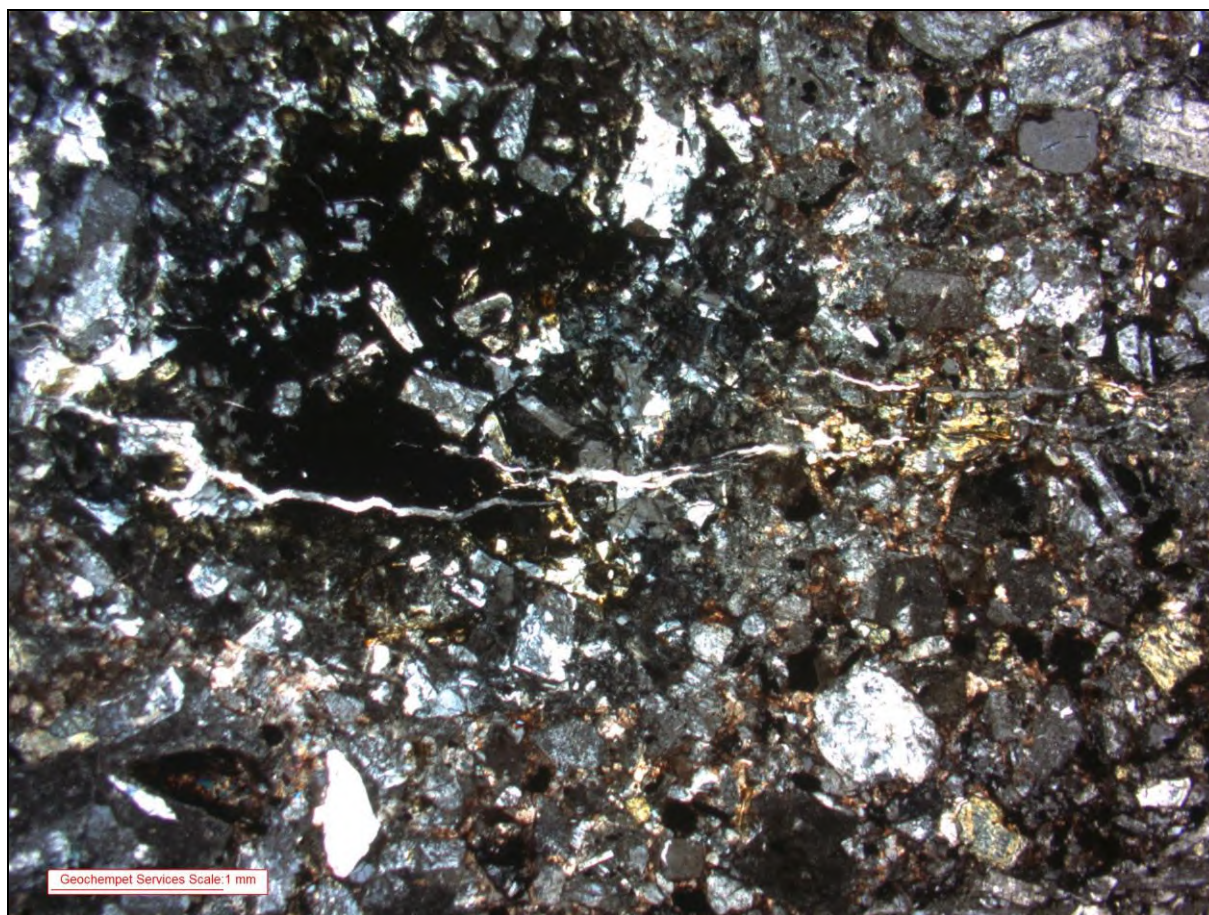


Plate 2. Low magnification, crossed polarised, transmitted light image of latite agglomerate. Note the variations in lithic clasts due to hematite replacement and patches of reddened anisotropic zeolite and green smectite clay. Note the calcite in fracture veins cutting across clasts.

**PETROGRAPHIC REPORT
ON A DRILL CORE SAMPLE (10628/BH105/33.07-33.24)
FROM LOT 65 DP 752473 BLIND CREEK ROAD, GLENDON BROOK, NSW**

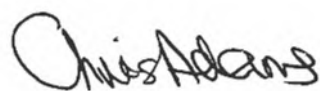
Prepared for

**MARTENS AND ASSOCIATES PTY LTD
HORNSBY, NSW**

Order Number 10628
Invoice Number I074-250293
Client Reference Ali Kandil

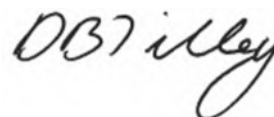
Sample ID	10628/BH105/33.07-33.24	Date Sampled	27/05/2025
Geochempet ID	G25060070	Date Processed	16/06/2025
Project	Resource Feasibility Assessment – Proposed Pittman Quarry	Sample Source	Lot 65 DP 752473 Blind Creek Road, Glendon Brook, NSW
Sample Type	Drill Core		

Issued by



C. Adams
BSc (Hons)
Grad Cert (Geostatistics)
Grad Dip (Data Science)
27 June 2025

Reviewed by



D. B. Tilley
BSc (Hons) PhD
27 June 2025

WORK REQUESTED

Engineering Petrographic Report on a Single Rock Type 100-point Count: Rock identification and description, percentage of minerals based on a 100-point count. Comment on durability, concrete-related secondary/deleterious minerals, and potential for alkali-silica reactivity (ASR). Free silica content percentage. Petrographic analysis in relation for use as concrete aggregate, petrographic analysis in relation for use as road base, petrographic analysis in relation for use as rail ballast, petrographic analysis in relation for use in asphalt.

METHOD

The method entails a count of 100 random points in a single standard-sized thin section. All durable, moderately durable and non-durable mineral species are identified and recorded separately.

The work requested was carried out with account taken of ASTM C 295 Standard Guide for Petrographic Assessment of Aggregates for Concrete, the AS2758.1 – 2014 Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B), the AS1141 Standard Guide for the Method for sampling and testing aggregates; of the content of the 2015 joint publication of the Cement and Concrete Association of Australia and Standards Australia, (HB 79-2015) entitled Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia, and in accordance with the 2015 publication of Standards Australia (AS 2758.7 – Appendix B), entitled *Aggregates and Rock for Engineering Purposes- Part 7: Railway Ballast*.

PETROGRAPHIC ANALYSIS

Identification Crystal rich andesite tuff.

Description

The supplied rock appears to have an igneous origin. It comprises an andesite composition volcanic rock with a porphyritic texture. Very light grey to white and greyish black (Munsell Colour Chart 2009 N8 to N9 and N2) phenocrysts about 1 mm to 3 mm in size are present in a fine-grained, medium dark grey (Munsell Colour Chart 2009 N4) groundmass that is less than about 1 mm in size (Figure 1). The sample is hard and unweathered.



Figure 1: Photograph of the supplied core. Grid spacing is 1 cm.

Mineralogy

One thin section was prepared to permit detailed examination in polarised transmitted light of the sample. An approximate average mineralogical composition was determined, expressed in volume percent, and based on a count of 100 widely spaced points:

Hard, durable components

- 13% Quartz (<1% mildly strained fine groundmass, ~13%* microcrystalline groundmass)
- 26% Alkali feldspar (11% phenocrysts, 2% fine groundmass, ~13%* microcrystalline groundmass)
- 35% Plagioclase (18% phenocrysts, 4% fine groundmass, ~13%* microcrystalline groundmass)
- 5% Amphibole (phenocrysts)
- 6% Pyroxene (phenocrysts)
- 2% Opaque minerals (fine groundmass)
- <1% Apatite (fine groundmass)

Soft/weak & deleterious components

- 4% Chlorite and chlorite/smectite (4% phenocrysts alteration, <1% fracture fill)
- 1% Iron oxides (1% phenocrysts alteration <1% fracture fill)
- 8% Illite/sericite (groundmass alteration)

** Definitive identification of individual mineral grains was not possible due to the fine to microcrystalline grain size. Confidence in the tabulated percentages for these components is low.*

Thin Section Description

The sample consists of a porphyritic intermediate volcanic igneous rock of andesite composition. Subhedral to euhedral phenocrysts of feldspar about 0.5 – 3.0 mm in size, subhedral to euhedral phenocrysts of amphibole about 0.5 – 1.5 mm in size, subhedral to anhedral phenocrysts of pyroxene about 0.5 – 1.5 mm in size, and anhedral to subhedral pseudomorphs after phenocrysts of former mafic minerals about 0.5 – 1.0 mm in size are present in a fine-grained to microcrystalline groundmass of quartz and feldspar that is less than about 0.15 mm in size (Figure 2). Pockets of the groundmass display eutaxitic banding textures, interpreted to have been formed by the flow, collapse and compaction of pumice and ash fragments in a pyroclastic flow (Figure 3). A minor amount of superficial late fracturing up to 0.1 mm in thickness is also observed (Figure 4).

The feldspar phenocrysts (11% alkali feldspar and 18% plagioclase) are unaltered to weakly altered to illite/sericite. The amphibole phenocrysts (5%, likely hornblende) are commonly outlined by rims of iron oxide minerals but are otherwise unaltered. The pyroxene phenocrysts (6%) are unaltered to moderately altered to chlorite or chlorite/smectite clay, which has formed alteration rims around the mineral grains and within internal grain fractures. Former phenocrysts of mafic minerals, likely biotite based on the pseudomorph outlines, are completely altered to a mix of iron oxides and chlorite, forming pseudomorphs after the original grains; the unaltered or partly altered equivalents of which were not observed in the thin section.

Definitive identification of individual mineral grains within the groundmass (53%) was not always possible due its fine to microcrystalline grain size. Groundmass of grain size *greater than* about 0.1 mm in size was found to be composed predominantly of mildly strained quartz (<1%), alkali feldspar (2%) and plagioclase (4%). Groundmass of grain size *less than* about 0.1 mm in size (39%) is assumed to be $\frac{1}{3}$ moderately strained quartz (~13.0%), $\frac{1}{3}$ alkali feldspar (~13.0%) and $\frac{1}{3}$ plagioclase (~13.0%). The groundmass is typically weakly to moderately altered to illite/sericite throughout the sample. Some patches of the groundmass, possibly representing former glassy shards, are completely altered to illite/sericite clay (8%) forming discontinuous bands and patches of darker coloured groundmass. It is noted that the estimate of the groundmass components as determined by optical means carries with it a degree of uncertainty due to the fine to microcrystalline grain size, and the proportions of the minerals identified may vary.

The remainder of the intermediate volcanic consists of minor amounts of opaque minerals (2%) which occur scattered throughout the groundmass, and trace amounts of apatite (<0.1%) which occurs scattered throughout the groundmass and occasionally as inclusions in larger mineral grains.

Also present are superficial thin fractures up to 0.1 mm in thickness, which contain trace amounts (<1%) of chlorite, and occasionally iron oxide, mineral fill. The fractures are observed to cut both the groundmass and the phenocrysts, and do not appear to have a preferred orientation through the sample or with respect to each other.

Comments and Interpretations

The supplied sample (labelled with client Sample ID “10628/BH105/33.07-33.24”) from Lot 65 DP 752473 Blind Creek Road NSW can be classified broadly for engineering purposes as crystal rich andesite tuff, an igneous rock, that is unweathered and has undergone mild alteration under sub-greenschist facies metamorphic conditions.

For engineering purposes, the supplied sample may be summarised as:

- **Crystal rich andesite tuff (an intermediate volcanic igneous rock)**
- porphyritic and holocrystalline textures
- non-porous
- unweathered
- mildly altered
- carrying about 87% hard, durable minerals (quartz, feldspar, pyroxene, amphibole, opaque oxide, apatite)
- carrying about 13% soft/weak & deleterious components (chlorite, smectite, sericite, illite, iron oxides)
- **hard**
- **strong**

The rock is predicted to be **durable**. Hard/durable mineral content is 87% of the total sample, and only a minor amount (13%) of soft/weak & deleterious minerals is present. As far as can be determined by optical petrographic examination the rock appears to be devoid of significant fractures, open joints, pervasive strong foliation fabric or other such potential structural weaknesses.

The rock contains <1% mildly strained quartz and ~13% microcrystalline quartz. The rock is therefore predicted to **have potential for mild or slow deleterious alkali-silica reactivity in concrete** (as per AS 1141.65 standard criteria).

The rock does not contain alkali-carbonate reactive rock components, such as dolomitic limestones of moderate to high clay content. The rock is therefore predicted to be **innocuous in relation to alkali-carbonate reactivity in concrete**.

Rock of the type supplied is predicted to be **suitable for use as concrete aggregate**, provided that the appropriate precautions are taken to account for its predicted potential for alkali-silica reactivity.

Guidance on appropriate precautions can be obtained from the 2015 joint publication of the *Cement and Concrete Association of Australia* and *Standards Australia*, entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*.

Rock of the type supplied is predicted to be **suitable for use as roadbase**, subject to wet/dry strength variation and abrasion assessments. Previous service record, if available, for this material may also clarify the suitability for use.

Rock of the type supplied is predicted to be **suitable for use as rail ballast**, subject to compliance with the Durability Criteria of CT147 / AS2758.7, and provided that large enough fragments exist that are devoid of fissile cleavage planes, fractures, open joints or other such structural weaknesses. It is noted that such large samples were not examined for this analysis. Previous service record, if available, for this material may also clarify the suitability for use.

Rock of the type supplied is predicted to be **suitable for use in asphalt**, subject to bitumen stripping and polishing assessments. Previous service record, if available, for this material may also clarify the suitability for use.

Free Silica Content

The **free silica content** of the rock is **approximately 13%**. The groundmass of the andesite carries about 39% of microcrystalline quartzofeldspathic material which has been assumed to be approximately $\frac{1}{3}$ quartz (~13%), $\frac{1}{3}$ alkali feldspar (~13%) and $\frac{1}{3}$ plagioclase (~13%). Therefore, the estimate of total free silica content as determined by optical means carries with it a degree of uncertainty, as the groundmass material may contain a higher or lower content of finely microcrystalline quartz than was observable in thin section. If a more accurate determination of quartz content is required, phase quantification by powder X-ray diffraction is recommended.

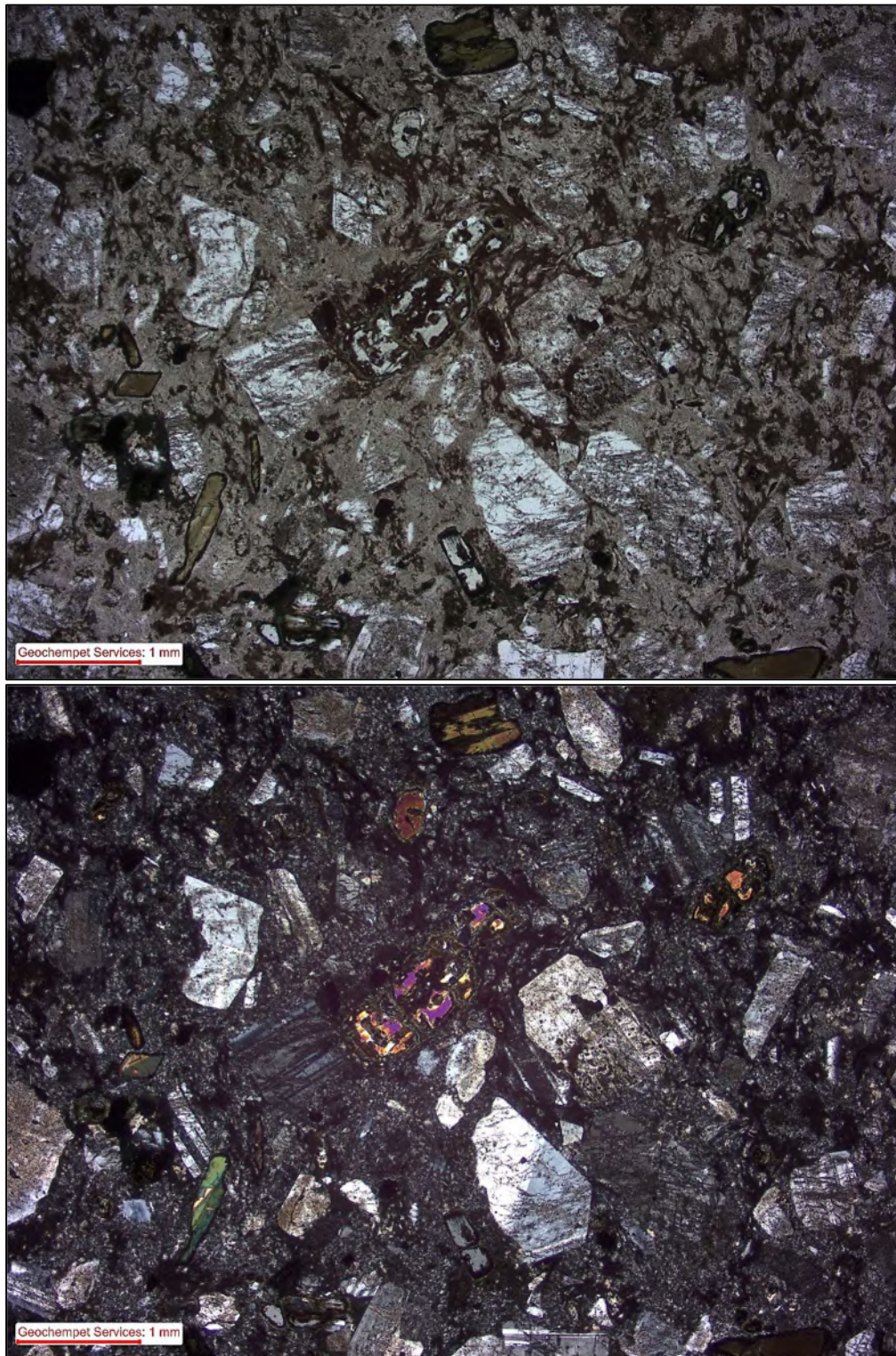


Figure 2: Photomicrograph of the sample taken at low magnification (2× objective) using plane-polarised (upper) and cross-polarised (lower) transmitted light. The image shows phenocrysts of variably sericite/illite altered feldspar, chlorite altered pyroxene and iron oxide rimmed amphibole in a microcrystalline groundmass of quartz and feldspar.

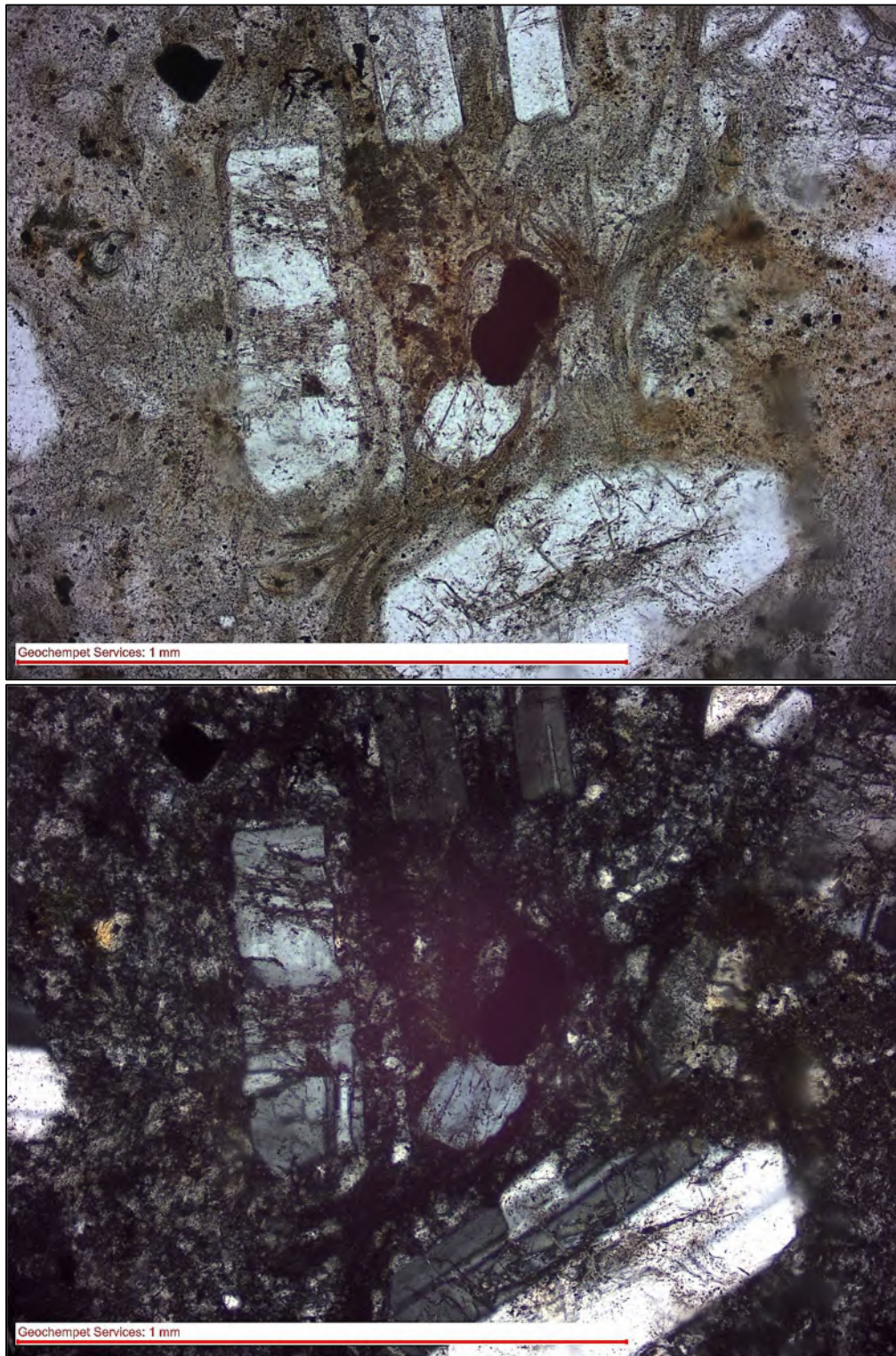


Figure 3: Photomicrograph of the sample taken at high magnification (10× objective) using plane-polarised (upper) and cross-polarised (lower) transmitted light. The image shows a pocket of remnant eutaxitic banding in the microcrystalline groundmass.

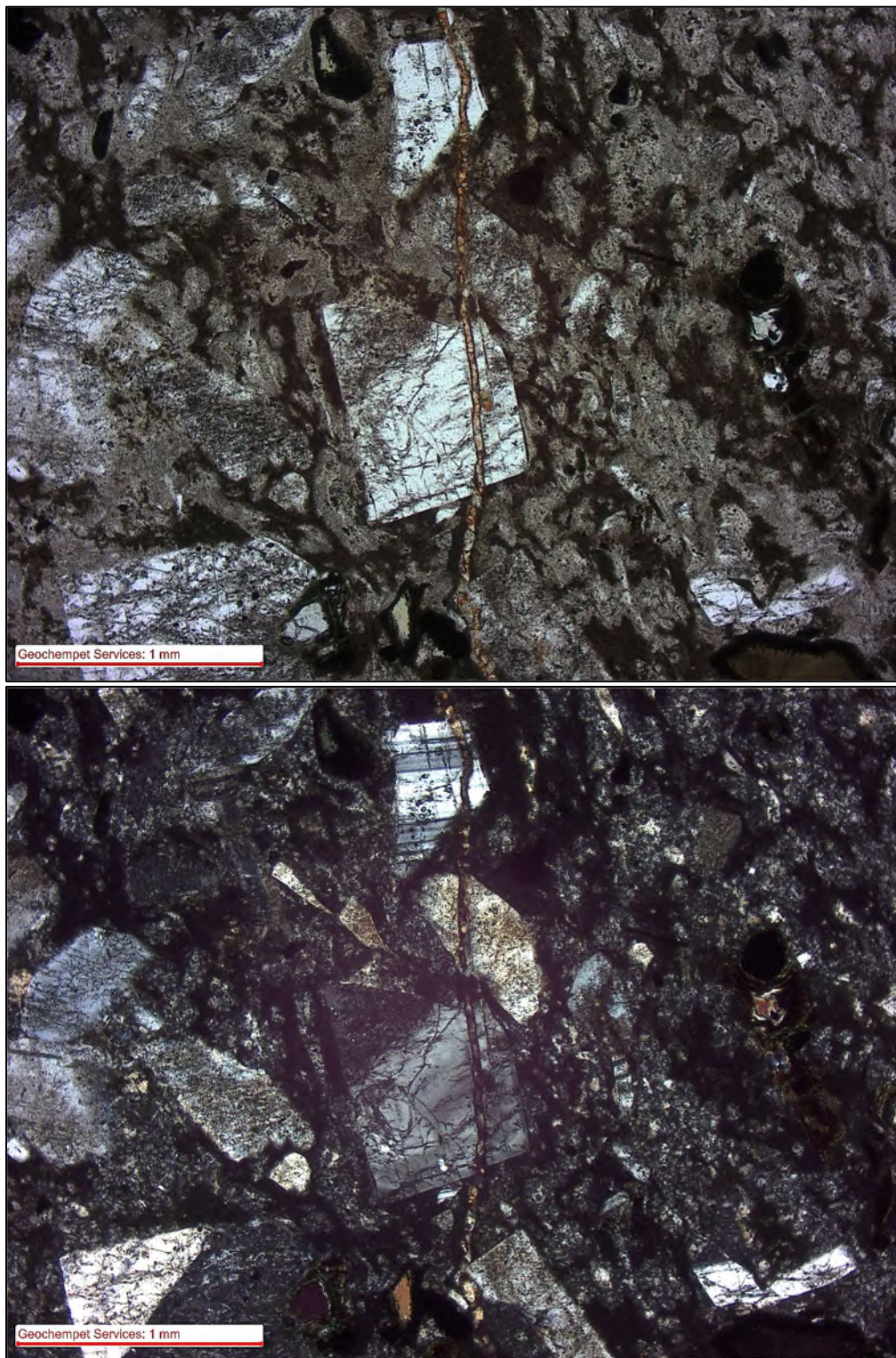


Figure 4: Photomicrograph of the sample taken at medium magnification (4× objective) using plane-polarised (upper) and cross-polarised (lower) transmitted light. The image shows a late fracture cutting across feldspar phenocrysts and the groundmass mineralogy.

**PETROGRAPHIC REPORT
ON A DRILL CORE SAMPLE (10628/BH108/31.0-31.1)
FROM LOT 65 DP 752473 BLIND CREEK ROAD, GLENDON BROOK, NSW**

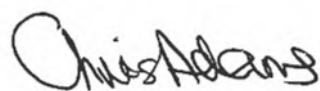
Prepared for

**MARTENS AND ASSOCIATES PTY LTD
HORNSBY, NSW**

Order Number 10628
Invoice Number 1074-250293
Client Reference Ali Kandil

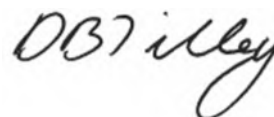
Sample ID	10628/BH108/31.0-31.1	Date Sampled	27/05/2025
Geochempet ID	G25060071	Date Processed	16/06/2025
Project	Resource Feasibility Assessment – Proposed Pittman Quarry	Sample Source	Lot 65 DP 752473 Blind Creek Road, Glendon Brook, NSW
Sample Type	Drill Core		

Issued by



C. Adams
BSc (Hons)
Grad Cert (Geostatistics)
Grad Dip (Data Science)
27 June 2025

Reviewed by



D. B. Tilley
BSc (Hons) PhD
27 June 2025

WORK REQUESTED

Engineering Petrographic Report on a Single Rock Type 100-point Count: Rock identification and description, percentage of minerals based on a 100-point count. Comment on durability, concrete-related secondary/deleterious minerals, and potential for alkali-silica reactivity (ASR). Free silica content percentage. Petrographic analysis in relation for use as concrete aggregate, petrographic analysis in relation for use as road base, petrographic analysis in relation for use as rail ballast, petrographic analysis in relation for use in asphalt.

METHOD

The method entails a count of 100 random points in a single standard-sized thin section. All durable, moderately durable and non-durable mineral species are identified and recorded separately.

The work requested was carried out with account taken of ASTM C 295 Standard Guide for Petrographic Assessment of Aggregates for Concrete, the AS2758.1 – 2014 Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B), the AS1141 Standard Guide for the Method for sampling and testing aggregates; of the content of the 2015 joint publication of the Cement and Concrete Association of Australia and Standards Australia, (HB 79-2015) entitled Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia, and in accordance with the 2015 publication of Standards Australia (AS 2758.7 – Appendix B), entitled *Aggregates and Rock for Engineering Purposes- Part 7: Railway Ballast*.

PETROGRAPHIC ANALYSIS

Identification Crystal-lithic rhyodacite tuff.

Description

The supplied rock appears to have an igneous origin. It comprises a rhyodacite composition volcanic rock with a porphyritic texture. Very light grey to white (Munsell Colour Chart 2009 N8 to N9) phenocrysts about 1 mm to 3 mm in size and medium light grey to medium dark grey (Munsell Colour Chart 2009 N6 to N5) lithic fragments about 1 mm to 10 mm in size are present in a fine-grained, moderate reddish brown to moderate brown (Munsell Colour Chart 2009 10R 4/6 to 5YR 4/4) groundmass that is less than about 1 mm in size (Figure 1). The sample is moderately soft and mildly weathered.

The rock has minor amounts of fracturing less than 1 mm in thickness. The fracturing appears to be randomly oriented throughout the sample and contains moderate reddish brown to dark reddish brown (Munsell Colour Chart 2009 10R 4/6 to 10R 3/4) secondary iron oxide mineral fill.



Figure 1: Photograph of the supplied core. Grid spacing is 1 cm.

Mineralogy

One thin section was prepared to permit detailed examination in polarised transmitted light of the sample. An approximate average mineralogical composition was determined, expressed in volume percent, and based on a count of 100 widely spaced points:

Hard, durable components

- 19% Quartz (5% mildly strained phenocrysts, 10% moderately strained phenocrysts, 1% moderately strained grains in lithic fragments of quartzite, 1% mildly strained phenocrysts and ~2%* microcrystalline quartz groundmass in lithic fragments of felsic volcanic rock, <1% moderately strained grains in lithic fragments of epidosite)
- 7% Alkali feldspar (5% phenocrysts, ~2%* microcrystalline alkali feldspar groundmass in lithic fragments of felsic volcanic rock)
- 32% Plagioclase (30% phenocrysts, <1% grains and ~2%* microcrystalline plagioclase groundmass in lithic fragments of felsic volcanic rock)
- 3% Amphibole (phenocrysts)
- 3% Opaque minerals (3% phenocrysts, <1% grains in lithic fragments of felsic volcanic rock)
- 1% Epidote (lithic fragments of epidosite)

Soft/weak & deleterious components

- 7% Biotite (phenocrysts)
- <1% Chlorite (phenocryst alteration)
- 7% Iron oxides (2% phenocryst alteration, 3% groundmass alteration, 2% fracture fill)
- 21% Illite/sericite (groundmass alteration)

** Definitive identification of individual mineral grains was not possible due to the fine to microcrystalline grain size. Confidence in the tabulated percentages for these components is low.*

Thin Section Description

The sample consists of a porphyritic felsic volcanic igneous rock of rhyodacite composition. Subhedral to anhedral phenocrysts of quartz about 0.5 – 3.0 mm in size, subhedral to euhedral phenocrysts of feldspar about 0.5 – 2.0 mm in size, subhedral to anhedral phenocrysts of biotite about 0.5 – 3.0 mm in size, and lithic fragments of volcanic rock up to about 1.5 mm in size are present in a very fine-grained groundmass of illite/sericite clay (Figures 2 to 4). A minor amount of late fracturing up to 0.5 mm in thickness is also observed (Figure 2).

The quartz phenocrysts are mildly strained (5%) and moderately strained (10%). The feldspar phenocrysts (5% alkali feldspar and 30% plagioclase) are weakly altered to moderately altered to illite/sericite. The amphibole phenocrysts (3%, likely hornblende) are commonly outlined by rims of iron oxide minerals, and some phenocrysts appear to have been strongly altered and almost completely replaced making them difficult to distinguish from strongly iron oxide altered patches within the groundmass. The biotite phenocrysts (7%) are unaltered to weakly altered to chlorite or chlorite/smectite clay and occasionally are partially outlined by iron oxide minerals. Opaque mineral grain phenocrysts (3%, likely oxide minerals) up to about 0.25 mm in size are also present scattered throughout the sample.

The lithic fragments of volcanic rock comprise subangular to subrounded fragments of felsic volcanic rock (1% mildly strained quartz phenocrysts, ~2%* microcrystalline quartz groundmass, <1% plagioclase phenocrysts and ~2%* microcrystalline groundmass, <1% opaque minerals) in lithic fragments of felsic volcanic rock), subangular fragments of quartzite (1% moderately strained quartz grains), and subrounded fragments of what appears to be epidosite (1% epidote, <1% moderately strained quartz grains). The lithic fragments are randomly distributed throughout the sample.

The groundmass is interpreted to have originally been composed of the glassy shards of pumice and ash fragments from a pyroclastic flow, which has since been devitrified and altered to illite/sericite clay (21%) and/or iron oxides (3%). It is noted that the groundmass component mineralogy as determined by optical means carries with it a degree of uncertainty due to the very fine to grain size, and it is possible that small amounts of other components such as microcrystalline quartzofeldspathic material are also present.

Also present are thin fractures up to 0.5 mm in thickness, which are either open, or are partially filled with iron oxide mineral fill (2%). The fractures are observed to cut both the groundmass and the phenocrysts, and do not appear to have a preferred orientation through the sample or with respect to each other.

Comments and Interpretations

The supplied sample (labelled with client Sample ID “10628/BH108/31.0-31.1”) from Lot 65 DP 752473 Blind Creek Road, NSW can be classified broadly for engineering purposes as crystal-lithic rhyodacite tuff, an igneous rock, that is mildly weathered and has undergone moderate alteration under sub-greenschist facies metamorphic conditions.

TRILAB - GEOCHEMPET SERVICES, BRISBANE

For engineering purposes, the supplied sample may be summarised as:

- Crystal-lithic rhyodacite tuff (**a felsic volcanic igneous rock**)
- porphyritic and holocrystalline textures
- non-porous
- mildly weathered
- moderately altered
- carrying about 65% hard, durable minerals (quartz, feldspar, amphibole, epidote, opaque oxide)
- carrying about 35% soft/weak & deleterious components (sericite, illite, iron oxides, biotite)
- **moderately soft**
- **moderately strong**

The rock is predicted to be **moderately durable**. The rock contains an elevated content of soft/weak & deleterious components (35%) and has mild degree of unhealed fractures, both of which may negatively impact the overall mechanical strength and long-term integrity of the rock mass.

The rock contains 6% mildly strained quartz, 11% moderately strained quartz and ~2% microcrystalline quartz. The rock is therefore predicted to **have potential for mild or slow deleterious alkali-silica reactivity in concrete** (as per AS 1141.65 standard criteria).

The rock does not contain alkali-carbonate reactive rock components, such as dolomitic limestones of moderate to high clay content. The rock is therefore predicted to be **innocuous in relation to alkali-carbonate reactivity in concrete**.

Rock of the type supplied is predicted to be **essentially suitable for use as concrete aggregate**, provided that the appropriate precautions are taken to account for its predicted potential for alkali-silica reactivity, the elevated soft/weak mineral content, and potentially limited long-term durability of the rock.

Guidance on appropriate precautions can be obtained from the 2015 joint publication of the *Cement and Concrete Association of Australia* and *Standards Australia*, entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*.

Rock of the type supplied is predicted to be **suitable for use as roadbase**, subject to wet/dry strength variation and abrasion assessments. Previous service record, if available, for this material may also clarify the suitability for use.

Rock of the type supplied is predicted to be **essentially suitable for use as rail ballast**, subject to compliance with ASTM D4992-14 Standard Guide for Evaluation of Rock to be used for Erosion Control, and provided that large enough fragments exist that are devoid of fissile cleavage planes, fractures, open joints or other such structural weaknesses. It is noted that such large samples were not examined for this analysis. Attention is drawn to the elevated clay content of the sample (21%) and the mild degree of open unhealed fracturing (2%). This may reduce the durability of the rock during normal service and with exposure to water. A wet-dry accelerated weathering test and freeze-thaw accelerated weathering test is recommended to confirm the suitability of this material for the intended use as rail ballast. Previous service record, if available, for this material may also clarify the suitability for use.

Rock of the type supplied is predicted to be **suitable for use in asphalt**, subject to bitumen stripping and polishing assessments. Previous service record, if available, for this material may also clarify the suitability for use.

Free Silica Content

The **free silica content** of the rock is **approximately 19%**. The groundmass of the lithic fragments of felsic volcanic rock within the rhyodacite carries about 6% of microcrystalline quartzofeldspathic material which has been assumed to be approximately $\frac{1}{3}$ quartz (~2%), $\frac{1}{3}$ alkali feldspar (~2%) and $\frac{1}{3}$ plagioclase (~2%). Therefore, the estimate of total free silica content as determined by optical means carries with it a degree of uncertainty, as the groundmass material may contain a higher or lower content of finely microcrystalline quartz than was observable in thin section. If a more accurate determination of quartz content is required, phase quantification by powder X-ray diffraction is recommended.

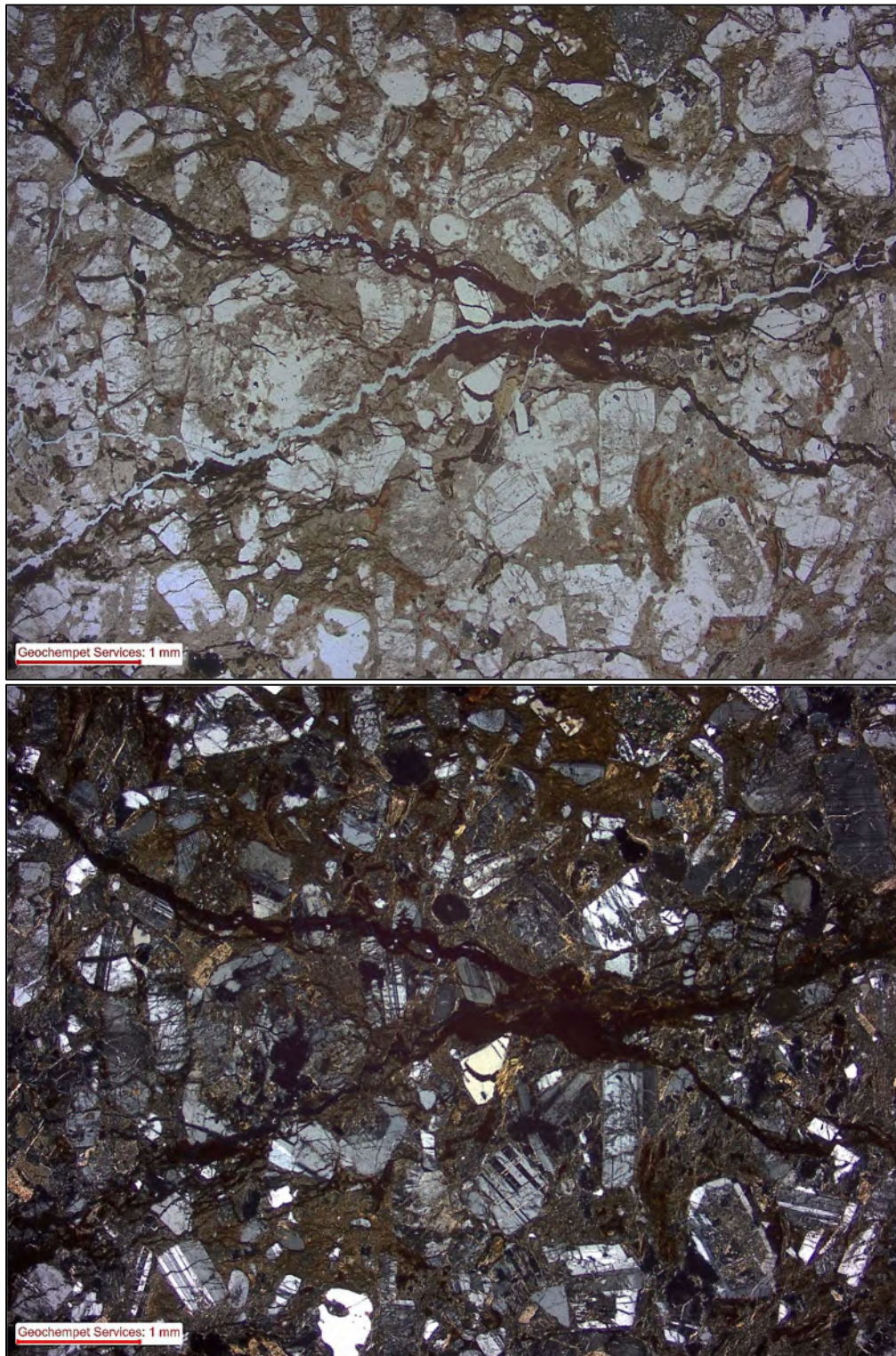


Figure 2: Photomicrograph of the sample taken at low magnification (2× objective) using plane-polarised (upper) and cross-polarised (lower) transmitted light. The image shows variably strained quartz phenocrysts and variably sericite/illite altered feldspar phenocrysts in the altered groundmass. Also shown are several randomly oriented late fractures that are variably filled with iron oxides.

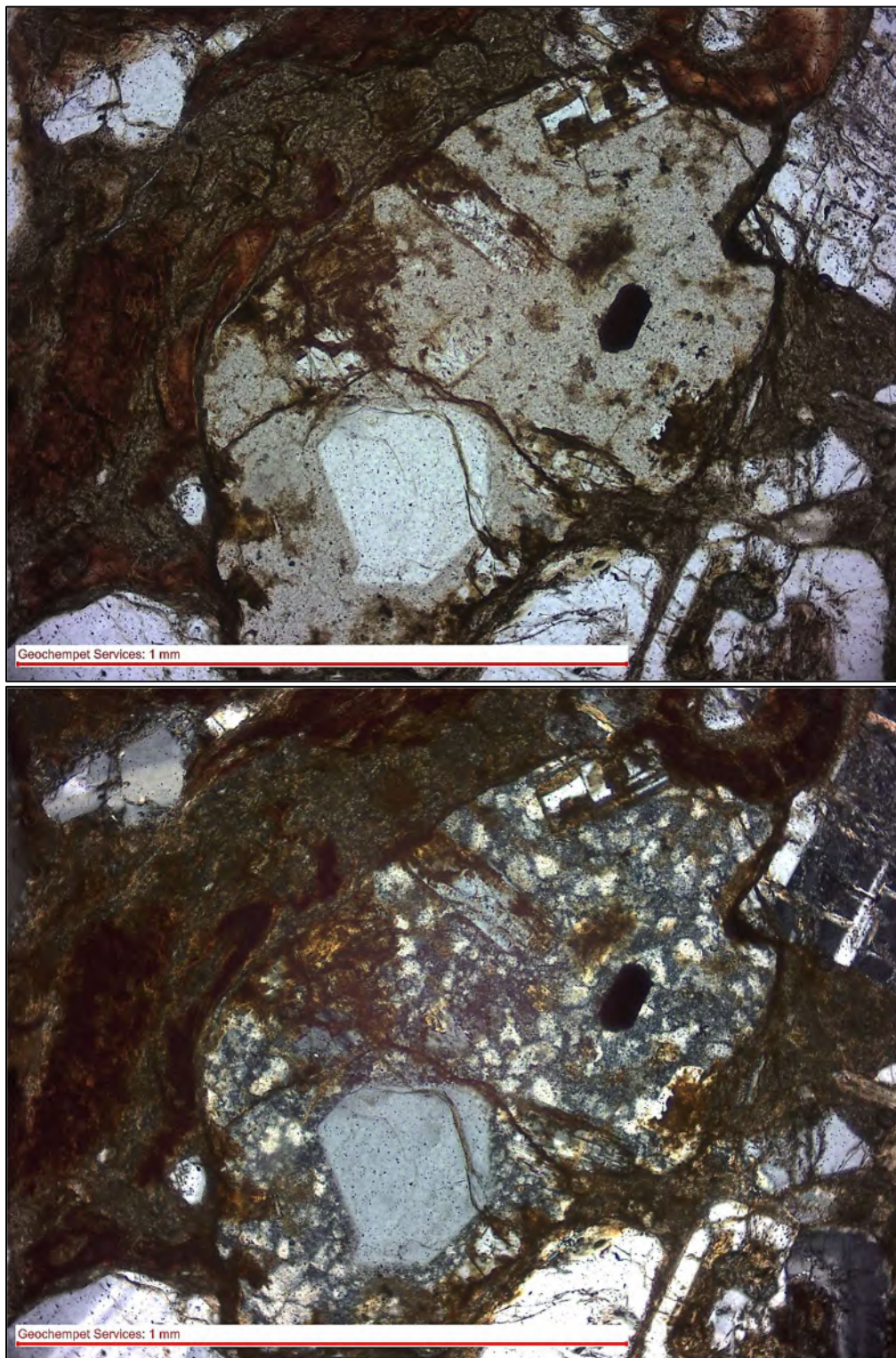


Figure 3: Photomicrograph of the sample taken at high magnification (10× objective) using plane-polarised (upper) and cross-polarised (lower) transmitted light. The image shows a lithic fragment of felsic volcanic rock within the altered groundmass of the rhyodacite tuff.

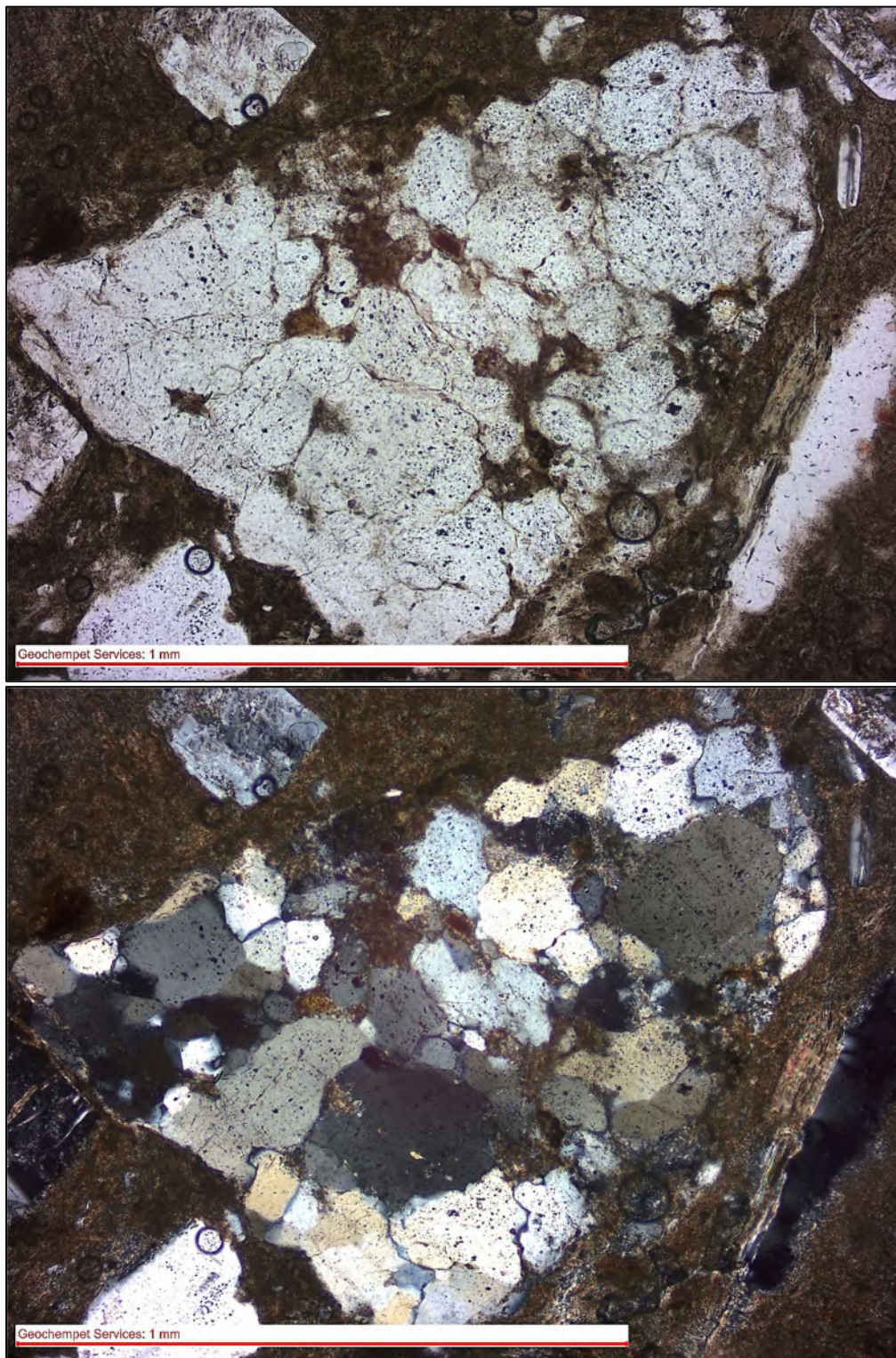


Figure 4: Photomicrograph of the sample taken at high magnification (10× objective) using plane-polarised (upper) and cross-polarised (lower) transmitted light. The image shows a lithic fragment of quartzite within the altered groundmass of the rhyodacite tuff.

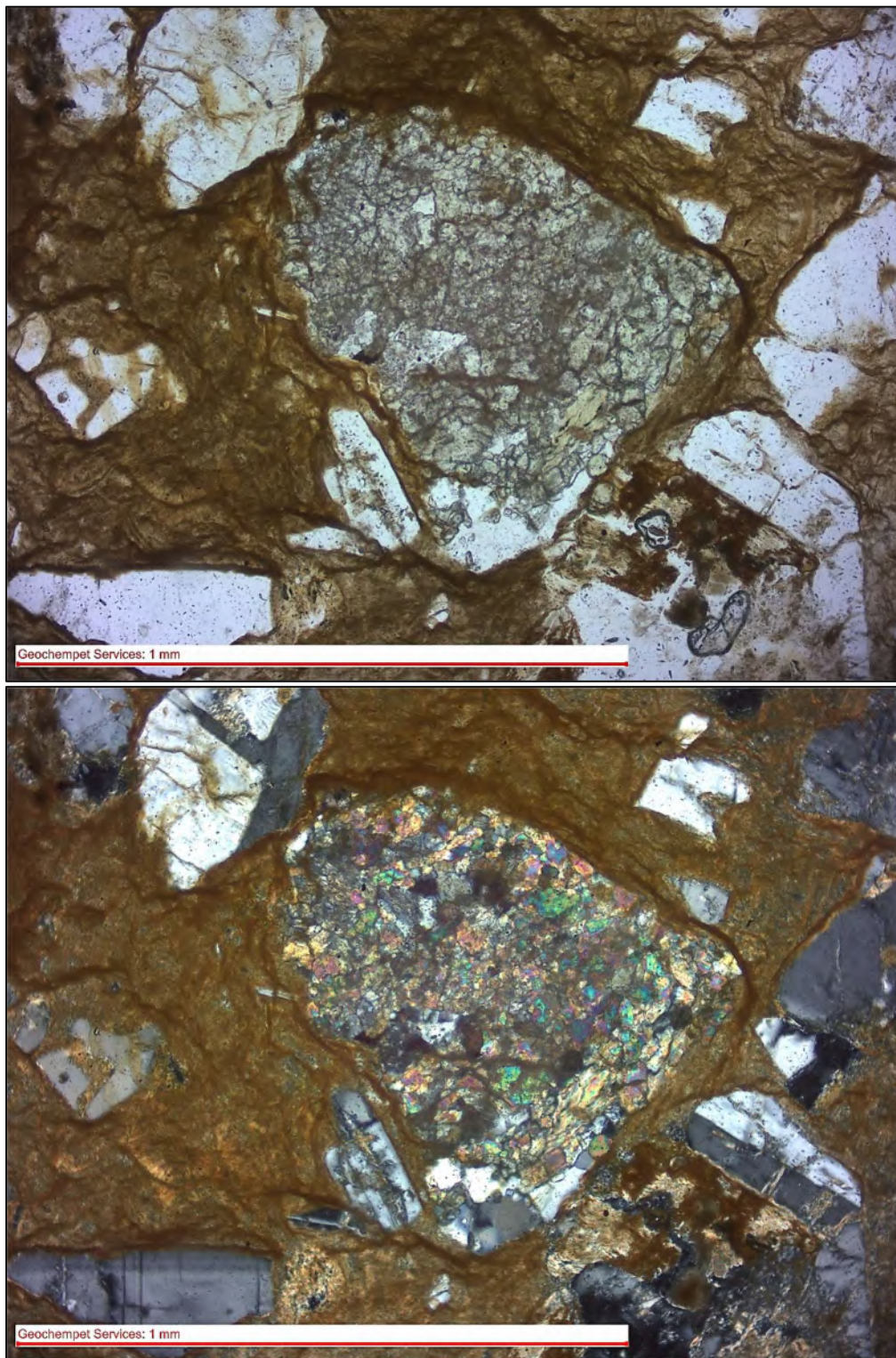


Figure 5: Photomicrograph of the sample taken at high magnification (10× objective) using plane-polarised (upper) and cross-polarised (lower) transmitted light. The image shows a lithic fragment of epidosite (epidote and quartz rock) within the altered groundmass of the rhyodacite tuff.

Appendix F – Laboratory Test Certificates

Test Report

Customer: Martens & Associates Pty Ltd

Job number: 17-0060

Project: Resource Preliminary Investigation: 1706007

Report number: 1

Location: Suite 201, 20 George Street, Hornsby NSW 2077

Page: 1 of 1

Wet/Dry Strength Variation

Sampling method: Sample tested as received

Test method(s): RMS T105, T215

	Results				
Laboratory sample no.	11959				
Customer sample no.	6007/Surface/0/R/1				
Date sampled	07/06/2017				
Material description	GRAVEL, grey				
Nature of bulk sample	Crushed rock				
Nominal size of aggregate	14mm				
Size fraction of test portion	-19.0 to +9.5mm				
Test cylinder size (mm)	150				
Significant breakdown	No				
Average wet strength (kN)	230				
Average dry strength (kN)	248				
Wet dry strength variation (%)	7				

Notes: Bulk sample jaw crushed during preparation. Duplicate testing performed

Approved Signatory:  C. Greely

Date: 19/07/2017



ACCREDITED FOR
TECHNICAL
COMPETENCE

Accredited for compliance with ISO/IEC 17025.

NATA Accredited Laboratory Number: **17062**

**SYDNEY
ANALYTICAL
LABORATORIES**

Page 1 of 3

Office:
PO BOX 48
ERMINGTON NSW 2115

Laboratory:
1/4 ABBOTT ROAD
SEVEN HILLS NSW 2147
Telephone: (02) 9838 8903
Fax: (02) 9838 8919
A.C.N. 003 614 695
A.B.N. 81 829 182 852
NATA No: 1884

ANALYTICAL REPORT for:

RESOURCE LABORATORIES

12/1 BODEN ROAD
SEVEN HILLS 2147

ATTN: CHRIS GREELY

JOB NO: SAL26361C
CLIENT ORDER: 17-0060
DATE RECEIVED: 07/07/17
DATE COMPLETED: 14/07/17
TYPE OF SAMPLES: AGGREGATE
NO OF SAMPLES: 1



.....
Issued on 14/07/17
Lance Smith
(Chief Chemist)

**SYDNEY
ANALYTICAL
LABORATORIES**

Page 2 of 3

ANALYTICAL REPORT

JOB NO: SAL26361C
CLIENT ORDER: 17-0060

	SAMPLES	SO4 % as SO3
1	11959	0.021

MDL	0.001
Method Code	C34
Preparation	P5

RESULTS ON DRY BASIS
SAMPLE DESCRIPTION: GREY GRAVEL

ANALYTICAL REPORT

JOB NO: SAL26361C
CLIENT ORDER: 17-0060

METHODS OF PREPARATION AND ANALYSIS

The tests contained in this report have been carried out on the samples as received by the laboratory.

P5 Sample dried, split and crushed to -150um
C34 Acid Soluble Sulphate - RMS T219

SYDNEY ANALYTICAL LABORATORIES

Page 1 of 3

Office:
PO BOX 48
ERMINGTON NSW 2115

Laboratory:
1/4 ABBOTT ROAD
SEVEN HILLS NSW 2147
Telephone: (02) 9838 8903
Fax: (02) 9838 8919
A.C.N. 003 614 695
A.B.N. 81 829 182 852
NATA No: 1884

ANALYTICAL REPORT for:

RESOURCE LABORATORIES

12/1 BODEN ROAD
SEVEN HILLS 2147

ATTN: CHRIS GREELY

JOB NO: SAL29252E
CLIENT ORDER: 25-0055
DATE RECEIVED: 15/07/25
DATE COMPLETED: 24/07/25
TYPE OF SAMPLES: AGGREGATES
NO OF SAMPLES: 2



.....
Issued on 24/07/25
Lance Smith
(Chief Chemist)

ANALYTICAL REPORT

**JOB NO: SAL29252E
CLIENT ORDER: 25-0055**

SAMPLES	Cl - %	SO4 % as SO3	SO4 % as SO3
1 37905	0.004	0.008	0.007
2 37908	0.004	0.007	0.007
MDL	0.001	0.001	0.001
Method Code	C32	C33	C34
Preparation	P5	P5	P5

RESULTS ON DRY BASIS

PROJECT: P2410628, RESOURCE FEASIBILITY AND GEOTECHNICAL ASSESSMENT

SAMPLE DETAILS: 37905 - 10628/BH105/30.0-40.0

37908 - 10628/BH106/0.72-10.0

ANALYTICAL REPORT

JOB NO: SAL29252E

CLIENT ORDER: 25-0055

METHODS OF PREPARATION AND ANALYSIS

The tests contained in this report have been carried out on the samples as received by the laboratory. In the case where an analyte or group of analytes are received outside of recommended holding times, the analysis will proceed and the report annotated. Analysis is carried out within analyte holding times where possible.

P5	Sample dried, split and crushed to -150um
C32	Acid Soluble Chloride - AS1012.20.1
C33	Acid Soluble Sulphate - AS1012.20.1
C34	Acid Soluble Sulphate - RMS T219

Test Report

Customer: Martens & Associates Pty Ltd

Job number: 17-0140

Project: P1706007

Report number: 1

Location: Preliminary Resource Investigation

Page: 1 of 1

Particle Size Distribution

Sampling method: Samples tested as received

Test method(s): RMS T105, T106

	Results				
Laboratory sample no.	13687	13688			
Customer sample no.	6007/ Agglomerate	6007/BH103 + BH104/18.0- 22.0m			
Date sampled	24/11/2017	24/11/2017			
Material description	GRAVEL, with sand, trace of silt, grey/pale red	GRAVEL, with sand, trace of silt, grey/pale red			
% Passing AS Sieve					
150.0mm					
100.0mm					
75.0mm					
63.0mm					
53.0mm					
37.5mm					
26.5mm	100	100			
19.0mm	91	84			
13.2mm	66	53			
9.5mm	45	34			
6.7mm	33	24			
4.75mm	25	17			
2.36mm	17	11			

Notes: Material jaw crushed prior to testing

Approved Signatory:



E. Maldonado

Date: 21/12/2017



ACCREDITED FOR
TECHNICAL
COMPETENCE

Accredited for compliance with ISO/IEC 17025.

NATA Accredited Laboratory Number: **17062**

Test Report

Customer: Martens & Associates Pty Ltd

Job number: 17-0140

Project: P1706007

Report number: 2

Location: Preliminary Resource Investigation

Page: 1 of 1

Particle Shape By Proportional Caliper

Sampling method: Samples tested as received

Test method(s): RMS T105, T213

	Results				
Laboratory sample no.	13687	13688			
Customer sample no.	6007/ Agglomerate	6007/BH103 + BH104/18.0- 22.0m			
Date sampled	24/11/2017	24/11/2017			
Material description	GRAVEL, with sand, trace of silt, grey/pale red	GRAVEL, with sand, trace of silt, grey/pale red			
Total misshapen particles (%)	32	36			
Flat particles (%)	21.2	22.6			
Flat & elongated particles (%)	10.2	11.2			
Elongated particles (%)	0.3	2.6			
Caliper ratio	2:1	2:1			
Notes: Material jaw crushed prior to testing					

Approved Signatory:



E. Maldonado

Date: 21/12/2017



ACCREDITED FOR
TECHNICAL
COMPETENCE

Accredited for compliance with ISO/IEC 17025.

NATA Accredited Laboratory Number: **17062**

Test Report

Customer: Martens & Associates Pty Ltd

Job number: 17-0140

Project: P1706007

Report number: 3

Location: Preliminary Resource Investigation

Page: 1 of 1

Fractured Faces of Coarse Aggregate

Sampling method: Samples tested as received

Test method (s): RMS T105, T239

	Results				
Laboratory sample no.	13687	13688			
Customer sample no.	6007/ Agglomerate	6007/BH103 + BH104/18.0-22.0m			
Date sampled	24/11/2017	24/11/2017			
Material description	GRAVEL, with sand, trace of silt, grey/pale red	GRAVEL, with sand, trace of silt, grey/pale red			
Nominal size of aggregate (mm)	14	19			
Percentage with no fractured faces	0	0			
Percentage with at least one fractured face	100	100			
Percentage with two or more fractured faces	100	100			
Notes: Material jaw crushed prior to testing					

Approved Signatory:  E. Maldonado

Date: 21/12/2017



ACCREDITED FOR
TECHNICAL
COMPETENCE

Accredited for compliance with ISO/IEC 17025.

NATA Accredited Laboratory Number: **17062**

Test Report

Customer: Martens & Associates Pty Ltd

Job number: 17-0140

Project: P1706007

Report number: 4

Location: Preliminary Resource Investigation

Page: 1 of 1

Wet/Dry Strength Variation

Sampling method: Samples tested as received

Test method(s): AS 1141.22

	Results				
Laboratory sample no.	13687	13688			
Customer sample no.	6007/ Agglomerate	6007/BH103 + BH104/18.0-22.0m			
Date sampled	24/11/2017	24/11/2017			
Material description	GRAVEL, with sand, trace of silt, grey/pale red	GRAVEL, with sand, trace of silt, grey/pale red			
Nature of bulk sample	Boulders	Drill Core			
Nominal size of aggregate	14	19			
Size fraction of test portion	-19.0mm to +9.5mm	-19.0mm to +9.5mm			
Test cylinder size (mm)	150	150			
Significant breakdown	Yes	Yes			
Average wet strength (kN)	63	145			
Average dry strength (kN)	115	203			
Wet dry strength variation (%)	45	29			

Notes: Oversize material crushed to the required size fraction.

Approved Signatory:



E. Maldonado

Date: 21/12/2017



ACCREDITED FOR
TECHNICAL
COMPETENCE

Accredited for compliance with ISO/IEC 17025.

NATA Accredited Laboratory Number: **17062**

Test Report

Customer: Martens & Associates Pty Ltd **Job number:** 25-0055
Address: Suite 201, 20 George Street, Hornsby NSW 2077 **Report number:** 4
Project: P2410628 **Page:** 1 of 1
Project Location: Resource Feasibility and Geotechnical Assessment - Proposed Pittman Quarry

Wet/Dry Strength Variation

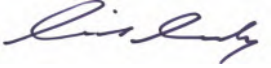
Sampling method: Sample(s) provided by customer, results apply to the sample(s) as received.

Test method(s): AS 1141.22

Date tested: 18/07/2025 to 26/07/2025

	Results				
Laboratory sample no.	37905	37908			
Customer sample no.	10628/BH105/ 30.0 - 40.0	10628/BH106/ 0.72-10.0			
Date sampled	01/01/2025 - 31/01/2025	01/01/2025 - 31/01/2025			
Material description	LATITE TUFF	LATITE TUFF			
Nature of bulk sample	Drill core	Drill core			
Nominal size of aggregate	14mm	14mm			
Size fraction of test portion	-19.0mm, +9.5mm	-19.0mm, +9.5mm			
Test cylinder size (mm)	150	150			
Significant breakdown	Yes	Yes			
Wet strength (kN)	284	94			
Dry strength (kN)	289	200			
Wet/dry strength variation (%)	2	53			

Notes: Oversize material crushed to the required size fraction

Approved Signatory:  C. Greely

Date: 31/07/2025



WORLD RECOGNISED
ACCREDITATION

Results relate only to items tested and/or sampled.

This report shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing.

NATA Accredited Laboratory Number: **17062**

SYDNEY ANALYTICAL LABORATORIES

Page 1 of 3

Office:
PO BOX 48
ERMINGTON NSW 2115

Laboratory:
1/4 ABBOTT ROAD
SEVEN HILLS NSW 2147
Telephone: (02) 9838 8903
Fax: (02) 9838 8919
A.C.N. 003 614 695
A.B.N. 81 829 182 852
NATA No: 1884

ANALYTICAL REPORT for:

RESOURCE LABORATORIES

12/1 BODEN ROAD
SEVEN HILLS 2147

ATTN: CHRIS GREELY

JOB NO: SAL26590B
CLIENT ORDER: 17-0140
DATE RECEIVED: 14/12/17
DATE COMPLETED: 15/12/17
TYPE OF SAMPLES: AGGREGATES
NO OF SAMPLES: 2



.....
Issued on 15/12/17
Lance Smith
(Chief Chemist)

SYDNEY ANALYTICAL LABORATORIES

Page 2 of 3

ANALYTICAL REPORT

JOB NO: SAL26590B
CLIENT ORDER: 17-0140

	SAMPLES	SO4 % as SO3
1	13687	0.034
2	13688	0.014

MDL	0.001
Method Code	C34
Preparation	P5

RESULTS ON DRY BASIS

SAMPLE DESCRIPTION: 13687 - 6007/AGGLOMERATE,
13688 - 6007/BH103 + BH104/18.0-22.0m

ANALYTICAL REPORT

JOB NO: SAL26590B

CLIENT ORDER: 17-0140

METHODS OF PREPARATION AND ANALYSIS

The tests contained in this report have been carried out on the samples as received by the laboratory.

P5 Sample dried, split and crushed to -150um

C34 Acid Soluble Sulphate - RMS T219



Boral Construction Materials
Materials Technical Services

Unit 4, 3-5 Gibbon Road,
Baulkham Hills NSW 2153 Australia
PO Box 400,
Winston Hills NSW 2153

T +61 (02) 9624 9900
boral.com.au

TEST REPORT
POLISHED AGGREGATE FRICTION VALUE

CLIENT: RESOURCE LABORATORIES PTY LTD
PROJECT: Resource Feasibility and Geotechnical Assessment of Aggregate
PROJECT NO: P2410628
JOB NO: 25-0055
SAMPLE DESCRIPTION: Aggregate – 10628/Surface/01
SIZE OF AGGREGATE TESTED: -9.5mm+6.7mm
CLIENT SAMPLE NO: 37910

FILE NO: 764/25
REQUEST NO: 119562
DATE RECEIVED: 9.7.25
DATE TESTED: 5.8.25
LAB. SAMPLE NO: 324531
LOCATION: Resource Lab

Samples were prepared as per AS1141.41 and tested in a wet condition as per AS1141.42 prior to and after polishing. The sample were polished using the procedure of AS114.41.

A reference aggregate sample, "Panmure Basalt" is included with each testing run. This sample acts as a control on test performance and is used to standardise the sample results. After polishing, the samples were again tested in the wet condition according to AS1141.42.

Test Method	Test	Results for the Test Sample	Results for Panmure Reference Specimen Pan No: Pan A15-25
AS1141.41/42	Sample mean friction value corrected for temperature before polishing	78	75
	Sample mean friction value corrected for temperature after polishing	52	51
	Polished aggregate friction value (PAFV) for the test sample after polishing.	52	-

The air temperature during the friction test was 23°C.

Sample submitted by client.

C. Greely, File

Approved signatory _____

Alex Liu

Date _____

5.8.25

Serial no. _____

AGG119562.AL.1

Accredited for compliance with ISO/IEC 17025 – Testing
This report shall not be reproduced in full without the approval of the Boral MTS Laboratory.
Test results in this Test Report relate only to the samples tested.



NATA Accredited Laboratory
Number: 547

Test Report

Customer: Martens & Associates Pty Ltd

Job number: 25-0055

Address: Suite 201, 20 George Street, Hornsby NSW 2077

Report number: 3

Project: P2410628

Page: 1 of 1

Project Location: Resource Feasibility and Geotechnical Assessment - Proposed Pittman Quarry

Particle Shape By Proportional Caliper

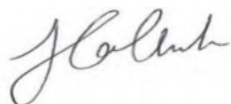
Sampling method: Sample(s) provided by customer, results apply to the sample(s) as received.

Test method(s): AS 1141.14

Date tested: 02/07/2025 to 04/07/2025

	Results				
Laboratory sample no.	37910				
Customer sample no.	10628/Surface/01				
Date sampled	01/01/2025 - 31/01/2025				
Material description	LATITE TUFF				
Total misshapen particles (%)	25				
Flat particles (%)	19				
Elongated particles (%)	6				
Flat and elongated particles (%)	0				
Caliper ratio	2:1				

Approved Signatory:



L. Coleman

Date: 22/07/2025



Results relate only to items tested and/or sampled.

This report shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing.

NATA Accredited Laboratory Number: **17062**



Building
something
great

Boral Construction Materials
Materials Technical Services

Unit 4, 3-5 Gibbon Road,
Baulkham Hills NSW 2153 Australia
PO Box 400,
Winston Hills NSW 2153

T +61 (02) 9624 9900
boral.com.au

TEST REPORT

CLIENT: Resource Laboratories Pty Ltd

FILE NO: 764/25

PROJECT: Resource Feasibility and Geotechnical Assessment of Aggregate.

REQUEST NO: 119604

TEST METHOD: AS1141 – Methods for Sampling and Testing Aggregates

DATE TESTED: 24.07-18.08.25

Sample Description:		Aggregate-10628/BH105/30.0-40.0
Location:		Resource Lab
Project No:		P2410628
Client Sample No:		37905
Job No:		25-0055
Date Received:		15.07.25
Laboratory Sample No:		324665
Test Method	Test	Results
AS1141.6.1	Particle Density (Dry) t/m ³	2.59
	Particle Density (SSD) t/m ³	2.62
	Apparent Particle Density t/m ³	2.67
	Water Absorption (%)	1.1
AS1141.24 (Mixed Aggregate)	Sodium Sulphate Soundness (Total weighted % Loss)	0.1
	Fraction tested:	
	-19.0mm+13.2mm (%Loss)	0.1
	-13.2mm+9.5mm (%Loss)	0.1
	-9.5mm+4.75mm (%Loss)	0.4
	-4.75mm +2.36mm (%Loss)	0.4

Note:
Material sampled by client
C. Greely, File.

Approved signatory _____ Mahdi Baei

Date 19.08.25 Serial no AGG119604.MB.1

Accredited for compliance with ISO/IEC 17025 – Testing
This report shall not be reproduced in full without the approval of the Boral MTS Laboratory.
Test results in this Test Report relate only to the samples tested.



NATA Accredited Laboratory
Number: 547



Boral Construction Materials
Materials Technical Services

Unit 4, 3-5 Gibbon Road,
Baulkham Hills NSW 2153 Australia
PO Box 400,
Winston Hills NSW 2153

T +61 (02) 9624 9900
boral.com.au

TEST REPORT

CLIENT: RESOURCE LABORATORIES PTY LTD

FILE No.: 764 / 25

PROJECT: Resource Feasibility and Geotechnical Assessment of Aggregate.
Project No; P2410628 Job No: 25-0055

REQUEST No.: 119604

TEST PROCEDURE:

RMS T659 – Methylene Blue Adsorption Value of Road Construction Material

Laboratory Sample No.:	324665
Date Sampled:	Unknown
Date Received:	15.07.25
Date Tested:	7.08.25
Sample Description:	Aggregate-10628/BH105/30.0-40.0 Client Sample No.37905

Field No.: 1

TEST RESULTS:

Methylene Blue Value (mg/g)	4
Methylene Blue Value for a Duplicate (mg/g)	4
Average Methylene Blue Value (mg/g)	4

Sample was provided by the Client.

Chris Greely, File.

Approved signatory  SAM DEBRINCAT
Date 7.08.25 Serial no. CHEM119604SD.1



Accredited for compliance with ISO/IEC 17025 – Testing
This report shall not be reproduced in full without the approval of the Boral MTS Laboratory.
Test results in this Test Report relate only to the samples tested.

NATA Accredited Laboratory
Number: 547



**Building
something
great**

Boral Construction Materials
Materials Technical Services

Unit 4, 3-5 Gibbon Road,
Baulkham Hills NSW 2153 Australia
PO Box 400,
Winston Hills NSW 2153

T +61 (02) 9624 9900
boral.com.au

Test Report

Client: RESOURCE LABORATORIES PTY LTD
Address: P.O. BOX 45, PENDLE HILL, NSW 2145
Date Received: 15/07/2025
Project: Resource Feasibility and Geotechnical Assessment of Aggregate – Project No. P2410628 – Job No. 25-0055.
Test Method: Accelerated Mortar Bar Test for AAR Assessment - RMS T363

File No: 764/25
Req. No: 119604
Date Sampled: Unknown

Lab Sample No	Sample Description	Location
324665	Aggregate – 10628 / BH105 / 30.0 - 40.0, Sample No. 37905	Resource Lab
N/A	Boral GP/SL Cement	Berrima

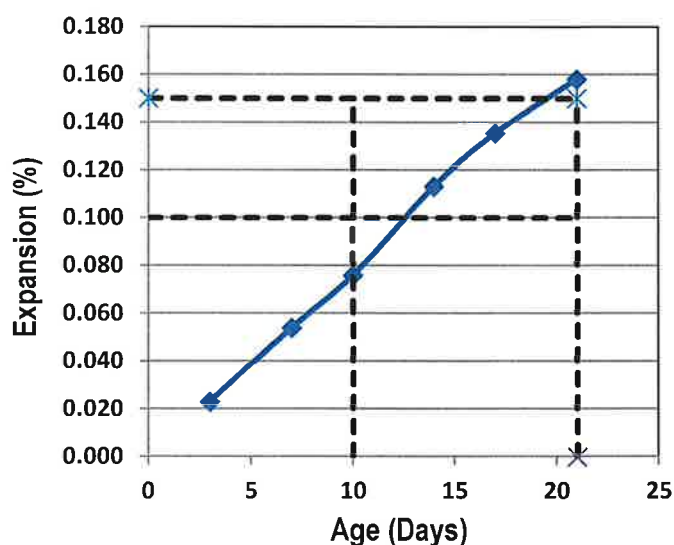
Results:

Flow (%): 14

W/C Ratio: 0.41

Mixing Date: 05/08/2025

Age (Days)	Expansion (%) Avg. of 3 specimens
3	0.023
7	0.054
10	0.076
14	0.113
17	0.135
21	0.158



Mortar Bar Expansion (E) % Duration of Specimens In 1mol/L NaOH at 80°C		RMS T363 Aggregate Reactivity Classification
10 Days	21 Days	
< 0.1*	< 0.1*	Non-Reactive
< 0.1*	≥ 0.1*	Slowly Reactive
≥ 0.1*	>> 0.1*	Reactive

* 0.15% for naturally occurring fine aggregates

Note:

- Sample supplied by the client.

Chris Greely, File

Approved signatory

Sujan Ghimire

Date 29/08/2025

Serial no. CEM119604.SG.1



NATA Accredited Laboratory
Number: 547



Building
something
great

Boral Construction Materials
Materials Technical Services

Unit 4, 3-5 Gibbon Road,
Baulkham Hills NSW 2153 Australia
PO Box 400,
Winston Hills NSW 2153

T +61 (02) 9624 9900
boral.com.au

TEST REPORT

CLIENT: Resource Laboratories Pty Ltd

FILE NO: 764/25

PROJECT: Resource Feasibility and Geotechnical Assessment of Aggregate.

REQUEST NO: 119604

TEST METHOD: AS1141 – Methods for Sampling and Testing Aggregates

DATE TESTED: 24.07-18.08.25

Sample Description:		Aggregate-10628/BH106/0.72-10.0
Location:		Resource Lab
Project No:		P2410628
Client Sample No:		37908
Job No:		25-0055
Date Received:		15.07.25
Laboratory Sample No:		324666
Test Method	Test	Results
AS1141.6.1	Particle Density (Dry) t/m ³	2.42
	Particle Density (SSD) t/m ³	2.51
	Apparent Particle Density t/m ³	2.65
	Water Absorption (%)	3.6
AS1141.24 (Mixed Aggregate)	Sodium Sulphate Soundness (Total weighted % Loss)	7.8
	Fraction tested:	
	-19.0mm+13.2mm (%Loss)	8.5
	-13.2mm+9.5mm (%Loss)	12.0
	-9.5mm+4.75mm (%Loss)	9.8
	-4.75mm +2.36mm (%Loss)	10.1
	-2.36mm+1.18mm(%Loss)	6.6

Note:

Material sampled by client

C. Greely, File.

Mahdi Baei

Approved signatory

Date 19.08.25

Serial no.

AGG119604.MB.2



Accredited for compliance with ISO/IEC 17025 – Testing

This report shall not be reproduced in full without the approval of the Boral MTS Laboratory.

Test results in this Test Report relate only to the samples tested.

NATA Accredited Laboratory
Number: 547



Boral Construction Materials
Materials Technical Services

Unit 4, 3-5 Gibbon Road,
Baulkham Hills NSW 2153 Australia
PO Box 400,
Winston Hills NSW 2153

T +61 (02) 9624 9900
boral.com.au

TEST REPORT

CLIENT: RESOURCE LABORATORIES PTY LTD

FILE No.: 764 / 25

PROJECT: Resource Feasibility and Geotechnical Assessment of Aggregate.
Project No; P2410628 Job No: 25-0055

REQUEST No.: 119604

TEST PROCEDURE:

RMS T659 – Methylene Blue Adsorption Value of Road Construction Material

Laboratory Sample No.: 324666
Date Sampled: Unknown
Date Received: 15.07.25
Date Tested: 7.08.25
Sample Description: Aggregate-10628/BH106/0.72-10.0
Client Sample No.37908

Field No.: 2

TEST RESULTS:

Methylene Blue Value (mg/g) 10
Methylene Blue Value for a Duplicate (mg/g) 10
Average Methylene Blue Value (mg/g) 10

Sample was provided by the Client.

Chris Greely, File.

Approved signatory  SAM DEBRINCAT
Date 7.08.25 Serial no. CHEM119604SD.2





**Building
something
great**

Boral Construction Materials
Materials Technical Services

Unit 4, 3-5 Gibbon Road,
Baulkham Hills NSW 2153 Australia
PO Box 400,
Winston Hills NSW 2153

T +61 (02) 9624 9900
boral.com.au

Test Report

Client: RESOURCE LABORATORIES PTY LTD
Address: P.O. BOX 45, PENDLE HILL, NSW 2145
Date Received: 15/07/2025
Project: Resource Feasibility and Geotechnical Assessment of Aggregate – Project No. P2410628 – Job No. 25-0055.
Test Method: Accelerated Mortar Bar Test for AAR Assessment - RMS T363

File No: 764/25
Req. No: 119604
Date Sampled: Unknown

Lab Sample No	Sample Description	Location
324666	Aggregate – 10628 / BH106 / 0.72 - 10.0, Sample No. 37908	Resource Lab
N/A	Boral GP/SL Cement	Berrima

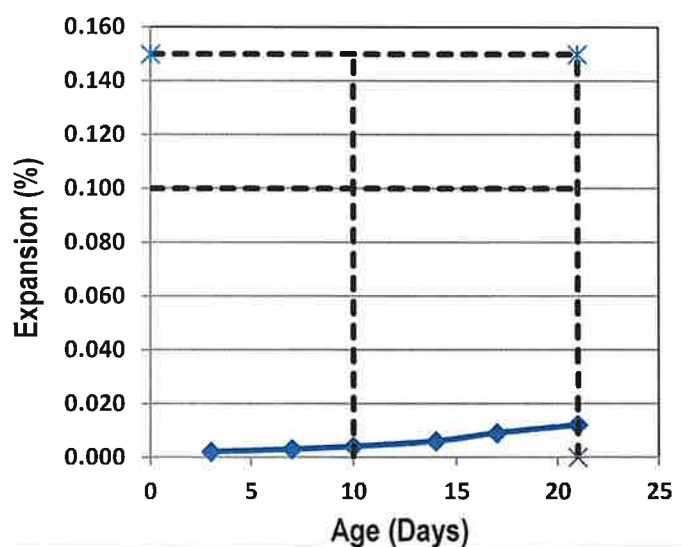
Results:

Flow (%): 6

W/C Ratio: 0.45

Mixing Date: 05/08/2025

Age (Days)	Expansion (%) Avg. of 3 specimens
3	0.002
7	0.003
10	0.004
14	0.006
17	0.009
21	0.012



Mortar Bar Expansion (E) % Duration of Specimens In 1mol/L NaOH at 80°C		RMS T363 Aggregate Reactivity Classification
10 Days	21 Days	
< 0.1*	< 0.1*	
< 0.1*	≥ 0.1*	
≥ 0.1*	>> 0.1*	
		Non-Reactive
		Slowly Reactive
		Reactive

* 0.15% for naturally occurring fine aggregates

Note:

- Sample supplied by the client.

Chris Greely, File

Approved signatory

Sujan Ghimire

Date 29/08/2025

Serial no. CEM119604.SG.2



Accredited for compliance with ISO/IEC 17025 – Testing
This report shall not be reproduced in full without the approval of the Boral MTS Laboratory.
Test results in this Test Report relate only to the samples tested.

NATA Accredited Laboratory
Number: 547

Test Report

Customer: Martens & Associates Pty Ltd **Job number:** 25-0055
Address: Suite 201, 20 George Street, Hornsby NSW 2077 **Report number:** 6
Project: P2410628 **Page:** 1 of 1
Project Location: Resource Feasibility and Geotechnical Assessment - Proposed Pittman Quarry

Sugar in Aggregate

Sampling method: Sample(s) provided by customer, results apply to the sample(s) as received.

Test method(s): AS 1141.35

Date tested: 29/07/2025

	Results				
Laboratory sample no.	37905	37908			
Customer sample no.	10628/BH105/ 30.0 - 40.0	10628/BH106/ 0.72-10.0			
Date sampled	01/01/2025 - 31/01/2025	01/01/2025 - 31/01/2025			
Material description	LATITE TUFF	LATITE TUFF			
Sugar present or absent	Absent	Absent			

Approved Signatory:



C. Greely

Date: 31/07/2025



Results relate only to items tested and/or sampled.

This report shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing.

NATA Accredited Laboratory Number: **17062**

Test Report

Customer: Martens & Associates Pty Ltd **Job number:** 25-0055
Address: Suite 201, 20 George Street, Hornsby NSW 2077 **Report number:** 1
Project: P2410628 **Page:** 1 of 1
Project Location: Resource Feasibility and Geotechnical Assessment - Proposed Pittman Quarry

Point Load Strength Index

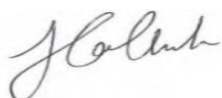
Sampling method: Sample(s) provided by customer, results apply to the sample(s) as received.

Test method(s): AS 4133.4.1 Clause 3.2, 3.3

Date tested: 16/06/2025

	Results				
Laboratory sample no.	37912	37913	37914		
Customer sample no.	10628/BH106/ 5.58 - 5.78	10628/BH106/ 7.0 - 7.16	10628/BH106/ 9.28 - 9.39		
Date sampled	01/01/2025 - 31/01/2025	01/01/2025 - 31/01/2025	01/01/2025 - 31/01/2025		
Lithological description	LATITE TUFF	LATITE TUFF	LATITE TUFF		
Diametral					
Moisture content condition and storage	Sealed core box, specimen moist	Sealed core box, specimen moist	Sealed core box, specimen moist		
Nature of weakness planes	Vein	Vein	n/a		
Specimen size					
Length (mm)	75	85	105		
Diameter (mm)	51.2	51.6	51.3		
I _s (MPa)	1.2	1.9	4.2		
I _{s(50)} (MPa)	1.3	1.9	4.3		
Axial					
Moisture content condition and storage	Sealed core box, specimen moist	Sealed core box, specimen moist	Sealed core box, specimen moist		
Nature of weakness planes	Vein	Vein	n/a		
Specimen size					
Height (mm)	40.5	37.5	41.2		
Diameter (mm)	51.2	51.6	51.3		
I _s (MPa)	0.77	0.22	5.6		
I _{s(50)} (MPa)	0.78	0.22	5.7		

Approved Signatory:



L. Coleman

Date: 16/06/2025



Results relate only to items tested and/or sampled.

This report shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing.

NATA Accredited Laboratory Number: **17062**

Test Report

Customer: Martens & Associates Pty Ltd

Job number: 25-0055

Address: Suite 201, 20 George Street, Hornsby NSW 2077

Report number: 2

Project: P2410628

Page: 1 of 3

Project Location: Resource Feasibility and Geotechnical Assessment - Proposed Pittman Quarry

Uniaxial Compressive Strength of Rock Core

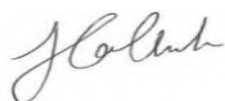
Sampling method: Sample(s) provided by customer, results apply to the sample(s) as received.

Test method(s): AS 4133.1.1.1, 4.2.1

Date tested: 25/06/2025 to 27/06/2025

	Results			
Laboratory sample no.	37906	37907	37911	
Customer sample no.	10628/BH105/ 34.18 - 34.35	10628/BH105/ 39.7 - 40.0	10628/BH106/ 2.52 - 2.82	
Sample depth	34.18-34.35m	39.70-40.00m	2.52-2.82m	
Date sampled	01/01/2025 - 31/01/2025	01/01/2025 - 31/01/2025	01/01/2025 - 31/01/2025	
Lithological description	LATITE TUFF	LATITE TUFF	LATITE TUFF	
Condition of specimen, storage history, curing, and environment	Dry, stored in core box, moisture condition as received	Dry, stored in core box, moisture condition as received	Dry, stored in core box, moisture condition as received	
Average specimen length (mm)	143.9	148.1	146.5	
Average specimen diameter (mm)	50.6	50.5	50.9	
Length to diameter ratio	2.8	2.9	2.9	
Rate of displacement (mm/min)	0.02	0.03	0.05	
Test duration (mins)	98	35	19	
Description of failure	Multiple fracture	Multiple fracture	Single shear plane	
Moisture content at time of test (%)	0.8	0.8	2.5	
Dry density (t/m ³)	2.61	2.61	2.51	
Uniaxial Compressive Strength (MPa)	290	260	56	

Approved Signatory:



L. Coleman

Date: 27/06/2025



Results relate only to items tested and/or sampled.

This report shall not be reproduced except in full.

WORLD RECOGNISED
ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing.

NATA Accredited Laboratory Number: **17062**

Test Report

Customer: Martens & Associates Pty Ltd
Address: Suite 201, 20 George Street, Hornsby NSW 2077
Project: P2410628
Project Location: Resource Feasibility and Geotechnical Assessment - Proposed Pittman Quarry

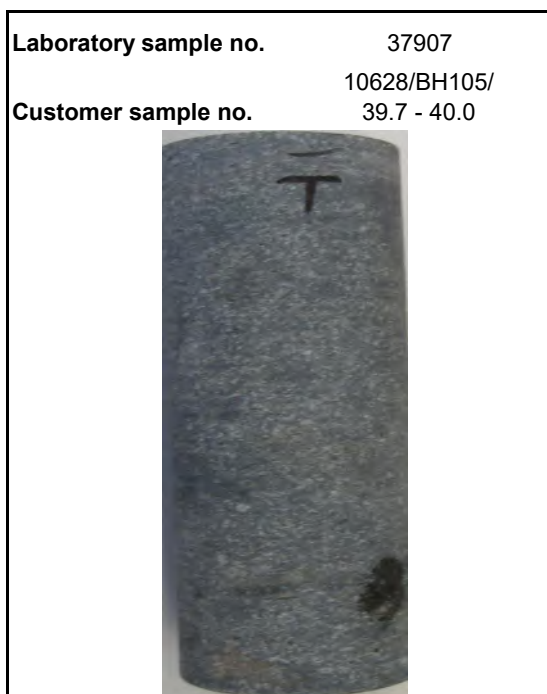
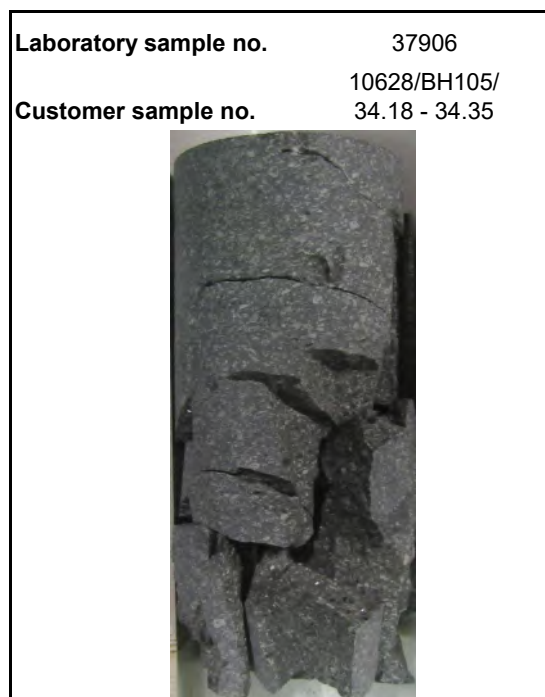
Job number: 25-0055
Report number: 2
Page: 2 of 3

Uniaxial Compressive Strength of Rock Core

Specimen prior to testing



Specimen after failure



Test Report

Customer: Martens & Associates Pty Ltd
Address: Suite 201, 20 George Street, Hornsby NSW 2077
Project: P2410628
Project Location: Resource Feasibility and Geotechnical Assessment - Proposed Pittman Quarry

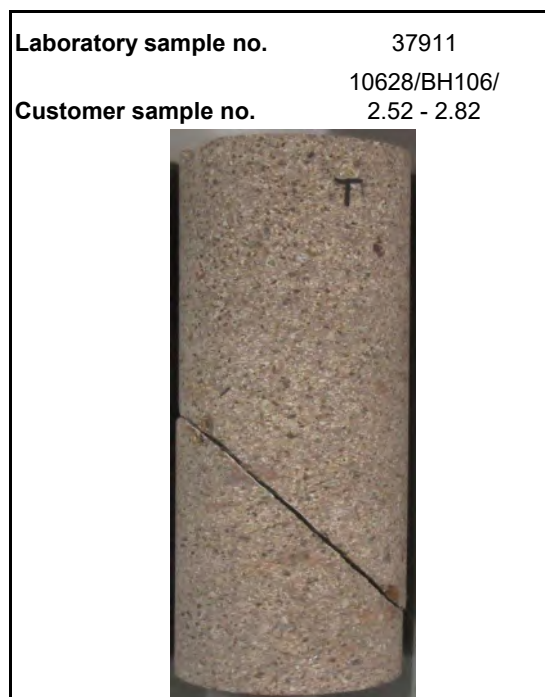
Job number: 25-0055
Report number: 2
Page: 3 of 3

Uniaxial Compressive Strength of Rock Core

Specimen prior to testing



Specimen after failure



Test Report

Customer: Martens & Associates Pty Ltd

Job number: 25-0055

Address: Suite 201, 20 George Street, Hornsby NSW 2077

Report number: 5

Project: P2410628

Page: 1 of 2

Project Location: Resource Feasibility and Geotechnical Assessment - Proposed Pittman Quarry

Uniaxial Compressive Strength of Rock Core

Sampling method: Sample(s) provided by customer, results apply to the sample(s) as received.

Test method(s): AS 4133.1.1.1, 4.2.1

Date tested: 24/07/2025 to 25/07/2025

	Results			
Laboratory sample no.	38195			
Customer sample no.	10628/BH108/ 37.49-37.70			
Sample depth	37.49-37.70m			
Date sampled	01/01/2025 - 31/01/2025			
Lithological description	AGGLOMERATE			
Condition of specimen, storage history, curing, and environment	Dry, stored in core box, moisture condition as received			
Average specimen length (mm)	153.2			
Average specimen diameter (mm)	51.8			
Length to diameter ratio	3.0			
Rate of displacement (mm/min)	0.05			
Test duration (mins)	19			
Description of failure	Tensile dominated			
Moisture content at time of test (%)	3.7			
Dry density (t/m ³)	2.35			
Uniaxial Compressive Strength (MPa)	5.8			

Approved Signatory:  C. Greely

Date: 31/07/2025



Results relate only to items tested and/or sampled.

This report shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing.

NATA Accredited Laboratory Number: **17062**

Test Report

Customer: Martens & Associates Pty Ltd
Address: Suite 201, 20 George Street, Hornsby NSW 2077
Project: P2410628
Project Location: Resource Feasibility and Geotechnical Assessment - Proposed Pittman Quarry

Job number: 25-0055
Report number: 5
Page: 2 of 2

Uniaxial Compressive Strength of Rock Core

Specimen prior to testing



Specimen after failure



Laboratory sample no.

Customer sample no.

Laboratory sample no.

Customer sample no.

Appendix G – Comments on RMS3051: Traffic Category

Source: Reproduced from RMS 3051 (2014) – Table GN.2

Traffic Category	Typical Application	Comments on Specified Material Properties
A	Freeways and major highways	Increased aggregate strength, tightly controlled particle size distribution, a permeability requirement and a plasticity requirement to provide increased resistance to high traffic loading, low permeability and a cohesive surface finish resistant to the effects of traffic prior to sprayed sealing.
B	Rural highways	Traditional level of aggregate strength, an evenly graded particle size distribution and a plasticity requirement to provide a cohesive surface finish resistant to the effects of traffic prior to sprayed sealing.
C	Arterial and collector roads	Traditional level of aggregate strength, an evenly graded particle size distribution and a plasticity requirement to provide a cohesive surface finish resistant to the effects of traffic prior to sprayed sealing. Can be assessed for conformity based on shear criteria.
D	Lower trafficked rural or urban local roads	Generally higher than that for cycleways, shared paths, property access ways and footpath base/subbase requirements unless access is required for maintenance or commercial vehicles. (Note: Industrial areas, grain and stock routes and other freight traffic generating developments may require a higher traffic category due to the high gross mass of these vehicles.)

Appendix H – Important Information About Your Report

These notes have been prepared by Martens to help you interpret and understand the limitations of your report. Not all are necessarily relevant to all reports but are included as general reference.

Engineering Reports - Limitations

Engineering reports are based on information that may be gained from limited subsurface site testing and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Engineering Reports – Project Specific Criteria

Engineering reports are prepared by qualified personnel. They are based on information obtained, on current engineering standards of interpretation and analysis, and on the basis of your unique project specific requirements as understood by Martens. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the Client.

Where the report has been prepared for a specific design proposal (e.g. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (e.g. to a twenty storey building). Your report should not be relied upon, if there are changes to the project, without first asking Martens to assess how factors, which changed subsequent to the date of the report, affect the report's recommendations. Martens will not accept responsibility for problems that may occur due to design changes, if not consulted.

Engineering Reports – Recommendations

Your report is based on the assumption that site conditions, as may be revealed through selective point sampling, are indicative of actual conditions throughout an area. This assumption often cannot be substantiated until project implementation has commenced. Therefore your site investigation report recommendations should only be regarded as preliminary.

Only Martens, who prepared the report, are fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report, there is a risk that the report will be misinterpreted and Martens cannot be held responsible for such misinterpretation.

Engineering Reports – Use for Tendering Purposes

Where information obtained from investigations is provided for tendering purposes, Martens recommend that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document.

Martens would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Engineering Reports – Data

The report as a whole presents the findings of a site assessment and should not be copied in part or altered in any way.

Logs, figures, drawings etc are customarily included in a Martens report and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel), desktop studies and laboratory evaluation of field samples. These data should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Engineering Reports – Other Projects

To avoid misuse of the information contained in your report it is recommended that you confer with Martens before passing your report on to another party who may not be familiar with the background and purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Subsurface Conditions - General

Every care is taken with the report in relation to interpretation of subsurface conditions, discussion of geotechnical aspects, relevant standards and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- o Unexpected variations in ground conditions - the potential will depend partly on test point (eg. excavation or borehole) spacing and sampling frequency, which are often limited by project imposed budgetary constraints.
- o Changes in guidelines, standards and policy or interpretation of guidelines, standards and policy by statutory authorities.

- o The actions of contractors responding to commercial pressures.
- o Actual conditions differing somewhat from those inferred to exist, because no professional, no matter how qualified, can reveal precisely what is hidden by earth, rock and time.

The actual interface between logged materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

If these conditions occur, Martens will be pleased to assist with investigation or providing advice to resolve the matter.

Subsurface Conditions - Changes

Natural processes and the activity of man create subsurface conditions. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Reports are based on conditions which existed at the time of the subsurface exploration / assessment.

Decisions should not be based on a report whose adequacy may have been affected by time. If an extended period of time has elapsed since the report was prepared, consult Martens to be advised how time may have impacted on the project.

Subsurface Conditions - Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those that were expected from the information contained in the report, Martens requests that it immediately be notified. Most problems are much more readily resolved at the time when conditions are exposed, rather than at some later stage well after the event.

Report Use by Other Design Professionals

To avoid potentially costly misinterpretations when other design professionals develop their plans based on a Martens report, retain Martens to work with other project professionals affected by the report. This may involve Martens explaining the report design implications and then reviewing plans and specifications produced to see how they have incorporated the report findings.

Subsurface Conditions – Geo-environmental Issues

Your report generally does not relate to any findings, conclusions, or recommendations about the potential for hazardous or contaminated materials existing at the site unless specifically required to do so as part of Martens' proposal for works.

Specific sampling guidelines and specialist equipment, techniques and personnel are typically used to perform geo-environmental or site contamination assessments. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Martens for information relating to such matters.

Responsibility

Geo-environmental reporting relies on interpretation of factual information based on professional judgment and opinion and has an inherent level of uncertainty attached to it and is typically far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded.

To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Martens to other parties but are included to identify where Martens' responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Martens closely and do not hesitate to ask any questions you may have.

Site Inspections

Martens will always be pleased to provide engineering inspection services for aspects of work to which this report relates. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site. Martens is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction.

Appendix I – Notes About This Report

These notes have been prepared by Martens to help you interpret and understand the limitations of your report. Not all are necessarily relevant to all reports but are included as general reference.

Engineering Reports - Limitations

The recommendations presented in this report are based on limited investigations and include specific issues to be addressed during various phases of the project. If the recommendations presented in this report are not implemented in full, the general recommendations may become inapplicable and Martens & Associates accept no responsibility whatsoever for the performance of the works undertaken.

Occasionally, sub-surface conditions between and below the completed boreholes or other tests may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact Martens & Associates.

Relative ground surface levels at borehole locations may not be accurate and should be verified by on-site survey.

Engineering Reports – Project Specific Criteria

Engineering reports are prepared by qualified personnel. They are based on information obtained, on current engineering standards of interpretation and analysis, and on the basis of your unique project specific requirements as understood by Martens. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the Client.

Where the report has been prepared for a specific design proposal (e.g. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (e.g. to a twenty storey building). Your report should not be relied upon, if there are changes to the project, without first asking Martens to assess how factors, which changed subsequent to the date of the report, affect the report's recommendations. Martens will not accept responsibility for problems that may occur due to design changes, if not consulted.

Engineering Reports – Recommendations

Your report is based on the assumption that site conditions, as may be revealed through selective point sampling, are indicative of actual conditions throughout an area. This assumption often cannot be substantiated until project implementation has commenced. Therefore your site investigation report recommendations should only be regarded as preliminary.

Only Martens, who prepared the report, are fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report, there is a risk that the report will be misinterpreted and Martens cannot be held responsible for such misinterpretation.

Engineering Reports – Use for Tendering Purposes

Where information obtained from investigations is provided for tendering purposes, Martens recommend that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document.

Martens would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Engineering Reports – Data

The report as a whole presents the findings of a site assessment and should not be copied in part or altered in any way.

Logs, figures, drawings etc are customarily included in a Martens report and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel), desktop studies and laboratory evaluation of field samples. These data should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Engineering Reports – Other Projects

To avoid misuse of the information contained in your report it is recommended that you confer with Martens before passing your report on to another party who may not be familiar with the background and purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Subsurface Conditions - General

Every care is taken with the report in relation to interpretation of subsurface conditions, discussion of geotechnical aspects, relevant standards and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions - the potential will depend partly on test point (eg. excavation or borehole) spacing and sampling frequency, which are often limited by project imposed budgetary constraints.

- Changes in guidelines, standards and policy or interpretation of guidelines, standards and policy by statutory authorities.
- The actions of contractors responding to commercial pressures.
- Actual conditions differing somewhat from those inferred to exist, because no professional, no matter how qualified, can reveal precisely what is hidden by earth, rock and time.

The actual interface between logged materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

If these conditions occur, Martens will be pleased to assist with investigation or providing advice to resolve the matter.

Subsurface Conditions - Changes

Natural processes and the activity of man create subsurface conditions. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Reports are based on conditions which existed at the time of the subsurface exploration / assessment.

Decisions should not be based on a report whose adequacy may have been affected by time. If an extended period of time has elapsed since the report was prepared, consult Martens to be advised how time may have impacted on the project.

Subsurface Conditions - Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those that were expected from the information contained in the report, Martens requests that it immediately be notified. Most problems are much more readily resolved at the time when conditions are exposed, rather than at some later stage well after the event.

Report Use by Other Design Professionals

To avoid potentially costly misinterpretations when other design professionals develop their plans based on a Martens report, retain Martens to work with other project professionals affected by the report. This may involve Martens explaining the report design implications and then reviewing plans and specifications produced to see how they have incorporated the report findings.

Subsurface Conditions – Geo-environmental Issues

Your report generally does not relate to any findings, conclusions, or recommendations about the potential for hazardous or contaminated materials existing at the site unless specifically required to do so as part of Martens' proposal for works.

Specific sampling guidelines and specialist equipment, techniques and personnel are typically used to perform geo-environmental or site contamination assessments. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Martens for information relating to such matters.

Responsibility

Geo-environmental reporting relies on interpretation of factual information based on professional judgment and opinion and has an inherent level of uncertainty attached to it and is typically far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded.

To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Martens to other parties but are included to identify where Martens' responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Martens closely and do not hesitate to ask any questions you may have.

Site Inspections

Martens will always be pleased to provide engineering inspection services for aspects of work to which this report relates. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site. Martens is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction.

Definitions

In engineering terms, soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material does not exhibit any visible rock properties and can be remoulded or disintegrated by hand in its field condition or in water, it is described as a soil. Other materials are described using rock description terms.

The methods of description and classification of soils and rocks used in this report are typically based on Australian Standard 1726 and the Unified Soil Classification System (USCS) – refer Soil Data Explanation of Terms (2 of 3). In general, descriptions cover the following properties: strength or density, colour, moisture, structure, soil or rock type and inclusions.

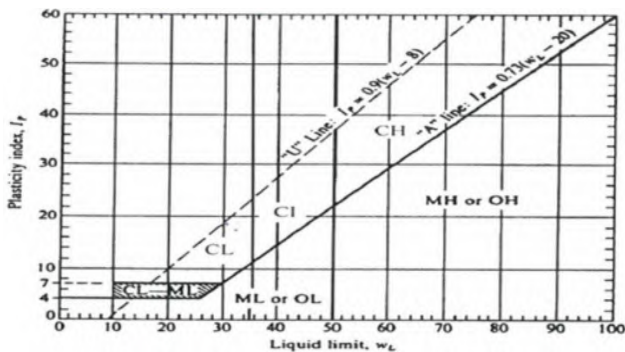
Particle Size

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (e.g. sandy CLAY). Unless otherwise stated, particle size is described in accordance with the following table.

Division	Subdivision		Particle Size (mm)
Oversized	BOULDERS		>200
	COBBLES		63 to 200
Coarse Grained Soil	GRAVEL	Coarse	19 to 63
		Medium	6.7 to 19
		Fine	2.36 to 6.7
	SAND	Coarse	0.6 to 2.36
		Medium	0.21 to 0.6
		Fine	0.075 to 0.21
Fine Grained Soil	SILT		0.002 to 0.075
	CLAY		< 0.002

Plasticity Properties

Plasticity properties of cohesive soils can be assessed in the field by tactile properties or by laboratory procedures.



Soil Moisture Condition

Coarse Grained (Granular) Soil:

Dry (D):	Looks and feels dry. Cemented soils are hard, friable or powdery. Uncemented soils run freely through fingers.
Moist (M):	Feels cool and damp and is darkened in colour. Particles tend to cohere.
Wet (W):	As for moist but with free water forming on hands when handled.

Fine Grained (Cohesive) Soil:

Moist, dry of plastic limit ¹ (w < PL):	Looks and feels dry. Hard, friable or powdery.
Moist, near plastic limit (w ≈ PL):	Can be moulded, feels cool and damp, is darkened in colour, at a moisture content approximately equal to the PL.
Moist, wet of plastic limit (w > PL):	Usually weakened and free water forms on hands when handled.
Wet, near liquid limit ² (w ≈ LL)	
Wet, wet of liquid limit (w > LL)	

¹ Plastic Limit (PL): Moisture content at which soil becomes too dry to be in a plastic condition.

² Liquid Limit (LL): Moisture content at which soil passes from plastic to liquid state.

Consistency of Cohesive Soils

Cohesive soils refer to predominantly clay materials.

(Note: consistency is affected by soil moisture condition at time of measurement)

Term	C _u (kPa)	Field Guide
Very Soft (VS)	≤12	A finger can be pushed well into the soil with little effort. Sample exudes between fingers when squeezed in fist.
Soft (S)	>12 and ≤25	A finger can be pushed into the soil to about 25mm depth. Easily moulded by light finger pressures.
Firm (F)	>25 and ≤50	The soil can be indented about 5mm with the thumb, but not penetrated. Can be moulded by strong figure pressure.
Stiff (St)	>50 and ≤100	The surface of the soil can be indented with the thumb, but not penetrated. Cannot be moulded by fingers.
Very Stiff (VSt)	>100 and ≤200	The surface of the soil can be marked, but not indented with thumb pressure. Difficult to cut with a knife. Thumbnail can readily indent.
Hard (H)	> 200	The surface of the soil can only be marked with the thumbnail. Brittle. Tends to break into fragments.
Friable (Fr)	-	Crumbles or powders when scraped by thumbnail. Can easily be crumbled or broken into small pieces by hand.

Density of Granular Soils

Non-cohesive soils are classified on the basis of relative density, generally from standard penetration test (SPT) or Dutch cone penetrometer test (CPT) results as below:

Relative Density	%	SPT 'N' Value* (blows/300mm)	CPT Cone Value (q _c MPa)
Very loose	≤15	< 5	< 2
Loose	>15 and ≤35	5 - 10	2 - 5
Medium dense	>35 and ≤65	10 - 30	5 - 15
Dense	>65 and ≤85	30 - 50	15 - 25
Very dense	> 85	> 50	> 25

* Values may be subject to corrections for overburden pressures and equipment type and influenced by soil moisture condition at time of measurement.

Minor Components

Minor components in soils may be present and readily detectable, but have little bearing on general geotechnical classification. Terms include:

Description of components	Proportion of component in:					
	coarse grained soil			fine grained soil		
	% Fines	Terminology	% Accessory coarse fraction	Terminology	% Sand/ gravel	Terminology
Minor	≤5	Trace clay / silt, as applicable	≤15	Trace sand / gravel, as applicable	≤15	Trace sand / gravel, as applicable
	>5, ≤12	With clay / silt, as applicable	>15, ≤30	With sand / gravel, as applicable	>5, ≤30	With sand / gravel, as applicable
Secondary	>12	Prefix soil name as 'silty' or 'clayey', as applicable	>30	Prefix soil name as 'sandy' or 'gravelly', as applicable	>30	Prefix soil name as 'sandy' or 'gravelly', as applicable



FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 63 mm and basing fractions on estimated mass)					USCS	Primary Name	
COARSE GRAINED SOILS More than 65 % of material less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.36 mm.	GRAVEL and SAND mixtures (≥ 5% fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes; not enough fines to bind coarse grains; no dry strength	GW	GRAVEL	
				Predominantly one size or a range of sizes with some intermediate sizes missing; not enough fines to bind coarse grains; no dry strength	GP	GRAVEL	
			GRAVEL-SILT and GRAVEL-SAND mixtures (≥ 12% fines) ¹	With excess non-plastic fines (for identification procedures see ML below); zero to medium dry strength; may also contain sand	GM	Silty GRAVEL	
				With excess plastic fines (for identification procedures see CL below); medium to high dry strength; may also contain sand	GC	Clayey GRAVEL	
		SANDS More than half of coarse fraction is smaller than 2.36 mm	SAND and GRAVEL-SAND mixtures (≥5% fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes; not enough fines to bind coarse grains; no dry strength.	SW	SAND	
				Predominantly one size or a range of sizes with some intermediate sizes missing; not enough fines to bind coarse grains; no dry strength	SP	SAND	
			SAND-SILT and SAND-CLAY mixtures (≥ 12% fines) ¹	With excess non-plastic fines (for identification procedures see ML below); zero to medium dry strength;	SM	Silty SAND	
				With excess plastic fines (for identification procedures see CL below); medium to high dry strength	SC	Clayey SAND	
FINE GRAINED SOILS More than 35 % of material less than 63 mm is smaller than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	IDENTIFICATION PROCEDURES ON FRACTIONS < 0.2 MM					
		DRY STRENGTH (Crushing Characteristics)	DILATANCY	TOUGHNESS	DESCRIPTION	USCS	Primary Name
		None to Low	Quick to Slow	Low	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or silt with low plasticity ²	ML	SILT ³
		Medium to High	None to Slow	Medium	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays	CL (or CL ¹)	CLAY
		Low to Medium	Slow	Low	Organic silts and organic silty clays of low plasticity	OL	Organic SILT or CLAY
		Low to Medium	None to Slow	Low to Medium	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	MH	SILT ³
		High to Very High	None	High	Inorganic clays of high plasticity, fat clays	CH	CLAY
		Medium to High	None to Very Slow	Low to Medium	Organic clays of medium to high plasticity, organic silt of high plasticity	OH	Organic SILT or CLAY
		HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture				PT
Notes: 1. Between 5% and 12% - dual classification, e.g. GP-GM. 2. Low Plasticity Clay – Liquid Limit W _L ≤35%; Medium Plasticity Clay – Liquid limit W _L >35%, ≤50%; High Plasticity Clay - Liquid limit W _L > 50%. 3. Low Plasticity Silt – Liquid Limit W _L ≤50%; High Plasticity Silt - Liquid limit W _L > 50%. 4. CL may be adopted for clay of medium plasticity to distinguish from clay of low plasticity.							

Soil Agricultural Classification Scheme

In some situations, such as where soils are to be used for effluent disposal purposes, soils are often more appropriately classified in terms of traditional agricultural classification schemes. Where a Martens report provides agricultural classifications, these are undertaken in accordance with descriptions by Northcote, K.H. (1979) *The factual key for the recognition of Australian Soils*, Rellim Technical Publications, NSW, p 26 - 28.

Symbol	Field Texture Grade	Behaviour of moist bolus	Ribbon length	Clay content (%)
S	Sand	Coherence nil to very slight; cannot be moulded; single grains adhere to fingers	0 mm	< 5
LS	Loamy sand	Slight coherence; discolours fingers with dark organic stain	6.35 mm	5
CLS	Clayey sand	Slight coherence; sticky when wet; many sand grains stick to fingers; discolours fingers with clay stain	6.35mm - 1.3cm	5 - 10
SL	Sandy loam	Bolus just coherent but very sandy to touch; dominant sand grains are of medium size and are readily visible	1.3 - 2.5	10 - 15
FSL	Fine sandy loam	Bolus coherent; fine sand can be felt and heard	1.3 - 2.5	10 - 20
SCL	Light sandy clay loam	Bolus strongly coherent but sandy to touch, sand grains dominantly medium size and easily visible	2.0	15 - 20
L	Loam	Bolus coherent and rather spongy; smooth feel when manipulated but no obvious sandiness or silkiness; may be somewhat greasy to the touch if much organic matter present	2.5	25
Lfsy	Loam, fine sandy	Bolus coherent and slightly spongy; fine sand can be felt and heard when manipulated	2.5	25
SiL	Silt loam	Coherent bolus, very smooth to silky when manipulated	2.5	25 + > 25 silt
SCL	Sandy clay loam	Strongly coherent bolus sandy to touch; medium size sand grains visible in a finer matrix	2.5 - 3.8	20 - 30
CL	Clay loam	Coherent plastic bolus; smooth to manipulate	3.8 - 5.0	30 - 35
SiCL	Silty clay loam	Coherent smooth bolus; plastic and silky to touch	3.8 - 5.0	30- 35 + > 25 silt
FSCL	Fine sandy clay loam	Coherent bolus; fine sand can be felt and heard	3.8 - 5.0	30 - 35
SC	Sandy clay	Plastic bolus; fine to medium sized sands can be seen, felt or heard in a clayey matrix	5.0 - 7.5	35 - 40
SiC	Silty clay	Plastic bolus; smooth and silky	5.0 - 7.5	35 - 40 + > 25 silt
LC	Light clay	Plastic bolus; smooth to touch; slight resistance to shearing	5.0 - 7.5	35 - 40
LMC	Light medium clay	Plastic bolus; smooth to touch, slightly greater resistance to shearing than LC	7.5	40 - 45
MC	Medium clay	Smooth plastic bolus, handles like plasticine and can be moulded into rods without fracture, some resistance to shearing	> 7.5	45 - 55
HC	Heavy clay	Smooth plastic bolus; handles like stiff plasticine; can be moulded into rods without fracture; firm resistance to shearing	> 7.5	> 50

Symbols for Rock

SEDIMENTARY ROCK



BRECCIA



CONGLOMERATE



CONGLOMERATIC SANDSTONE



SANDSTONE/QUARTZITE



SILTSTONE



MUDSTONE/CLAYSTONE



SHALE



COAL



LIMESTONE



LITHIC TUFF

IGNEOUS ROCK



GRANITE



DOLERITE/BASALT

METAMORPHIC ROCK



SLATE, PHYLLITE, SCHIST



GNEISS



METASANDSTONE



METASILTSTONE



METAMUDSTONE

Definitions

Descriptive terms used for Rock by Martens are based on AS1726 and encompass rock substance, defects and mass.

Rock Material The intact rock that is bounded by defects.

Rock Defect Discontinuity, fracture, break or void in the material or minerals across which there is little or no tensile strength.

Rock Structure The nature and configuration of the different defects within the rock mass and their relationship to each other.

Rock Mass The entirety of the system formed by all of the rock material and all of the defects that are present.

Degree of Weathering

Rock weathering is defined as the degree of decline in rock structure and grain property and can be determined in the field.

Term	Symbol	Definition
Residual soil ¹	RS	Material is weathered to such an extent that it has soil properties. Mass structure, material texture, and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered ¹	XW	Material is weathered to such an extent that it has soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System. Mass structure and material texture and fabric of original rock are still visible.
Highly weathered ²	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the original colour of the rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered ²	MW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the rock is not recognisable. Rock strength shows little or no change from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	Rock substance unaffected by weathering. No sign of decomposition of individual materials or colour changes.

Notes:

¹ RS and EW material is described using soil descriptive terms.

² The term "Distinctly Weathered" (DW) may be used to cover the range of substance weathering between EW and SW

Rock Strength

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the loading. The test procedure is described by the International Society of Rock Mechanics.

Term (Strength)	Is (50) MPa	Uniaxial Compressive Strength MPa	Field Guide	Symbol
Very low	>0.03 ≤0.1	0.6 – 2	May be crumbled in the hand. Sandstone is 'sugary' and friable.	VL
Low	>0.1 ≤0.3	2 – 6	Core 150mm long x 50mm diameter may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	L
Medium	>0.3 ≤1.0	6 – 20	Core 150mm long x 50mm diameter can be broken by hand with considerable difficulty. Readily scored with a knife.	M
High	>1 ≤3	20 – 60	Core 150mm long x 50mm diameter cannot be broken by unaided hands, can be slightly scratched or scored with a knife. Breaks with single blow from pick.	H
Very high	>3 ≤10	60 – 200	Core 150mm long x 50mm diameter, broken readily with hand held hammer. Cannot be scratched with knife. Breaks after more than one pick strike.	VH
Extremely high	>10	>200	A piece of core 150mm long x 50mm diameter is difficult to break with hand held hammer. Rings when struck with a hammer.	EH

Degree of Fracturing

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude fractures such as drilling breaks (DB) or handling breaks (HB).

Term	Description
Fragmented	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than core diameter.
Highly fractured	Core lengths are generally less than 20 mm to 40 mm with occasional fragments.
Fractured	Core lengths are mainly 30 mm to 100 mm with occasional shorter and longer sections.
Slightly fractured	Core lengths are generally 300 mm to 1000 mm, with occasional longer sections and sections of 100 mm to 300 mm.
Unbroken	The core does not contain any fractures.

Rock Core Recovery

TCR = Total Core Recovery

SCR = Solid Core Recovery

RQD = Rock Quality Designation

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100\%$$

$$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100\%$$

$$= \frac{\sum \text{Axial lengths of core } > 100 \text{ mm long}}{\text{Length of core run}} \times 100\%$$

Rock Strength Tests

- ▼ Point load strength Index (Is50) - axial test (MPa)
- Point load strength Index (Is50) - diametral test (MPa)
- Uniaxial compressive strength (UCS) (MPa)

Defect Type Abbreviations and Descriptions

Defect Type (with inclination given)	Planarity	Roughness
BP Bedding plane parting	PI Planar	Pol Polished
FL Foliation	Cu Curved	Sl Slickensided
CL Cleavage	Un Undulating	Sm Smooth
JT Joint	St Stepped	Ro Rough
FC Fracture	Ir Irregular	VR Very rough
SZ/SS Sheared zone/ seam (Fault)	Dis Discontinuous	
CZ/CS Crushed zone/ seam		
DZ/DS Decomposed zone/ seam		
FZ Fractured Zone	Thickness	Coating or Filling
IS Infilled seam	Zone > 100 mm	Cn Clean
VN Vein	Seam > 2 mm < 100 mm	Sn Stain
CO Contact	Plane < 2 mm	Ct Coating
HB Handling break		Vnr Veneer
DB Drilling break		Fe Iron Oxide
		X Carbonaceous
		Qz Quartzite
		MU Unidentified mineral
	Inclination	
	Inclination of defect is measured from perpendicular to and down the core axis. Direction of defect is measured clockwise (looking down core) from magnetic north.	

Test, Drill and Excavation Methods

Explanation of Terms (1 of 3)

Sampling

Sampling is carried out during drilling or excavation to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling or excavation provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples may be taken by pushing a thin-walled sampling tube, e.g. U_{50} (50 mm internal diameter thin walled tube), into soils and withdrawing a soil sample in a relatively undisturbed state. Such samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils. Other sampling methods may be used. Details of the type and method of sampling are given in the report.

Drilling / Excavation Methods

The following is a brief summary of drilling and excavation methods currently adopted by the Company and some comments on their use and application.

Hand Excavation - in some situations, excavation using hand tools, such as mattock and spade, may be required due to limited site access or shallow soil profiles.

Hand Auger - the hole is advanced by pushing and rotating either a sand or clay auger, generally 75-100 mm in diameter, into the ground. The penetration depth is usually limited to the length of the auger pole; however extender pieces can be added to lengthen this.

Test Pits - these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils and, if it is safe to descend into the pit, collection of bulk disturbed samples. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (e.g. Pengo) - the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling (Push Tube) - the hole is advanced by pushing a 50 - 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength etc. is only marginally affected.

Continuous Spiral Flight Augers - the hole is advanced using 90 - 115 mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface or, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling - the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling - similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling - a continuous core sample is obtained using a diamond tipped core barrel of usually 50 mm internal diameter. Provided full core recovery is achieved (not always possible in very weak or fractured rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

In-situ Testing and Interpretation

Cone Penetrometer Testing (CPT)

Cone penetrometer testing (sometimes referred to as Dutch Cone) described in this report has been carried out using an electrical friction cone penetrometer.

The test is described in AS 1289.6.5.1-1999 (R2013). In the test, a 35 mm diameter rod with a cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system.

Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the push rod centre to an amplifier and recorder unit mounted on the control truck. As penetration occurs (at a rate of approximately 20 mm per second) the information is output on continuous chart recorders. The plotted results given in this report have been traced from the original records. The information provided on the charts comprises:

- (i) Cone resistance (q_c) - the actual end bearing force divided by the cross sectional area of the cone, expressed in MPa.
- (ii) Sleeve friction (q_f) - the frictional force of the sleeve divided by the surface area, expressed in kPa.
- (iii) Friction ratio - the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower (A) scale (0 - 5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main (B) scale (0 - 50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1 % - 2 % are commonly encountered in sands and very soft clays rising to 4 % - 10 % in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:

$$q_c \text{ (MPa)} = (0.4 \text{ to } 0.6) N \text{ (blows/300 mm)}$$

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:

$$q_c = (12 \text{ to } 18) C_u$$

Test, Drill and Excavation Methods

Explanation of Terms (2 of 3)

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Standard Penetration Testing (SPT)

Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample.

The test procedure is described in AS 1289.6.3.1-2004. The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm penetration depth increments and the 'N' value is taken as the number of blows for the last two 150 mm depth increments (300 mm total penetration). In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued. The test results are reported in the following form:

- (i) Where full 450 mm penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7 blows:
- as 4, 6, 7
N = 13
- (ii) Where the test is discontinued, short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm
- as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil. Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

Dynamic Cone (Hand) Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150mm increments of penetration. Normally, there is a depth limitation of 1.2m but this may be extended in certain conditions by the use of extension rods. Two relatively similar tests are used.

Perth sand penetrometer (PSP) - a 16 mm diameter flat ended rod is driven with a 9 kg hammer, dropping 600 mm. The test, described in AS 1289.6.3.3-1997 (R2013), was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.

Cone penetrometer (DCP) - sometimes known as the Scala Penetrometer, a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm. The test, described in AS 1289.6.3.2-1997 (R2013), was developed initially for pavement sub-grade investigations, with correlations of the test results with California Bearing Ratio published by various Road Authorities.

Pocket Penetrometers

The pocket (hand) penetrometer (PP) is typically a light weight spring hand operated device with a stainless steel

loading piston, used to estimate unconfined compressive strength, q_u , (UCS in kPa) of a fine grained soil in field conditions. In use, the free end of the piston is pressed into the soil at a uniform penetration rate until a line, engraved near the piston tip, reaches the soil surface level. The reading is taken from a gradation scale, which is attached to the piston via a built-in spring mechanism and calibrated to kilograms per square centimetre (kPa) UCS. The UCS measurements are used to evaluate consistency of the soil in the field moisture condition. The results may be used to assess the undrained shear strength, C_u , of fine grained soil using the approximate relationship:

$$q_u = 2 \times C_u.$$

It should be noted that accuracy of the results may be influenced by condition variations at selected test surfaces. Also, the readings obtained from the PP test are based on a small area of penetration and could give misleading results. They should not replace laboratory test results. The use of the results from this test is typically limited to an assessment of consistency of the soil in the field and not used directly for design of foundations.

Test Pit / Borehole Logs

Test pit / borehole log(s) presented herein are an engineering and / or geological interpretation of the subsurface conditions. Their reliability will depend to some extent on frequency of sampling and methods of excavation / drilling. Ideally, continuous undisturbed sampling or excavation / core drilling will provide the most reliable assessment but this is not always practicable, or possible to justify on economic grounds. In any case, the test pit / borehole logs represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of test pits / boreholes, the frequency of sampling and the possibility of other than 'straight line' variation between the test pits / boreholes.

Laboratory Testing

Laboratory testing is carried out in accordance with AS 1289 Methods of Testing Soil for Engineering Purposes. Details of the test procedure used are given on the individual report forms.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems:

- In low permeability soils, ground water although present, may enter the hole slowly, or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent prior weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes, which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Test, Drill and Excavation Methods

Explanation of Terms (3 of 3)

DRILLING / EXCAVATION METHOD

HA	Hand Auger	RD	Rotary Blade or Drag Bit	NQ	Diamond Core - 47 mm
AD/V	Auger Drilling with V-bit	RT	Rotary Tricone bit	NMLC	Diamond Core – 51.9 mm
AD/T	Auger Drilling with TC-Bit	RAB	Rotary Air Blast	HQ	Diamond Core – 63.5 mm
AS	Auger Screwing	RC	Reverse Circulation	HMLC	Diamond Core – 63.5 mm
HSA	Hollow Stem Auger	CT	Cable Tool Rig	DT	Diatube Coring
S	Excavated by Hand Spade	PT	Push Tube	NDD	Non-destructive digging
BH	Tractor Mounted Backhoe	PC	Percussion	PQ	Diamond Core - 83 mm
JET	Jetting	E	Tracked Hydraulic Excavator	X	Existing Excavation

SUPPORT

Nil	No support	S	Shotcrete	RB	Rock Bolt
C	Casing	Sh	Shoring	SN	Soil Nail
WB	Wash bore with Blade or Bailer	WR	Wash bore with Roller	T	Timbering

WATER

- ∇ Water level at date shown
- ▷ Water inflow

- ◁ Partial water loss
- ◀ Complete water loss

GROUNDWATER NOT OBSERVED (NO) The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

GROUNDWATER NOT ENCOUNTERED (NX) The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

PENETRATION / EXCAVATION RESISTANCE

- L Low resistance: Rapid penetration possible with little effort from the equipment used.
- M Medium resistance: Excavation possible at an acceptable rate with moderate effort from the equipment used.
- H High resistance: Further penetration possible at slow rate & requires significant effort equipment.
- R Refusal/ Practical Refusal. No further progress possible without risk of damage/ unacceptable wear to digging implement / machine.

These assessments are subjective and dependent on many factors, including equipment power, weight, condition of excavation or drilling tools, and operator experience.

SAMPLING

D	Small disturbed sample	W	Water Sample	C	Core sample
B	Bulk disturbed sample	G	Gas Sample	CONC	Concrete Core
U63	Thin walled tube sample - number indicates nominal undisturbed sample diameter in millimetres				

TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004	CPT	Static cone penetration test
4,7,11	4,7,11 = Blows per 150mm.	CPTu	CPT with pore pressure (u) measurement
N=18	'N' = Recorded blows per 300mm penetration following 150mm seating	PP	Pocket penetrometer test expressed as instrument reading (kPa)
DCP	Dynamic Cone Penetration test to AS1289.6.3.2-1997.	FP	Field permeability test over section noted
	'n' = Recorded blows per 150mm penetration	VS	Field vane shear test expressed as uncorrected shear strength (sv = peak value, sr = residual value)
Notes:		PM	Pressuremeter test over section noted
RW	Penetration occurred under rod weight only	PID	Photoionisation Detector reading in ppm
HW	Penetration occurred under hammer and rod weight only	WPT	Water pressure tests
20/100mm	Where practical refusal or hammer double bouncing occurred, blows and penetration for that interval are reported (e.g. 20 blows for 100 mm penetration)		

SOIL DESCRIPTION

Density		Consistency		Moisture	
VL	Very loose	VS	Very soft	D	Dry
L	Loose	S	Soft	M	Moist
MD	Medium dense	F	Firm	W	Wet
D	Dense	St	Stiff	Wp	Plastic limit
VD	Very dense	VSt	Very stiff	WL	Liquid limit
		H	Hard		

ROCK DESCRIPTION

Strength		Weathering	
VL	Very low	EW	Extremely weathered
L	Low	HW	Highly weathered
M	Medium	MW	Moderately weathered
H	High	SW	Slightly weathered
VH	Very high	FR	Fresh
EH	Extremely high		