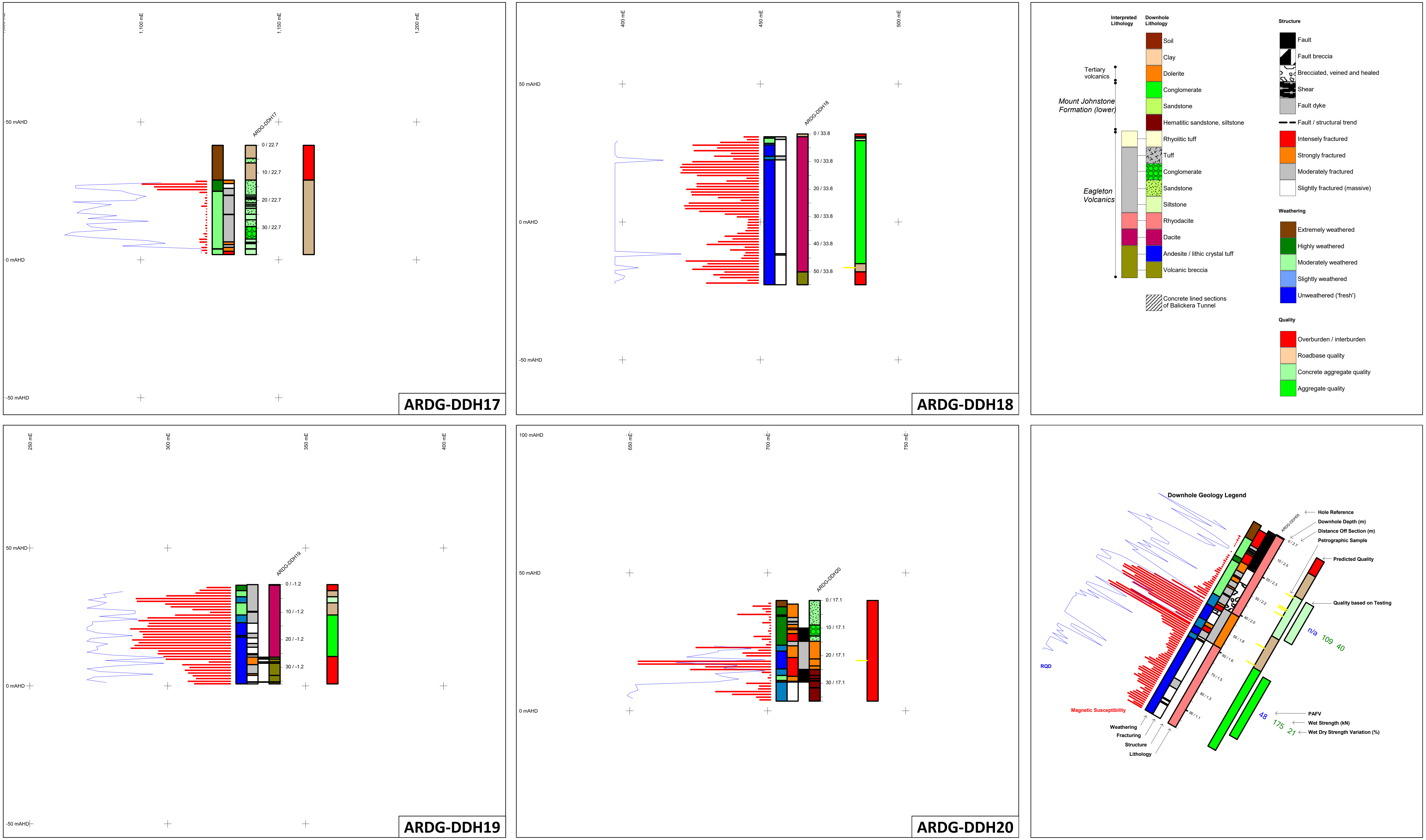
APPENDIX 4

Report on Quarry Resource Assessment Investigations



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Project:	**STONE RIDGE QUARRY PROJECT**
Title:	**Diamond Drill Hole Downhole Data - ARDG-DDH17, 18, 19, 20**
Author:	DMB
Date:	December 2019
Scale:	1:1250 @ A3
Grid:	
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates)

Figure 12e

7. PROJECT AREA GEOLOGY AND STRUCTURE

7.1 Introduction

The resource assessment investigations undertaken by ARDG (detailed in **Sections 4 – 6**) have significantly improved the understanding of the geological and structural character of the *Eagleton Volcanics* within the Project Area. They have also confirmed certain aspects and conclusions of historical investigations (detailed in **Section 3**) and provided clear direction for the geotechnical assessment of rock types considered most prospective as hard rock quarry resources.

The following sections summarise the important interpreted geological and structural attributes of the Project Area, based on the synthesis of historical information and that generated from ARDG investigations. An interpretation of surface geology and structure is illustrated by **Figure 13,** whereas the interpreted subsurface geology is illustrated in cross-sectional format by **Figures 14a-r**.

7.2 Stratigraphy

7.2.1 Lower Stratigraphic Sequence – Dacitic to Andesitic Volcanics

7.2.1.1 Surface expression and geometry

The lower part of the *Eagleton Volcanics,* and that which corresponds with the upper part of the *Mosman Swamp Andesites* of Rattigan (1966), is dominated by hornblende-biotite dacite, with lesser andesitic lithic fragmental tuff, volcanic breccia and rhyolitic vitric-crystal tuff. Outcrop exposure of these units is confined to areas of low topographic relief beyond the northwest flank of Stone Ridge. They can be mapped over a distance normal to the regional strike in excess of 480 metres, from near the interpreted base of rhyodacite, through to the interpreted lower contact of the *Eagleton Volcanics* with the underlying *Newtown Formation* (Geological Survey of NSW, 2015). Based on the interpreted 35° southeast dip of the volcanic stratigraphy (Rattigan, 1966), these units are interpreted to underlie the rhyodacite and extend to depth beneath the axis of Stone Ridge. It is estimated that the Lower Stratigraphic Sequence has an overall thickness of approximately 280 metres.

Outcrop exposure of dacitic rocks is confined to two discrete areas that correlate with areas of high magnetic intensity (*i.e.* MD1A and MD1B - refer **Section 5.3.1**). These are separated by a discrete zone of volcanic breccia associated with an area of lower and contrasting magnetic intensity (*i.e.* MD2 - refer **Section 5.3.2**).

7.2.1.2 Lower dacite unit

Dacitic rocks associated with MD1B are believed to represent the lowermost unit of the Eagleton Volcanics within the Project Area. Outcrop and drill exposures (*i.e.* drill hole ARDG-DDH19 – refer **Plate 11**) indicate that these comprise a mix of massive and fragmental rock types. Very minor outcrop exposures of rhyolitic vitric-crystal tuff were mapped within the footprint of MD1B, but these are volumetrically insignificant. Based on the surface 'geometry' of MD1B, the true thickness of this unit is likely to vary. It may reach a maximum thickness of approximately 180 metres in the southwest, assuming the stratigraphy dips at approximately 35° to the southeast.

Further drilling, supported by petrography and geotechnical testing, would be required to confirm whether the massive dacitic rocks within this unit represents a potential quarry resource.

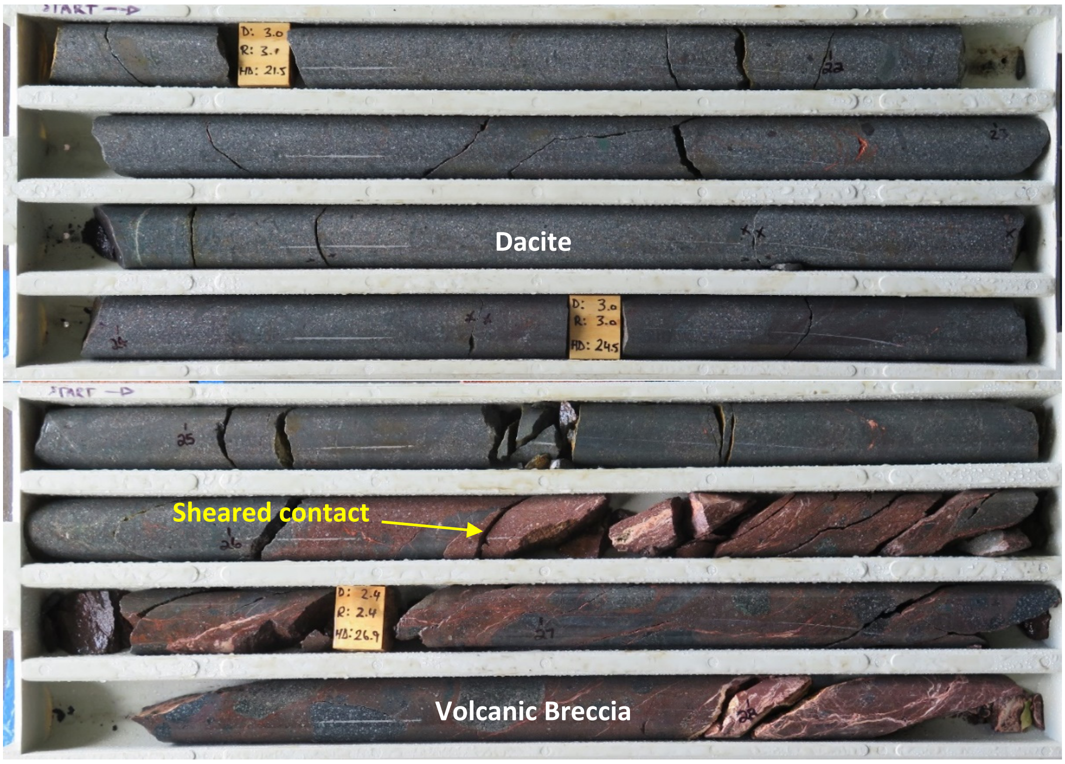


Plate 11 – Locally sheared and laumontite-veined contact between massive dacite and underlying coarse volcanic breccia – drill hole ARDG-DDH19 (21.35-28.20 m).

7.2.1.3 Volcanic breccia unit

Directly (and presumably conformably) overlying the lowermost dacitic unit is a volcaniclastic unit dominated by coarse volcanic breccia that includes a significant clast component of andesitic lithic fragmental tuff set in a strongly hematitic tuffaceous matrix. At surface this unit manifests as sparse subcrop and float of highly weathered fragmental (undefined) volcanic rocks, with scattered float of less-weathered andesitic volcanic rocks that are often easy to identify due to the presence of the blueish-green mineral celadonite. Several outcrops of rhyolitic vitric-crystal tuff occur within this unit, with the most prominent striking 024° grid, oblique to the strike of bedding (*i.e.* 054° grid). It is possible that the rhyolitic tuff at this location represents a large fragment within the surrounding volcaniclastics. Based on the surface 'geometry' of MD2, the true thickness of this unit is interpreted to range from 45-160 metres, assuming the stratigraphy dips at approximately 35° to the southeast.

Drill hole ARDG-DDH08 provided an excellent intersection through representative rock types that comprise the volcanic breccia unit (refer **Plate 12**). Summary petrographic descriptions of samples from this hole are presented in **Table 6-14** and the following extract from Petrographic Report 1054 provides a summary interpretation of observations based on petrographic assessment. Note that petrographic samples from hole ARDG-DDH08 include three dolerite samples that appear to be 'late' (? Tertiary-age) dyke rocks.

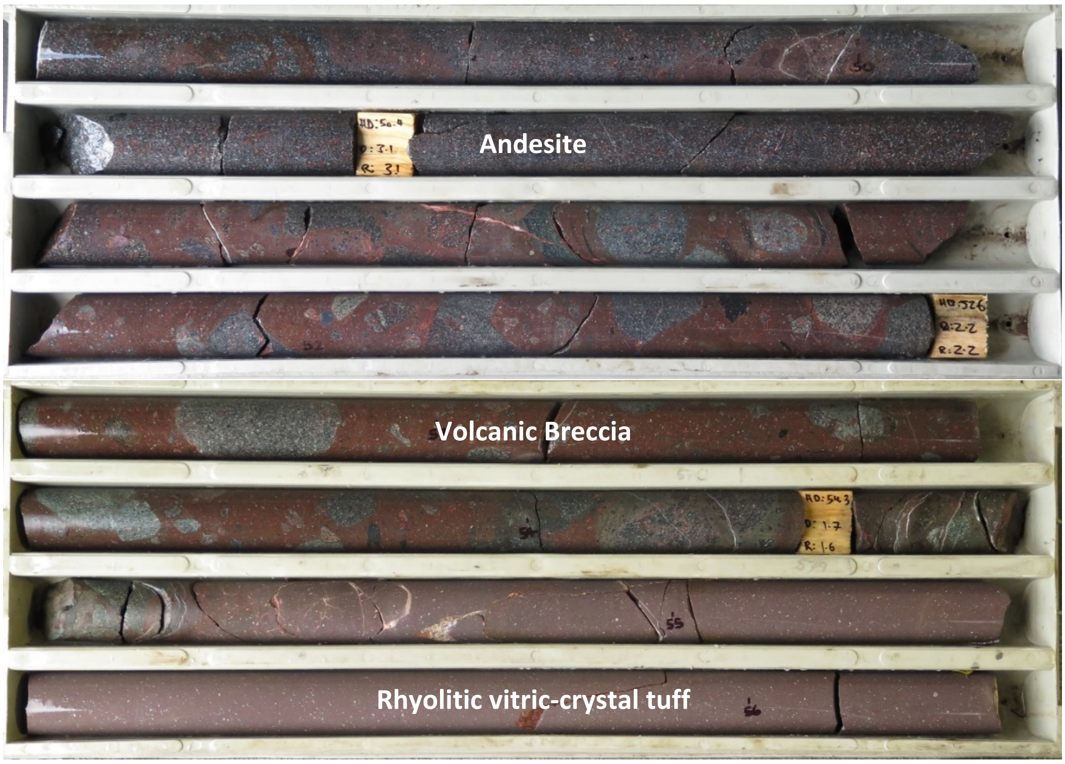


Plate 12 – Coarse volcanic breccia overlying rhyolitic vitric-crystal tuff – drill hole ARDG-DDH08 (49.20-56.25 m).

<u>Interpretation and Comment</u>

Several different primary rock types are present in DDH08. They include coherent and fragmental (pyroclastic) volcanic rocks, probable intrusives and a range in composition from felsic to mafic igneous. All have been affected by imposed alteration as a consequence of burial metamorphism (diagenesis) and this has led in most samples, to the formation of rather abundant secondary minerals, many of which would be considered to contribute to degradation of rock quality (e.g. strength, durability, reactivity).

Five samples (DDH08/30.4 m, 36.2 m, 44.06 m, 52.4 m and 87.07 m) are interpreted as being coarse, generally matrix-supported, volcanic breccias (e.g. **Plate 13***). They contain angular to sub-rounded fragments of porphyritic pyroxene andesite (commonly up to several centimetres across) enclosed in a matrix of lithic-crystal (-vitric) tuff. Another five samples (DDH08/40.58 m, 44.34 m, 50.27 m, 78.97 m and 95.09 m) are composed of porphyritic pyroxene andesite (e.g.* **Plate 14)** *of the same type that occurs as fragments in the volcanic breccia samples, with the sample at 44.34 m (***Plate 15***) also having a contact against lithic-crystal tuff. Originally, the andesite contained rather abundant phenocrysts, typically plagioclase, with subordinate amounts of interpreted orthopyroxene, minor pale green clinopyroxene (maybe diopside), sparse microphenocrysts of magnetite and trace apatite. These phases were enclosed in a fine grained, in many cases, perhaps glassy, feldspathic composition groundmass. All interpreted orthopyroxene was subsequently altered, but relict grain shapes are relatively diagnostic. Plagioclase, clinopyroxene and magnetite are commonly relatively fresh. Groundmass material is always affected by overprinting alteration. In one of the volcanic breccia samples (DDH08/87.07 m), there is a subordinate proportion of other volcanic fragments, identified as*

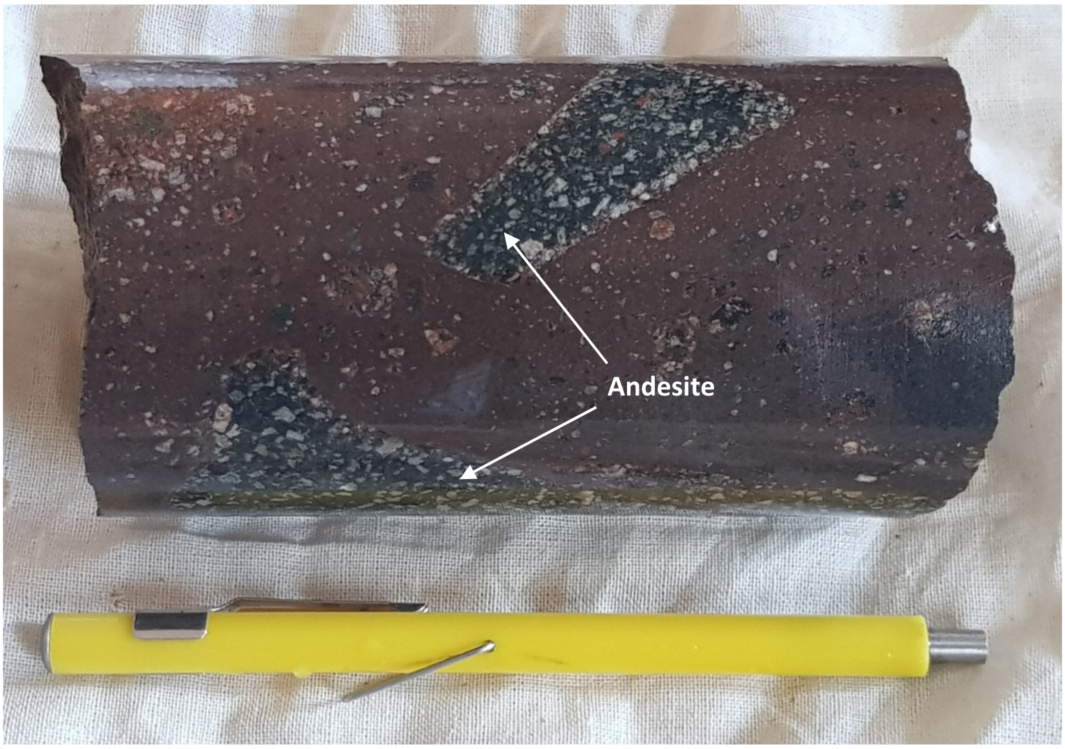


Plate 13 – Coarse volcanic breccia containing fragments of porphyritic pyroxene andesite – drill hole ARDG-DDH08 (36.29-36.41 m).

Plate 14 – Porphyritic pyroxene andesite with pervasive moderate to strong alteration – drill hole ARDG-DDH08 (40.58-40.68 m).

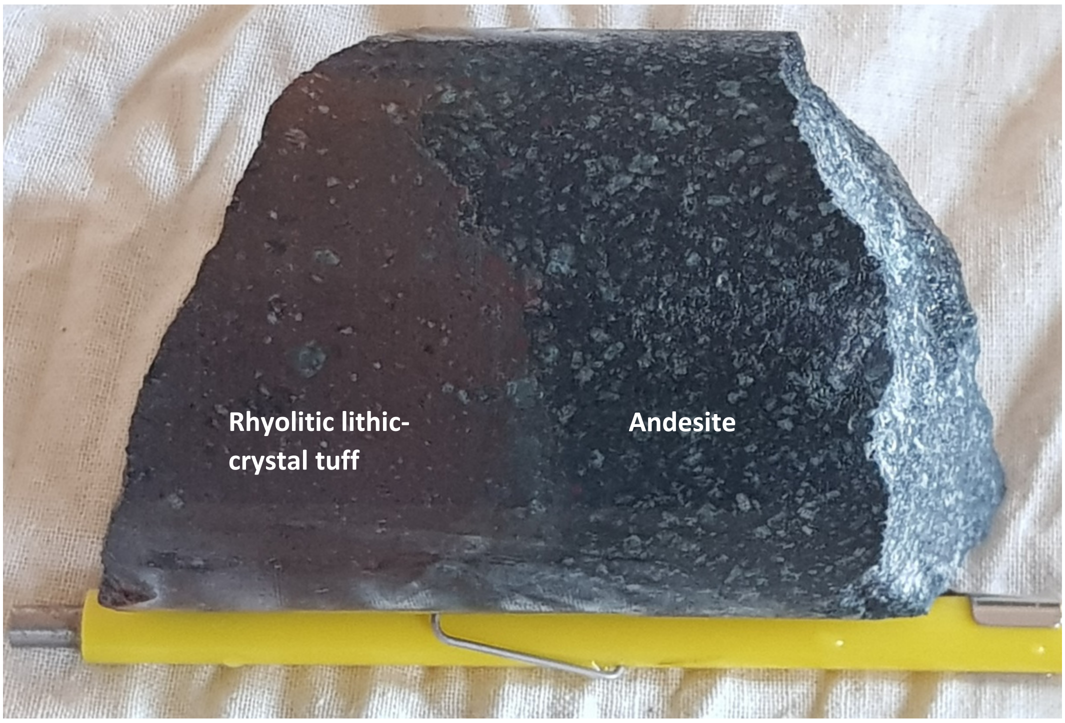


Plate 15 – Strongly porphyritic pyroxene andesite abutting matrix supported rhyolitic lithic crystal tuff – drill hole ARDG-DDH08 (44.34-44.42 m).

being of felsic pyroclastic type, e.g. rhyodacite composition vitric-crystal tuff. These are of similar type compositionally to sample DDH08/56.01 m (see below). In the volcanic breccia samples, tuffaceous matrix material commonly constitutes at least half the rock volume. It is characterised by small volcanic lithic fragments (mostly andesite, but can include felsic tuff), individual mineral grains that have been derived by liberation from volcanic fragments and interstitial finer grained tuffaceous material, some of which could have included fine vitriclasts (e.g. in DDH08/36.29 m, 52.4 m, 87.07 m). Individual, liberated mineral grains are dominated by plagioclase, but there are also smaller amounts of clinopyroxene, altered orthopyroxene, quartz, K-feldspar, hornblende, magnetite and muscovite. It is apparent that the bulk composition of the volcanic breccia matrix material is more felsic than the pyroxene andesite.

Some of the porphyritic andesite samples have indications of microbrecciation (DDH08/50.27 m, 78.97 m, 95.09 m) and local invasion by microbreccia zones. These phenomena might represent a transition from a coherent volcanic rock into the coarse breccias. The sample DDH08/56.01 m is distinctive in that it is of felsic volcanic composition (e.g. rhyodacite) and was dominated by fine vitriclastic material (including glass shards). It is interpreted as a vitric-crystal tuff, possibly ignimbritic (as it has a weak flow foliation). The crystal component of this rock included quartz, K-feldspar, plagioclase and biotite grains. The three other samples in the suite (DDH08/100.94 m, 105.3 m and 111.14 m) are interpreted as sparsely porphyritic, generally medium grained dolerite, with the first two also containing a few amygdules. These rocks could have been ultimately emplaced as part of an intrusive mass. They contain abundant plagioclase, intergrown with subordinate clinopyroxene (e.g. augite) and minor magnetite, with the sample at 111.14 m also hosting a thin igneous vein of finer grained plagioclase-rich material, perhaps a small volume, more felsic differentiate of the dolerite.

As mentioned above, all samples in the suite have been overprinted by alteration. In the porphyritic andesite (coherent material and fragments in the coarse volcanic breccias), all former interpreted orthopyroxene was replaced, typically by fine grained chlorite, but in several examples, also accompanied by a khaki-coloured phase interpreted to be interlayered chlorite-smectite, as well as a little hematite, laumontite, epidote and in DDH08/40.58 m, a small amount of a phase that could be interlayered chlorite-celadonite. Plagioclase phenocrysts, although commonly partly retained, also show variable replacement by chlorite and laumontite, as well as local minor amounts of sericite, quartz, chlorite-celadonite, carbonate, epidote, hematite and clay (kaolinite), with probable albite replacement in some samples. Clinopyroxene is generally retained, although slight chlorite replacement is apparent locally, and magnetite can be partly replaced by hematite. In the andesite groundmass, there was replacement by varying amounts of fine grained alkali feldspar (mostly albite), laumontite and chlorite, with a little hematite dusting ranging to zones of strong impregnation.

In the volcanic breccia matrix material, alteration of lithic fragments and individual mineral grains is the same as described above. Interstitial material (some of which was originally vitriclastic) was replaced by fine grained assemblages that include alkali feldspar (mostly albite), chlorite, laumontite, hematite and locally, clay (kaolinite). The felsic tuff sample DDH08/56.01 m has replacement of formerly abundant vitriclastic material by abundant alkali feldspar (K-feldspar, albite) and quartz, with development of a little clay (kaolinite), chlorite and hematite. This sample has, by far, the least development of layer silicate alteration. In the dolerite samples, there was significant development of fine grained chlorite (including as amygdule fillings), with less common laumontite, prehnite and epidote, local pyrite and trace carbonate, titanite and quartz.

Many of the samples have no veining or fracturing on the scale of the handspecimens or thin sections, and others generally only have minor veining, at varying angles to the core axis. Vein contents include, most commonly, laumontite and carbonate, with local occurrences of chlorite and hematite. In general, there are no significant concentrations of layer silicate phases on any planar structures in the sample suite.

When considered overall, the sample suite does have a typically large proportion of alteration minerals (not including alkali feldspars), generally in the range of 20-50%. The relevant alteration minerals, from a perspective of rock quality, are the "weak" or "soft" layer silicates (which in the suite include chlorite, chlorite-smectite, chlorite-celadonite, sericite and kaolinite) and laumontite. Carbonate and pyrite could also be included in this group, although their proportion is generally trivial. Only felsic tuff sample DDH08/56.01 m has a small amount of the above minerals and consequently is considered to be of high quality.

Although most of the samples superficially appear to be massive, hard and competent, and as mentioned above, have generally little or no fracturing and veining, and concentrations of "weak and soft" minerals on planar structures, the high proportion of alteration phases that are considered as "weak and soft" could compromise rock quality in use for construction purposes for most of the sample suite. Only sample DDH08/56.01 m (felsic tuff) is categorised as being of high quality, with all the others classified as being of moderate quality (locally poorer) – see table following. It is recommended that further testing be performed on the rocks encountered in DDH08, e.g. performance under load, reactivity towards wetting and drying, durability.

The fragmental character and unstable minerology of the volcanic breccia means that this unit should be avoided for production of high-quality quarry products. This has been confirmed by geotechnical testing (refer **Section 8**).

7.2.1.4 Upper dacite unit

Directly overlying the volcanic breccia in the northeast is another unit of dacitic volcanic rocks associated with MD1B. Outcrop exposure in this area is extensive and diamond drilling (*i.e.* drill holes ARDG-DDH03, ARDG-DDH18) indicates the dacite is relatively massive and homogeneous (refer **Plate 16 and Plate 17**). Drilling (including drill hole ARDG-DDH15) also confirms that the dacite has a true thickness of approximately 117 metres.

Petrographic assessment of dacite samples from hole ARDG-DDH03 indicates that the dacite is a crystal-vitric-lithic felsic tuff that has a large component of phenocrystal grains, dominated by plagioclase, with subordinate quartz, hornblende and biotite and microphenocrysts of Fe-Ti oxide (titanomagnetite). The dacite has experienced diagenetic alteration causing replacement of vitriclastic material, largely by very fine alkali feldspar and minor quartz. Plagioclase phenocrystal grains show minor replacement by chlorite, sericite, carbonate and zeolite, and ferromagnesian phases (particularly biotite) show replacement by hematite, sericite and chlorite.

The mineralogy of the dacite, combined with its massive and weakly fractured character, confirmed the upper dacite unit represents a potential quarry resource. Several intervals of drill core through the dacite were therefore selected to generate bulk samples for geotechnical testing to determine the suitability of the dacite for producing a range of typical quarry products (refer **Section 8**).

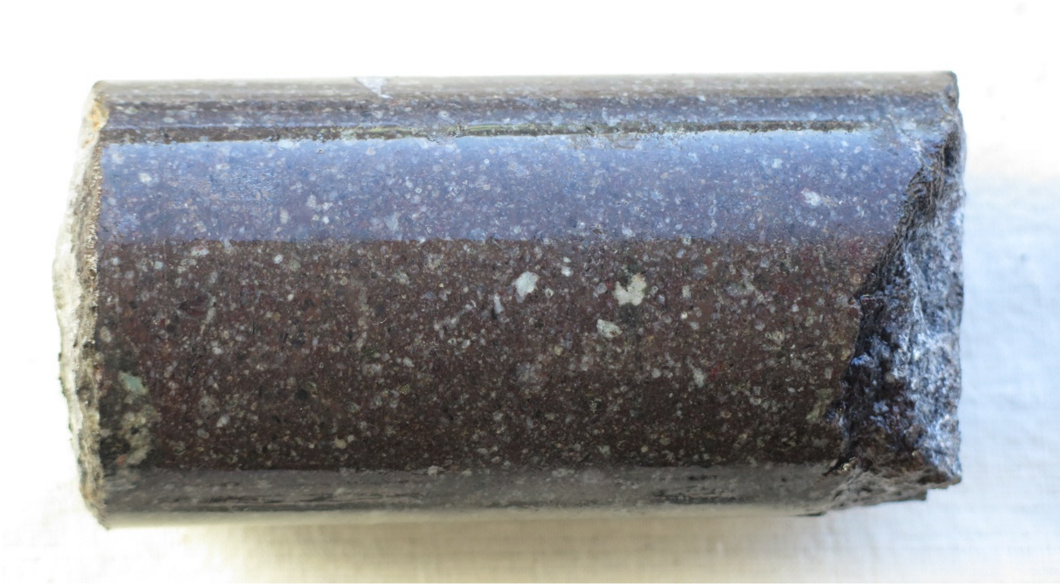


Plate 16 – Crystal-vitric-lithic felsic tuff of dacitic composition (dacite) – drill hole ARDG-DDH03 (41.70-41.80 m).

Plate 17 – Massive unfractured dacite – drill hole ARDG-DDH03 (35.80-43.00 m).

7.2.2 Middle Stratigraphic Sequence – Rhyodacitic Volcanics

7.2.2.1 Surface expression and geometry

The best exposed volcanic rocks within the *Eagleton Volcanics* are coherent tuffs and lavas of rhyodacitic composition. These outcrop extensively across Stone Ridge above an elevation of approximately 50 metres AHD, although outcrop exposure is sparse in the vicinity of the ridge saddle and within the adjacent gullies, reflecting localised zones of deeper weathering related to structural influences. The rhyodacite has been mapped along the full length of the ridge and over a distance normal to the ridge axis and bedding that ranges from 350-480 metres. Assuming the stratigraphy dips at approximately 35° to the southeast, the true thickness of this unit is interpreted to range from 200-275 metres.

At surface, the northeast limit of rhyodacite outcrop terminates abruptly at the interpreted southern edge of the Nine Mile Creek Fault Zone. In contrast, the rhyodacite outcrop at the southwest end of Stone Ridge continues through to Italia Road and above the alignment of the Balickera Tunnel. The mapped extent of rhyodacite in this location is consistent with Rattigan's (1966) mapping of 'toscanite' and 'dellenite' in the Balickera Tunnel excavation.

The downslope limit of rhyodacite outcrop on the southeast side of Stone Ridge is broadly parallel to the trend of the ridge line and strike of bedding (*i.e.* 058° grid). Consequently, this downslope outcrop limit is likely to be the approximate position of the upper contact between the rhyodacite and overlying units of the Upper Stratigraphic Sequence.

7.2.2.2 Lithology and alteration

Over 1153 metres of drilling (66 % of total metres drilled), spread across 13 holes, tested the rhyodacite. This generated a significant volume of diamond core to assess this geological unit, which is considered most prospective for quarrying purposes. Twenty-seven samples of rhyodacite from six drill holes were also selected for detailed petrographic assessment.

Where unoxidized, rhyodacitic rocks within the Project Area are generally massive, dark grey to brown-grey rocks. They contain a significant component of feldspar and quartz phenocrysts up to 3 mm across, with smaller amounts of dark ferromagnesian grains and occasional dark grey to dark red-brown lithic and or vitric fragments (refer **Plate 18**). Close to surface, the rhyodacite is typically a pink-brown colour due to weak oxidation associated with supergene effects (refer **Plate 19**). Where unoxidized, the rhyodacites commonly exhibit weak patchy red-brown hematite alteration (pigmentation), although this increases significantly in intensity (along with laumontite alteration) within several metres of the lower contact with underlying rocks of the Lower Stratigraphic Sequence.

The following extract from Petrographic Report 1096 provides a summary interpretation of petrographic observations for rhyodacite samples from drill holes ARDG-DDH15 and ARDG-DDH16. These are considered broadly representative of most of the rhyodacitic rocks encountered by drilling. Summary petrographic descriptions of samples from these holes are presented in **Table 6-21** and **Table 6-22**, respectively.

Rhyodacite samples from ARDG-DDH15 (refer **Plate 20**) are described as crystal-lithic-vitric felsic tuff (pyroclastic rocks), whereas those from ARDG-DDH16 (refer **Plates 21** and **22**) are massive, strongly porphyritic and may represent lavas. Note that ARDG-DDH15 was collared in the Central Fault, and therefore shallower samples from this hole have been impacted by structure and related alteration. Both drill holes penetrated the lower contact of the rhyodacite with underlying rocks of the Lower Stratigraphic Sequence. ARDG-DDH15 intersected the contact north of the Central Fault and confirmed that rhyodacite is in direct contact with dacite (*i.e.* the volcanic breccia marker bed does not define the contact). In contrast, ARDG-DDH16 intersected the contact south of the Central Fault, where volcanic breccia directly underlies the rhyodacite. **Plate 23** and **Plate 24** illustrate the significant alteration that impacts the rhyodacitic rocks within several metres of the underlying contact with either dacite or volcanic breccia.

> *<u>Interpretation and Comment</u>*
>
> *The pyroclastic rocks typically have a large population of phenocrystal grains, comprising quartz and plagioclase most commonly, with K-feldspar occurring in the rhyodacitic rocks, and minor amounts of biotite and/or hornblende, along with microphenocrysts of FeTi oxide (titanomagnetite) and a trace of apatite, generally associated with the ferromagnesian phases and FeTi oxide. Lithic fragments occur in several samples and these include porphyritic felsic volcanic rock (e.g. dacite/rhyodacite) and less common andesite, rhyolite and one occurrence of granodiorite (in DDH15/108.21 m). Some samples contain scattered vitriclasts (commonly porphyritic), and all pyroclastic rocks have a matrix component that was formerly dominated by finer grained vitriclastic material, locally accompanied by small individual mineral grains. There is not significant textural evidence that the pyroclastic rocks experienced welding on deposition. The preserved primary characteristics of the pyroclastic rocks indicate that they represent crystal-vitric (-lithic) tuffs.*

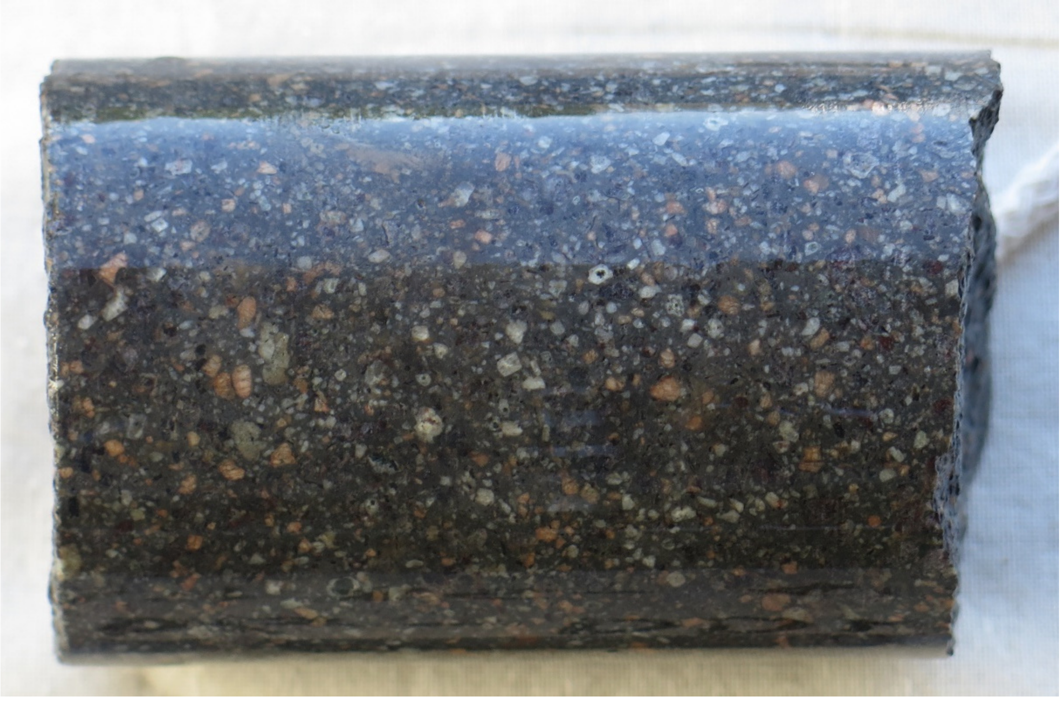


Plate 18 – Strongly porphyritic ignimbritic rhyodacite from drill hole ARDG-DDH01 (49.85-49.95 m).

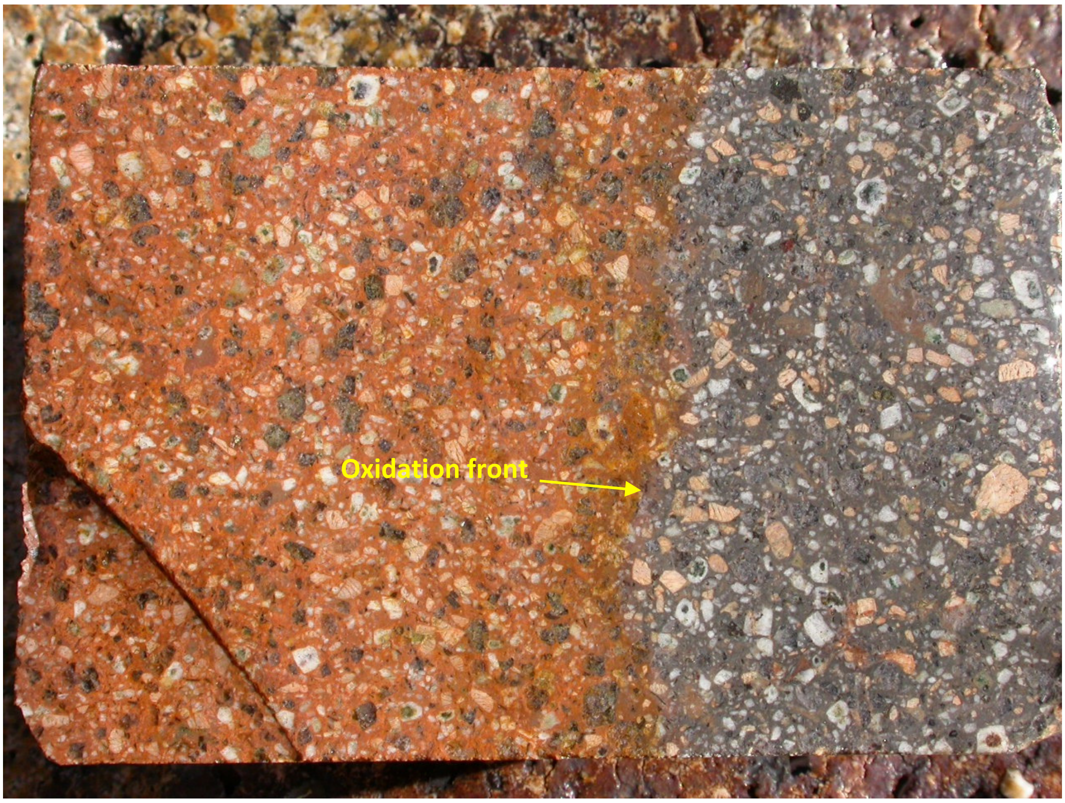


Plate 19 – Strongly porphyritic ignimbritic rhyodacite – drill hole ARDG-DDH01 (28.56-28.65 m). The prominent colour change across the sample (grey to pink-brown) is considered to be due to an imposed oxidation front, as a result of fracture-controlled weathering (supergene) effects.

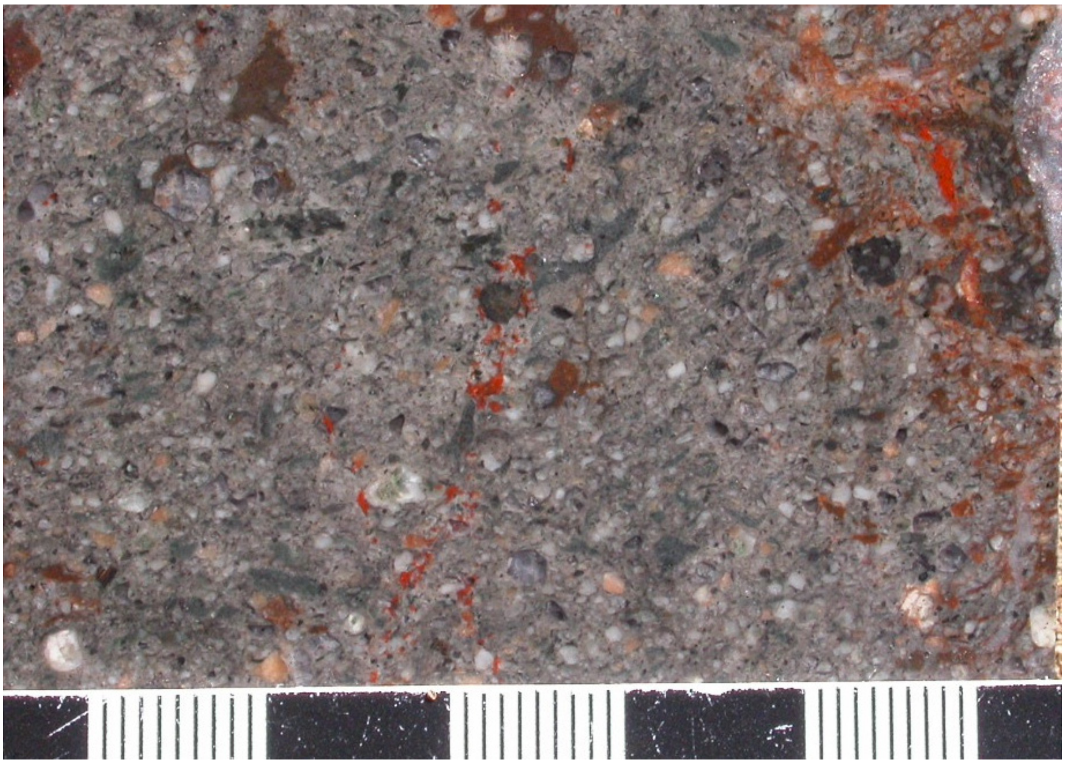


Plate 20 – Massive crystal-lithic-vitric felsic tuff of rhyodacitic composition – drill hole ARDG-DDH15 (83.55-83.67 m).

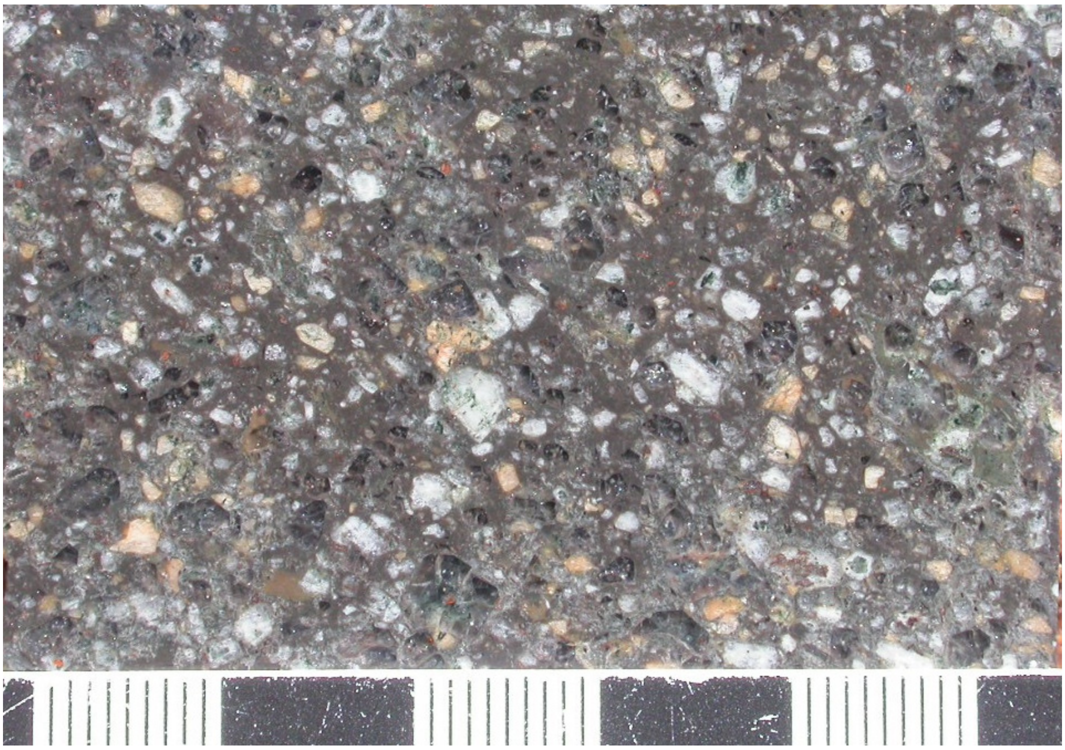


Plate 21 – Massive porphyritic rhyodacite, showing abundantly scattered feldspar and quartz phenocrysts in a grey, formerly glassy groundmass – drill hole ARDG-DDH16 (59.0-59.12 m)

Australian Resource Development Group	*Project:*	**STONE RIDGE QUARRY**			*Drill Hole:*	**ARDG-DDH16**	*Page:* 1 of 3
	Collar Details				*Hole Details*		
	Easting:	388,063 mE	*Northing:*	6,385,145 mN	*Drilling Contractor:*	Blacklaws Drilling	
	Grid:	MGA Zone 56 (GDA94)			*Drill Rig:*	Hanjin	
	Elevation:	100.0 mAHD			*Drill Method:*	HQIII from surface	
	Dip:	-60 degrees			*Date Commenced:*	26 March 2019	
	Azimuth:	346 degrees grid			*Date Completed:*	1 April 2019	
	Hole Depth:	141.3 m			*Supervising Geologist:*	Damon Bird	

Plate 22 – Typical intersection through rhyodacite of the middle stratigraphic sequence – diamond drill hole ARDG-DDH16

Australian Resource Development Group

Project:	**STONE RIDGE QUARRY**	*Drill Hole:*	**ARDG-DDH16** *Page:* 2 of 3
Collar Details		*Hole Details*	
Easting:	388,063 mE *Northing:* 6,385,145 mN	*Drilling Contractor:*	Blacklaws Drilling
Grid:	MGA Zone 56 (GDA94)	*Drill Rig:*	Hanjin
Elevation:	100.0 mAHD	*Drill Method:*	HQIII from surface
Dip:	-60 degrees	*Date Commenced:*	26 March 2019
Azimuth:	346 degrees grid	*Date Completed:*	1 April 2019
Hole Depth:	141.3 m	*Supervising Geologist:*	Damon Bird

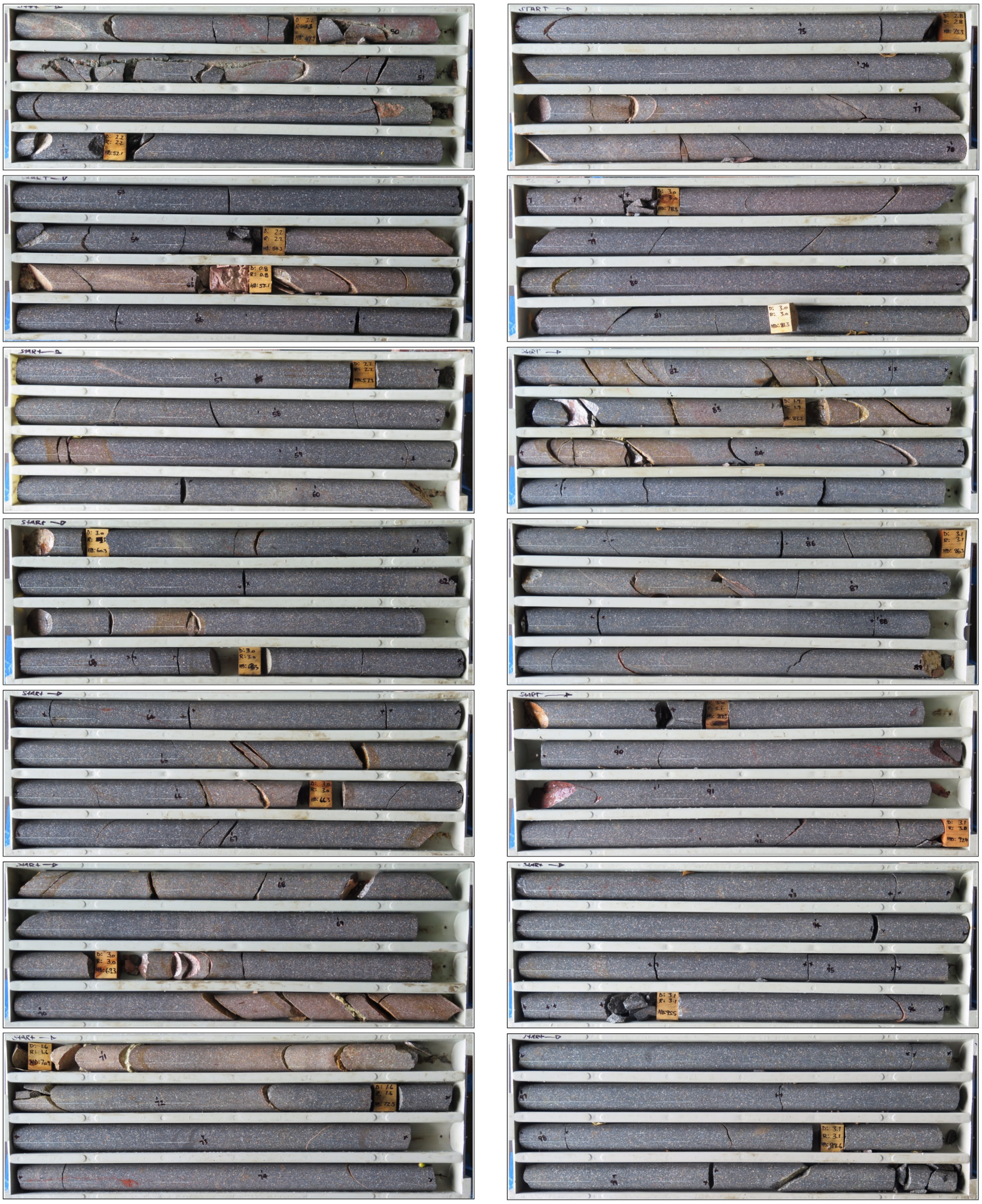


Plate 22 (continued) – Typical intersection through rhyodacite of the middle stratigraphic sequence – diamond drill hole ARDG-DDH16

Australian Resource Development Group	*Project:*	**STONE RIDGE QUARRY**			*Drill Hole:*	**ARDG-DDH16**	*Page:* 3 of 3
	Collar Details				*Hole Details*		
	Easting:	388,063 mE	*Northing:*	6,385,145 mN	*Drilling Contractor:*	Blacklaws Drilling	
	Grid:	MGA Zone 56 (GDA94)			*Drill Rig:*	Hanjin	
	Elevation:	100.0 mAHD			*Drill Method:*	HQIII from surface	
	Dip:	-60 degrees			*Date Commenced:*	26 March 2019	
	Azimuth:	346 degrees grid			*Date Completed:*	1 April 2019	
	Hole Depth:	141.3 m			*Supervising Geologist:*	Damon Bird	

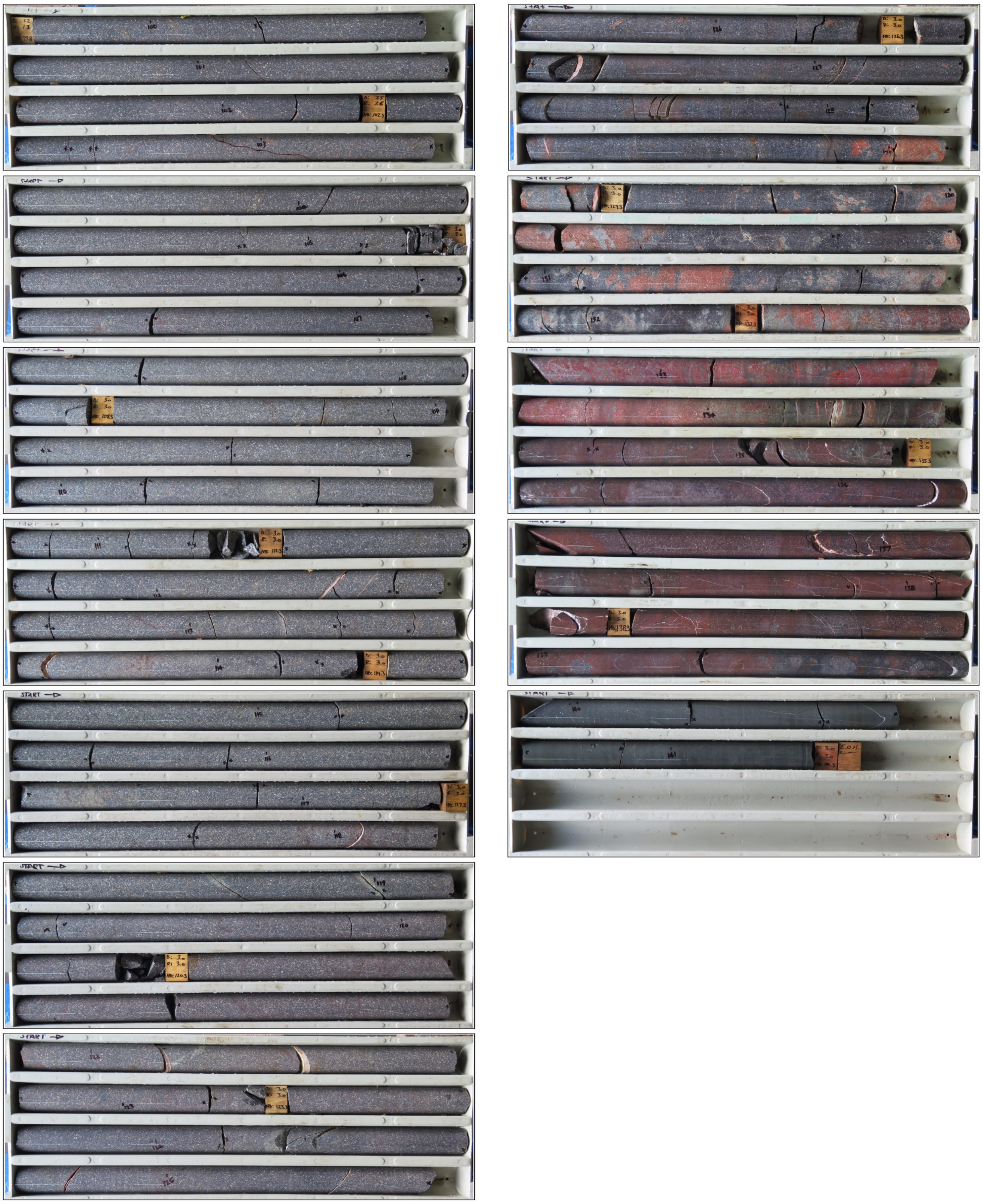


Plate 22 (continued) – Typical intersection through rhyodacite of the middle stratigraphic sequence – diamond drill hole ARDG-DDH16

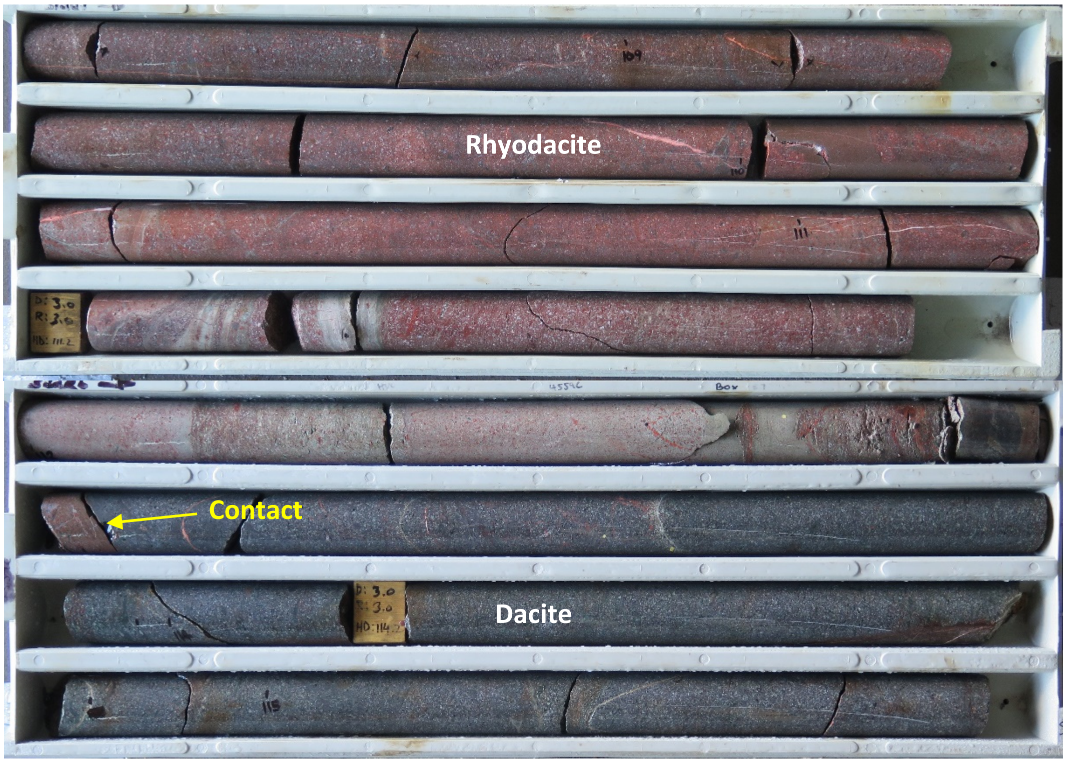


Plate 23 – Contact between rhyodacite and underlying dacite in drill hole ARDG-DDH15 (108.50-115.70 m). This contact occurs north of the Central Fault. The rhyodacite is pervasively altered by hematite ± laumontite.

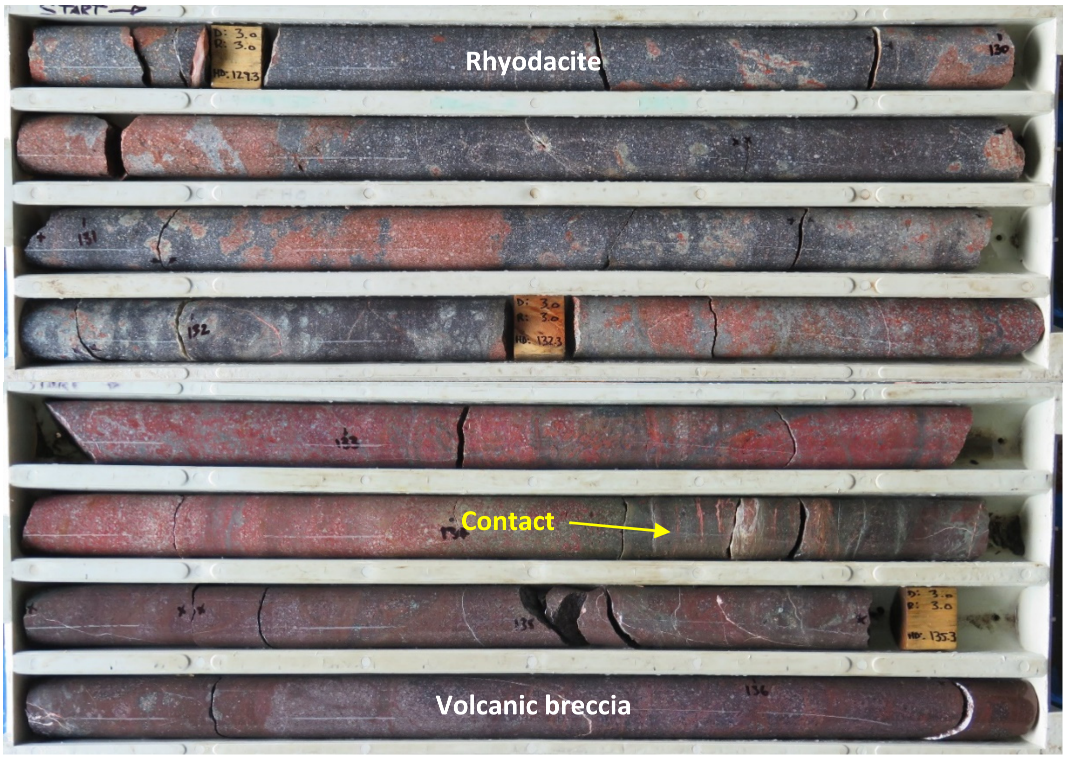


Plate 24 – Contact between rhyodacite and underlying volcanic breccia in drill hole ARDG-DDH16 (129.15-136.25 m). This contact occurs south of the Central Fault. The rhyodacite above the contact is variably altered.

Coherent felsic volcanic rocks mostly occur in DDH16, although the lowermost sample in DDH15 at 113.15 m is also considered to be of this type. These samples are all interpreted as porphyritic rhyodacite and are compositionally similar to the pyroclastic rocks described above. They contain abundant phenocrysts of quartz, plagioclase and K-feldspar, with less common biotite and hornblende, plus microphenocrysts of FeTi oxide (titanomagnetite). Again, traces of apatite (and rare zircon) tend to be associated with the ferromagnesian phases and FeTi oxide. In DDH15/113.15 m, a trace of clinopyroxene is recognised. The phenocrystal phases occur in what was a formerly glassy groundmass, commonly with flow foliation, and locally preserving perlitic cracking (e.g. in DDH16/132.72 m). It is possible that some glass might be preserved, but more likely it was totally devitrified and altered in most samples.

Minor deformation effects are apparent in some samples. These are most commonly manifest in shattering of phenocrystal quartz grains, and to a small extent, feldspar grains. It is speculated that in part, these effects occurred during emplacement, e.g. during pyroclastic or lava flow and cooling. In samples DDH15/100.04 m and DDH15/104.51 m, there are a few narrow through-going zones of micro-cataclasis and shearing, but these do not appear to have had any consequence on rock quality, i.e. these zones do not appear to be planes of weakness, or have developed concentrations of weak/soft alteration minerals.

All samples in the suite have been affected by overprinting alteration. This is of a low grade type and is interpreted to be a result of diagenesis, i.e. burial metamorphism. Effects are pervasive, although locally, there are variations in intensity on the scale of the handspecimens (e.g. in DDH16/129.61 m, DDH16/132.84 m). In the felsic volcanic rocks, probably most former glassy material (i.e. groundmasses in coherent rocks and vitriclastic material in pyroclastics) was altered. The most common alteration product is very fine grained alkali feldspar (varying proportions of K-feldspar and albite, depending on bulk rock composition), and with minor fine grained quartz and chlorite, and in some, a little illite-sericite, a low-birefringent clay phase (kaolinite) and patchy dusty hematite pigmentation. In a few samples, there is patchy replacement by minor to abundant laumontite, with amounts estimated to be up to 20% (e.g. in DDH15/83.55 m, DDH15/91.56 m, DDH15/108.21 m, DDH16/129.61 m, DDH16/132.84 m). Phenocryst phases also show variable, but commonly minor, alteration to retrograde minerals. Plagioclase (and to a small extent K-feldspar) can show minor alteration to phases including illite-sericite, kaolinite, chlorite, carbonate and laumontite. Biotite is more susceptible to alteration than hornblende, with alteration products of the ferromagnesian phases including chlorite, illite-sericite, laumontite, hematite and leucoxene. Igneous FeTi oxide is locally altered to hematite. Minor veining occurs in some of the felsic volcanic rocks, but these tend to be narrow (< 1 mm) and widely spaced, mostly containing carbonate and/or laumontite…

The mineral assemblages that have developed during alteration are consistent with zeolite facies metamorphism (i.e. burial metamorphism). They do infer that alteration involved fluid egress into the rocks (e.g. hydration reactions, in part forming layer silicate minerals and laumontite), with influx of a little CO_2 in places and generally forming under oxidising conditions, manifest in the occurrence of hematite in many samples.

Many of the samples have no veining or fracturing on the scale of the handspecimens or thin sections, and others generally only have minor veining, at varying angles to the core axis. Vein contents include, most commonly, laumontite and carbonate, with local occurrences of chlorite and hematite. In general, there are no significant concentrations of layer silicate phases on any planar structures in the sample suite.

> *The sample suite generally has a small proportion of alteration minerals (not including alkali feldspars), mostly in the range of 3-8%. The relevant alteration minerals, from a perspective of rock quality, are the "weak" or "soft" layer silicates (which in the suite include chlorite, chlorite-smectite, illite-sericite, celadonite and kaolinite). Although not considered to be a "soft or weak" mineral, the zeolite phase laumontite might also contribute to diminution of rock quality, but mainly where it occurs in closely spaced veins. Considerable laumontite (in the range of 4-20% estimated) occurs in DDH15/83.55 m, DDH15/91.56 m, DDH15/108.21 m, DDH16/129.61 m and DDH16/132.84, but mostly it is present as part of the pervasive alteration, with only a minority (or none in some samples) occurring in veins.*

The very top (upper 20 metres) of the rhyodacite unit observed in drill hole ARDG-DDH06 is defined by a crystal-vitric-lithic tuff that exhibits a significant component of partly glassy, felsic lithic fragments. These fragments increase in size and frequency towards the contact with overlying volcano-sedimentary units of the Upper Stratigraphic Sequence (refer **Plate 25**). Their presence appears to define the waning phase of volcanism associated with rhyodacitic volcanicsm and may represent a useful stratigraphic marker for future drill investigations and/or quarry development. Alteration mineralogy within this zone is also slightly different to that observed elsewhere, with sericite dominating over other alteration minerals and constituting 3-7 % of rock mineralogy. The presence of this softer mineral may account for deeper weathering and recessive topography associated with the top of the Middle Stratigraphic Sequence.

Plate 25 – Crystal-vitric-lithic tuff of rhyodacitic composition – drill hole ARDG-DDH06 (26.10-33.20 m). The pale cream-green colour is predominantly related to alteration by sericite.

The mineraological and textural characterisitics of rhyodacitic rocks, combined with their significant lateral and depth continuity, thickness and generally weakly fractured (massive) character, confirmed they represent the most significant potential quarry resource within the Project Area. Twenty-six intervals of drill core through the rhyodacite were therefore selected to generate bulk samples for geotechnical testing to determine the suitability of the rhyodacite for producing a range of typical quarry products (refer **Section 8**).

7.2.3 Upper Stratigraphic Sequence – Volcanic Sandstone, Siltstone, Tuff and Conglomerate

7.2.3.1 Surface expression and geometry

Outcrop exposures to the southeast of Stone Ridge beyond the downslope limit of rhyodacite outcrop are confined to a highly altered vitric-crystal tuff horizon of rhyolitic composition that defines the interpreted top of the *Eagleton Volcanics* stratigraphy. Outcrop of the tuff occurs between 60-150 metres beyond the southeast limit of rhyodacite outcrop and the intervening geology is not exposed at surface.

While being highly altered, the rhyolitic vitric-crystal tuff is less resistant to weathering than the surrounding geology and can be traced for 1200 metres, parallel to the length of Stone Ridge. It outcrops over a horizontal distance of up to 90 metres and based on the interpreted southeast dip of the volcanic stratigraphy (Rattigan, 1966), would have a true thickness of up 50 metres.

The upper contact of the rhyolitic vitric-crystal tuff is overlain by highly weathered pebbly conglomerate and sandstone that comprises the base of the Mount Johnstone Formation.

7.2.3.2 Lithology and alteration

Drill holes ARDG-DDH06 (refer **Plate 26**) and ARDG-DDH17 (refer **Plate 27)** provided the best intersections through representative rock types that comprise the Upper Stratigraphic Sequence. These holes confirmed the existence of a strongly interbedded sequence of volcanic sandstone, siltstone, tuff and minor conglomerate, that directly overlies rhyodacite of the Middle Stratigraphic Sequence and underlies the rhyolitic vitric-crystal tuff horizon. The moderately to highly weathered character of these rocks is likely to explain the absence of surface outcrop and recessive topography compared with the underlying rhyodacitic rocks and overlying rhyolitic tuff.

Bedding is well developed within this sequence and often highlighted by thin bands of sedimentary magnetite that locally give rise to high, albeit irregular, magnetic susceptibilities. Bedding is oriented at a high angle to the core axis, which is consistent with interpreted southeast dip of the stratigraphy.

While the rock types that comprise the Upper Stratigraphic Sequence are not considered suitable for producing high quality quarry products (*i.e.* aggregates, ballast, armour rock or gabion), their weathered nature and presence of clay minerals means they are a potential source of 'binder' material for blending with less weathered rock types to produce roadbase products. Geotechnical testing will be undertaken in due course to confirm whether this is the case.

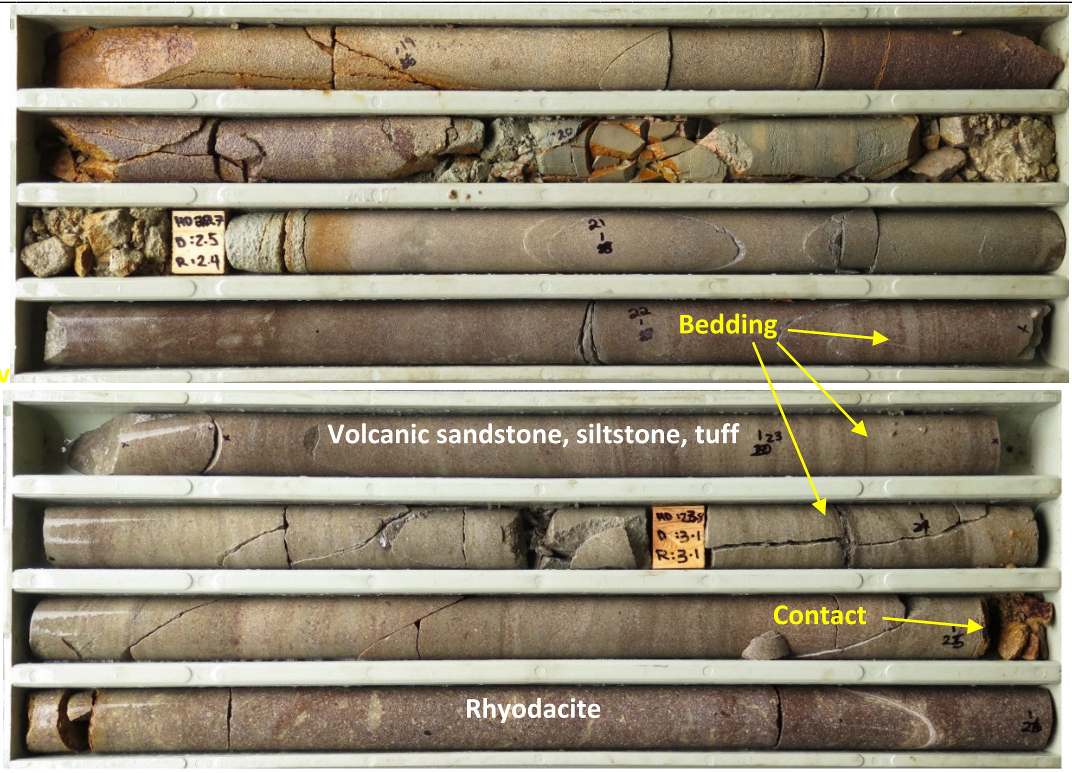


Plate 26 – Strongly bedded volcanic sandstone, siltstone and tuff, immediately overlying crystal-vitric-lithic tuff of rhyodacitic composition (rhyodacite) – drill hole ARDG-DDH06 (18.75-26.00 m).

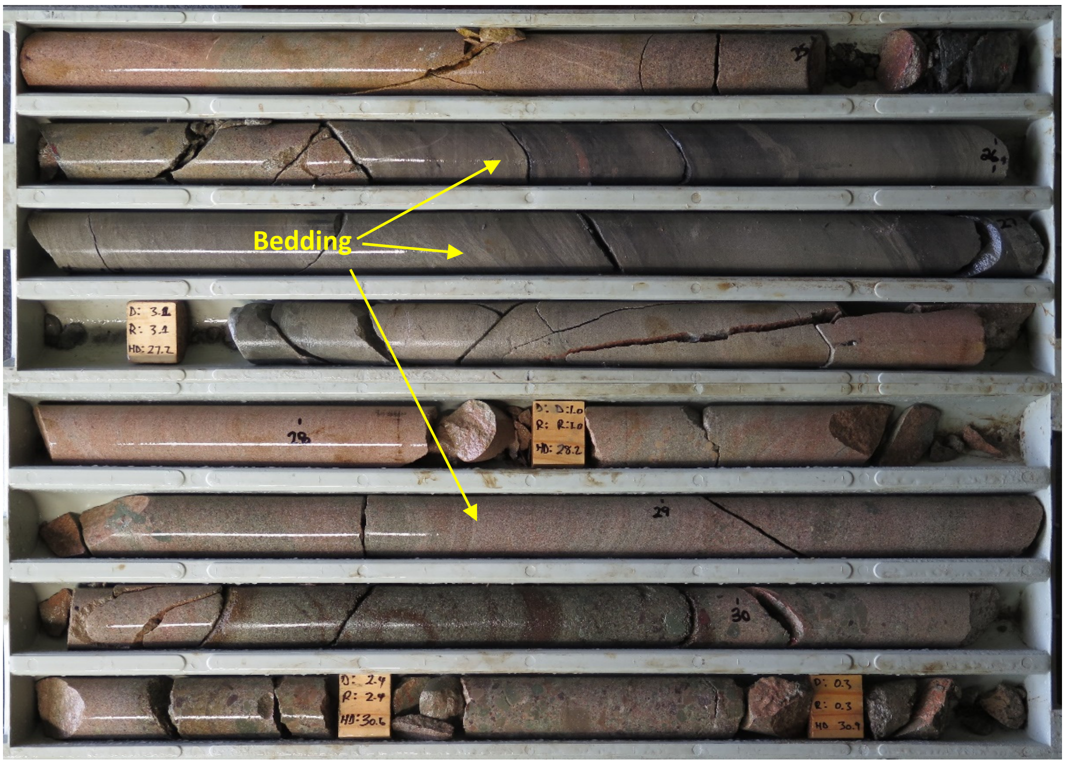


Plate 27 – Strongly bedded volcanic sandstone, siltstone, tuff and conglomerate – drill hole ARDG-DDH17 (24.30-30.95 m).

7.3 Structure

The *Eagleton Volcanics* stratigraphy within the Project Area has been overprinted by several prominent fault structures (refer **Figure 13**) that have been the focus of localised late (? Tertiary-age) dolerite dyke emplacement and enhanced oxidation and weathering of the surrounding geology. The main fault structures identified correspond to prominent magnetic lineaments interpreted from ground magnetic imagery and subsequently confirmed by diamond drilling and/or geological mapping.

Diamond drilling undertaken by ARDG across the Project area has revealed that rhyodacite and dacite units away from the main fault zones are typically massive to weakly or moderately jointed. In contrast, the geological units within fault zones are typically strongly to intensely fractured, brecciated, and healed by laumontite ± calcite.

7.3.1 Central Fault

The Central Fault is a northwest-southeast (288° grid) oriented structure that can be traced across the Project Area for approximately 1,400 metres, cross cutting all stratigraphic elements of the *Eagleton Volcanics*. The fault is interpreted from ground magnetic imagery to have a width of up to approximately 25 metres and its strongly linear trace with respect to topography as identified by ground magnetic imagery (refer **Section 5.4.1**) suggests it has a vertical to sub-vertical dip.

The Central Fault cross-cuts the rhyodacite in the location of the Stone Ridge saddle, and is more broadly associated with areas of poor to non-existent outcrop. In the east and west of the Project Area, the Central Fault defines the northern extent of the outcrop gap in the prominent rhyolitic tuff bed at the top of the *Eagleton Volcanics*.

The Central Fault was intersected by diamond drill holes ARDG-DDH05 (0.4 – 57.59 metres) and ARDG-DDH08 (0.5 – 13.7 metres). The Fault manifests in diamond core as zones of strong to intense fracturing and brecciation (**Plate 29**). It has been the focus of localised dolerite dyke emplacement and was active post-emplacement of the dolerite, as evidenced by intense fracturing and brecciation of the dolerite in ARDG-DDH05 (**Plate 30**). The fault is at least locally flanked by zones of increased fracture intensity, alteration and oxidation (*e.g.* diamond drill hole ARDG-DDH04 and ARDG-DDH15).

7.3.2 Central Fracture

The Central Fracture is a northwest-southeast (288° grid) oriented structural feature (?fault) that is located approximately 90 metres south of and parallel to the Central Fault. The fracture has been interpreted from ground magnetic imagery (refer **Section 5.4.2**) and confirmed by one diamond drill hole and can be traced across the Project Area for approximately 1,000 metres through the entire *Eagleton Volcanics* sequence. The structure is less significant than the Central Fault and is interpreted to have a vertical to sub-vertical dip.

The Central Fracture defines the southern side of the 95-metre-wide gap in outcrop exposure through the central part of the Project Area that is best observed in the east with the outcrop gap in the prominent rhyolitic tuff bed at the top of the *Eagleton Volcanics*.

Two diamond drill holes were drilled across the projected strike of the Central Fracture, though only one hole (ARDG-DDH16) intersected strongly fractured rhyodacite and dolerite dyke material associated with the structure (**Plate 31**). The other hole (ARDG-DDH10) intersected massive unaltered dacite in the interpreted position of the fracture zone, indicating that the position of the structure had deviated in this location.

Plate 28 – Intensely fractured rhyodacite associated with the Central Fault – drill hole ARDG-DDH05 (12.75-18.00 m).

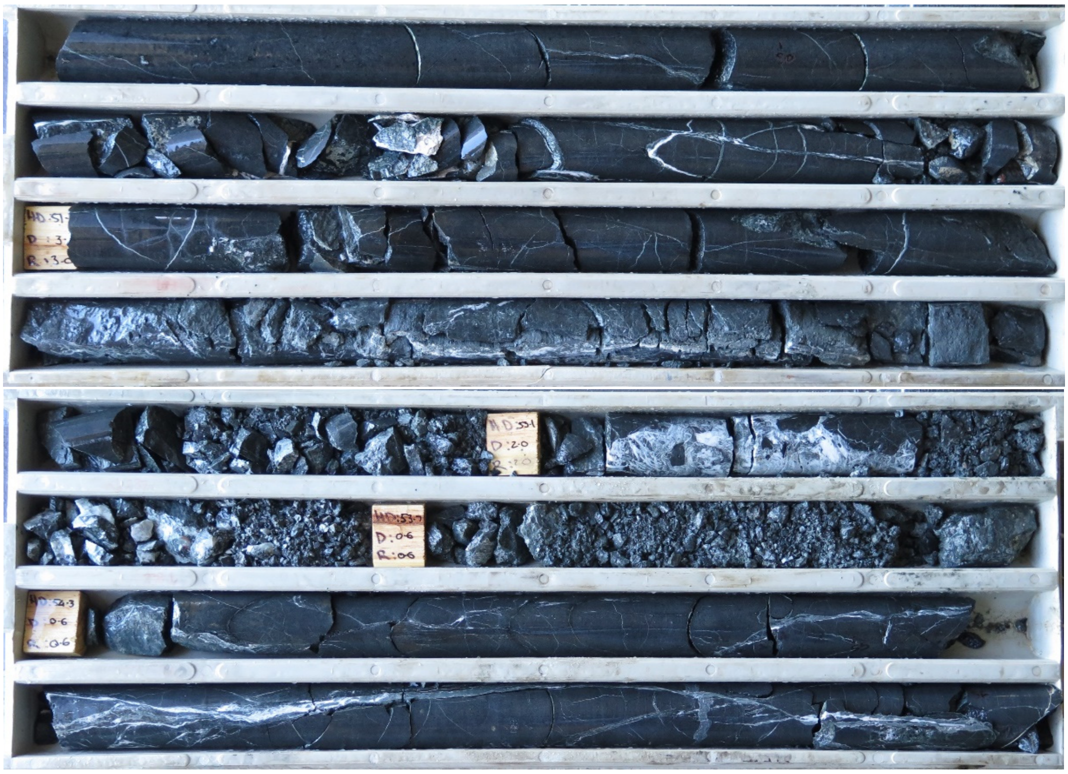


Plate 29 – Intensely fractured, brecciated and calcite veined dolerite within the Central Fault – drill hole ARDG-DDH05 (49.40-55.90 m).

Plate 30 – Strongly fractured rhyodacite and a narrow dolerite dyke associated with the Central Fracture – drill hole ARDG-DDH16 (10.60-17.20 m).

7.3.3 Splay Fault

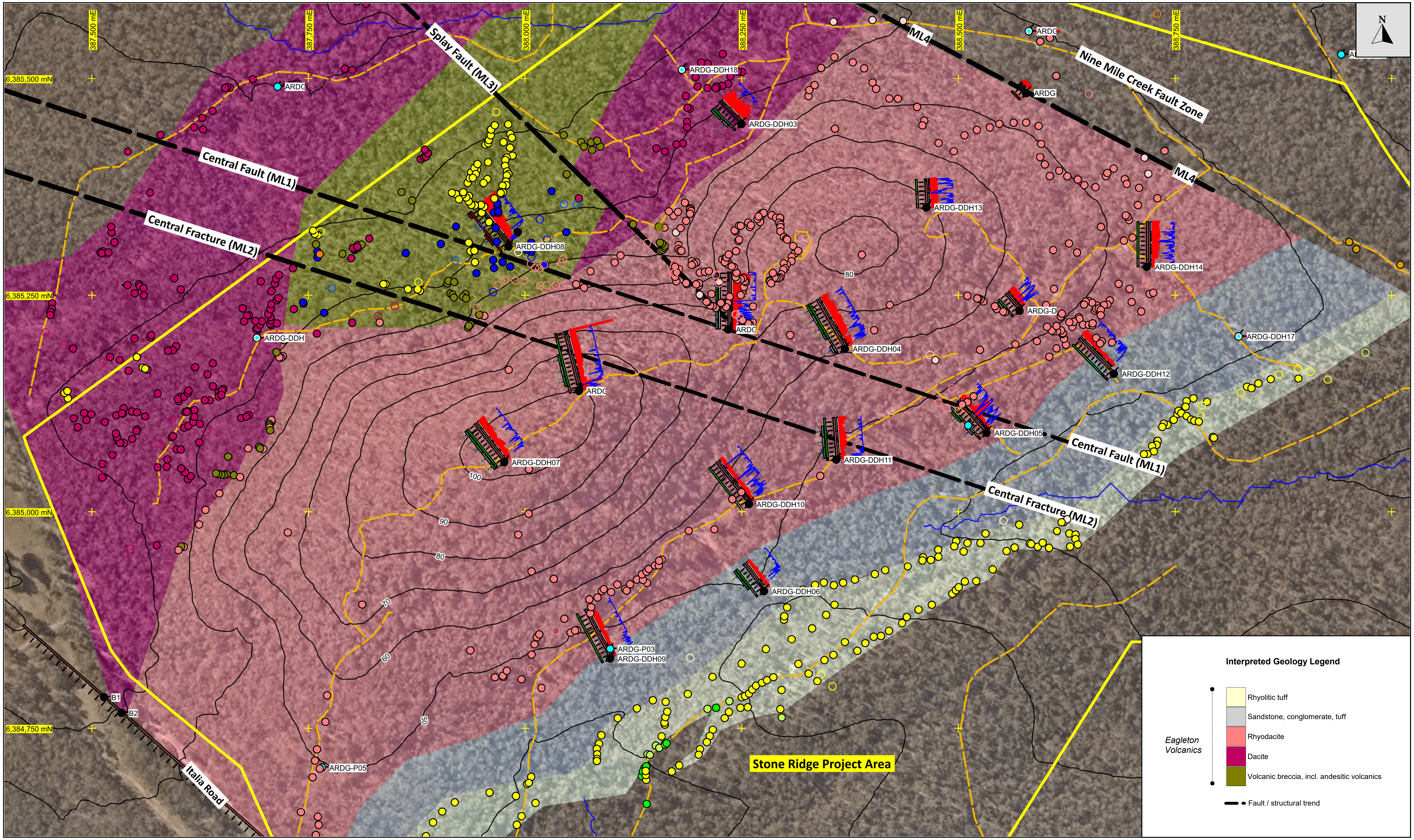
The Splay Fault is northwest-southeast (314° grid) oriented structure interpreted solely from ground magnetic imagery (refer **Section 5.4.3**) that is believed to be a subsidiary structure of the Central Fault. The Splay Fault can be traced for approximately 600 metres northwest (314° grid) from the Stone Ridge saddle. The fault is interpreted from ground magnetic imagery to be relatively narrow (several metres) and its linear trace suggests it has a vertical to sub-vertical dip.

Ground magnetic survey imagery suggests apparent sinistral displacement along the Splay Fault, and its trace defines the northern limit of a prominent outcrop of rhyolitic tuff.

7.3.4 Nine Mile Creek Fault Zone

The Nine Mile Creek Fault Zone is a broadly northwest-southeast oriented structural zone that defines the northern extent of the *Eagleton Volcanics* within the Project Area and has been a significant influence on the path of Nine Mile Creek. The fault zone was defined within the Project Area by ground magnetic imagery (refer **Section 5.4.4**) and by two diamond drill holes (ARDG-DDH02 and ARDG-DDH20). Both holes intersected highly fractured and locally haematitic sandstone, siltstone and conglomerate that may represent units of the *Newtown Formation* or *Wallaringa Formation*. The presence of units of either of these formations juxtaposed against rhyodacite of the *Eagleton Volcanics* would indicate significant apparent dextral displacement along the Nine Mile Creek Fault Zone. Dolerite dyke material was also intersected in ARDG-DDH20 at the contact between an interval of clay altered lithic sandstone and underlying hematitic mudstone, sandstone and siltstone (**Plate 31**).

Plate 31 – Strongly to intensely fractured dolerite dyke at contact between clay-altered lithic sandstone and hematitic sedimentary units within the Nine Mile Creek Fault Zone – drill hole ARDG-DDH20 (14.15-30.30 m).



Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Topographic contour (10m contour interval)
- Drainage line (ephemeral)
- Diamond drill hole collar location
- Diamond drill hole collar location - hole converted to water monitoring bore
- Diamond drill hole path

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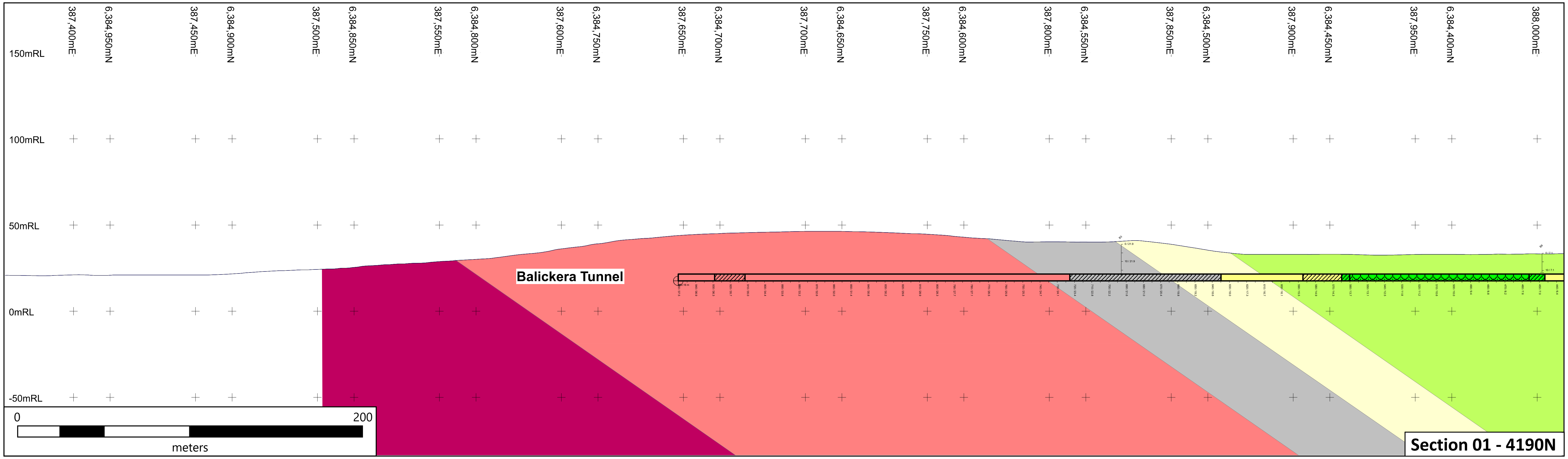
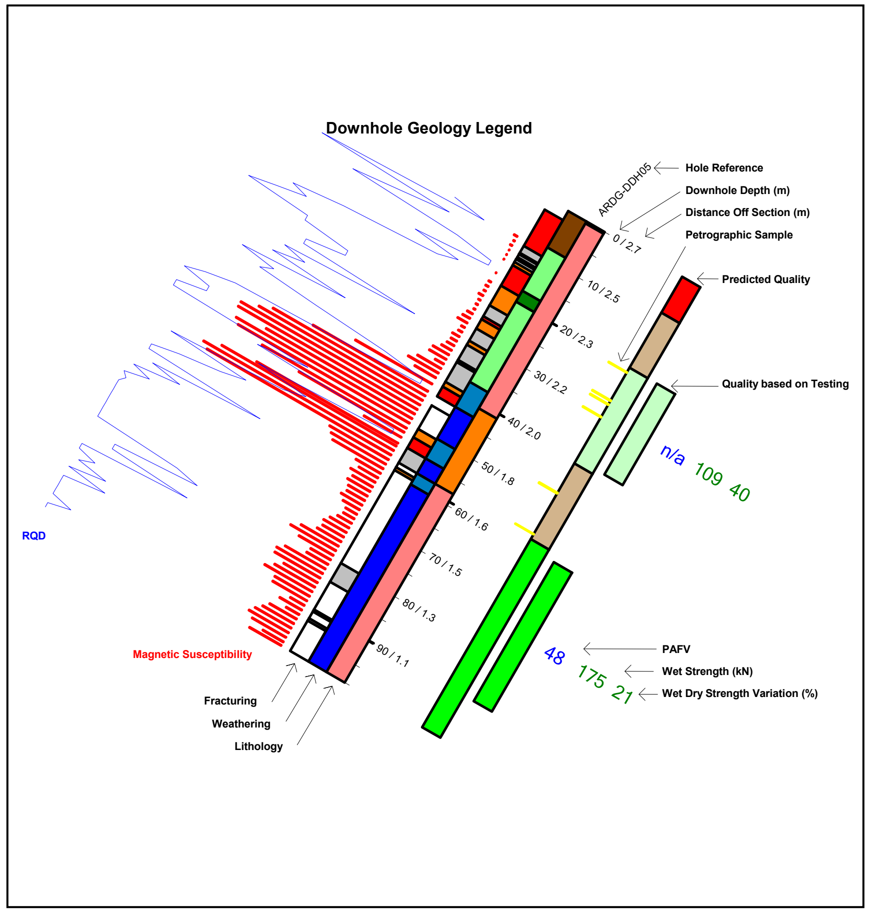
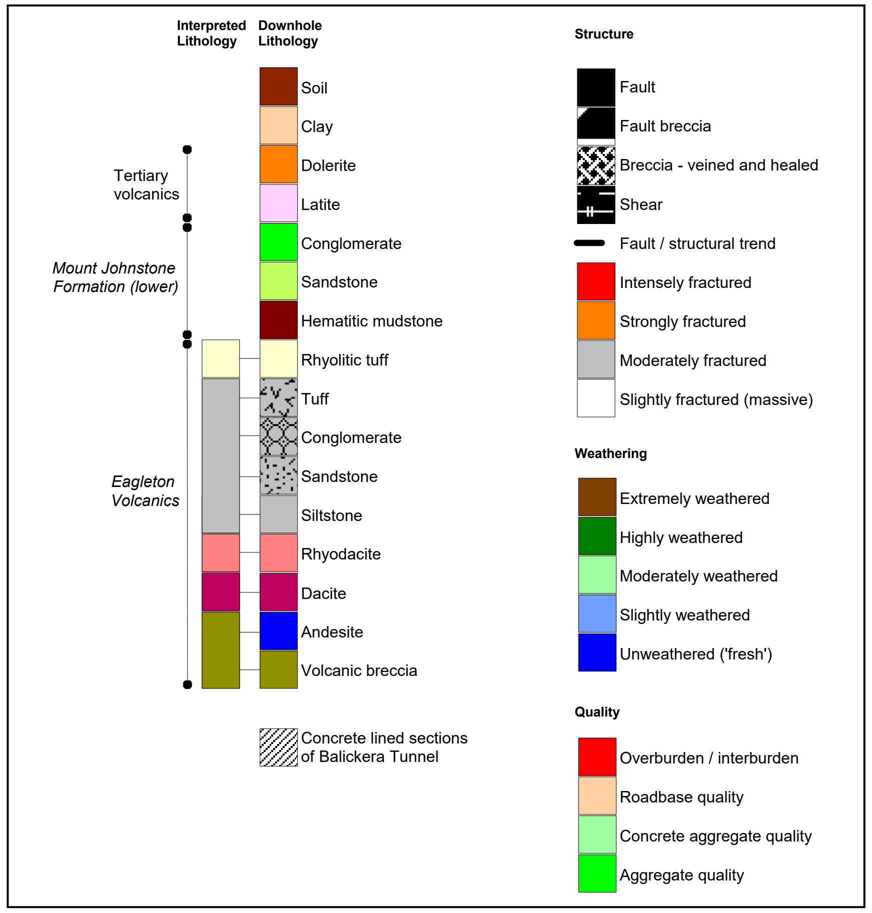
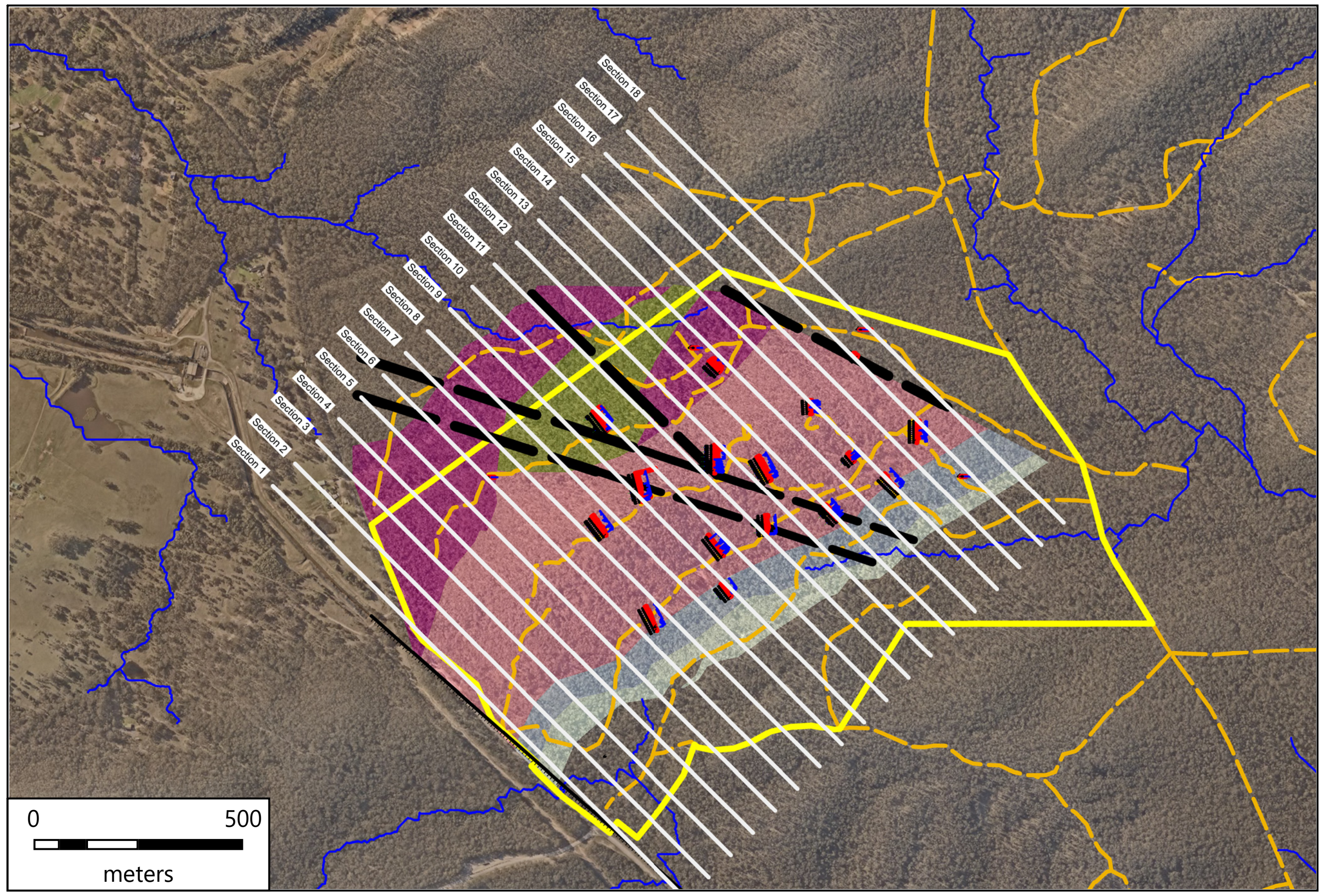
Project:	STONE RIDGE QUARRY PROJECT					Figure 13	
Title:	Interpeted Project Area Geology						
Author:	DMB	Date:	December 2019	Scale:	1:4000 @ A3	Grid:	MGA Zone 56 (GDA94)

Source:
Aerial Photograph: NearMap Image - 9 September 2018
Topographic Contours: 10m contour interval - generated from LIDAR 0.5m contour data
Diamond Drilling: Blacklaws Drilling - 2018-2019
Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates); Geological Interpretation: Damon Bird (ARDG)









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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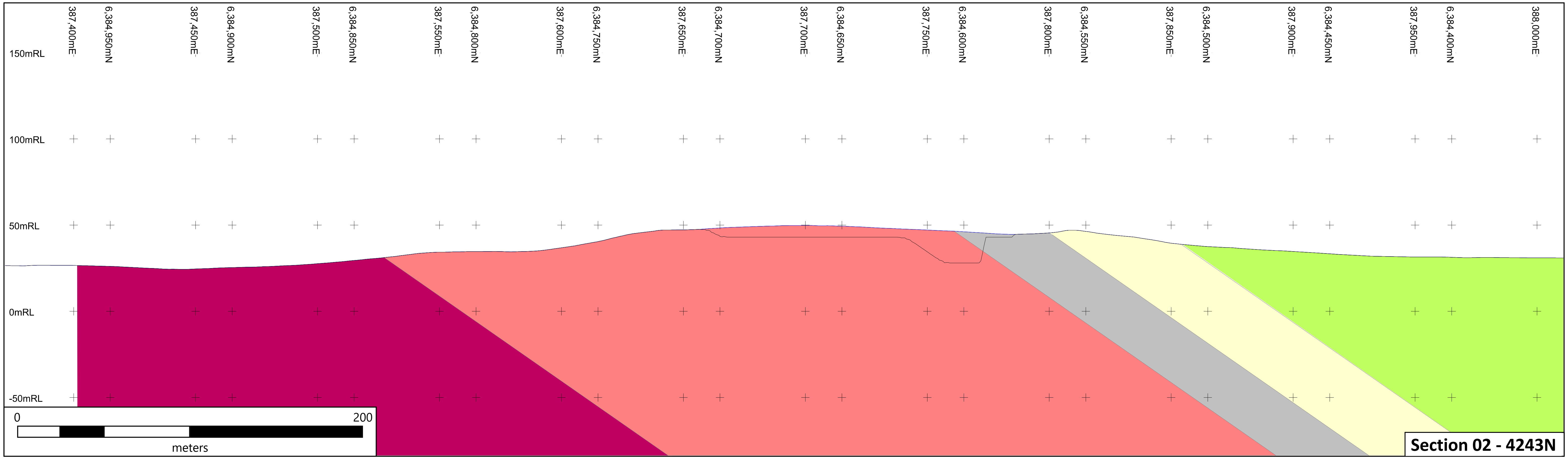
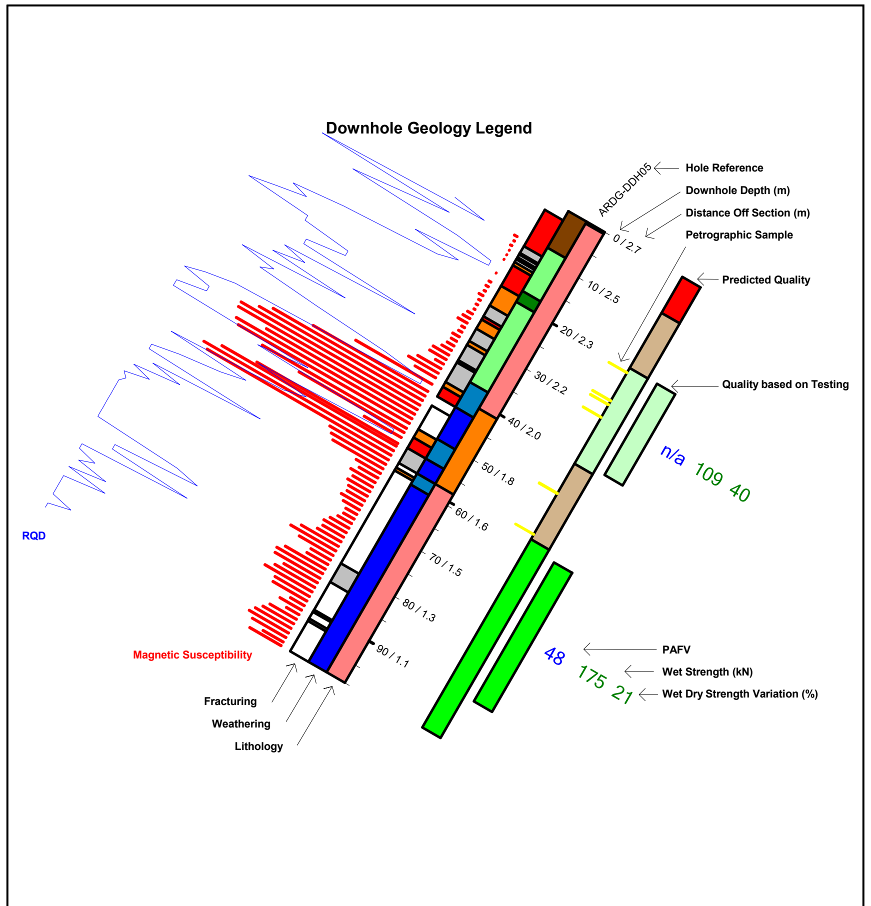
Project:	STONE RIDGE QUARRY PROJECT
Title:	Cross Section 1 - 4190N (+/- 37.5m) with Interpreted Geology

Figure 14a

Author:	DMB	Date:	December 2019	Scale:	1:2200 @ A3	Grid:	MGA Zone 56 (GDA94)

Source: Diamond Drilling: Blacklaws Drilling - 2018-2019
Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates)
Geological Interpretation: Damon Bird (ARDG)





Interpreted Lithology | Downhole Lithology

Tertiary volcanics

Mount Johnstone Formation (lower)

Eagleton Volcanics

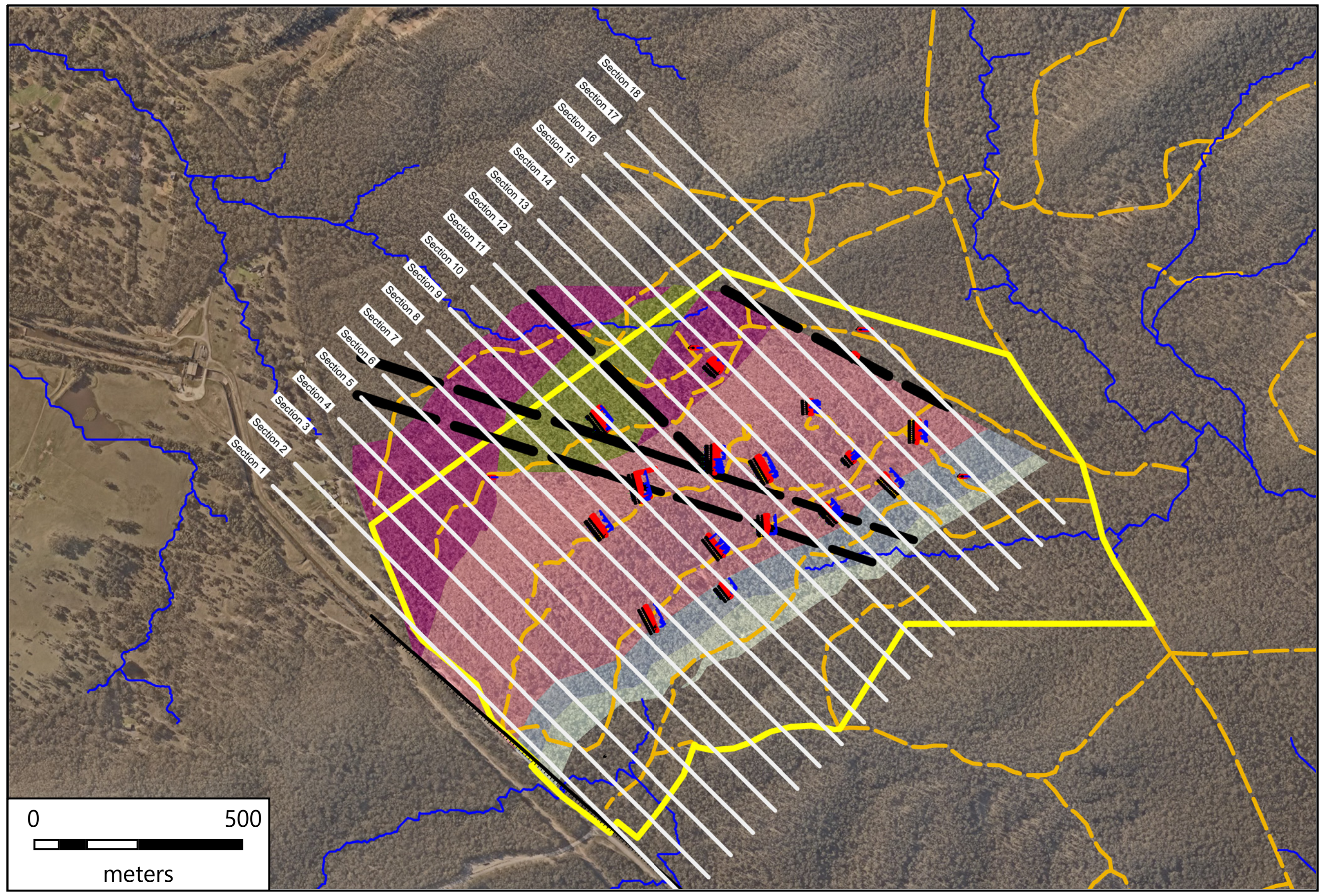
- Soil
- Clay
- Dolerite
- Latite
- Conglomerate
- Sandstone
- Hematitic mudstone
- Rhyolitic tuff
- Tuff
- Conglomerate
- Sandstone
- Siltstone
- Rhyodacite
- Dacite
- Andesite
- Volcanic breccia

Concrete lined sections of Balickera Tunnel

Structure
- Fault
- Fault breccia
- Breccia - veined and healed
- Shear
- Fault / structural trend
- Intensely fractured
- Strongly fractured
- Moderately fractured
- Slightly fractured (massive)

Weathering
- Extremely weathered
- Highly weathered
- Moderately weathered
- Slightly weathered
- Unweathered ('fresh')

Quality
- Overburden / interburden
- Roadbase quality
- Concrete aggregate quality
- Aggregate quality



Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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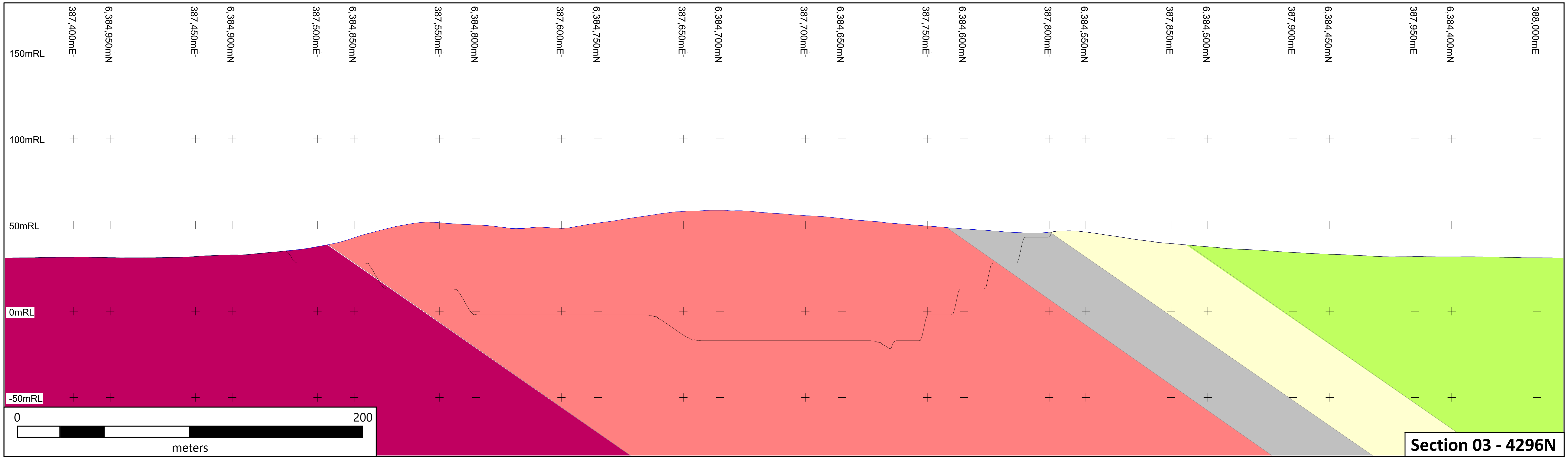
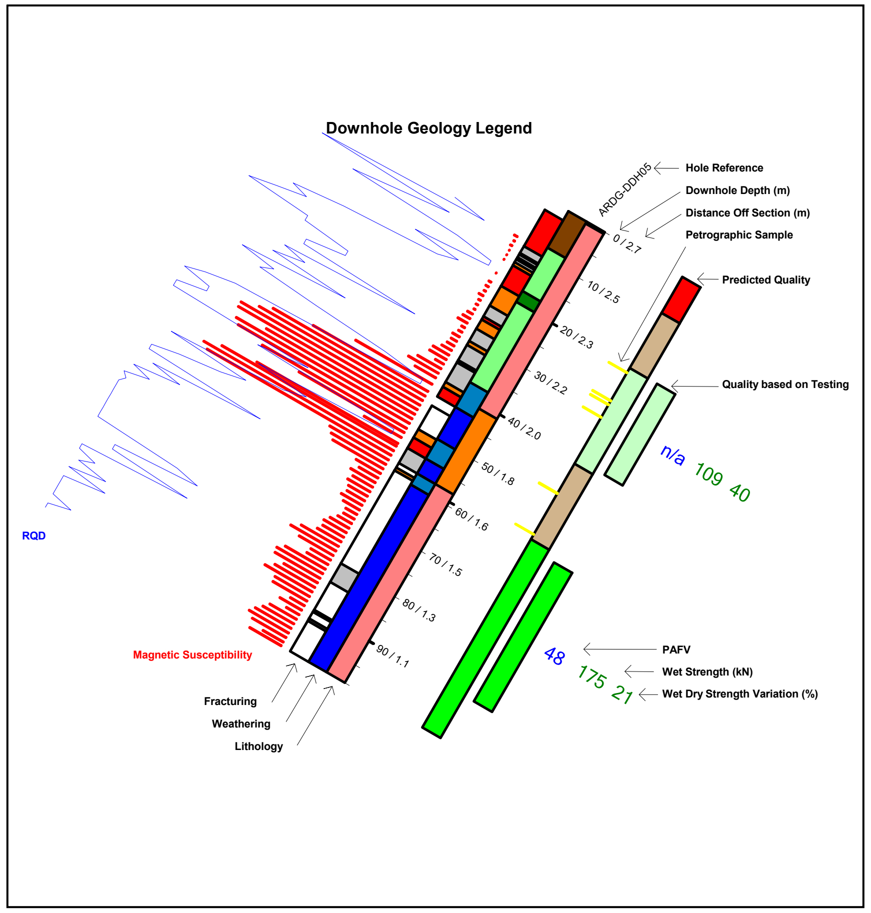
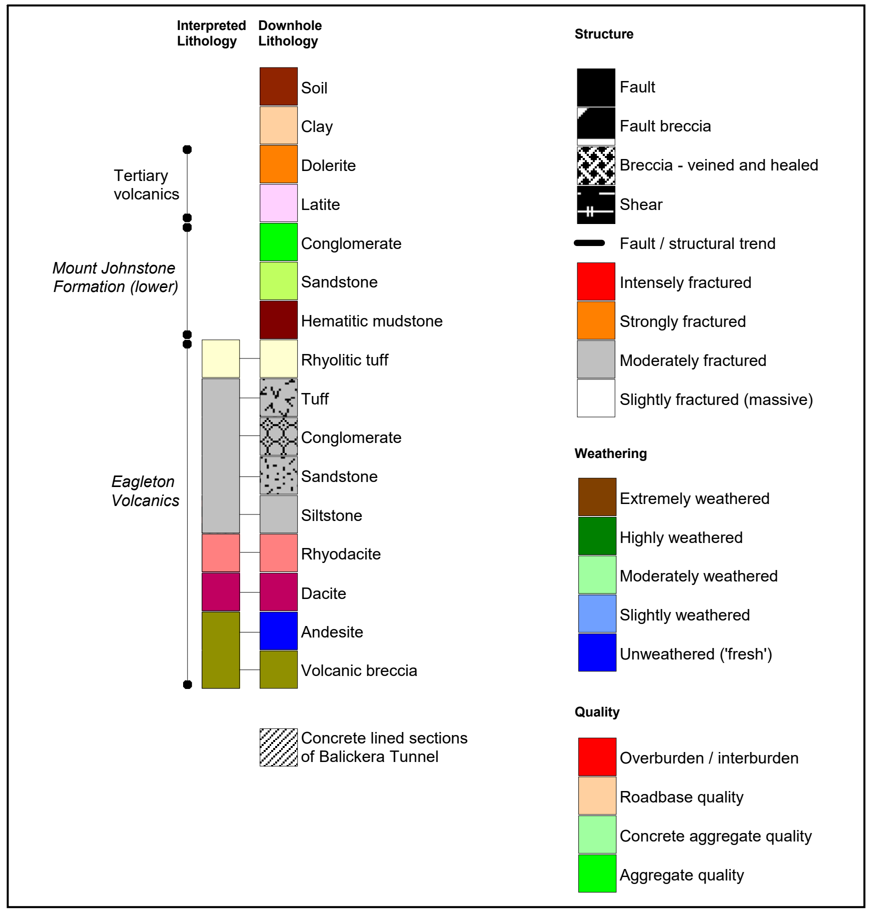
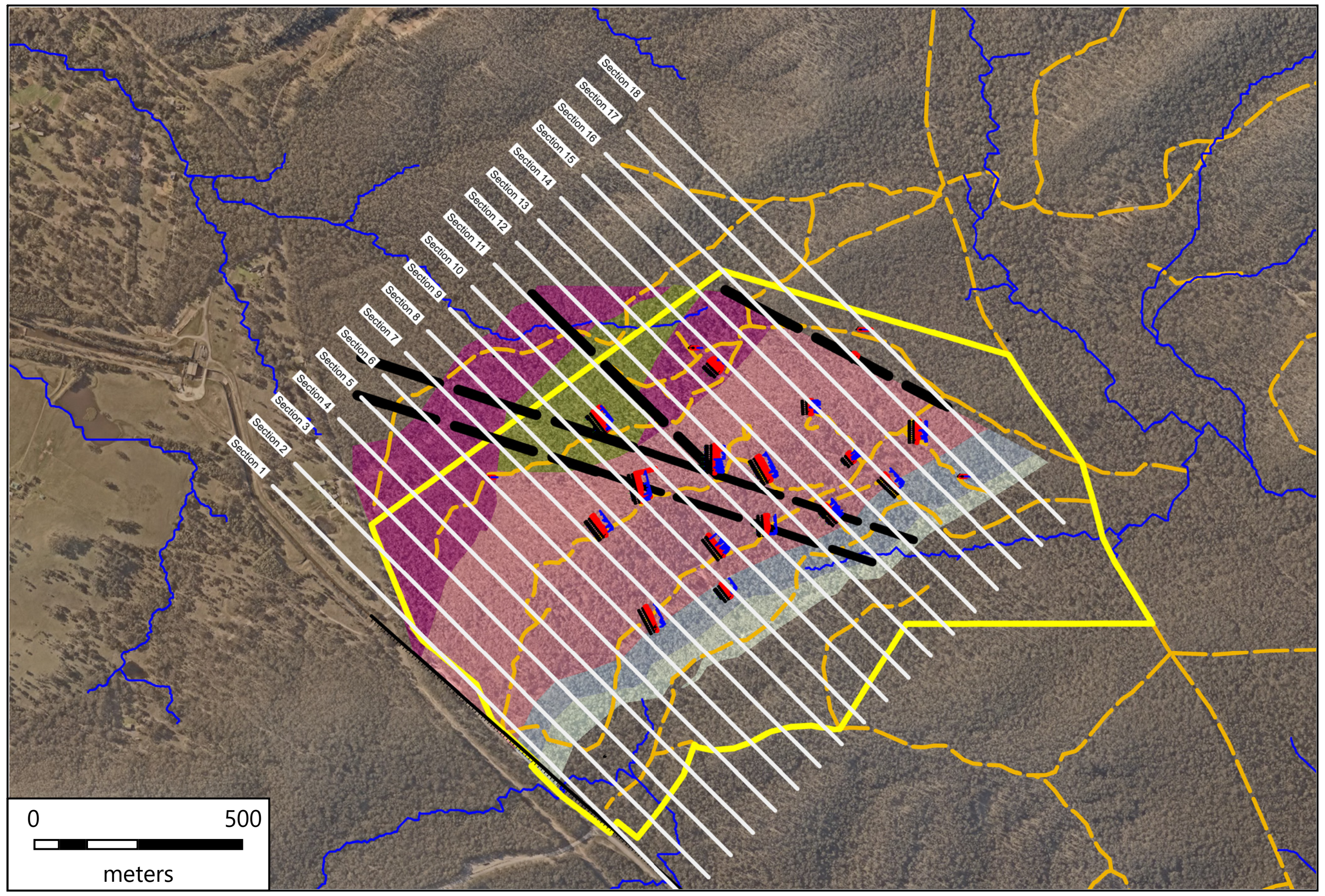
Project:	STONE RIDGE QUARRY PROJECT						Figure 14b
Title:	Cross Section 2 - 4243N (+/- 37.5m) with Interpreted Geology						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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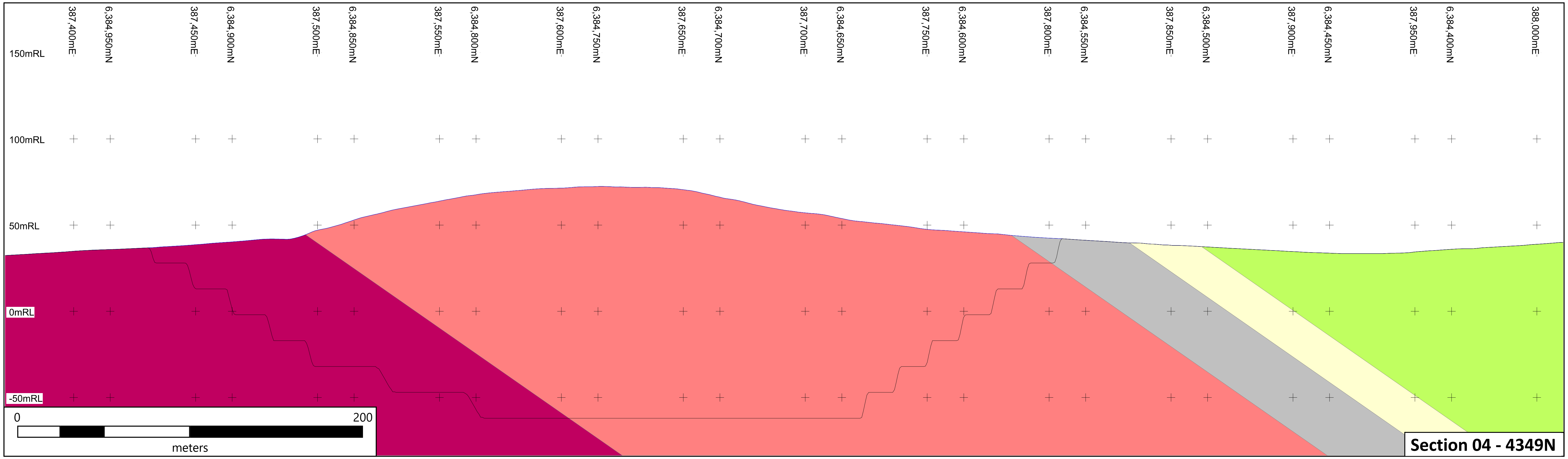
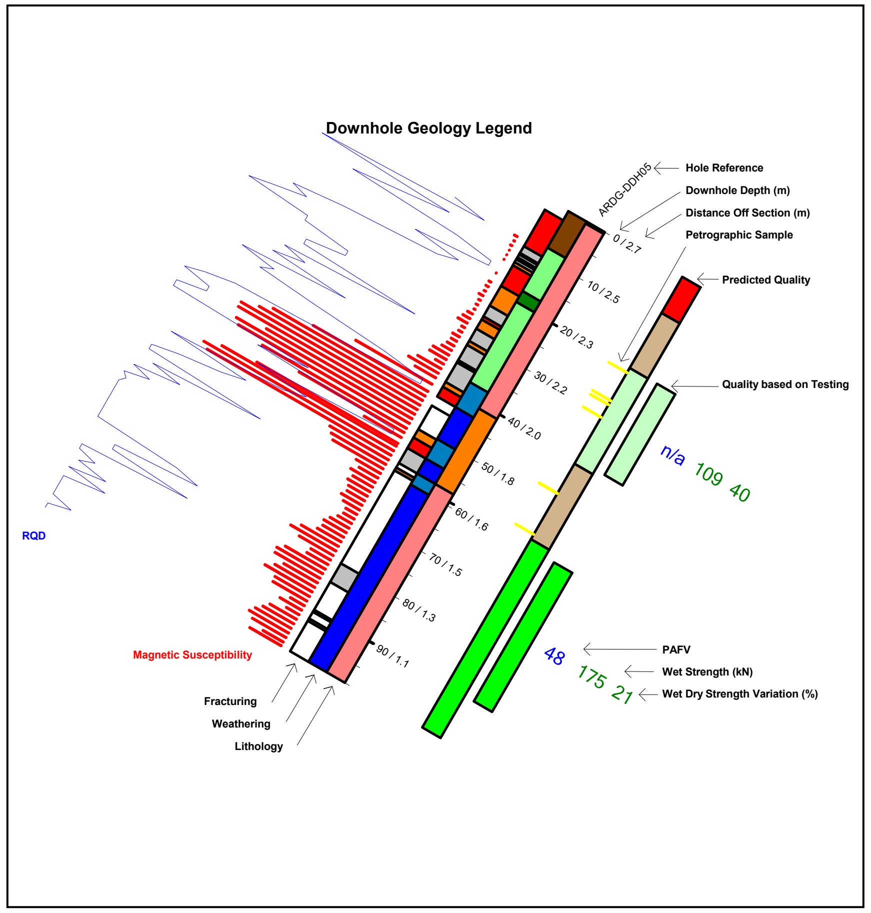
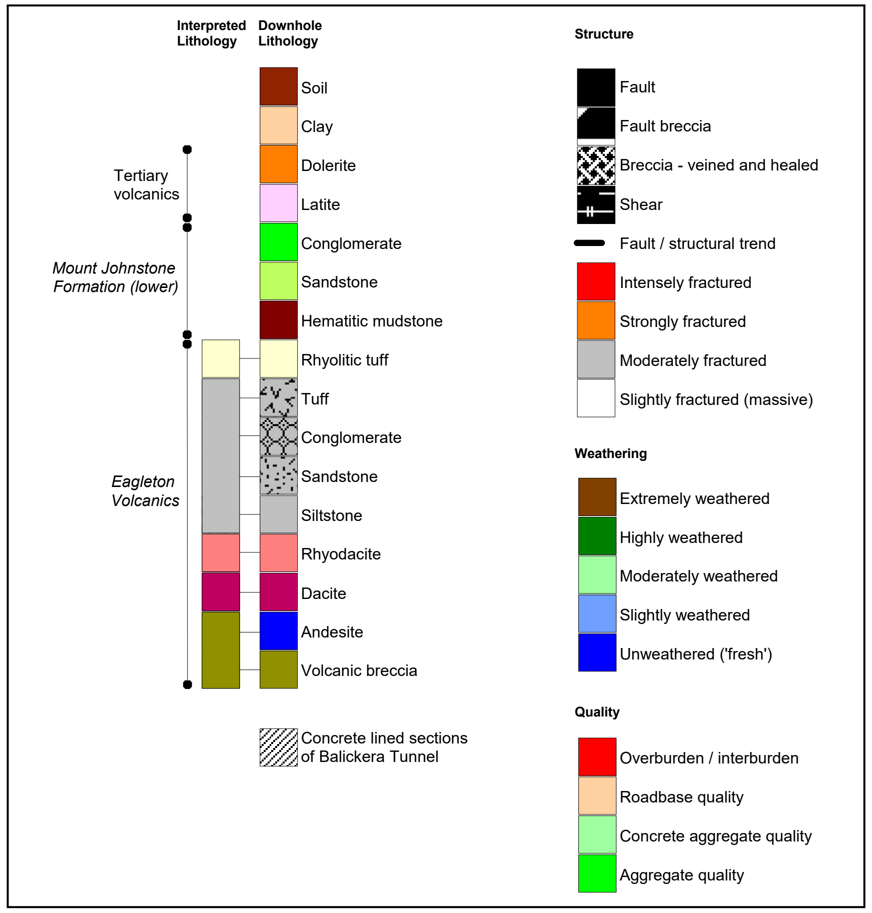
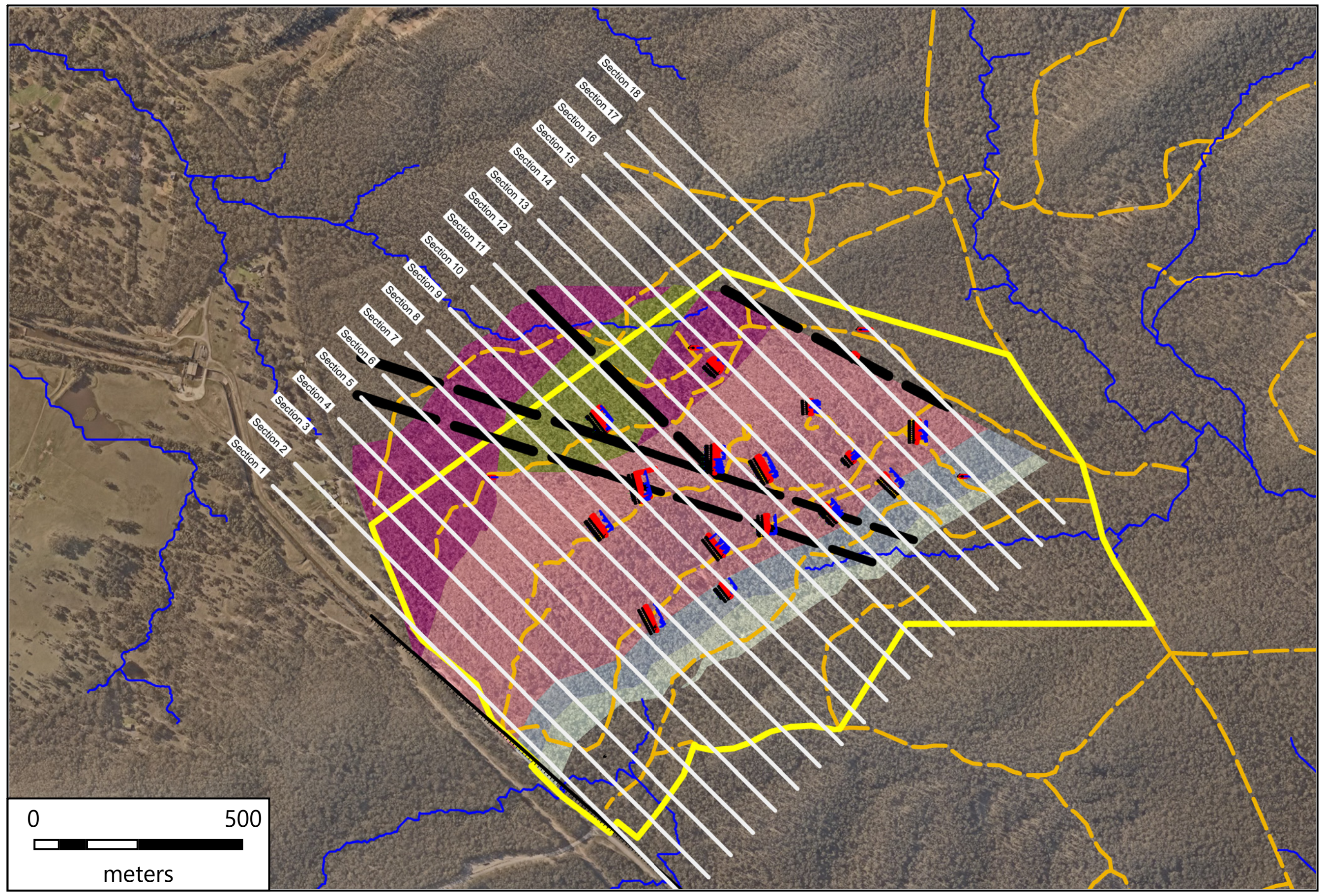
Project:	STONE RIDGE QUARRY PROJECT						Figure 14c
Title:	Cross Section 3 - 4296N (+/- 37.5m) with Interpreted Geology						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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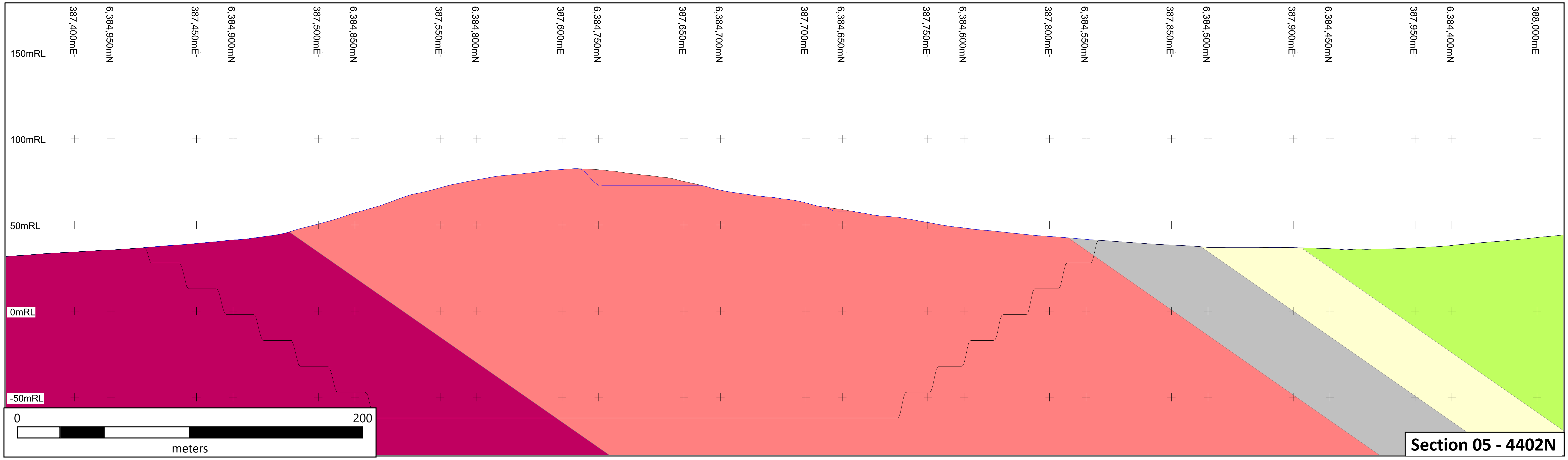
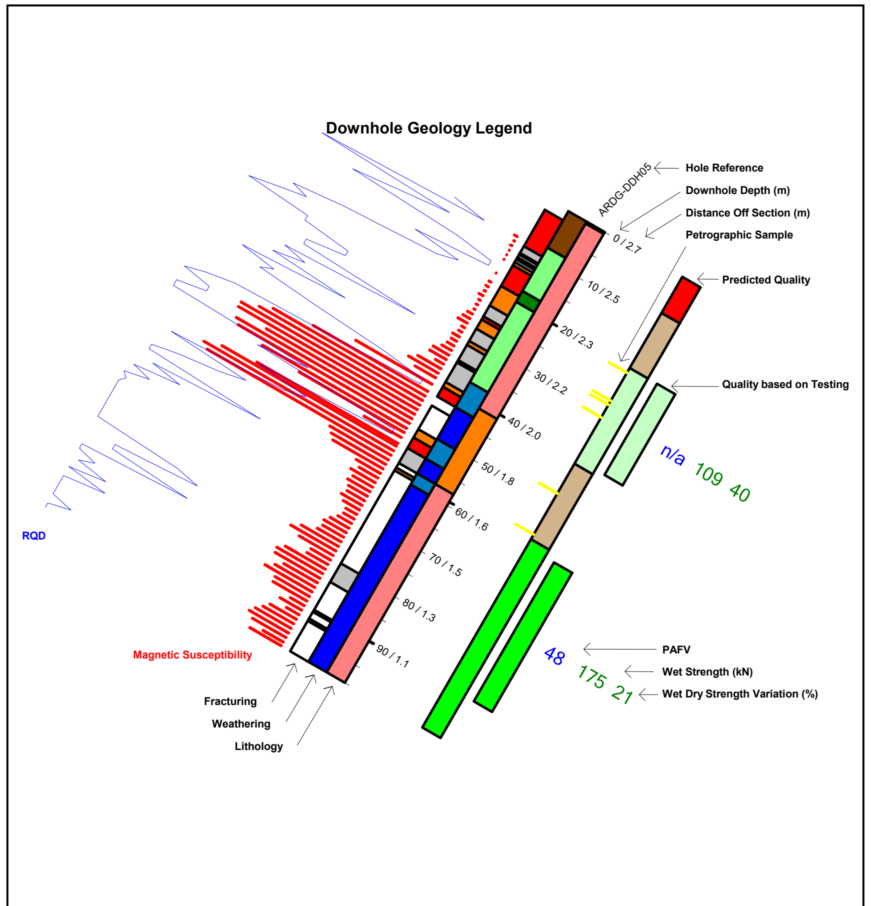
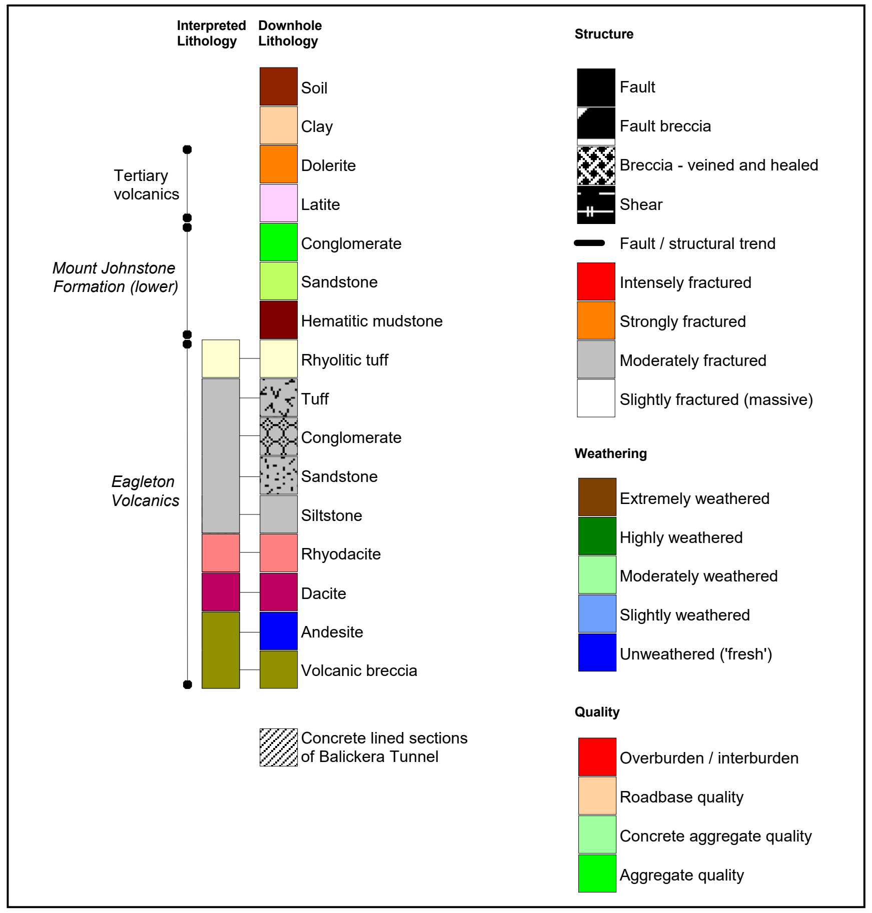
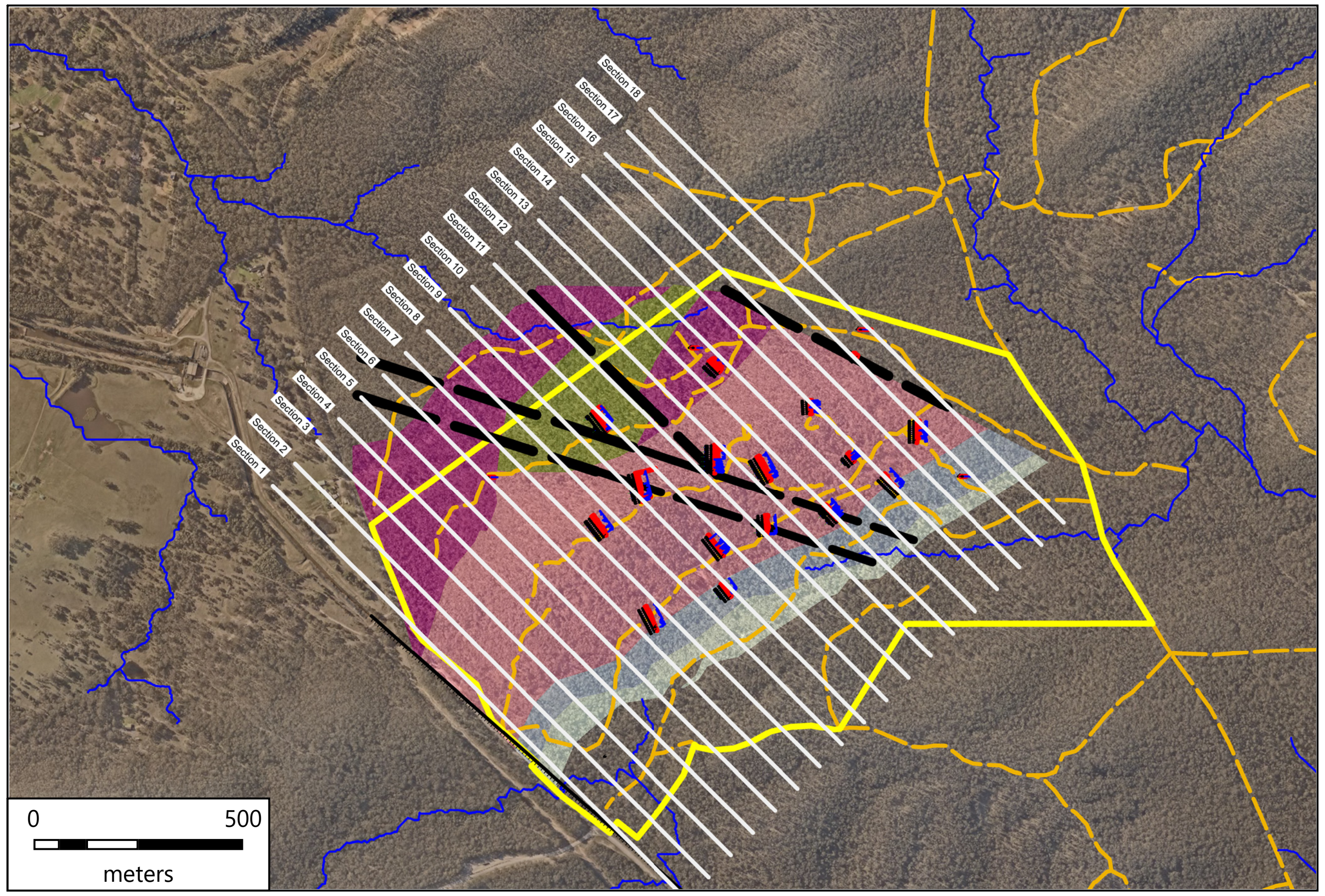
Project:	STONE RIDGE QUARRY PROJECT						Figure 14d
Title:	Cross Section 4 - 4349N (+/- 37.5m) with Interpreted Geology						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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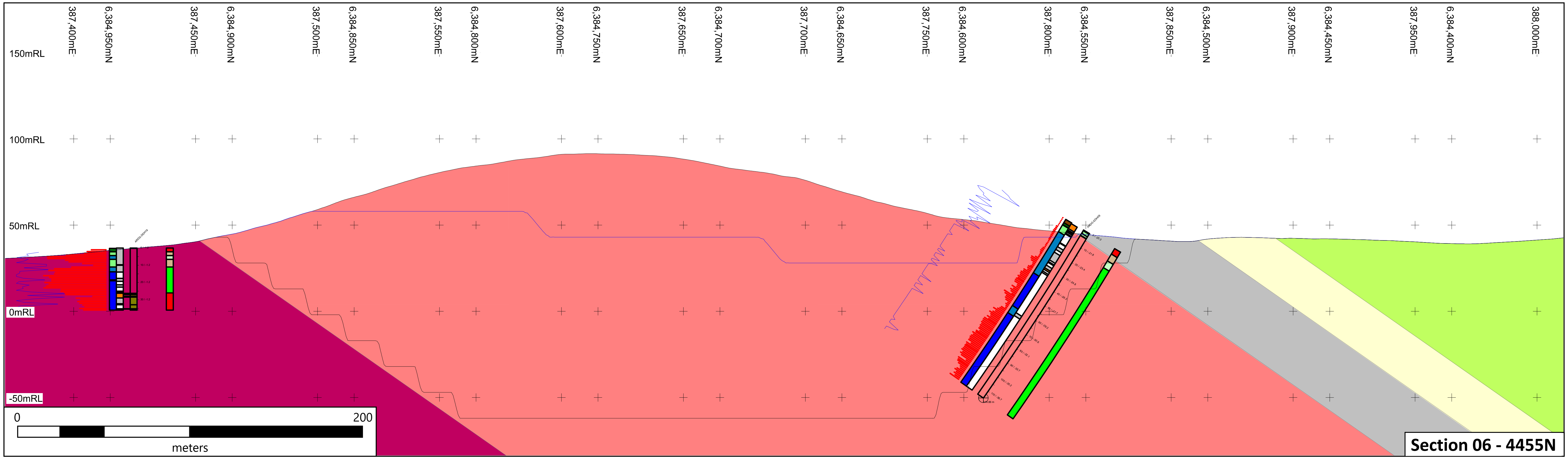
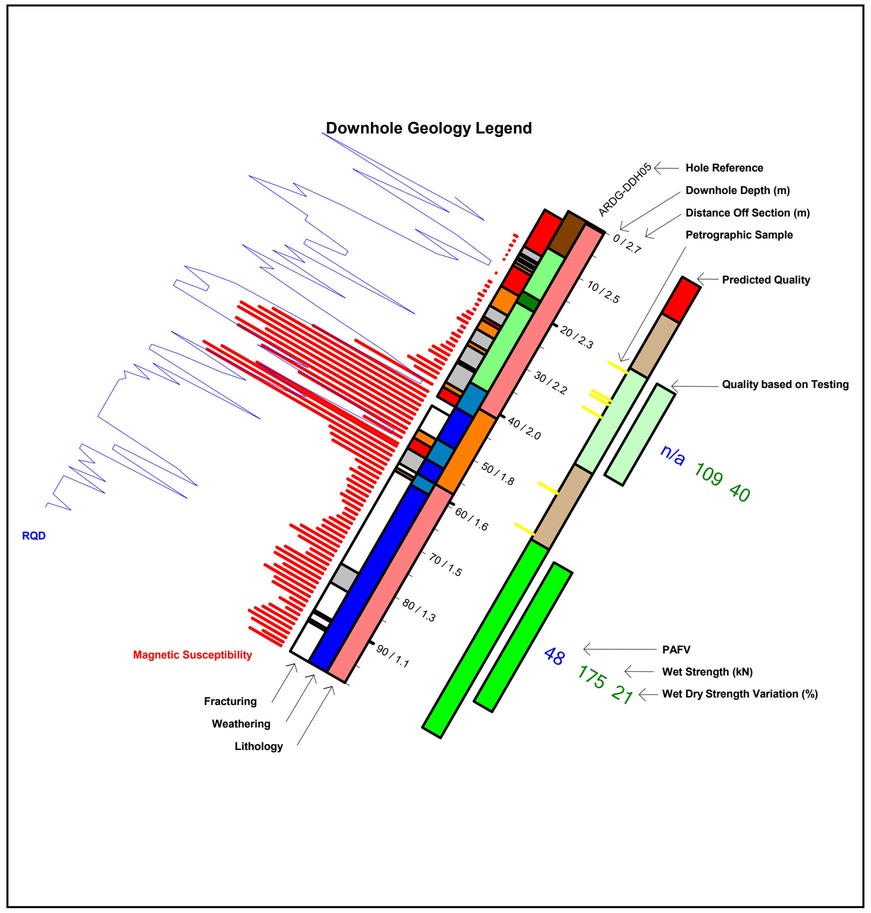
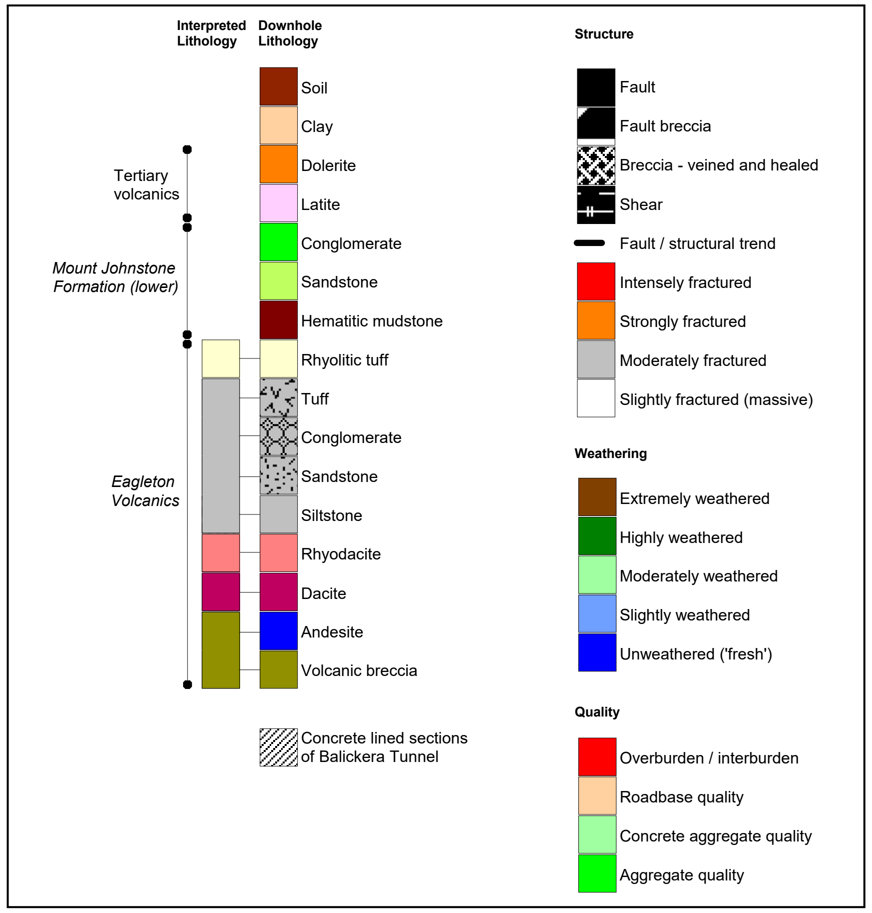
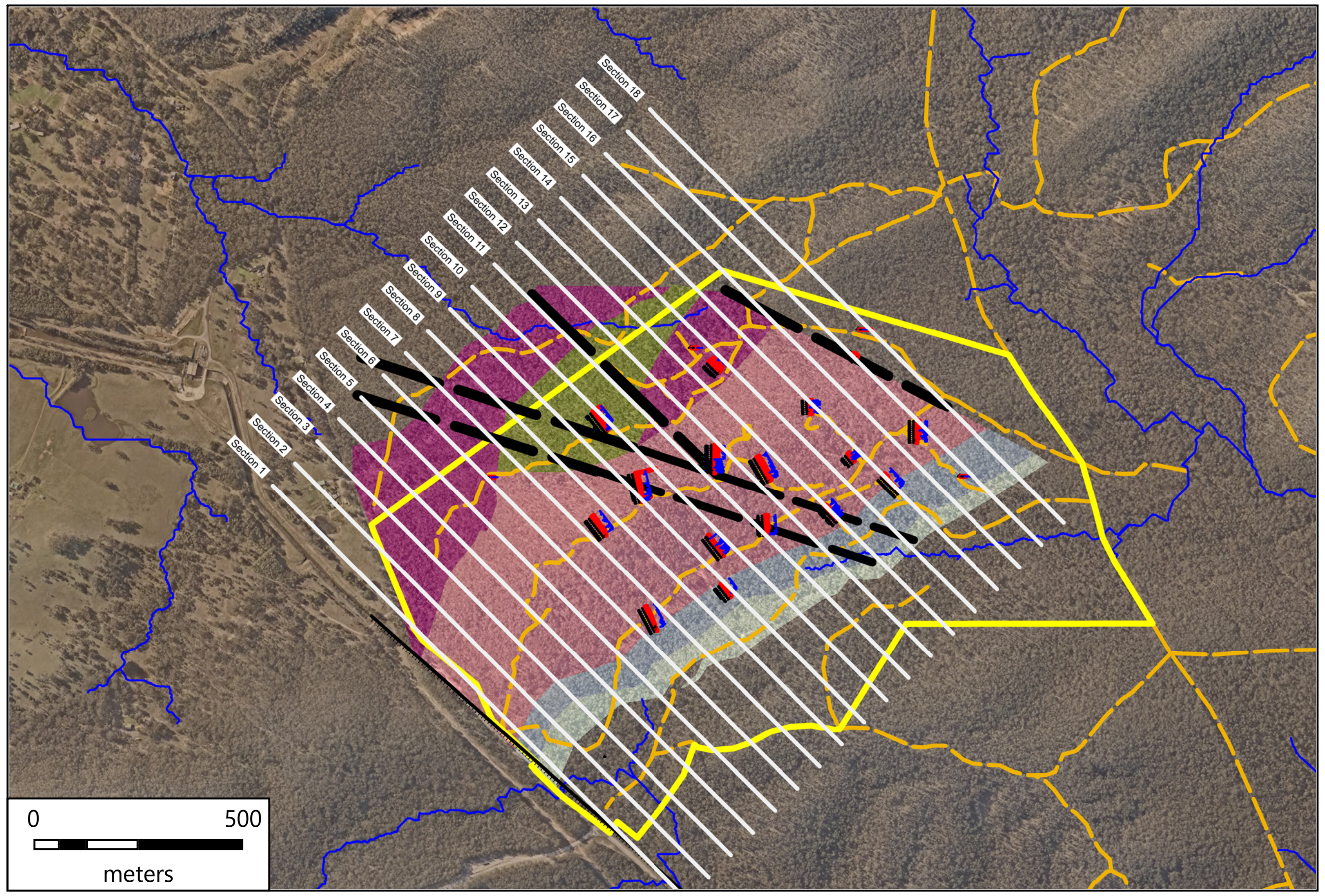
Project:	STONE RIDGE QUARRY PROJECT						Figure 14e
Title:	Cross Section 5 - 4402N (+/- 37.5m) with Interpreted Geology						
Author:	DMB	Date:	December 2019	Scale:	1:2200 @ A3	Grid:	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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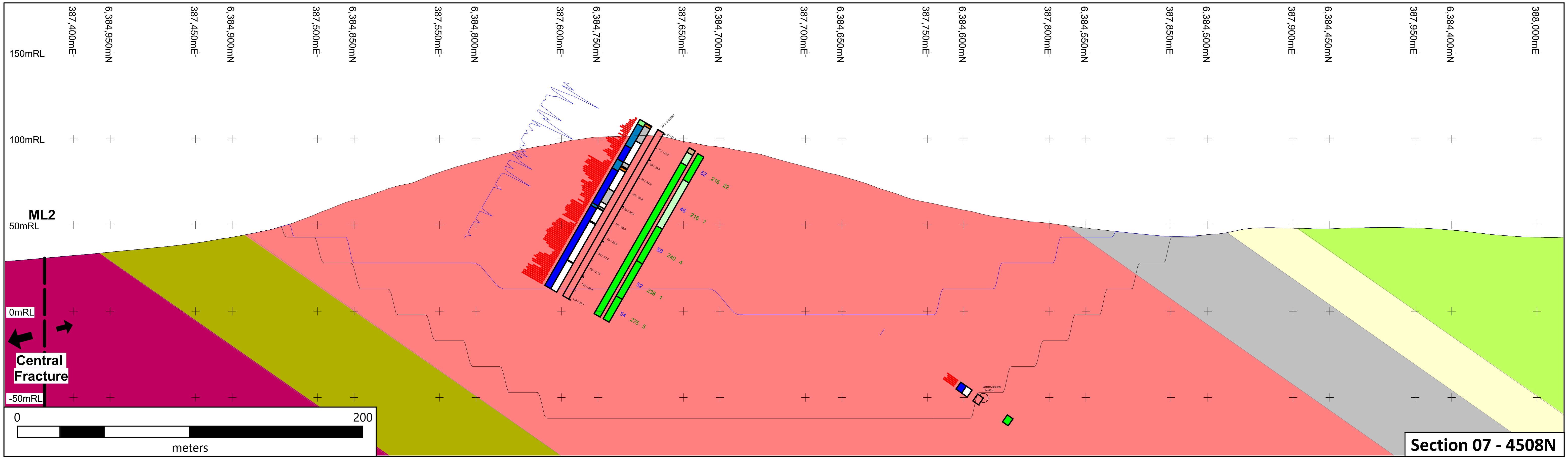
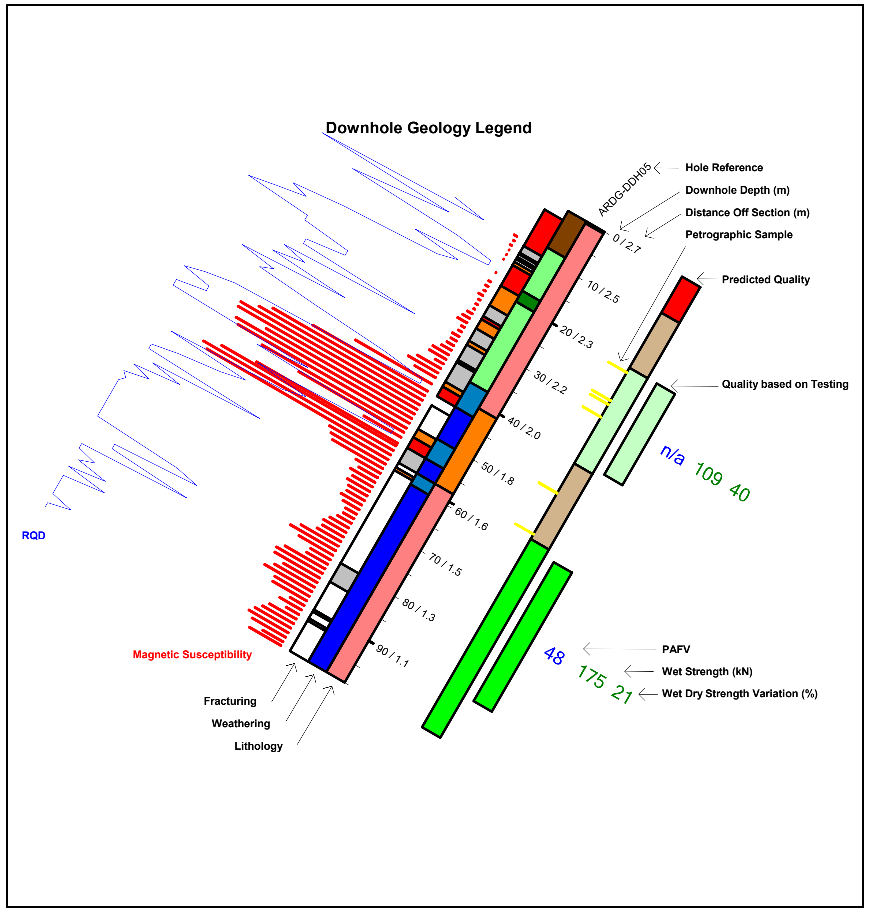
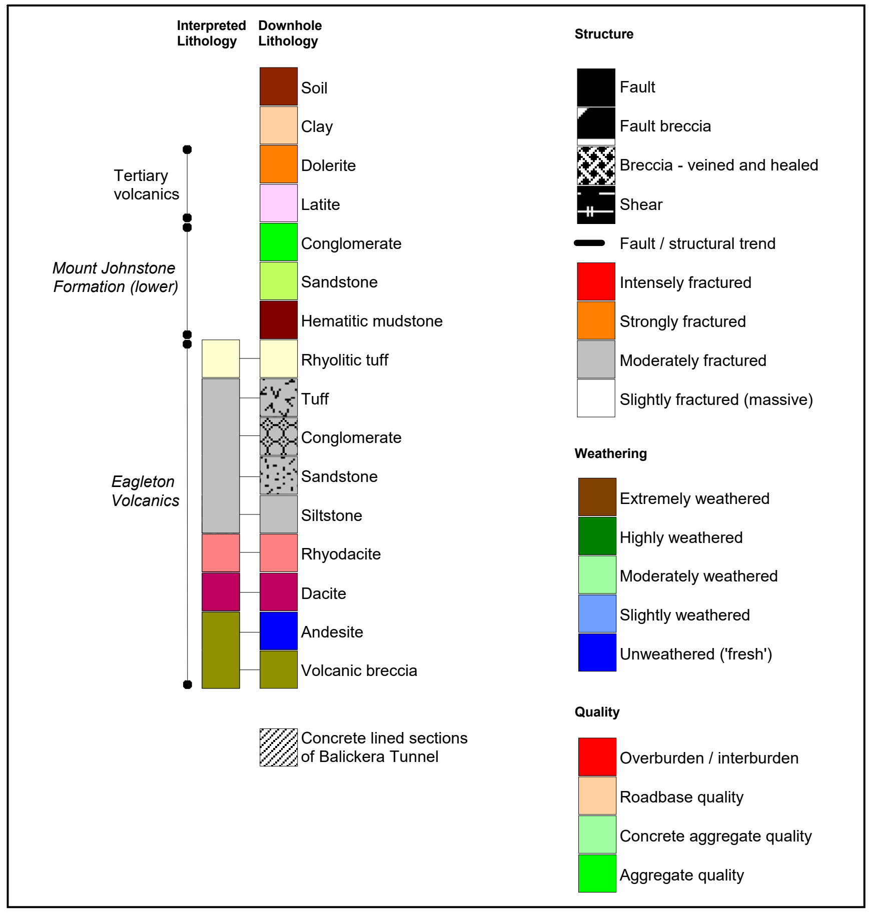
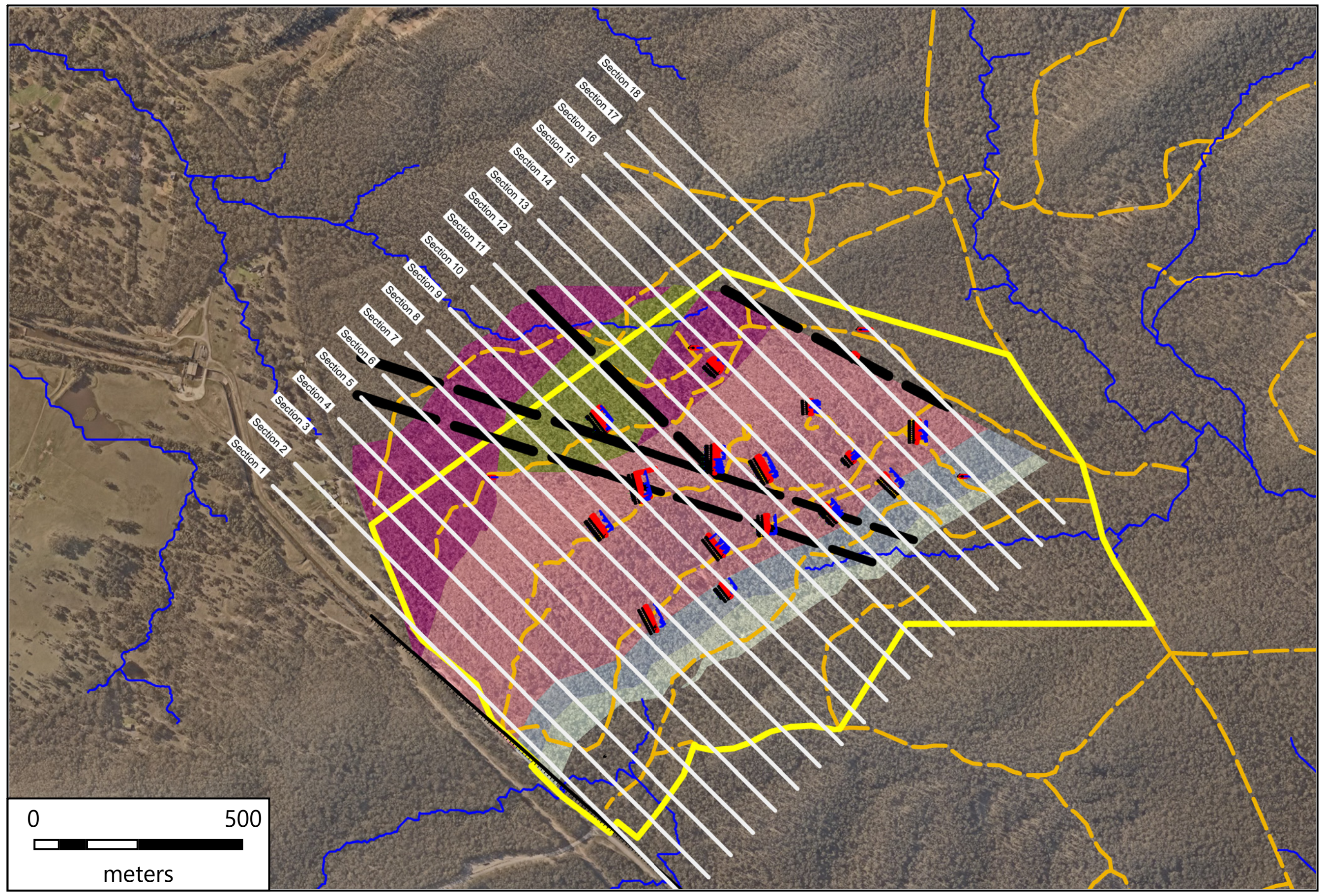
Project:	STONE RIDGE QUARRY PROJECT
	Figure 14f
Title:	Cross Section 6 - 4455N (+/- 37.5m) with Interpreted Geology
Author:	DMB
Date:	December 2019
Scale:	1:2200 @ A3
Grid:	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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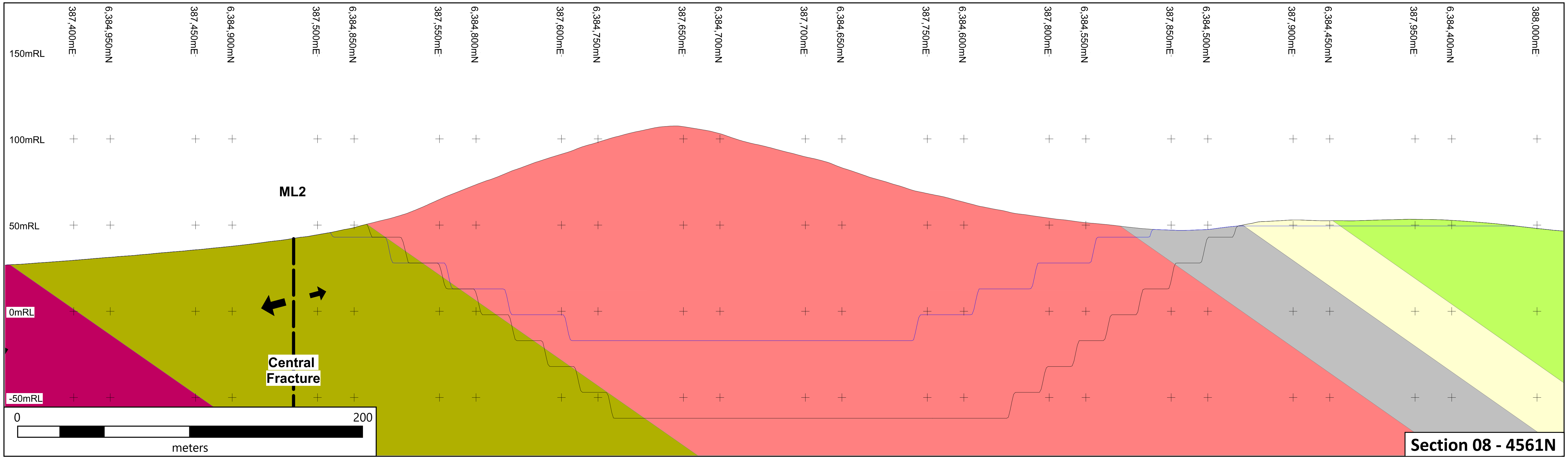
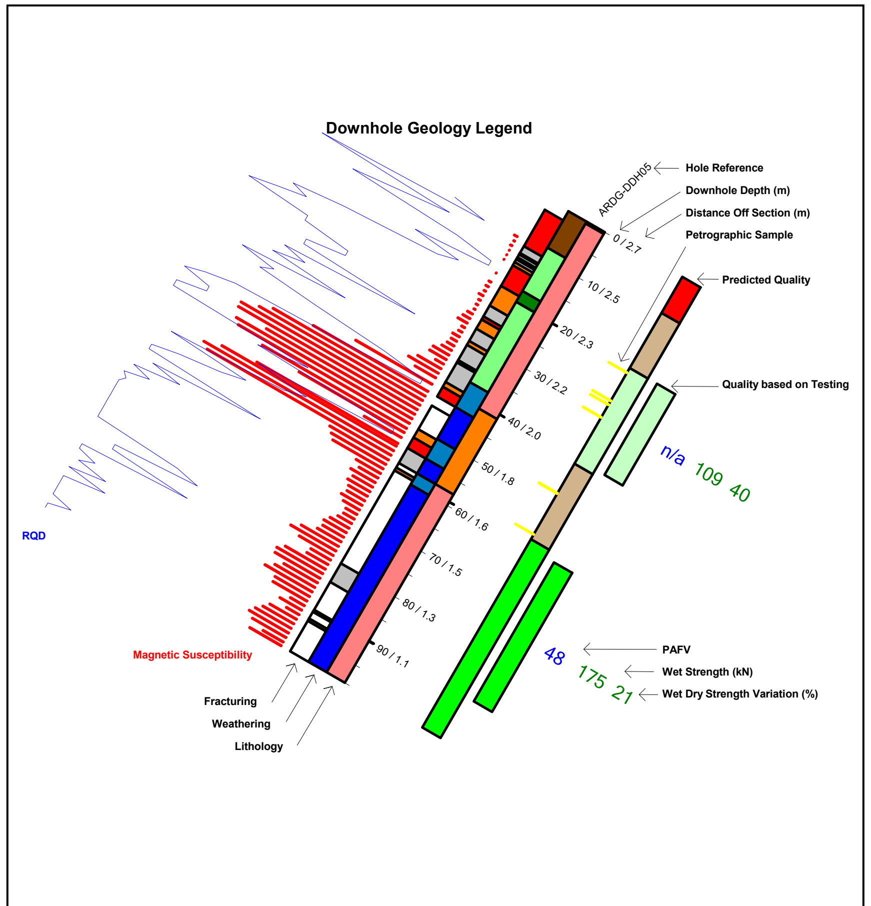
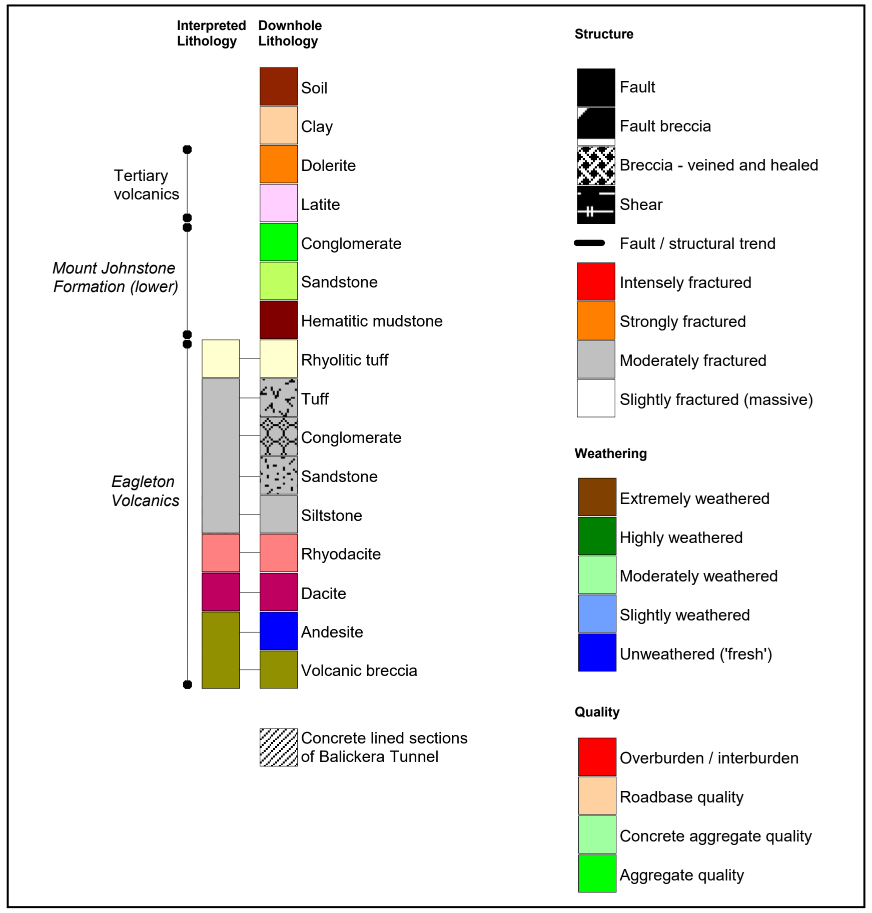
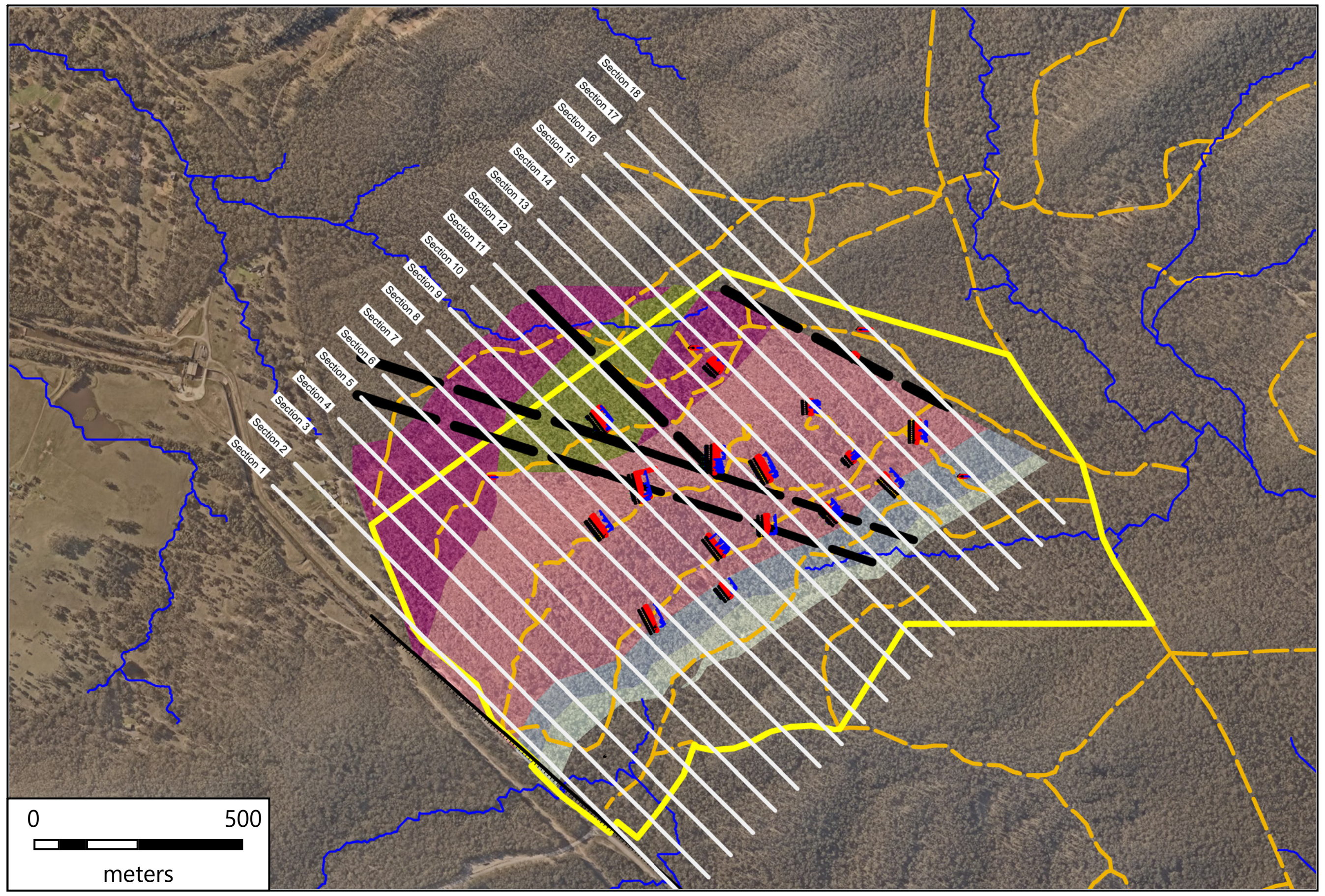
Project:	STONE RIDGE QUARRY PROJECT						Figure 14g
Title:	Cross Section 7 - 4508N (+/- 37.5m) with Interpreted Geology						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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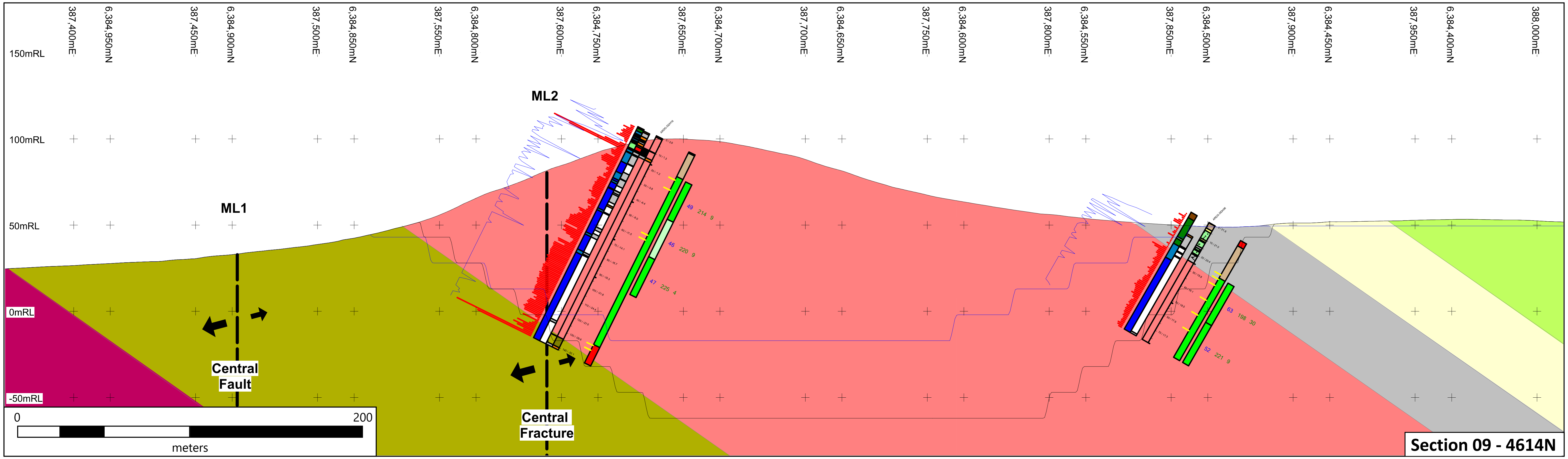
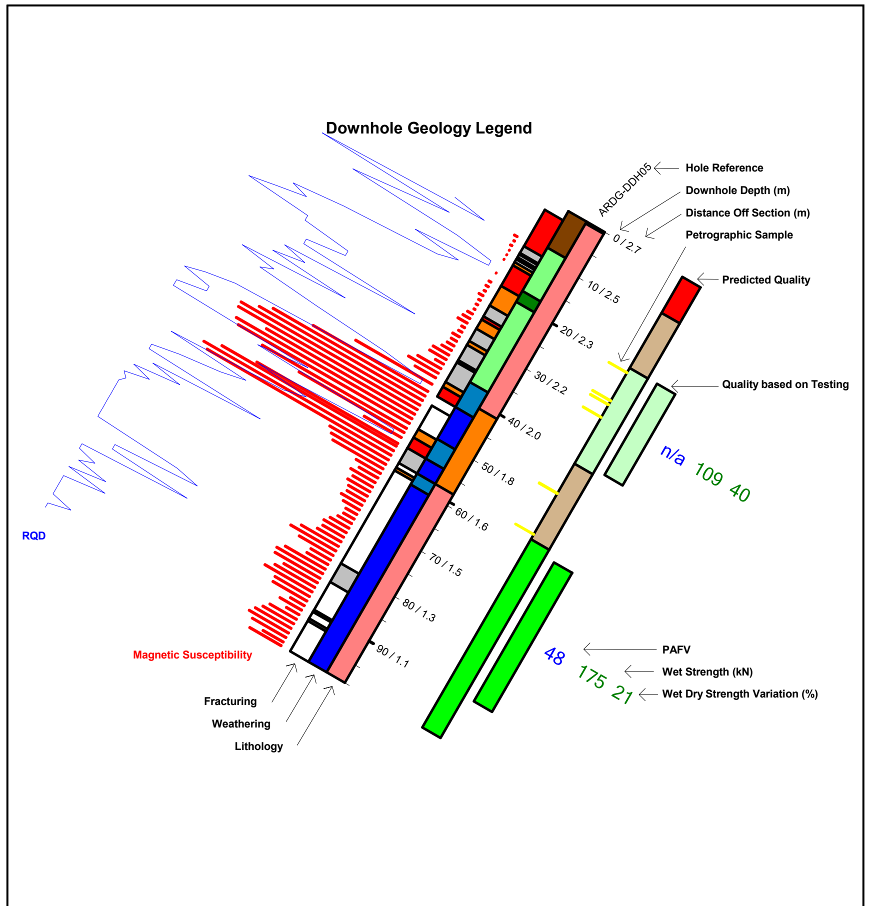
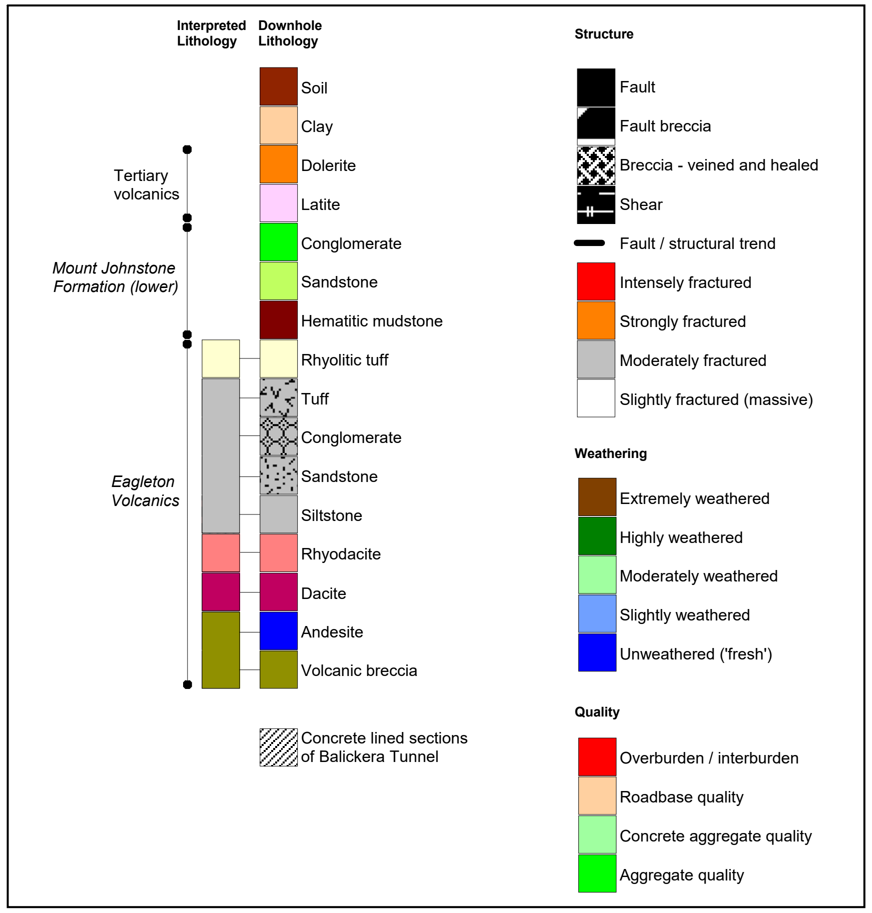
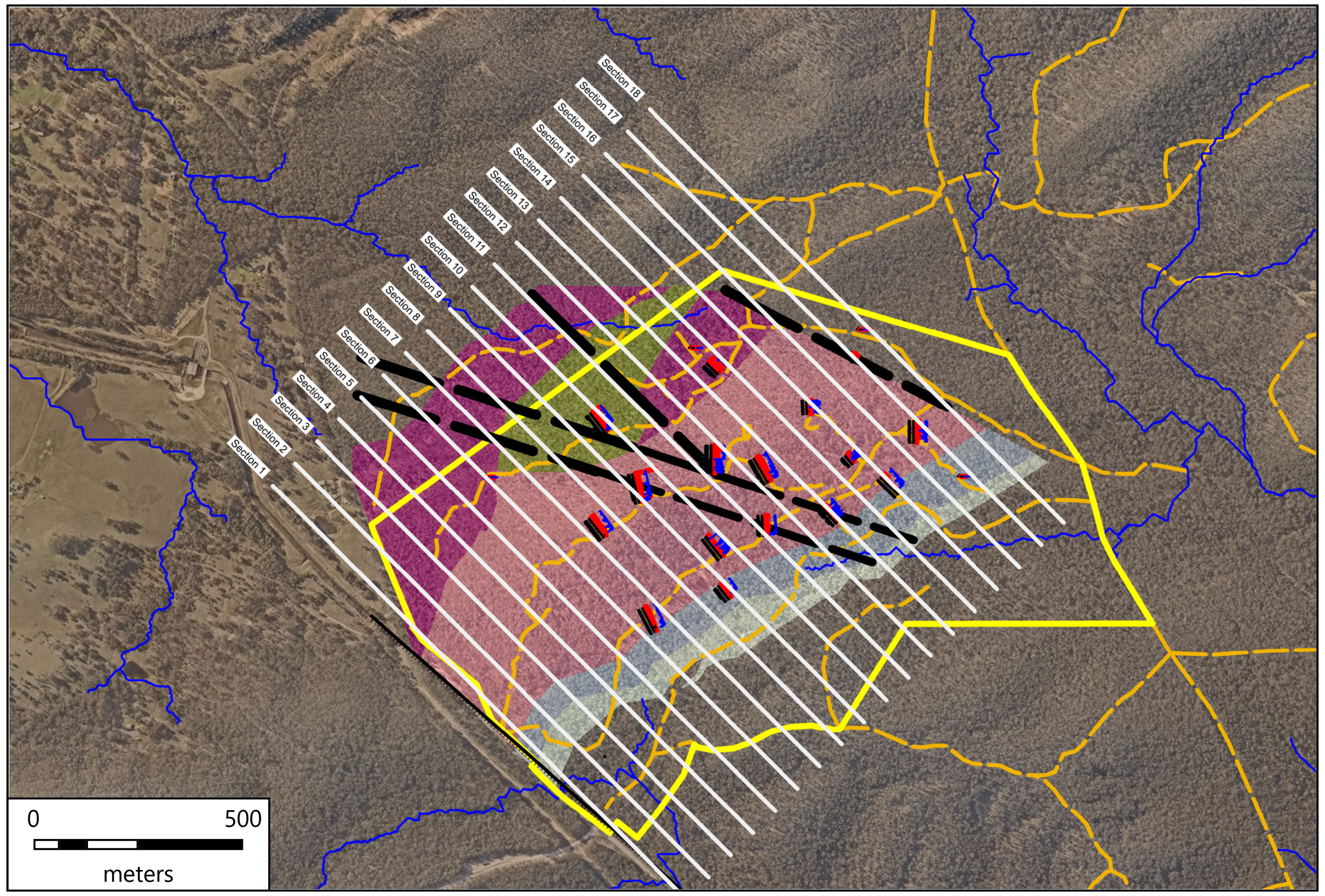
Project:	**STONE RIDGE QUARRY PROJECT**						**Figure 14h**
Title:	**Cross Section 8 - 4561N (+/- 37.5m) with Interpreted Geology**						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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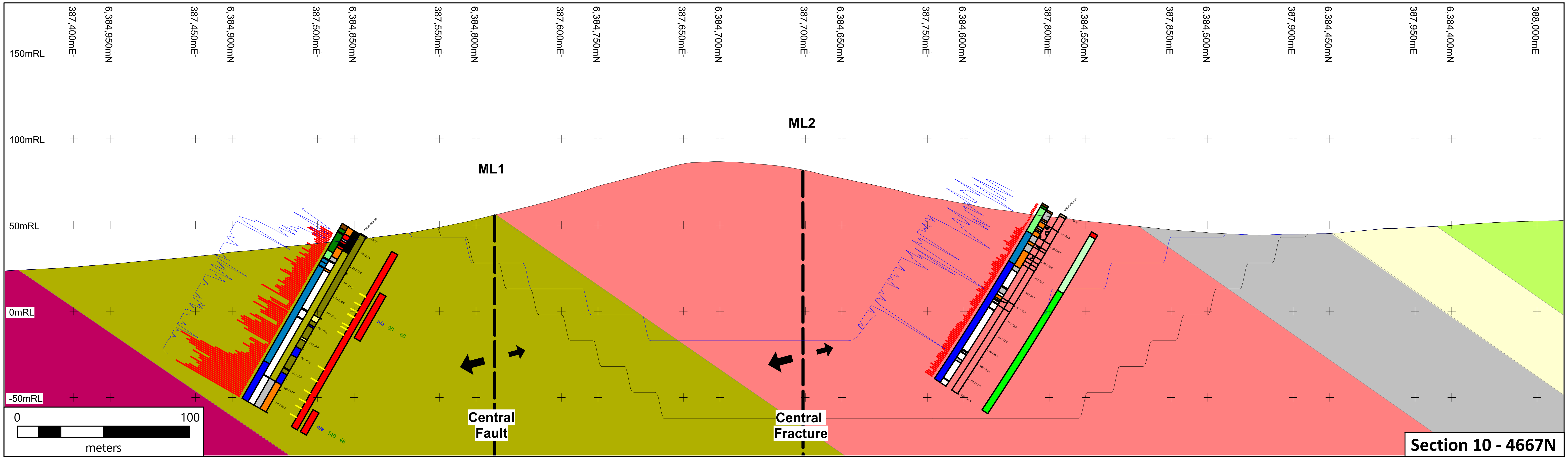
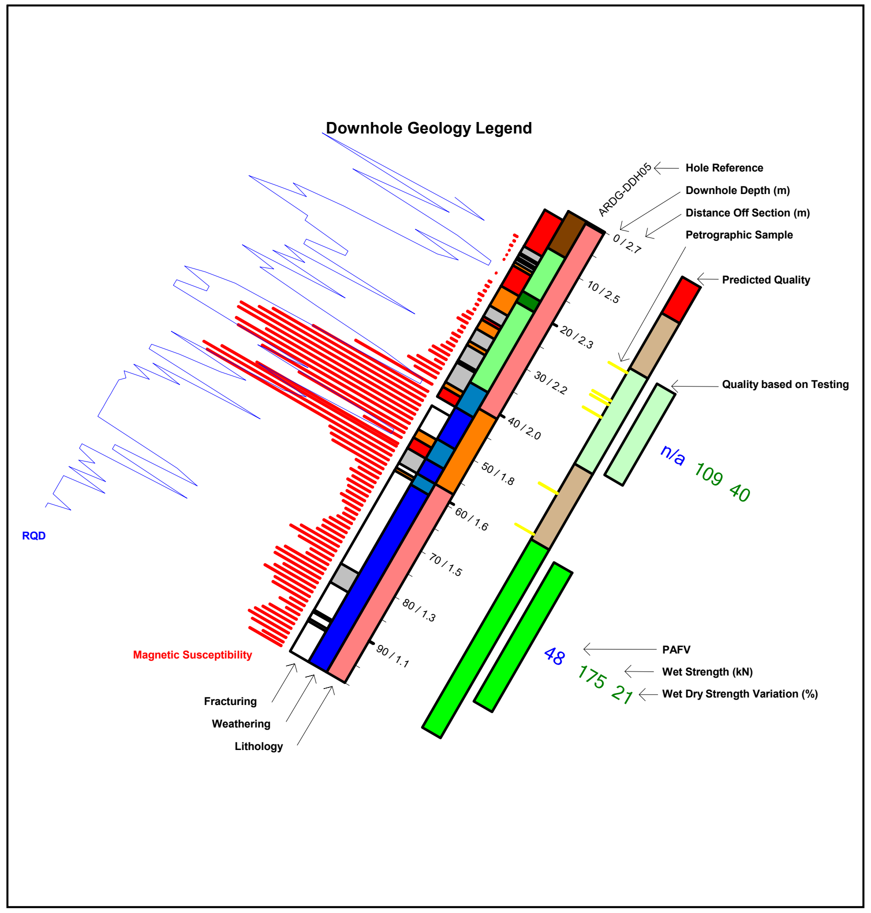
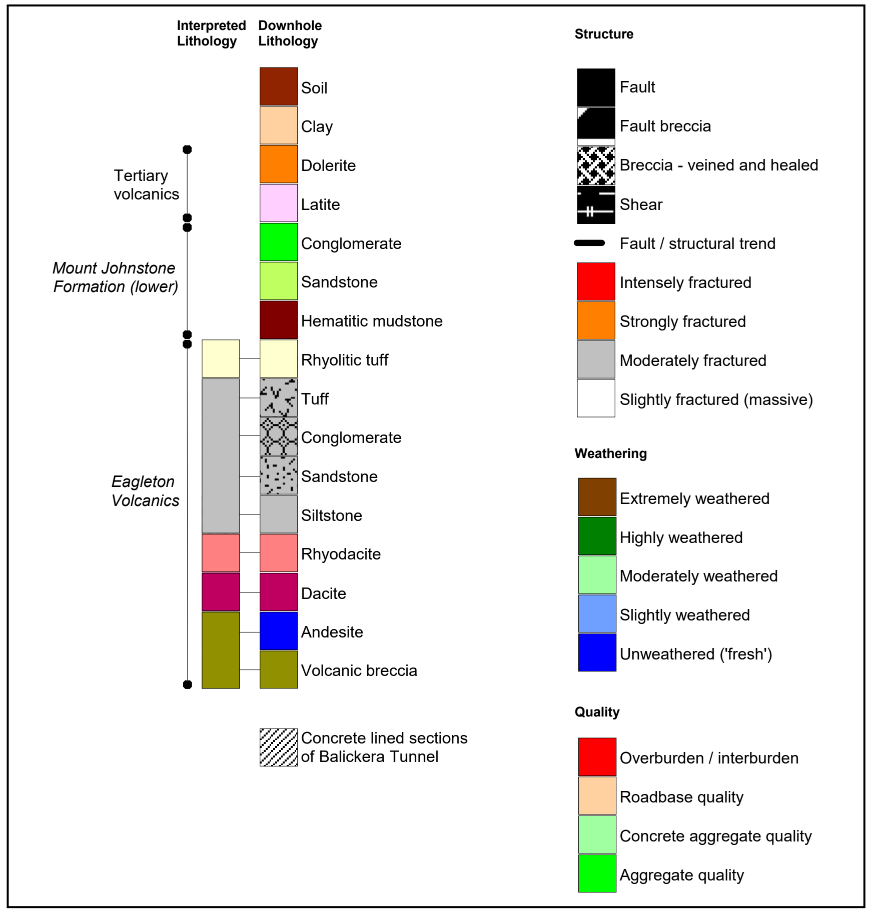
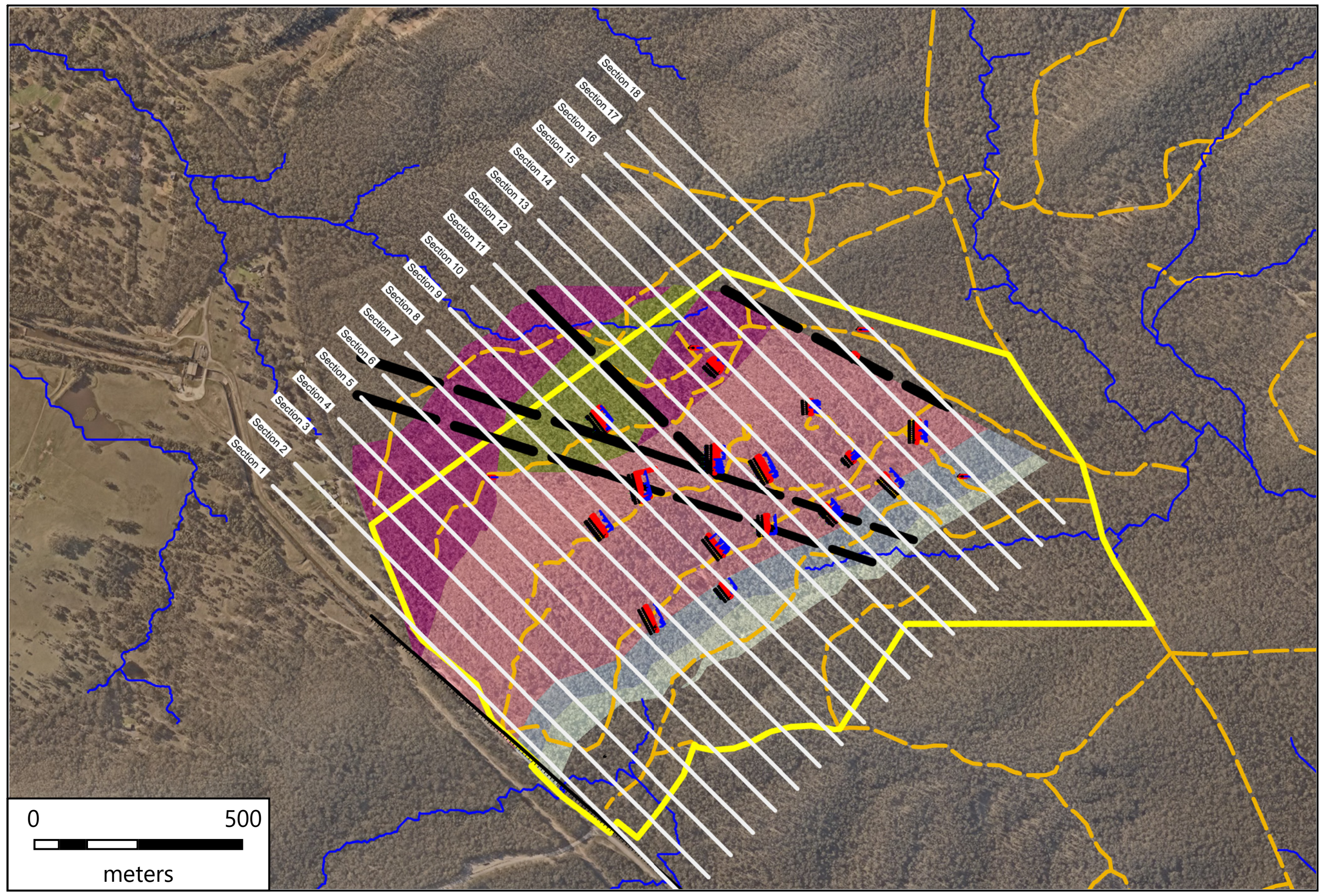
Project:	STONE RIDGE QUARRY PROJECT						Figure 14i
Title:	Cross Section 9 - 4614N (+/- 37.5m) with Interpreted Geology						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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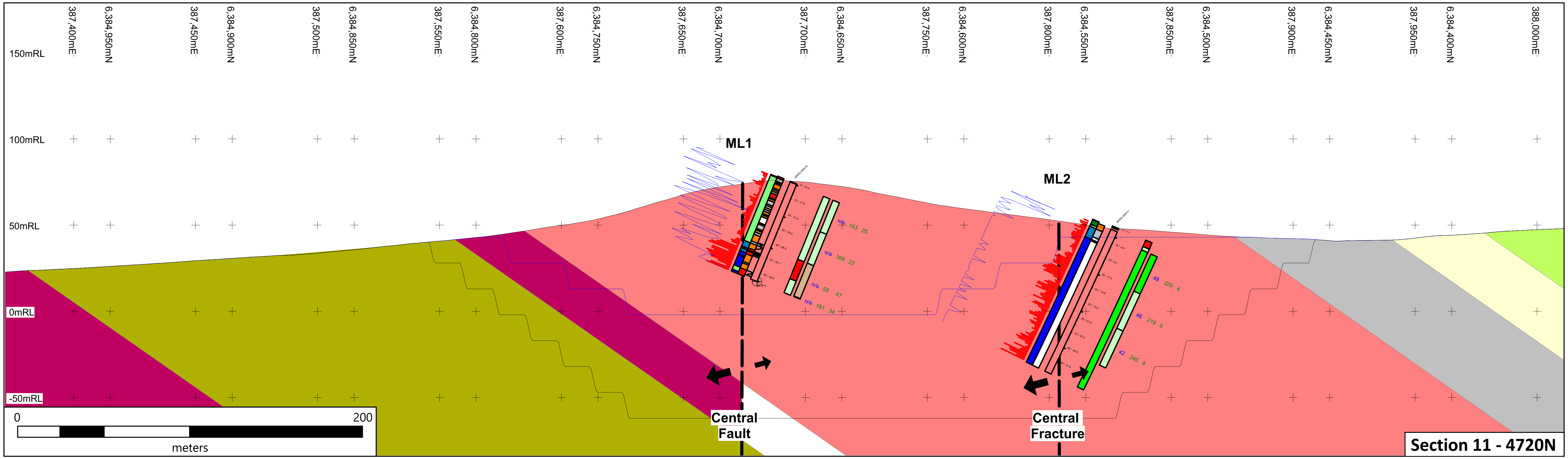
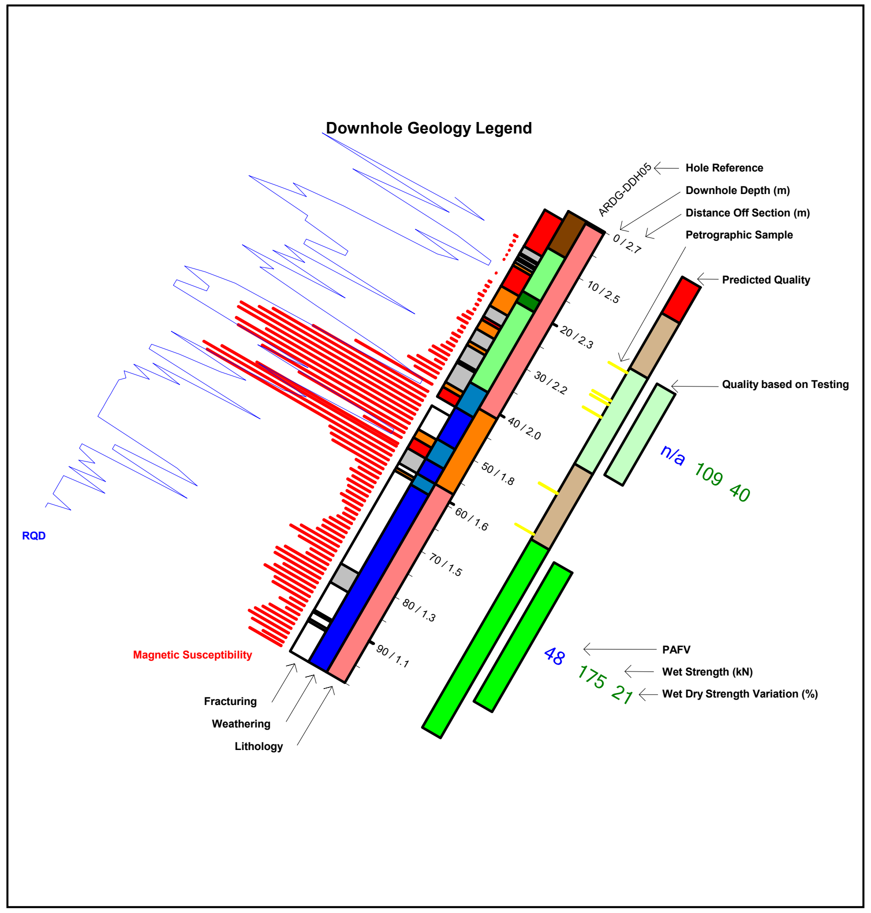
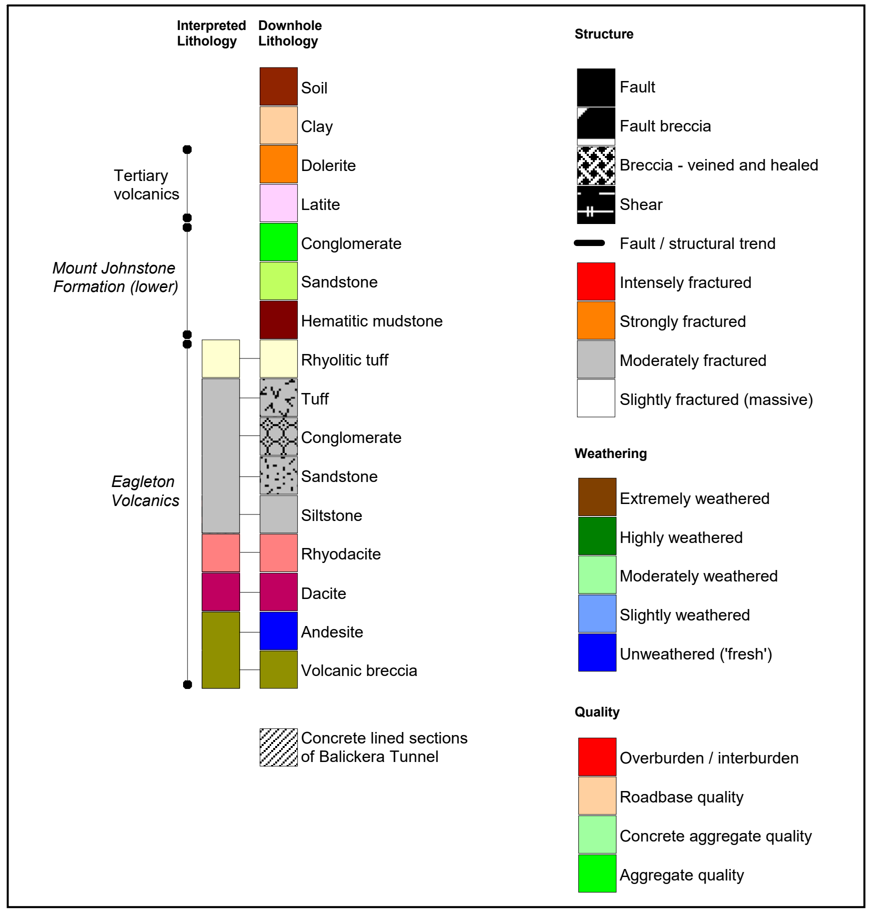
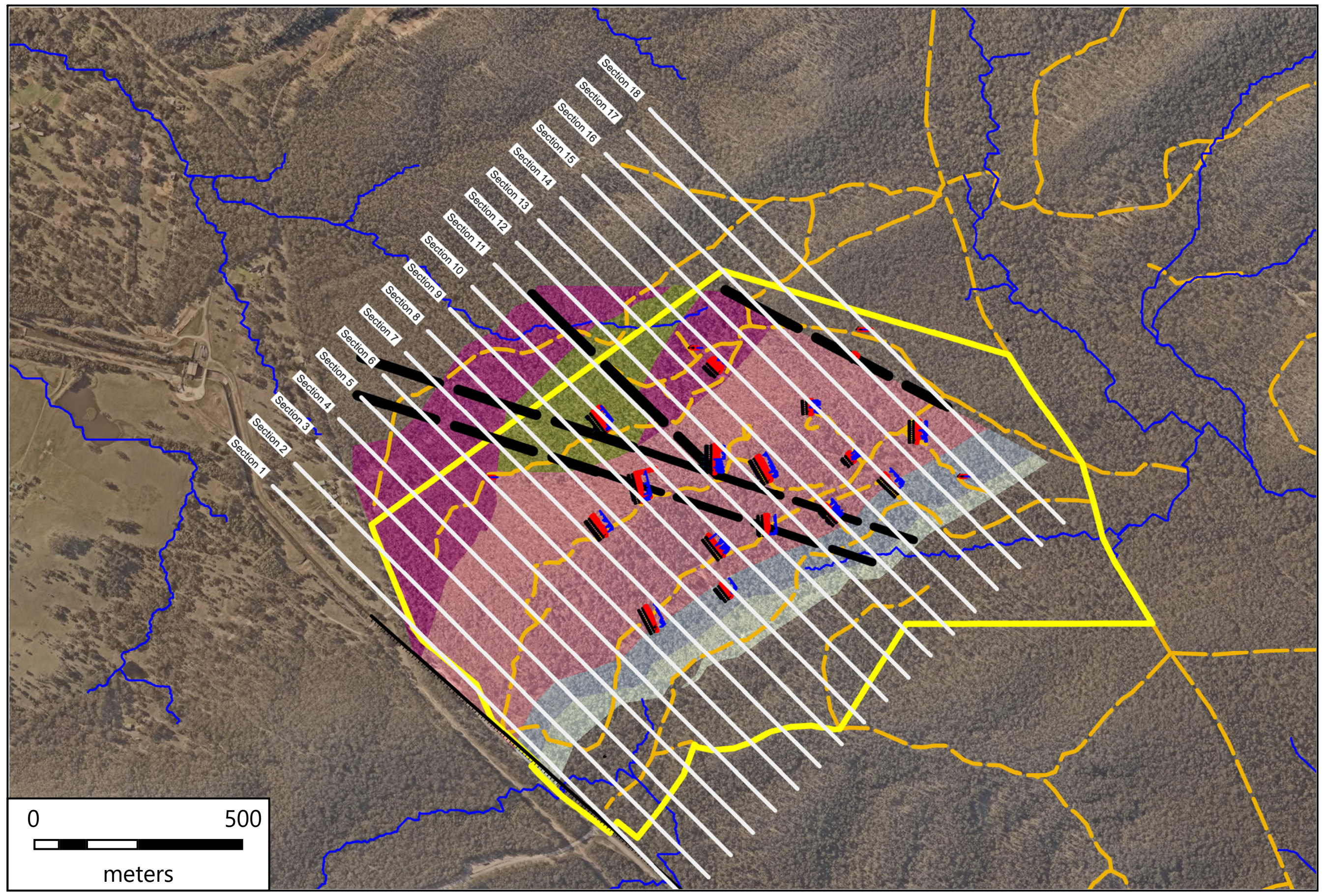
Project:	**STONE RIDGE QUARRY PROJECT**						**Figure 14j**
Title:	**Cross Section 10 - 4667N (+/- 37.5m) with Interpreted Geology**						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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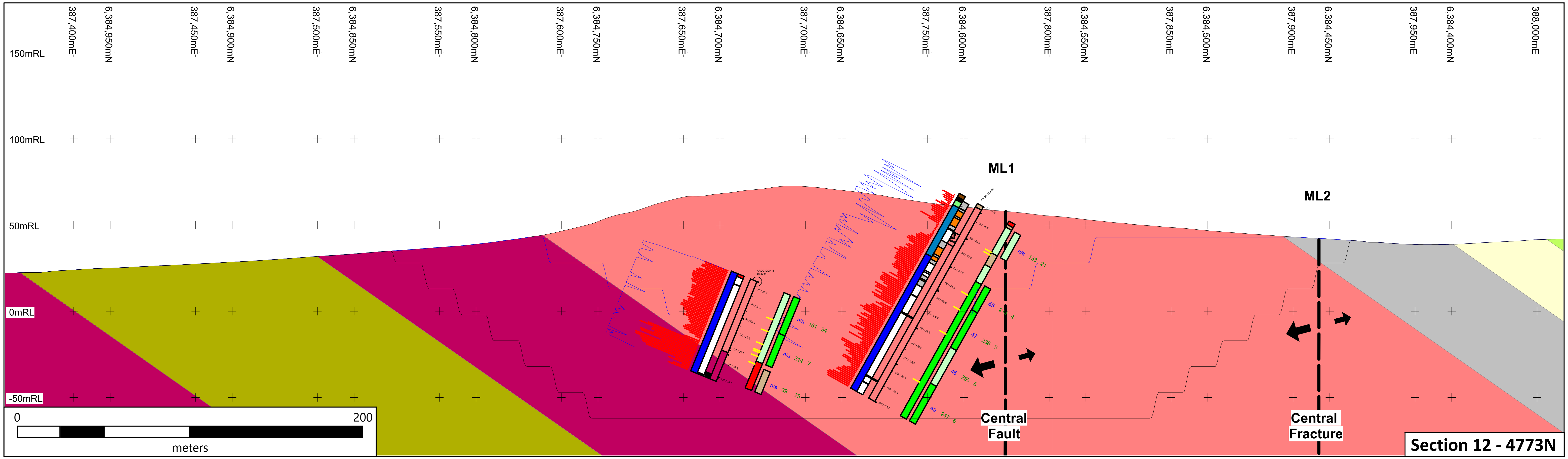
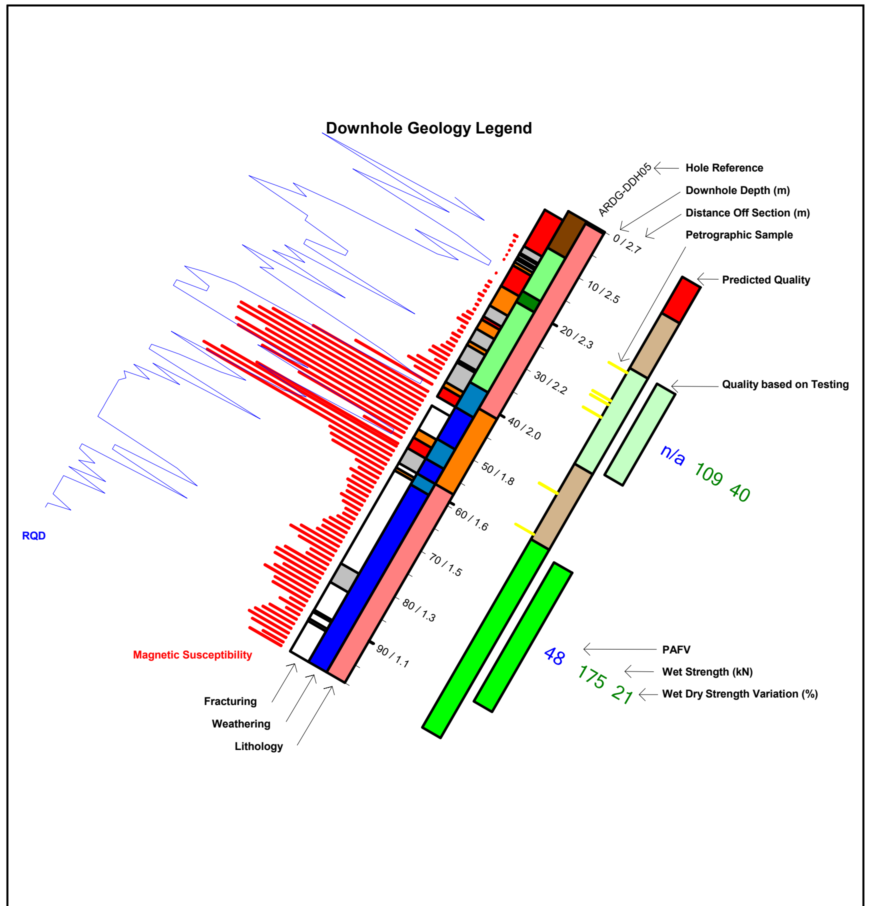
Project:	STONE RIDGE QUARRY PROJECT						Figure 14k
Title:	Cross Section 11 - 4720N (+/- 37.5m) with Interpreted Geology						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						



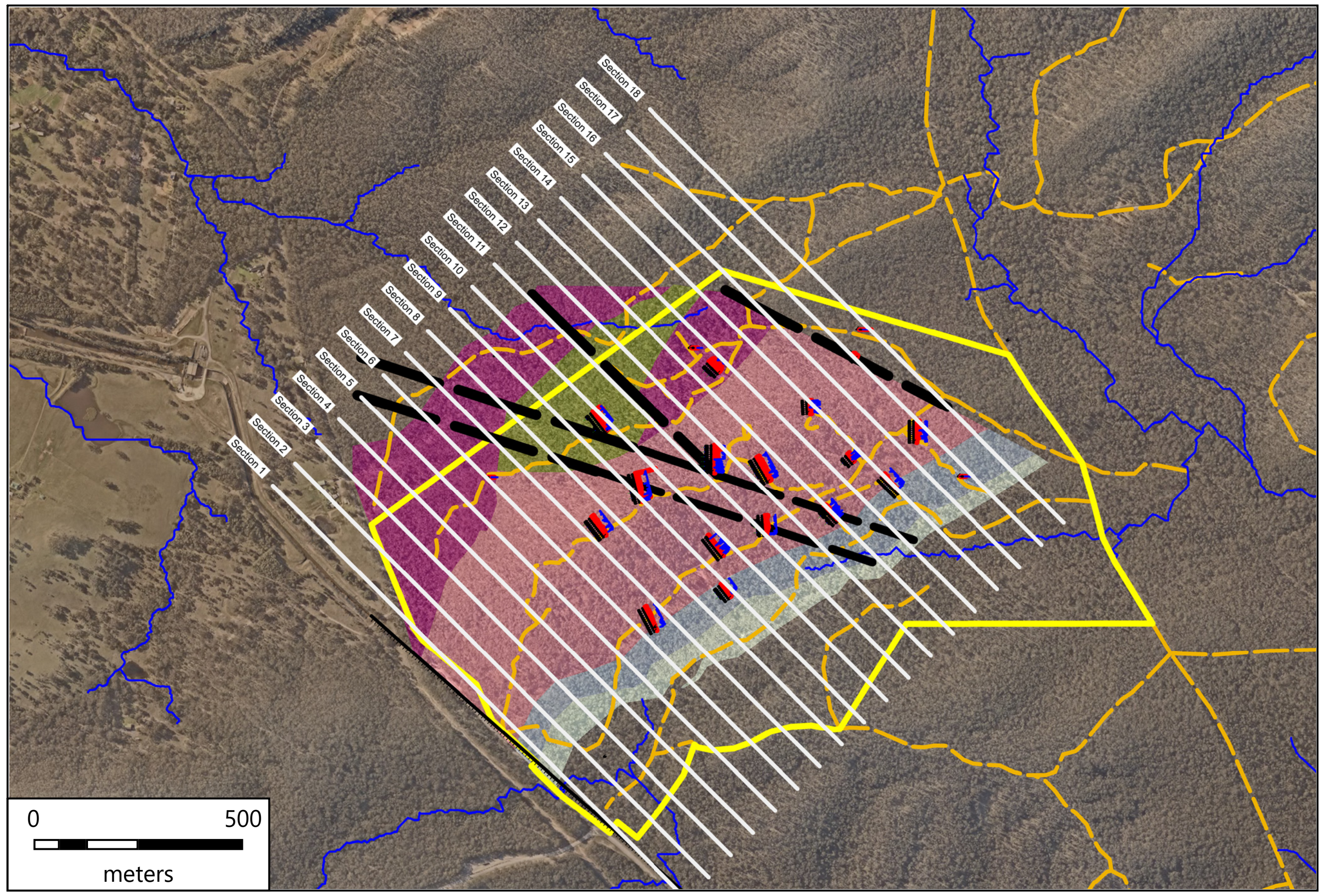


Interpreted Lithology	Downhole Lithology
	Soil
	Clay
	Dolerite
Tertiary volcanics	Latite
Mount Johnstone Formation (lower)	Conglomerate
	Sandstone
	Hematitic mudstone
Eagleton Volcanics	Rhyolitic tuff
	Tuff
	Conglomerate
	Sandstone
	Siltstone
	Rhyodacite
	Dacite
	Andesite
	Volcanic breccia
	Concrete lined sections of Balickera Tunnel

Structure
- Fault
- Fault breccia
- Breccia - veined and healed
- Shear
- Fault / structural trend
- Intensely fractured
- Strongly fractured
- Moderately fractured
- Slightly fractured (massive)

Weathering
- Extremely weathered
- Highly weathered
- Moderately weathered
- Slightly weathered
- Unweathered ('fresh')

Quality
- Overburden / interburden
- Roadbase quality
- Concrete aggregate quality
- Aggregate quality



Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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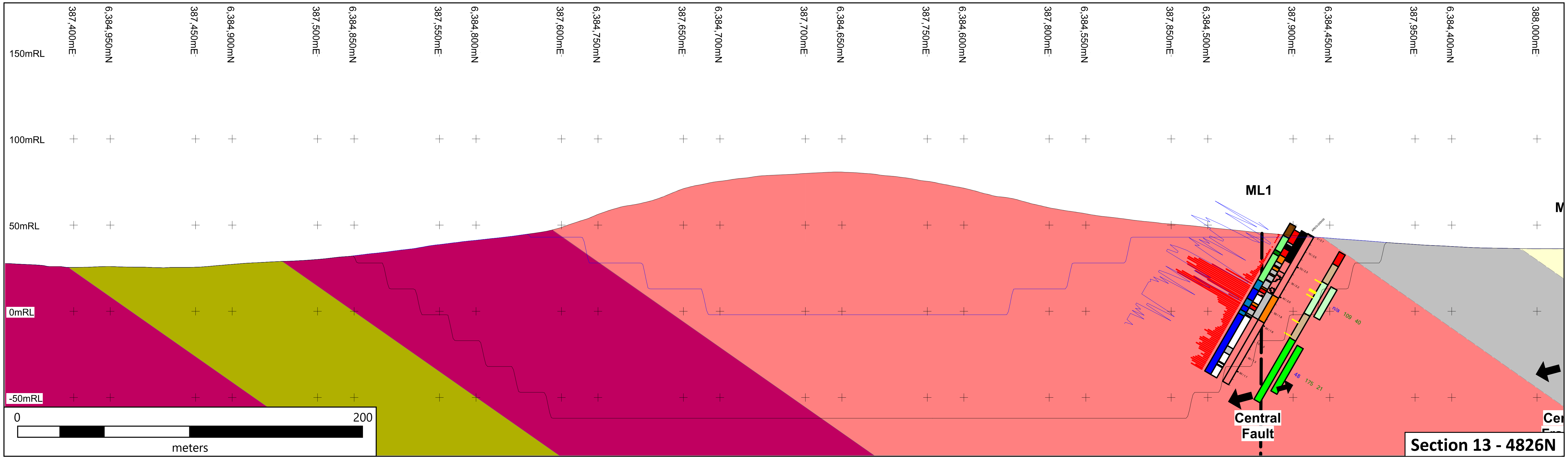
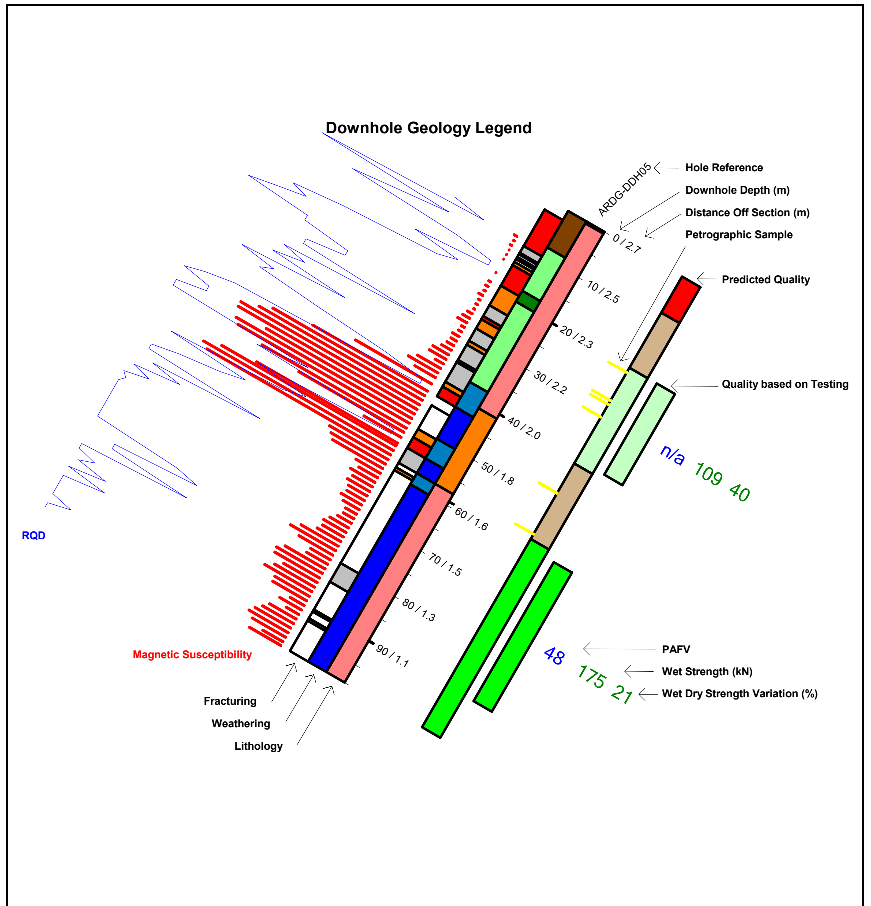
Project: **STONE RIDGE QUARRY PROJECT** — **Figure 14l**

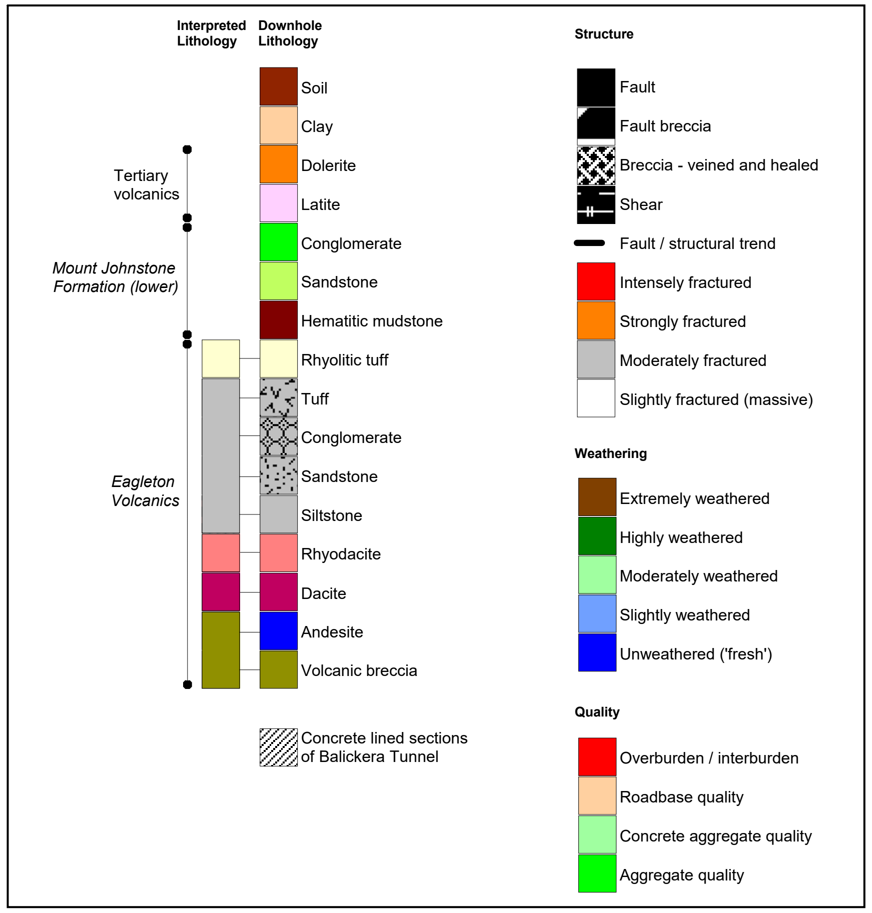
Title: **Cross Section 12 - 4773N (+/- 37.5m) with Interpreted Geology**

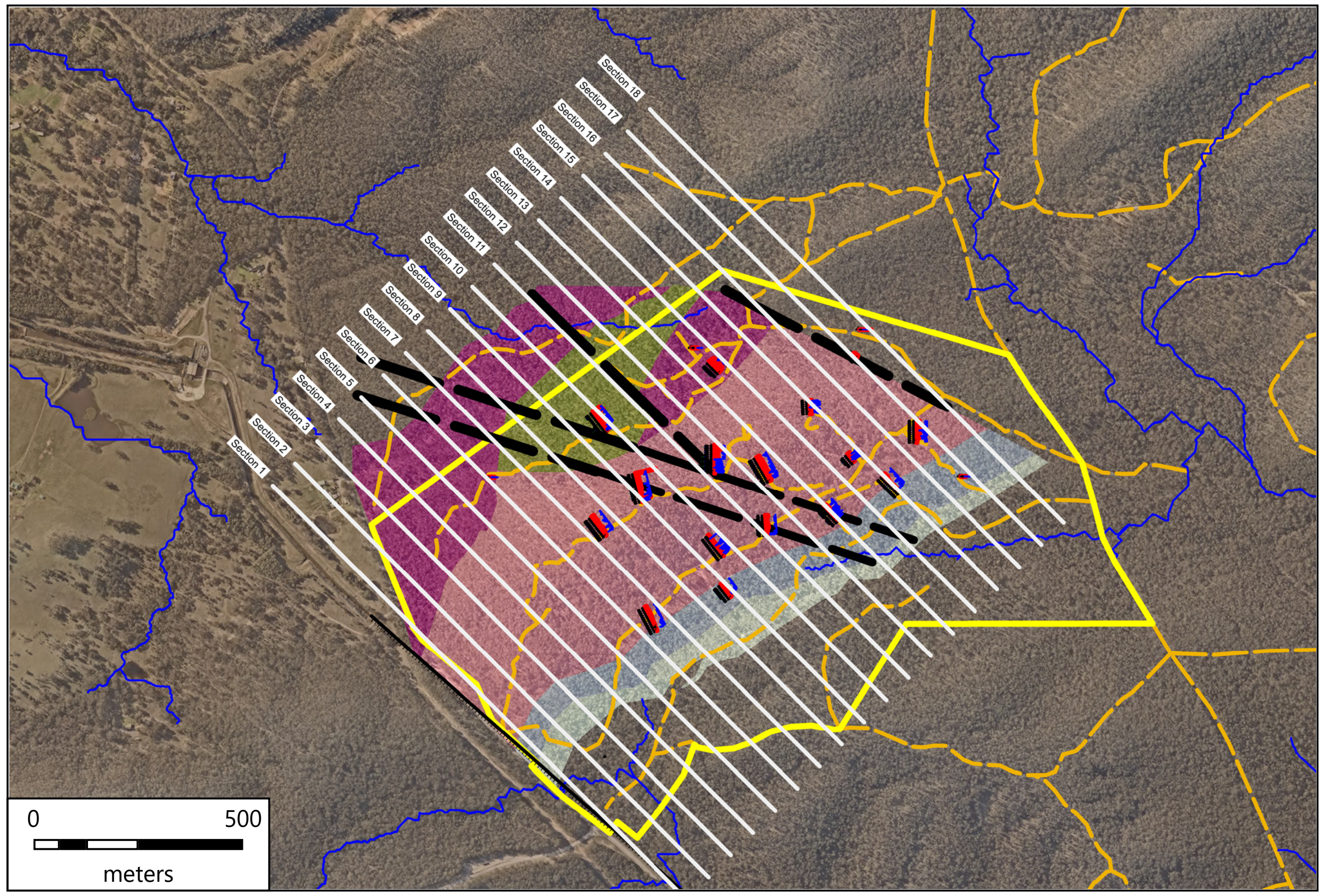
Author: DMB | Date: December 2019 | Scale: 1:2200 @ A3 | Grid: MGA Zone 56 (GDA94)

Source: Diamond Drilling: Blacklaws Drilling - 2018-2019
Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates)
Geological Interpretation: Damon Bird (ARDG)









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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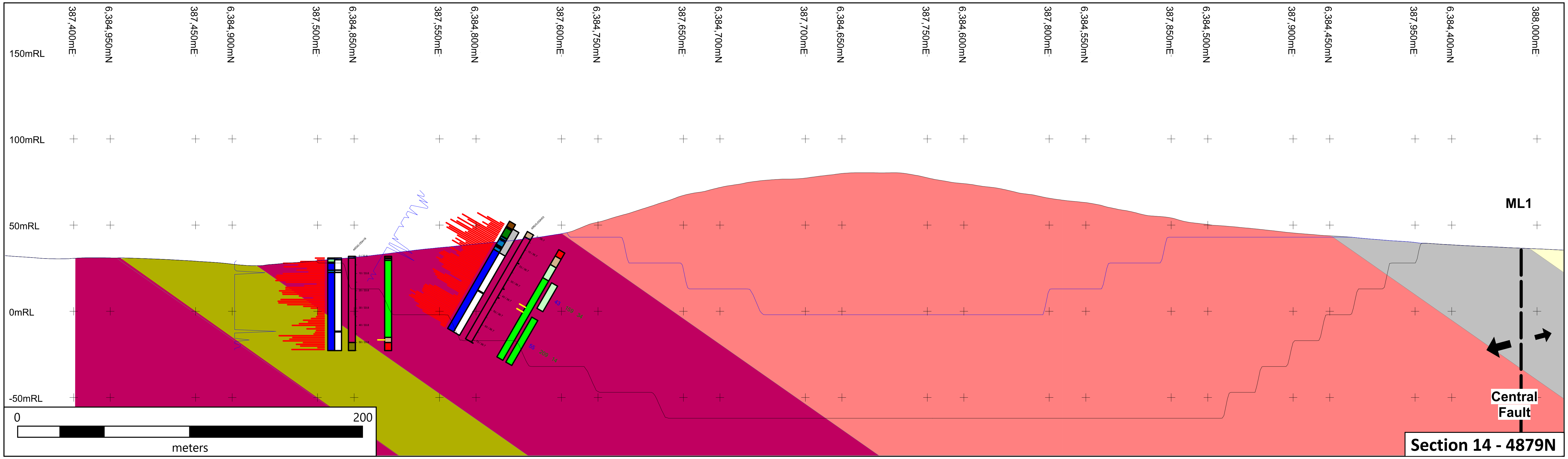
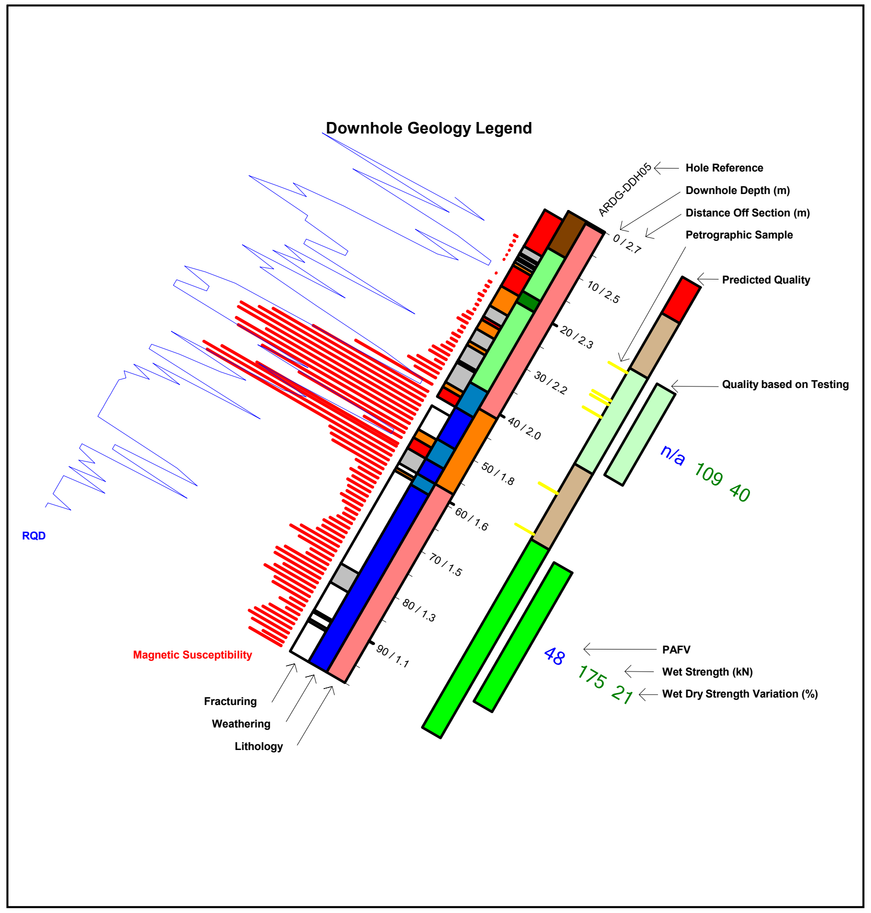
Project:	STONE RIDGE QUARRY PROJECT						Figure 14m
Title:	Cross Section 13 - 4826N (+/- 37.5m) with Interpreted Geology						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						





Interpreted Lithology	Downhole Lithology
Tertiary volcanics	Soil
	Clay
	Dolerite
	Latite
Mount Johnstone Formation (lower)	Conglomerate
	Sandstone
	Hematitic mudstone
Eagleton Volcanics	Rhyolitic tuff
	Tuff
	Conglomerate
	Sandstone
	Siltstone
	Rhyodacite
	Dacite
	Andesite
	Volcanic breccia

Concrete lined sections of Balickera Tunnel

Structure

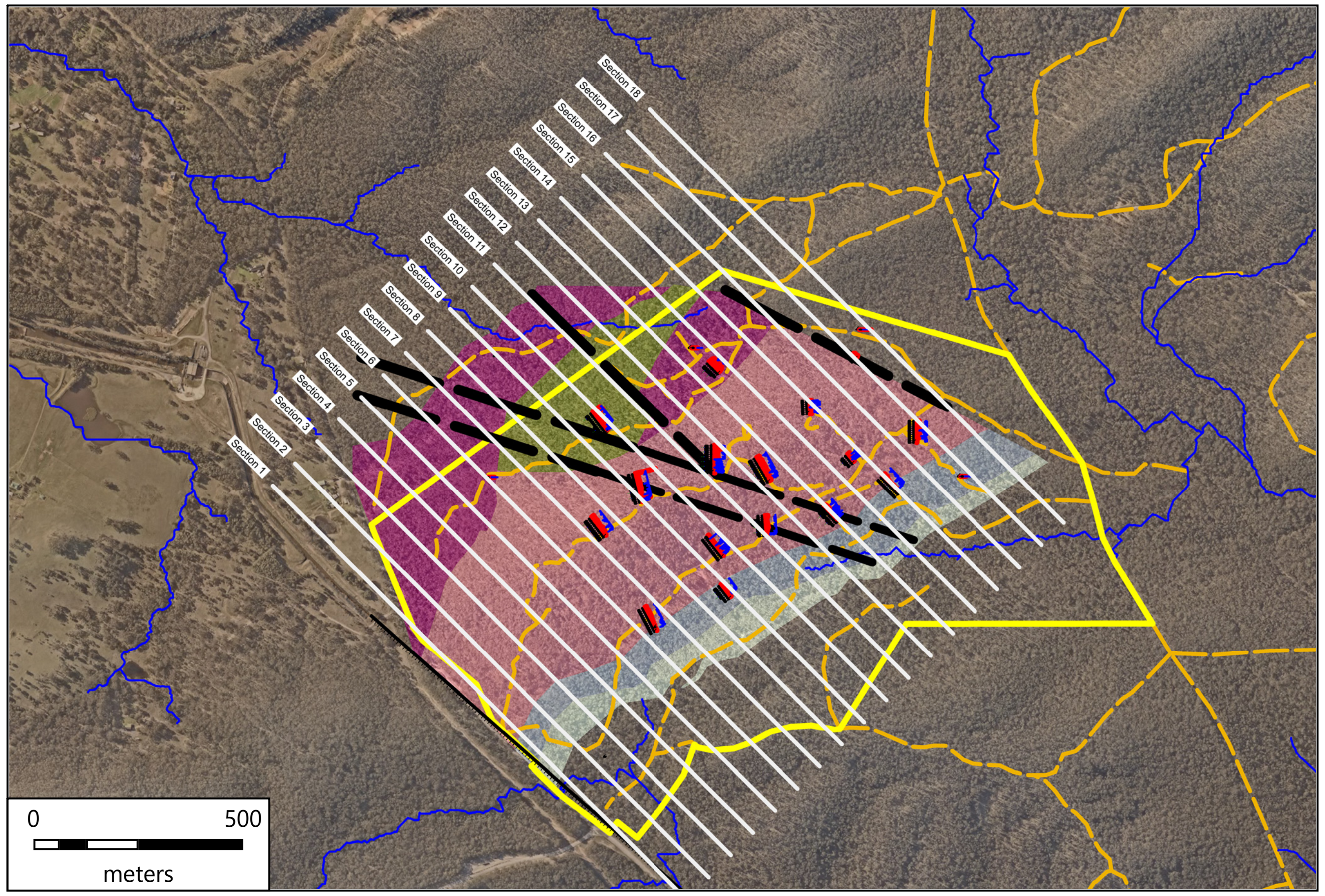
- Fault
- Fault breccia
- Breccia - veined and healed
- Shear
- Fault / structural trend
- Intensely fractured
- Strongly fractured
- Moderately fractured
- Slightly fractured (massive)

Weathering

- Extremely weathered
- Highly weathered
- Moderately weathered
- Slightly weathered
- Unweathered ('fresh')

Quality

- Overburden / interburden
- Roadbase quality
- Concrete aggregate quality
- Aggregate quality



Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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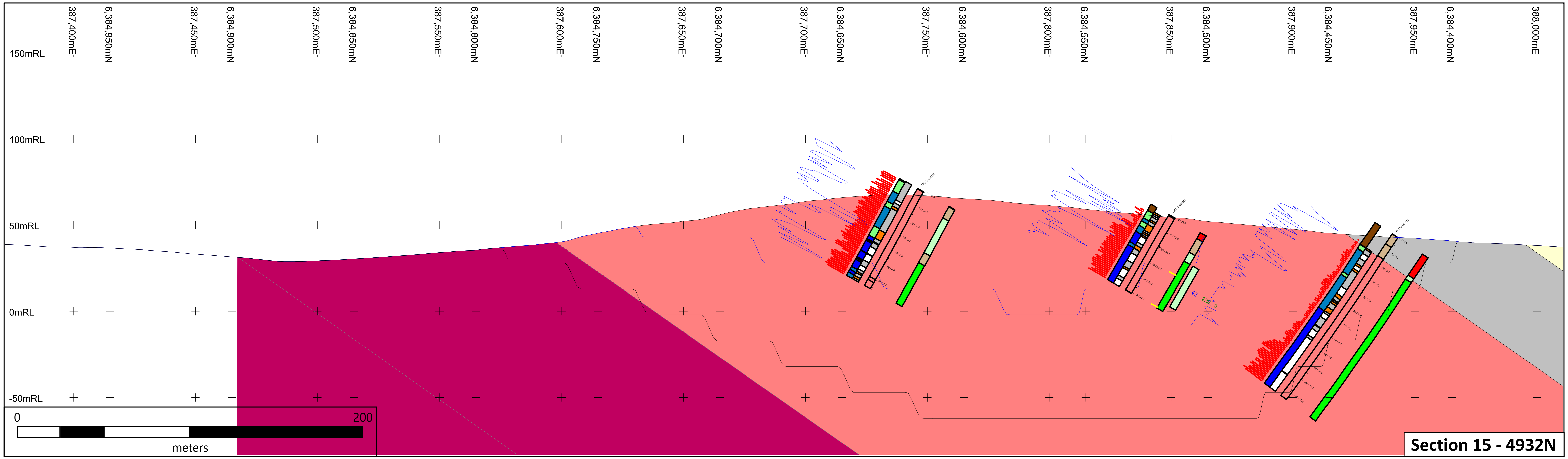
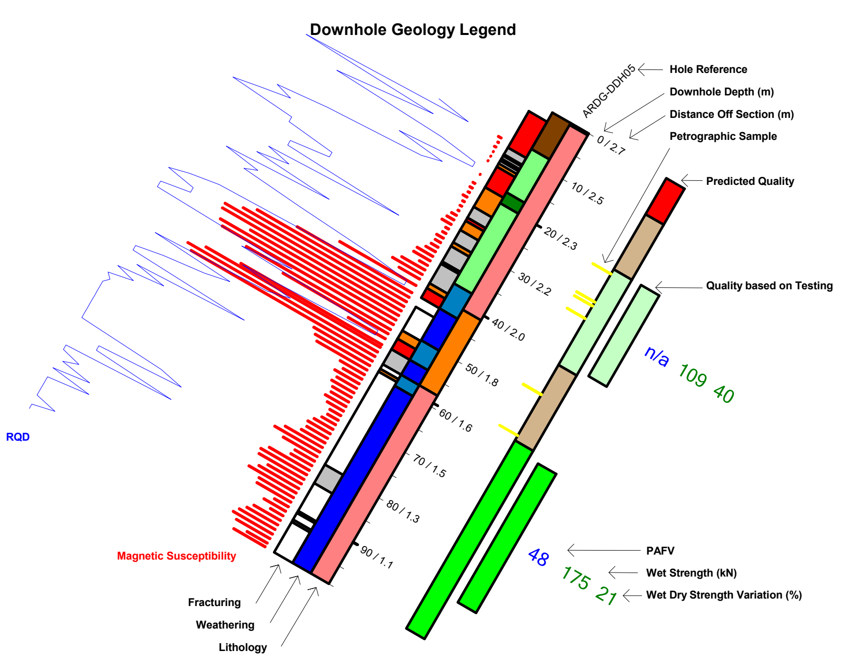
Project:	**STONE RIDGE QUARRY PROJECT**						**Figure 14n**
Title:	**Cross Section 14 - 4879N (+/- 37.5m) with Interpreted Geology**						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						



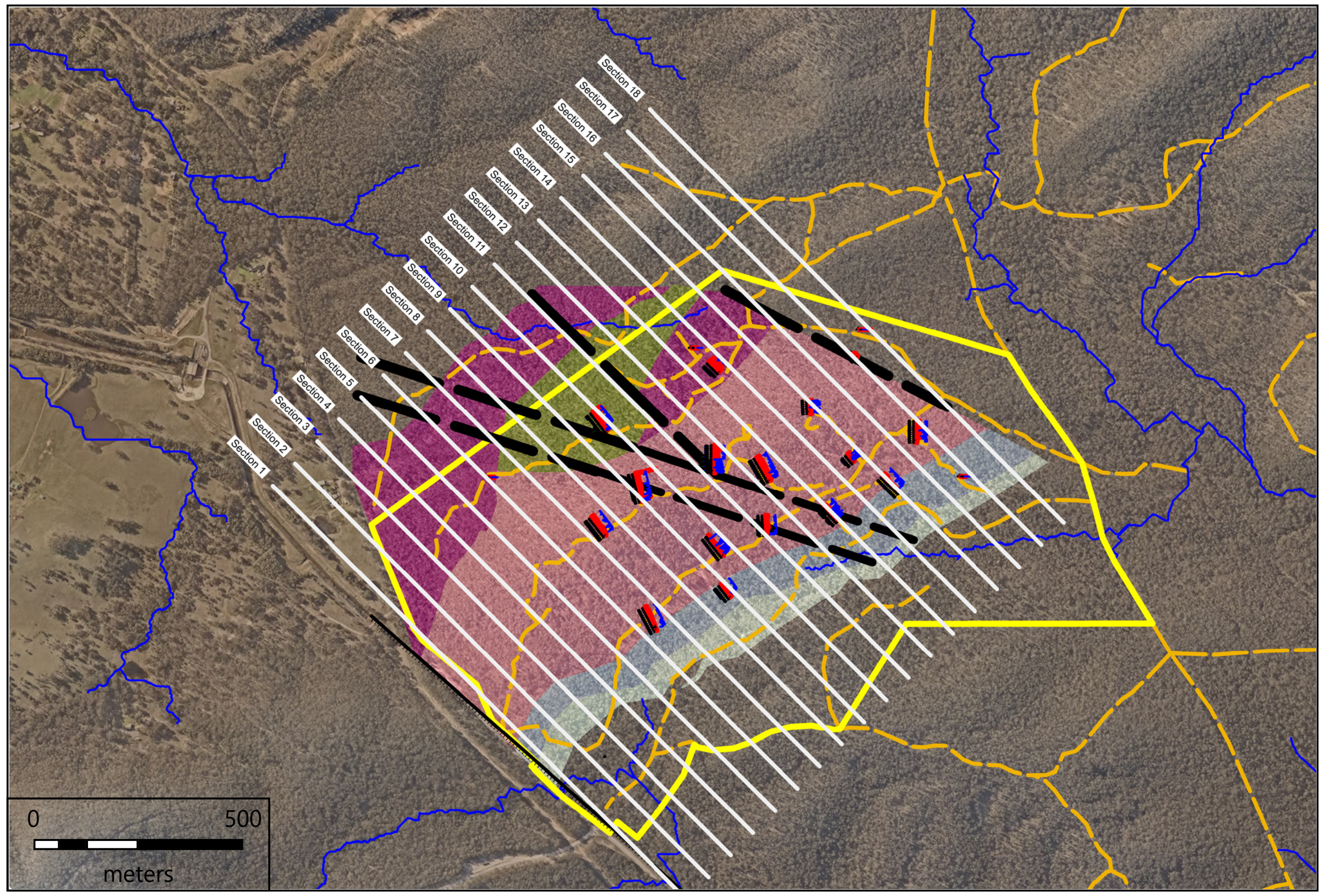


Interpreted Lithology	Downhole Lithology
Tertiary volcanics	Soil
	Clay
	Dolerite
	Latite
Mount Johnstone Formation (lower)	Conglomerate
	Sandstone
	Hematitic mudstone
Eagleton Volcanics	Rhyolitic tuff
	Tuff
	Conglomerate
	Sandstone
	Siltstone
	Rhyodacite
	Dacite
	Andesite
	Volcanic breccia
	Concrete lined sections of Balickera Tunnel

Structure
- Fault
- Fault breccia
- Breccia - veined and healed
- Shear
- Fault / structural trend
- Intensely fractured
- Strongly fractured
- Moderately fractured
- Slightly fractured (massive)

Weathering
- Extremely weathered
- Highly weathered
- Moderately weathered
- Slightly weathered
- Unweathered ('fresh')

Quality
- Overburden / interburden
- Roadbase quality
- Concrete aggregate quality
- Aggregate quality



Legend
- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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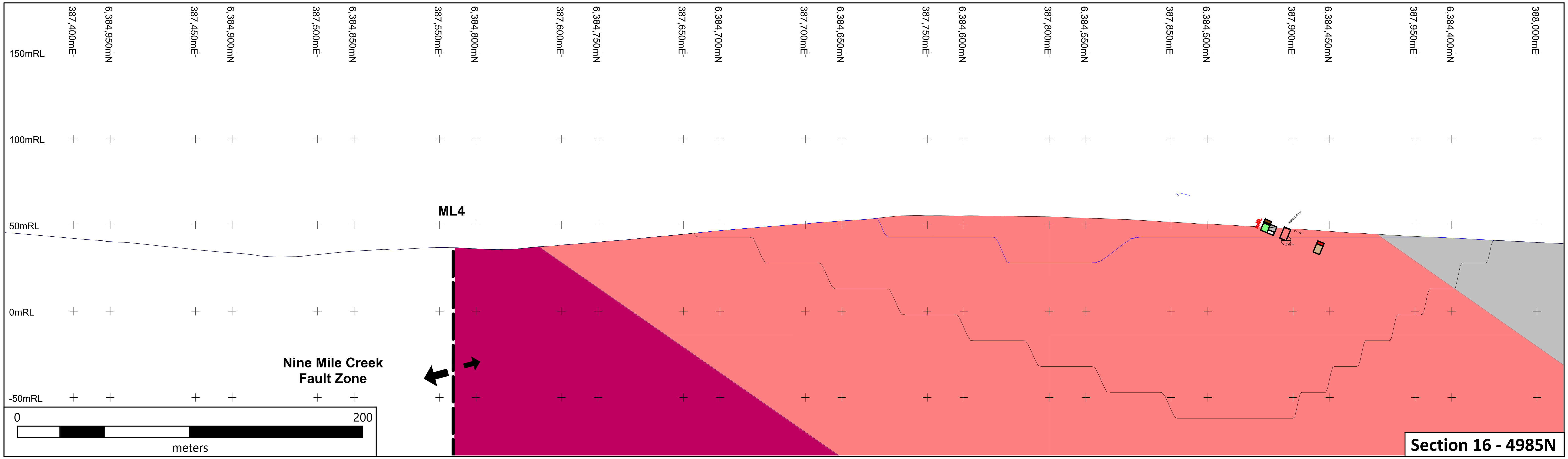
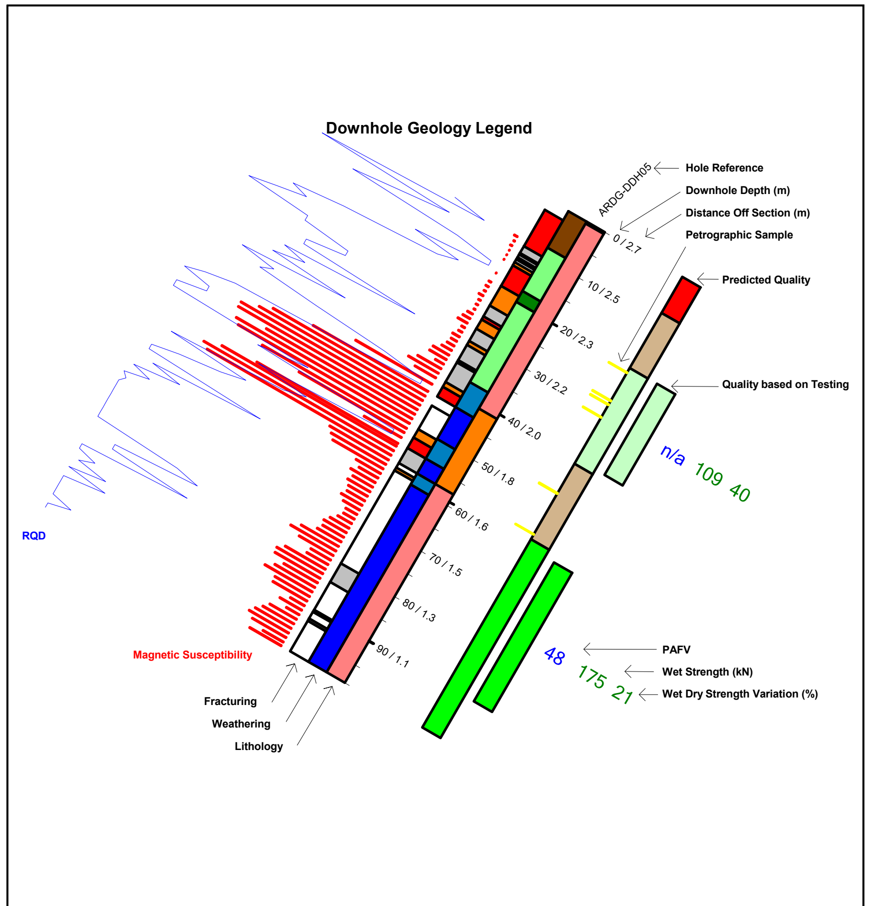
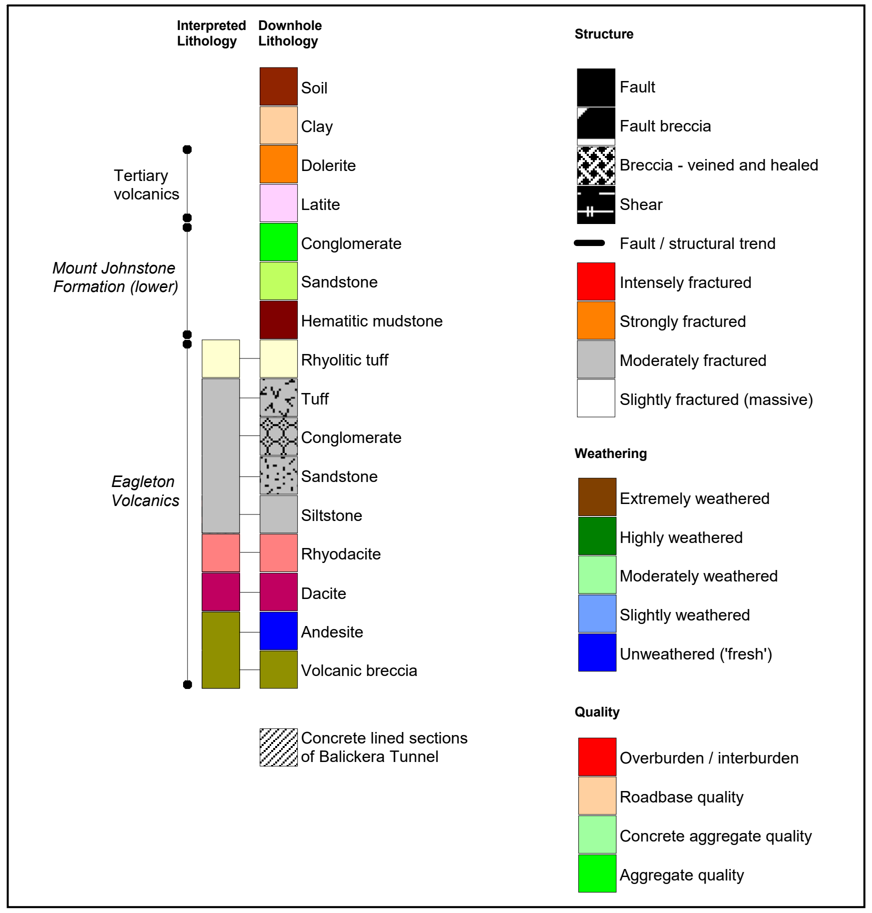
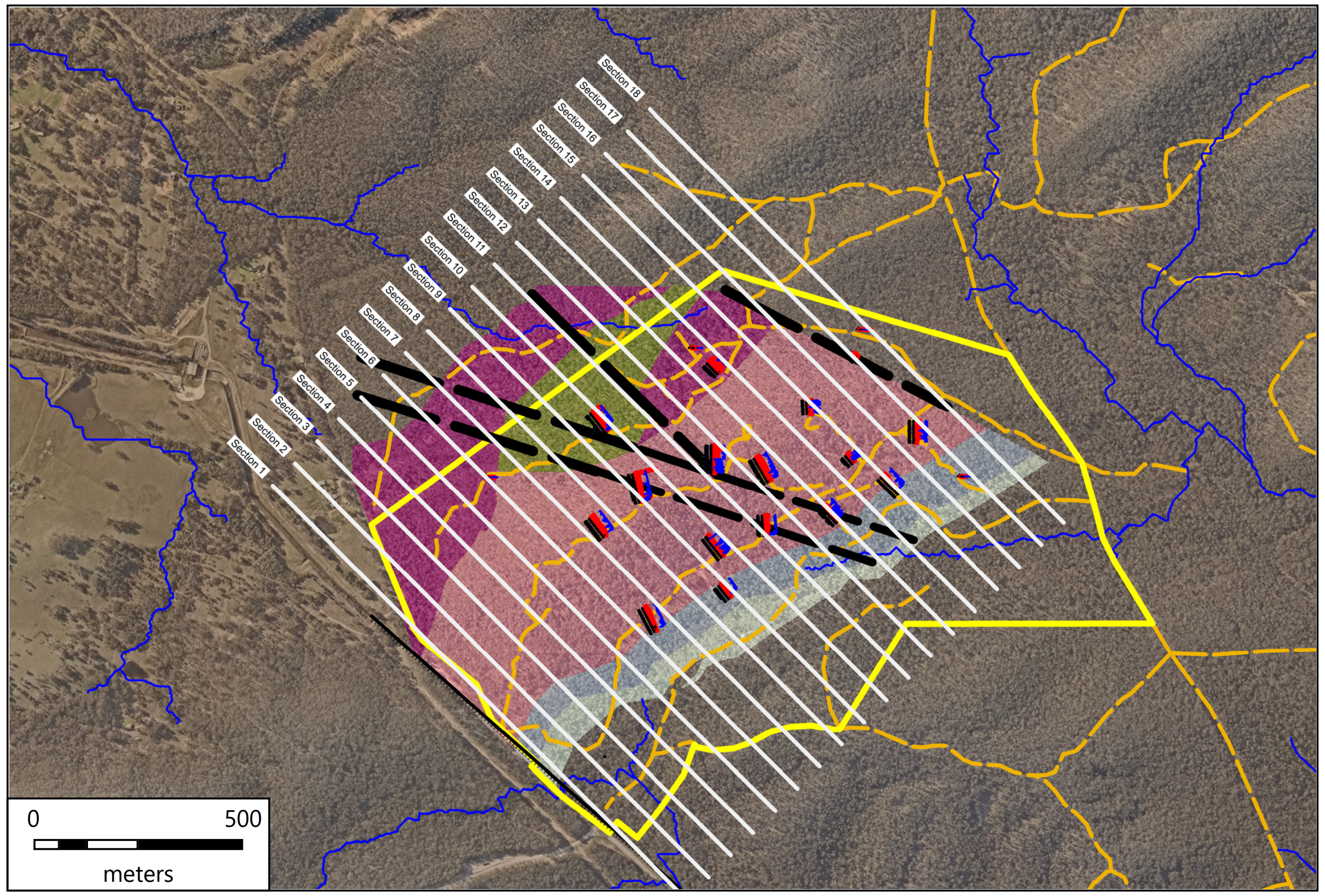
Project:	STONE RIDGE QUARRY PROJECT						Figure 14o
Title:	Cross Section 15 - 4932 (+/- 37.5m) with Interpreted Geology						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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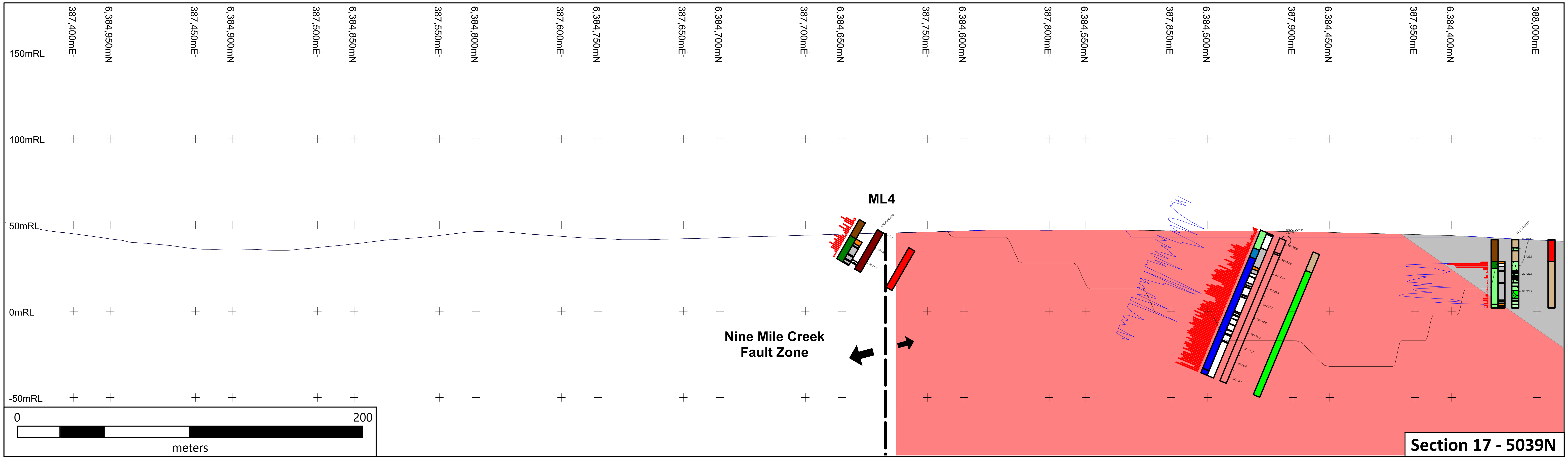
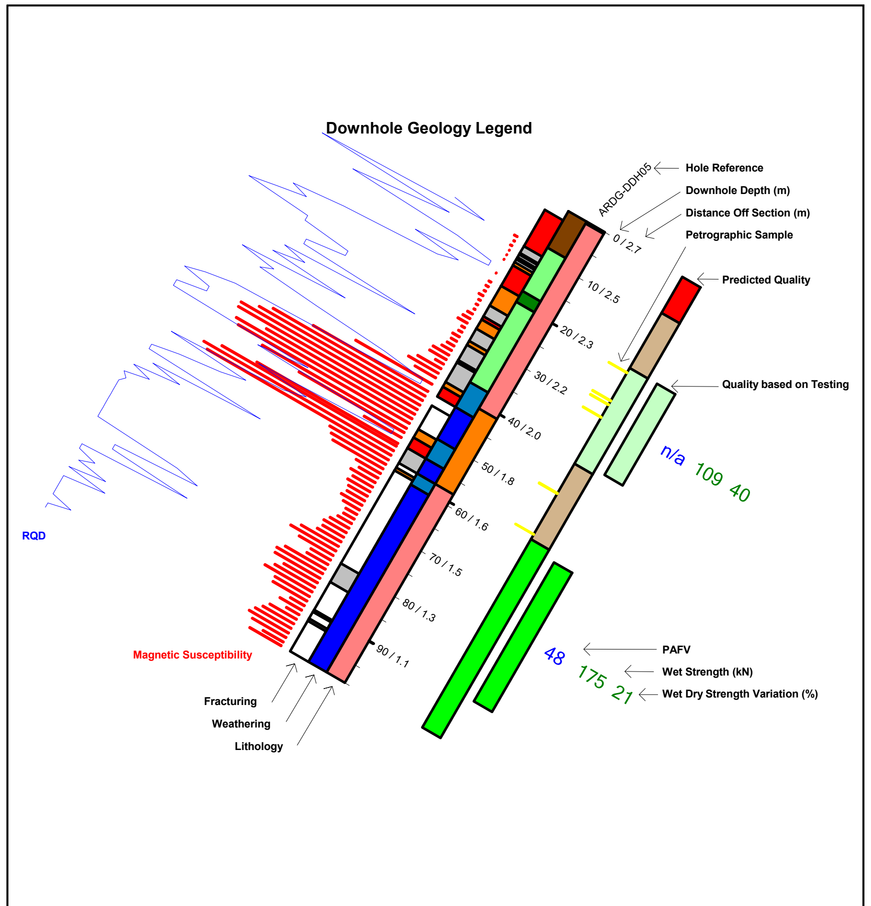
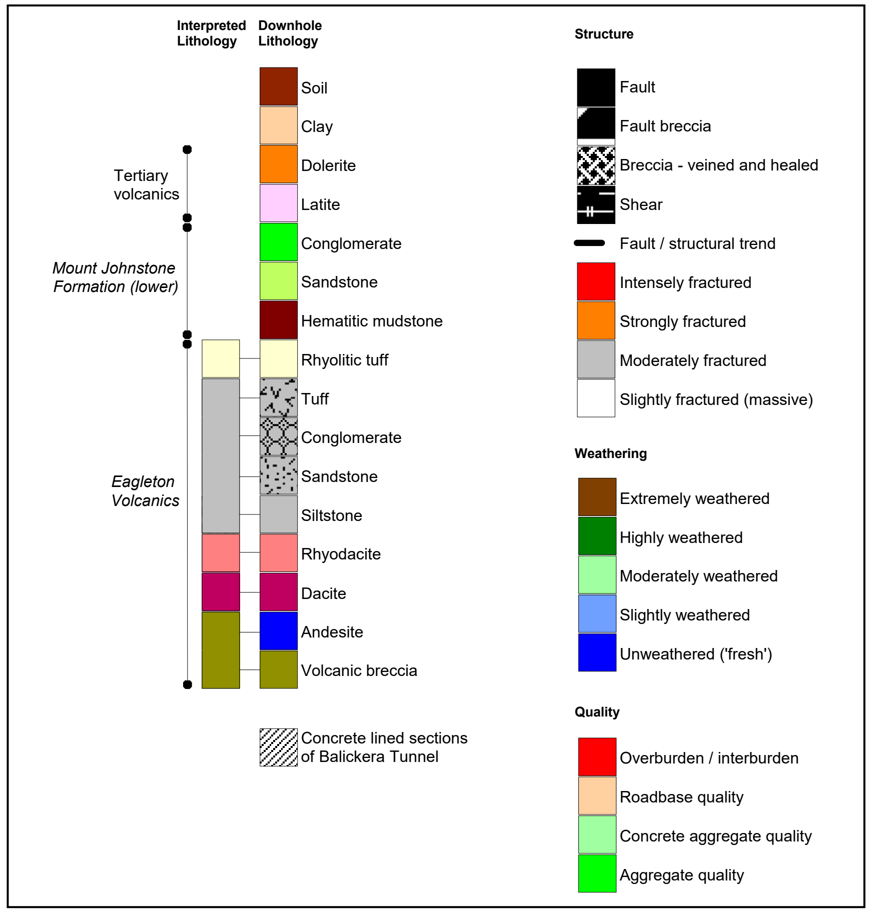
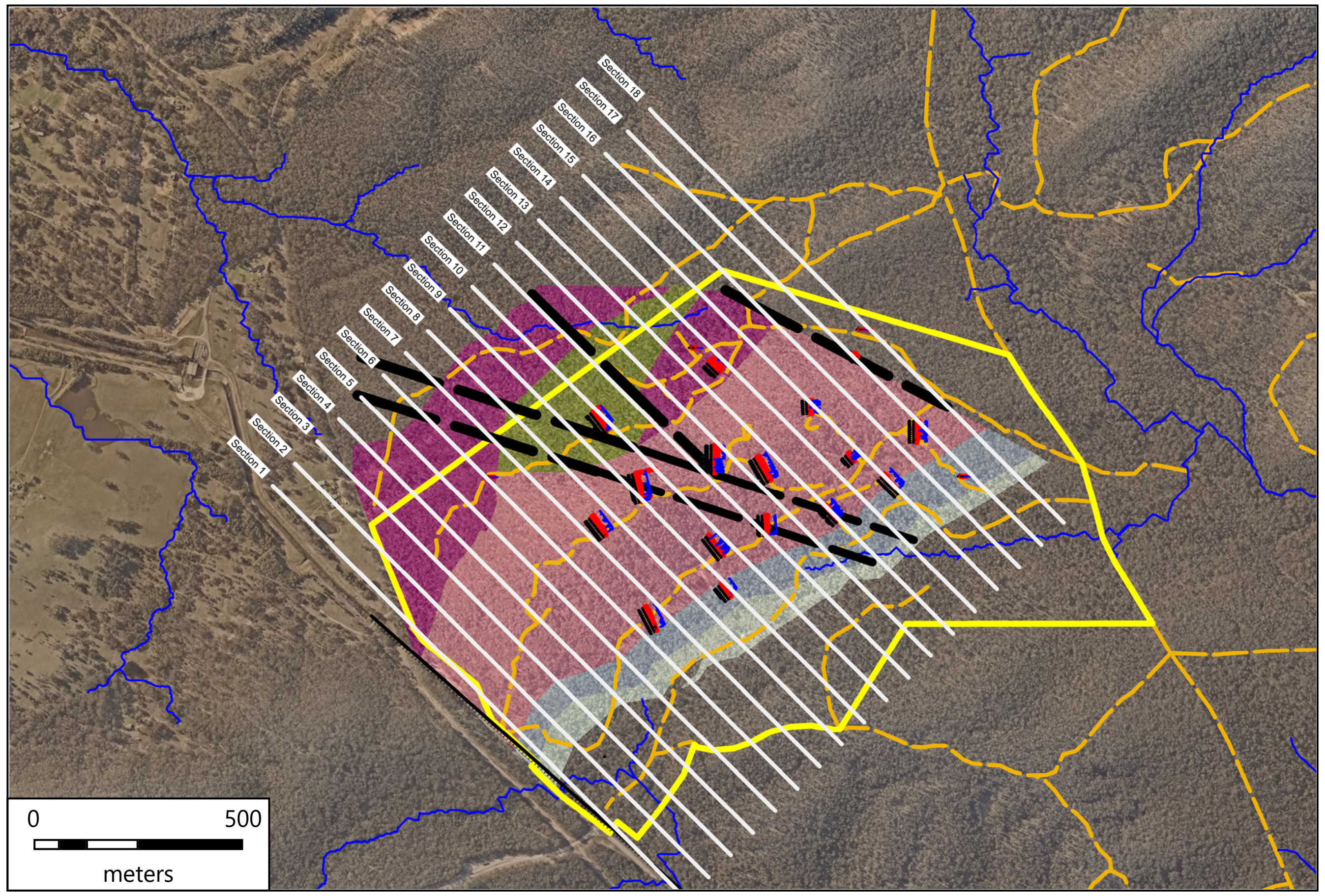
Project:	STONE RIDGE QUARRY PROJECT						Figure 14p
Title:	Cross Section 16 - 4985 (+/- 37.5m) with Interpreted Geology						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						









Legend

- Stone Ridge Project Area Boundary
- Forest tracks
- Drainage line (ephemeral)
- Diamond drillhole collar location
- Diamond drillhole collar location - hole converted to water monitoring bore
- Diamond drillhole path
- Conceptual Pit Design - 50Mt
- Conceptual Pit Design - 136Mt

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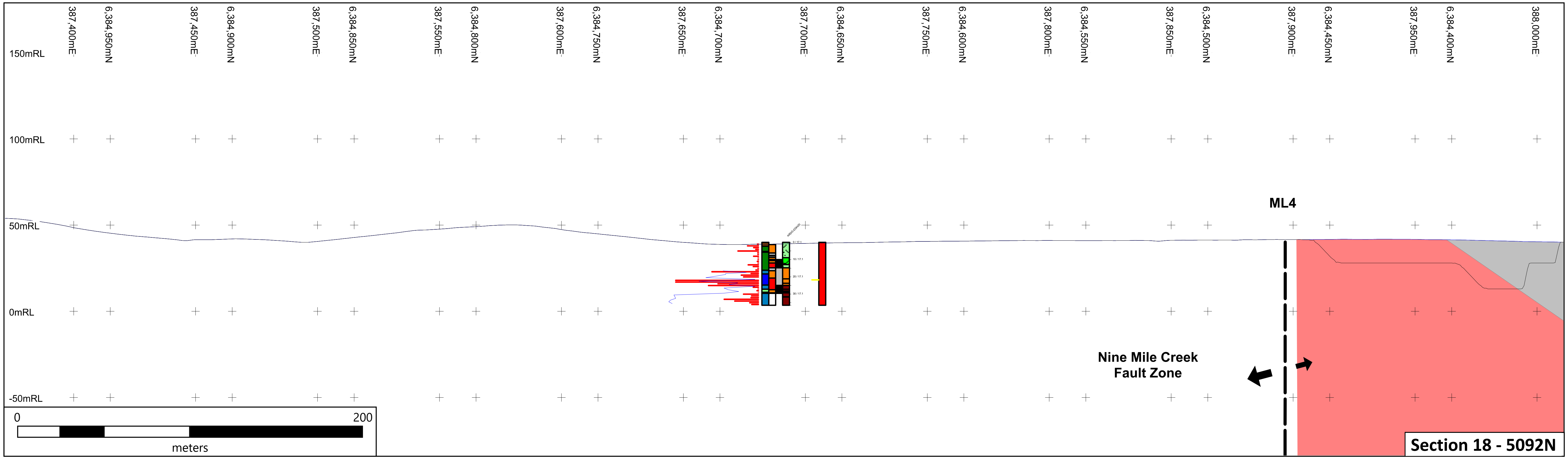
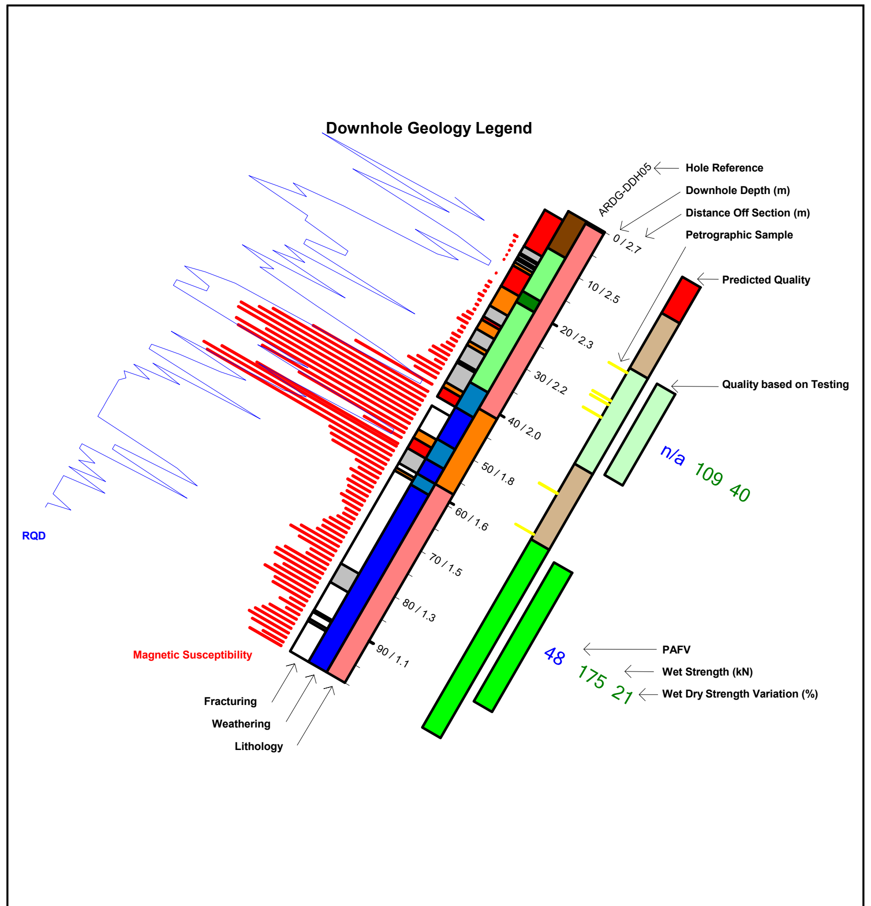
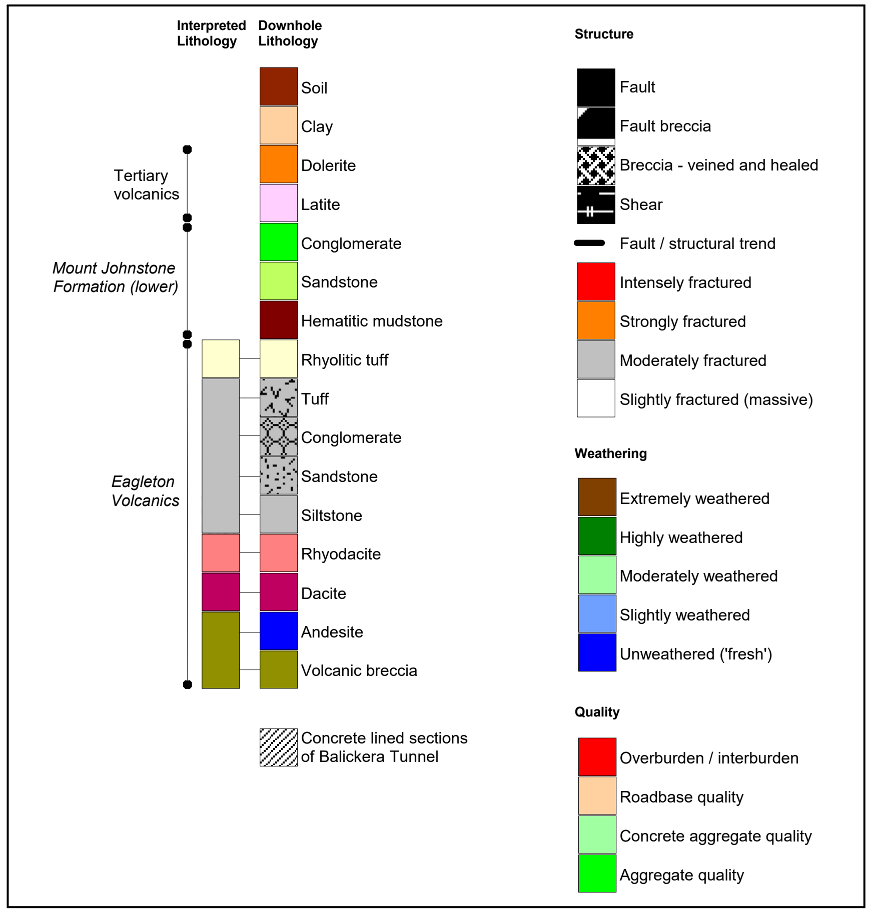
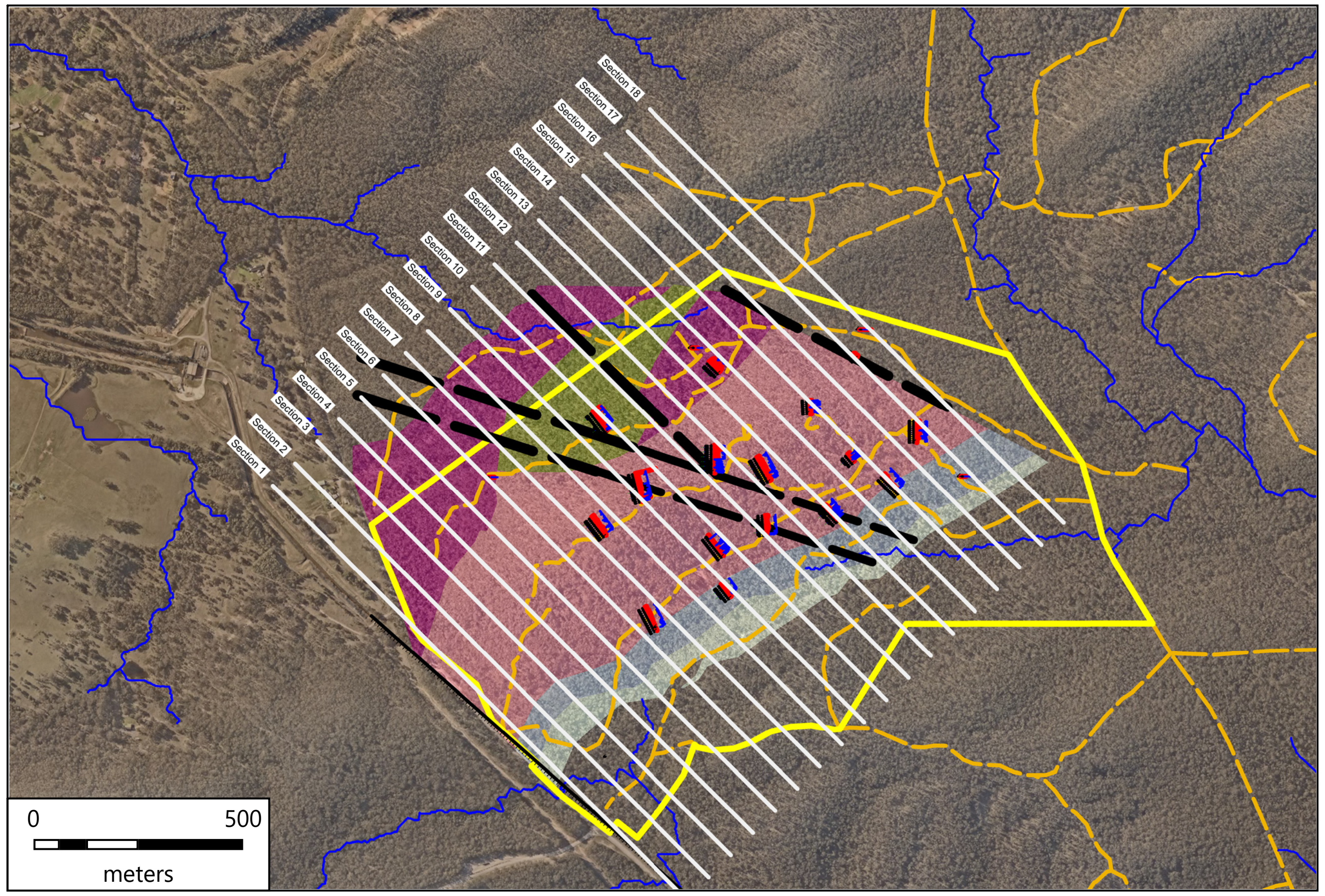
Project:	STONE RIDGE QUARRY PROJECT						Figure 14q
Title:	Cross Section 17 - 5039N (+/- 37.5m) with Interpreted Geology						
Author:	DMB	Date:	December 2019	Scale:	1:2200 @ A3	Grid:	MGA Zone 56 (GDA94)
Source:	Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates) Geological Interpretation: Damon Bird (ARDG)						









Legend

Stone Ridge Project Area Boundary	Conceptual Pit Design - 50Mt
Forest tracks	Conceptual Pit Design - 136Mt
Drainage line (ephemeral)	
Diamond drillhole collar location	
Diamond drillhole collar location - hole converted to water monitoring bore	
Diamond drillhole path	

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Project:	**STONE RIDGE QUARRY PROJECT**						**Figure 14r**
Title:	**Cross Section 18 - 5092N (+/- 37.5m) with Interpreted Geology**						
Author:	DMB	*Date:*	December 2019	*Scale:*	1:2200 @ A3	*Grid:*	MGA Zone 56 (GDA94)

Source: Diamond Drilling: Blacklaws Drilling - 2018-2019
Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates)
Geological Interpretation: Damon Bird (ARDG)

8. GEOTECHNICAL ASSESSMENT

8.1 Background

A comprehensive geotechnical testing program has been undertaken on diamond core from the Project Area to confirm the suitability of different rock types (*i.e.* rhyodacite, dacite, volcanic breccia and dolerite) within the *Eagleton Volcanics* for producing the following quarry products.

- Concrete aggregates – coarse and fine (including manufactured sand) to Australian Standard requirements (AS2758.1 - 2014).
- Asphalt aggregates – coarse and fine (including manufactured sand) to Australian Standard requirements (AS2758.5 - 2000) and Roads and Maritime Services (RMS) requirements (RMS 3152).
- Sealing aggregates – to Australian Standard requirements (AS2758.2 - 2009) and RMS requirements (RMS 3151).
- Railway ballast – to Australian Standard requirements (AS2758.7 - 2015).
- Armourstone – to Australian Standard requirements (AS2758.6 - 2008).
- Aggregates for gabion baskets and wire mattresses – to Australian Standard requirements (AS2758.4 - 2017).
- Roadbase materials – to RMS requirements (RMS 3051).

8.2 Testing Methodology

Bulk samples of diamond core, each comprising up to nine (9) plastic bags of consecutive core and weighing between 130 and 260 kilograms (depending on the length of sample interval) were delivered to the Coffey Services laboratory in Warrabrook, NSW, throughout the drilling program. Coffey undertook most of the testing in-house, although several specialist tests were undertaken by external laboratories under their direction.

Of the 1748.9 metres of diamond core drilled within the Project Area, geotechnical testing has consumed a combined total of 716.8 metres (41%) of diamond core from ten (10) holes to produce 31 bulk samples. The test samples comprise the following.

- Rhyodacite (competent) – twenty-one samples for a total of 523.2 linear metres of core. These include a single sample of sericite-altered lithic fragmental rhyodacite from the top of the rhyodacite stratigraphy.
- Rhyodacite (fractured) – five samples for a total of 101.3 linear metres of core of fractured and/or brecciated and laumontite-veined rhyodacite, spatially associated with the Central Fault.
- Dacite – three samples for a total of 62.2 linear metres of core. These include two samples of competent dacite and one of altered dacite.
- Volcanic breccia – one sample for a total of 30.1 linear metres of core.
- Dolerite – one sample for a total of 14.83 linear metres of core.

Table 8-1 summarises the hole, depth interval and general lithology of the diamond core sample intervals that were submitted for geotechnical testing.

Further testing may be undertaken in the future following the assessment of remaining core for geotechnical / slope stability investigation purposes.

TABLE 8-1
Summary of Bulk Diamond Core Samples submitted for Geotechnical Testing

Hole ID	Depth From (m)	Depth To (m)	Interval (m)	Lithology
ARDG-DDH01	19.00	46.19	27.19	Rhyodacite – competent
ARDG-DDH03	18.68	35.80	17.12	Dacite – competent
ARDG-DDH03	41.70	71.80	30.10	Dacite – competent
ARDG-DDH04	4.03	21.20	17.17	Rhyodacite – fractured adj to Central Fault
ARDG-DDH04	40.03	55.90	15.87	Rhyodacite – competent
ARDG-DDH04	55.90	81.10	25.20	Rhyodacite – competent
ARDG-DDH04	81.10	105.10	24.00	Rhyodacite – competent
ARDG-DDH04	105.10	130.40	25.30	Rhyodacite – competent
ARDG-DDH05	20.00	40.00	20.00	Rhyodacite – brecciated adj to Central Fault
ARDG-DDH05	59.20	89.70	30.50	Rhyodacite – competent
ARDG-DDH06	25.10	51.30	26.20	Rhyodacite – competent – lithic frag., sericite altered
ARDG-DDH06	51.30	78.20	26.90	Rhyodacite – competent
ARDG-DDH07	0.55	17.90	17.35	Rhyodacite – competent – pink and oxidised
ARDG-DDH07	17.90	48.93	31.03	Rhyodacite – competent
ARDG-DDH07	48.93	72.20	23.27	Rhyodacite – competent
ARDG-DDH07	72.20	95.90	23.70	Rhyodacite – competent
ARDG-DDH07	95.90	111.20	15.30	Rhyodacite – competent
ARDG-DDH08	24.30	54.40	30.10	Volcanic breccia
ARDG-DDH08	102.47	117.30	14.83	Altered dolerite
ARDG-DDH11	6.00	31.00	25.00	Rhyodacite – competent
ARDG-DDH11	31.00	56.00	25.00	Rhyodacite – competent
ARDG-DDH11	56.00	81.00	25.00	Rhyodacite – competent
ARDG-DDH15	0.90	22.00	21.10	Rhyodacite – fractured, Central Fault
ARDG-DDH15	22.00	43.00	21.00	Rhyodacite – fractured, Central Fault
ARDG-DDH15	43.00	65.00	22.00	Rhyodacite – fractured, Central Fault
ARDG-DDH15	65.00	90.00	25.00	Rhyodacite – competent
ARDG-DDH15	90.00	111.20	21.20	Rhyodacite – competent
ARDG-DDH15	114.20	129.20	15.00	Dacite – altered
ARDG-DDH16	17.00	42.00	25.00	Rhyodacite – competent
ARDG-DDH16	42.00	67.00	25.00	Rhyodacite – competent
ARDG-DDH16	67.00	92.40	25.40	Rhyodacite – competent

Test samples were subjected to a range of different test methods in order to determine compliance (or otherwise) with the various standards relevant to different quarry product types. The results of general durability tests (*e.g.* Wet / Dry Strength Variation, Los Angeles Abrasion) determined whether a sample was subjected to other product-specific tests (*e.g.* polished aggregate friction value).

Table 8-2 summarises the various test methods used for geotechnical assessment of the diamond core sample intervals. **Table 8-3** presents the test results for all diamond core sample intervals that were submitted for geotechnical testing.

TABLE 8-2 **Australian Standard and RMS Tests Employed in Geotechnical Testing Program**			
Test	**Australian Standard #**	**RMS Standard**	**No of Tests**
Uncompacted Bulk Density	AS1141.4		15
Compacted Bulk Density	AS1141.4		15
Particle Density (Coarse)	AS1141.6		31
Water Absorption	AS1141.6		31
Particle Size Distribution (Grading)	AS1141.11.1		31
% Passing 75µm by Washing	AS1141.12		15
Particle Shape (% Mishapen Particles 2:1)	AS1141.14		12
Flakiness Index	AS1141.15		12
Aggregate Crushing Value	AS1141.21		22
Wet/Dry Strength Variation	AS1141.22		31
Los Angeles Abrasion	AS1141.23		22
Sodium Sulphate Soundness	AS1141.24		2
Light Particles	AS1141.31		11
Weak Particles	AS1141.32		11
Chlorides & Sulphates	AS1012.20		11
Polished Aggregate Friction Value	AS1141.41/42		18
Methylene Blue Value (MBV) ISSA	AS1141.66		15
Bitumen Adhesion / Resistance to Stripping		RMS T230; RMS T238	8
Alkali Aggregate Reactivity		RMS T363	4

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TABLE 8-3

Stone Ridge Quarry Project - Source Rock Testing Program and Results

Hole	From (m)	To (m)	Interval (m)	Sample Type	Date Submitted	Laboratory	Coffey Laboratory Sample ID	Rock Type
ARDG-DDH01	19.00	46.19	27.19	HQ3 Core	14-Mar-18	Coffey - Warrabrook	NEWC18S-02733	Rhyodacite - competent
ARDG-DDH03	18.68	35.80	17.12	HQ3 Core	19-Mar-18	Coffey - Warrabrook	NEWC18S-02907	Dacite
ARDG-DDH03	41.70	71.80	30.10	HQ3 Core	14-Mar-18	Coffey - Warrabrook	NEWC18S-02734	Dacite - competent
ARDG-DDH04	4.03	21.20	17.17	HQ3 Core	19-Mar-18	Coffey - Warrabrook	NEWC18S-02908	Rhyodacite - fractured / marginal to Central Fault
ARDG-DDH04	40.03	55.90	15.87	HQ3 Core	19-Mar-18	Coffey - Warrabrook	NEWC18S-02909	Rhyodacite - competent
ARDG-DDH04	55.90	81.10	25.20	HQ3 Core	12-Apr-18	Coffey - Warrabrook	NEWC18S-03894	Rhyodacite - competent
ARDG-DDH04	81.10	105.10	24.00	HQ3 Core	12-Apr-18	Coffey - Warrabrook	NEWC18S-03895	Rhyodacite - competent
ARDG-DDH04	105.10	130.40	25.30	HQ3 Core	12-Apr-18	Coffey - Warrabrook	NEWC18S-03896	Rhyodacite - competent
ARDG-DDH05	20.00	40.00	20.00	HQ3 Core	17-Apr-18	Coffey - Warrabrook	NEWC18S-04317	Rhyodacite - brecciated / laumontite veined marginal to Central Fault
ARDG-DDH05	59.20	89.70	30.50	HQ3 Core	17-Apr-18	Coffey - Warrabrook	NEWC18S-04318	Rhyodacite - competent
ARDG-DDH06	25.10	51.30	26.20	HQ3 Core	4-May-18	Coffey - Warrabrook	NEWC18S-04824	Rhyodacite - competent- lithic fragmental sericite
ARDG-DDH06	51.30	78.20	26.90	HQ3 Core	20-Aug-18	Coffey - Warrabrook	NEWC18S-07588	Rhyodacite - competent
ARDG-DDH07	0.55	17.90	17.35	HQ3 Core	26-Apr-18	Coffey - Warrabrook	NEWC18S-04440	Rhyodacite - competent
ARDG-DDH07	17.90	48.93	31.03	HQ3 Core	26-Apr-18	Coffey - Warrabrook	NEWC18S-04441	Rhyodacite - competent
ARDG-DDH07	48.93	72.20	23.27	HQ3 Core	20-Aug-18	Coffey - Warrabrook	NEWC18S-07589	Rhyodacite - competent
ARDG-DDH07	72.20	95.90	23.70	HQ3 Core	20-Aug-18	Coffey - Warrabrook	NEWC18S-07590	Rhyodacite - competent
ARDG-DDH07	95.90	111.20	15.30	HQ3 Core	29-Aug-18	Coffey - Warrabrook	NEWC18S-07987	Rhyodacite - competent
ARDG-DDH08	24.30	54.40	30.10	HQ3 Core	4-May-18	Coffey - Warrabrook	NEWC18S-04825	Volcanic breccia
ARDG-DDH08	102.47	117.30	14.83	HQ3 Core	4-May-18	Coffey - Warrabrook	NEWC18S-04826	Dolerite
ARDG-DDH11	6.00	31.00	25.00	HQ3 Core	16-Apr-19	Coffey - Warrabrook	NEWC19S-02942	Rhyodacite - competent
ARDG-DDH11	31.00	56.00	25.00	HQ3 Core	16-Apr-19	Coffey - Warrabrook	NEWC19S-02943	Rhyodacite - competent
ARDG-DDH11	56.00	81.00	25.00	HQ3 Core	16-Apr-19	Coffey - Warrabrook	NEWC19S-02944	Rhyodacite - competent
ARDG-DDH15	0.90	22.00	21.10	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03172	Rhyodacite - fractured and/or brecciated and laumontite veined - Central Fault
ARDG-DDH15	22.00	43.00	21.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03173	Rhyodacite - fractured and/or brecciated and laumontite veined - Central Fault
ARDG-DDH15	43.00	65.00	22.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03174	Rhyodacite - fractured and/or brecciated and laumontite veined - Central Fault
ARDG-DDH15	65.00	90.00	25.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03175	Rhyodacite - competent
ARDG-DDH15	90.00	111.20	21.20	HQ3 Core	26-Apr-19	Coffey - Warrabrook	NEWC19S-03176	Rhyodacite - competent
ARDG-DDH15	114.20	129.20	15.00	HQ3 Core	26-Apr-19	Coffey - Warrabrook	NEWC19S-03177	Dacite - altered
ARDG-DDH16	17.00	42.00	25.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03169	Rhyodacite
ARDG-DDH16	42.00	67.00	25.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03170	Rhyodacite
ARDG-DDH16	67.00	92.40	25.40	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03171	Rhyodacite
ARDG-DDH17	0.00	3.30	3.30	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01146	Clay
ARDG-DDH17	3.30	6.40	3.10	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01147	Clay to 4.7 m; Sandstone - extremely to highly weathered from 4.7 - 6.4 m.
ARDG-DDH17	6.40	12.60	6.20	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01148	Clay
ARDG-DDH17	12.60	16.20	3.60	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01149	Sandstone / Siltsone - extremely to highly weathered
ARDG-DDH17	16.20	20.85	4.65	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01150	Sandstone / Siltsone - generally moderately weathered
ARDG-DDH17	20.85	22.77	1.92	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01151	Sandstone / Siltsone - generally moderately weathered
ARDG-DDH17	22.77	25.40	2.63	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01152	Sandstone / Siltsone - generally moderately weathered
ARDG-DDH17	25.40	27.20	1.80	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01153	Sandstone / Siltsone - generally moderately weathered
ARDG-DDH17	34.00	34.96	0.96	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01154	Sandstone / Siltsone - generally moderately weathered

Coarse (+4.75mm) Test Results

Hole	AS1141.6.1 Apparent Particle Density Coarse (t/m3)	AS1141.6.1 Water Absorption (%)	AS1141.11 Particle Size Distribution (% passing) 53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	6.7mm	4.75mm	2.36mm	1.18mm	600µm	425µm	300µm	150µm	75µm	AS1141.14 Particle Shape (% mishapen particles) 2:1	AS1141.15 Flakiness Index	AS1141.21 Aggregate Crushing Value
ARDG-DDH01	2.62	1.0	100	96	76	37	22	15	10	7	4	3	2	2	1	1	0	18	26.0	20.7
ARDG-DDH03	2.73	1.4	100	99	72	39	25	19	14	11	7	5	3	3	2	1	1	31	32.0	19.0
ARDG-DDH03	2.68	1.1	100	96	73	35	17	9	5	3	1	1	1	1	0	0	0	22	29.0	19.9
ARDG-DDH04	2.61	2.1	100	100	76	43	28	19	13	10	6	4	2	2	2	1	0	23	28.0	21.4
ARDG-DDH04	2.62	0.9	100	96	72	42	29	21	16	13	9	6	4	4	3	2	1	27	35.0	18.9
ARDG-DDH04	2.59	0.9	100	99	87	54	35	27	21	17	11	7	5	4	3	2	1	28	33.0	18.7
ARDG-DDH04	2.59	0.9	100	97	80	45	31	23	18	14	9	6	4	4	3	2	1	33	41.0	20.3
ARDG-DDH04	2.60	0.7	100	100	88	52	34	25	19	14	8	5	3	3	2	1	1	26	27.0	19.8
ARDG-DDH05	2.58	3.0	100	100	95	65	40	28	21	16	11	7	5	4	3	2	1	13	18	28.4
ARDG-DDH05	2.59	1.1	100	100	96	71	45	34	26	20	13	10	7	6	5	3	1	26	31.0	21.7
ARDG-DDH06	2.59	1.6	100	100	94	64	35	25	19	14	9	7	4	4	3	2	1			18.7
ARDG-DDH06	2.62	1.2	100	100	93	68	39	28	21	16	11	7	5	4	3	2	1			20.0
ARDG-DDH07	2.60	1.3	100	99	91	57	33	22	17	13	8	6	4	4	3	2	1	23	39.0	23.1
ARDG-DDH07	2.60	0.8	100	100	91	59	37	28	21	17	11	7	5	4	3	1	1	16	44.0	22.8
ARDG-DDH07	2.60	1.2	100	100	94	67	39	28	21	16	11	7	5	4	3	2	1			18.8
ARDG-DDH07	2.61	0.7	100	100	93	62	37	26	19	15	10	7	4	3	3	1	1			21.0
ARDG-DDH07	2.61	0.7																		20.0
ARDG-DDH08	2.64	2.3	100	99	94	66	37	27	20	15	10	6	4	3	3	1	1			22.5
ARDG-DDH08	2.76	2.1	100	100	96	65	36	27	21	16	11	8	6	5	5	3	2			19.9
ARDG-DDH11	2.63	1.4	100	100	100	90	59	36	24	18	12	7	5	4	3	1	1			25.0
ARDG-DDH11	2.64	1.5	100	100	100	88	57	34	23	17	11	7	4	4	3	2	1			25.4
ARDG-DDH11	2.63	1.3	100	100	100	88	58	35	24	17	11	7	5	4	3	1	0			25.5
ARDG-DDH15	2.60	1.8	100	100	99	89	58	36	25	19	12	7	5	4	3	2	1			
ARDG-DDH15	2.59	2.4	100	100	99	92	62	37	26	18	12	7	5	4	3	2	1			
ARDG-DDH15	2.66	2.2	100	100	100	93	62	37	25	18	11	7	5	4	3	2	1			
ARDG-DDH15	2.61	2.4	100	100	100	90	6	35	24	18	11	7	4	4	3	2	1			
ARDG-DDH15	2.58	1.4	100	100	100	95	72	45	31	23	15	9	6	5	4	2	1			
ARDG-DDH15	2.53	3.9	100	100	100	95	69	43	29	22	14	9	6	5	4	2	1			
ARDG-DDH16	2.62	1.4	100	100	99	92	58	35	23	16	10	6	4	4	3	2	1			24.2
ARDG-DDH16	2.63	1.3	100	100	99	91	69	42	29	22	14	9	6	6	4	2	1			24.3
ARDG-DDH16	2.64	1.4	100	100	99	92	63	38	24	17	10	5	3	3	2	1	1			23.4

= meets all product requirements

= meets most product requirements

= non compliant

= mostly compliant; improved shape / blending should achieve full compliance

= non compliant; improved shape / blending should achieve full compliance

= non compliant; improved shape / blending should achieve partial compliance

Product	Apparent Particle Density Coarse (t/m3)	Water Absorption (%)	Particle Shape 2:1	Flakiness Index	Aggregate Crushing Value
Concrete Coarse Aggregates - Standard Exposure (A1, A2) (AS2758.1 - 2014) #1	> 2.1			< 35	
Concrete Coarse Aggregates - Moderate Exposure (B1, B2) (AS2758.1 - 2014) #1	> 2.1			< 35	
Concrete Coarse Aggregates - Severe Exposure (C) (AS2758.1 - 2014) #1	> 2.1			< 35	
Concrete Fine Aggregates (<5mm) (AS2758.1 - 2014)	> 2.1				
Coarse Asphalt Aggregate (AS2758.5 - 2009) (RMS3152)	> 2.1	< 2.5	≤ 25	< 25	
Asphalt Fine Aggregates (RMS3152)		< 3.0			
Sealing Coarse Aggregates (AS2758.2 - 2009) (RMS3151)	> 2.1	< 3.0	≤ 35	< 35	
Railway Ballast (AS2758.7 - 2015) #5	> 2.5		≤ 30		≤ 25
Aggregates for Gabion Baskets and Wire Mattreses (AS2758.4 - 2017)					
Armourstone (AS2758.6 - 2008)	≥ 2.6	≤ 1.5			
Roadbase RMS DGB20 (Heavy Duty) (RMS3051)			≤ 35		

Notes:

#1 Durability assessment under AS2758.1 was undertaken using Wet Strength and Wet Dry Strength Variation (WDSV).

#2 AS2758.5 requires a minimum Wet Strength of 150 kN for aggregates used in open grade mixes and not less than 100 kN for all other mixes.

#3 RMS3152 specification relevant to course asphalt aggregate used in wearing course. All other applications must have a PAFV ≥ 44.

#4 RMS specification relevant to Wearing Course. AS2758.2 does not specify frictional values

#5 Durability assessment under AS2758.7 undertaken using Aggregate Crushing Value (ACV) and Los Angeles value (LA).

#6 AS 2758.6 permits a wet strength of ≥ 100kN and WDSV of ≤ 30% for 'moderate risk areas', and wet strength of ≥ 80kN and WDSV of ≤ 35% for 'low risk areas'.

Australian Resource Development Group Pty Limited (ARDG)

Stone Ridge Quarry Project - Source Rock Testing Program and Results

TABLE 8-3

Hole	From (m)	To (m)	Interval (m)	Sample Type	Date Submitted	Laboratory	Coffey Laboratory Sample ID	Rock Type	Coarse (+4.75mm) Test Results														Fine (-4.75mm) Test Results		
									AS1141.22			AS1141.23	AS1141.24	AS1012.20		AS1141.31	AS1141.32	AS1141.41/42	RMS T230	RMS T238	RMS T363		AS1141.12	AS1141.66	
									Wet Strength (kN)	Dry Strength (kN)	WDSV (%)	Los Angeles Value (%)	Sodium Sulphate Soundness (% loss)	Chlorides (%)	Sulphates (% as SO3)	Light Particles (%)	Weak Particles (%)	PAFV	Resistance to Stripping (%) (Binders: SAMI320, Polyseal S35E, S45R)	Initial Bitumen Adhesion (%) (Binders: SAMI320, Polyseal S35E, S45R)	Alkali Aggregate Reactivity SR = slowly reactive; NR = non-reactive		% Passing 75µm by washing (A)	MBV ISSA (B)	Deleterious Fines Index (=A x B)
																					No fly-ash	25% fly-ash			
ARDG-DDH01	19.00	46.19	27.19	HQ3 Core	14-Mar-18	Coffey - Warrabrook	NEWC18S-02733	Rhyodacite - competent	229	252	9	19						42					0.2	4.0	1
ARDG-DDH03	18.68	35.80	17.12	HQ3 Core	19-Mar-18	Coffey - Warrabrook	NEWC18S-02907	Dacite	159	240	34	27						43					1.0	3.5	4
ARDG-DDH03	41.70	71.80	30.10	HQ3 Core	14-Mar-18	Coffey - Warrabrook	NEWC18S-02734	Dacite - competent	209	242	14	19		0.011	0.009	0	0	55	< 2, < 2, 2	< 5, < 5, < 5			0.4	10.5	4
ARDG-DDH04	4.03	21.20	17.17	HQ3 Core	19-Mar-18	Coffey - Warrabrook	NEWC18S-02908	Rhyodacite - fractured / marginal to Central Fault	133	169	21	22	0.8	0.002	0.021		0						1.0	2.0	2
ARDG-DDH04	40.03	55.90	15.87	HQ3 Core	19-Mar-18	Coffey - Warrabrook	NEWC18S-02909	Rhyodacite - competent	213	222	4	18	0.4					55					1.0	1.5	2
ARDG-DDH04	55.90	81.10	25.20	HQ3 Core	12-Apr-18	Coffey - Warrabrook	NEWC18S-03894	Rhyodacite - competent	238	251	5	18		0.006	0.008	0	0	47			SR	NR	1.0	2.0	2
ARDG-DDH04	81.10	105.10	24.00	HQ3 Core	12-Apr-18	Coffey - Warrabrook	NEWC18S-03895	Rhyodacite - competent	255	268	5	18		0.001	0.004	0	0	46			SR	NR	1.0	1.5	2
ARDG-DDH04	105.10	130.40	25.30	HQ3 Core	12-Apr-18	Coffey - Warrabrook	NEWC18S-03896	Rhyodacite - competent	247	262	6	18		0.002	0.007		0	49					1.0	1.0	1
ARDG-DDH05	20.00	40.00	20.00	HQ3 Core	17-Apr-18	Coffey - Warrabrook	NEWC18S-04317	Rhyodacite - brecciated / laumontite veined marginal to Central Fault	109	181	40	28		0.002	0.025		0						1.0	1.5	2
ARDG-DDH05	59.20	89.70	30.50	HQ3 Core	17-Apr-18	Coffey - Warrabrook	NEWC18S-04318	Rhyodacite - competent	175	222	21	17		0.002	0.014		0.1	48					1.0	1.0	1
ARDG-DDH06	25.10	51.30	26.20	HQ3 Core	4-May-18	Coffey - Warrabrook	NEWC18S-04824	Rhyodacite - competent- lithic fragmental sericite	198	283	30	17		0.003	0.012	0	0	63	< 2, < 2, 2	< 5, < 5, < 5			3.0	4.0	12
ARDG-DDH06	51.30	78.20	26.90	HQ3 Core	20-Aug-18	Coffey - Warrabrook	NEWC18S-07588	Rhyodacite - competent	221	242	9	16		0.003	0.006	0	0	52	< 2, 2, 4	< 5, < 5, < 5					
ARDG-DDH07	0.55	17.90	17.35	HQ3 Core	26-Apr-18	Coffey - Warrabrook	NEWC18S-04440	Rhyodacite - competent	215	274	22	18						52	< 2, 2, 4	< 5, < 5, < 5	SR	NR	2.0	2.0	4
ARDG-DDH07	17.90	48.93	31.03	HQ3 Core	26-Apr-18	Coffey - Warrabrook	NEWC18S-04441	Rhyodacite - competent	216	233	7	18						46	< 2, < 2, 2	< 5, < 5, < 5	SR	NR	1.0	1.5	2
ARDG-DDH07	48.93	72.20	23.27	HQ3 Core	20-Aug-18	Coffey - Warrabrook	NEWC18S-07589	Rhyodacite - competent	240	251	4	16						50							
ARDG-DDH07	72.20	95.90	23.70	HQ3 Core	20-Aug-18	Coffey - Warrabrook	NEWC18S-07590	Rhyodacite - competent	238	240	1	16						52							
ARDG-DDH07	95.90	111.20	15.30	HQ3 Core	29-Aug-18	Coffey - Warrabrook	NEWC18S-07987	Rhyodacite - competent	275	291	5	16						54							
ARDG-DDH08	24.30	54.40	30.10	HQ3 Core	4-May-18	Coffey - Warrabrook	NEWC18S-04825	Volcanic breccia	90	224	60	25		0.001	0.011		0						3.0	5.5	17
ARDG-DDH08	102.47	117.30	14.83	HQ3 Core	4-May-18	Coffey - Warrabrook	NEWC18S-04826	Dolerite	140	268	48	19		<0.001	0.019		0						5.0	3.0	15
ARDG-DDH11	6.00	31.00	25.00	HQ3 Core	16-Apr-19	Coffey - Warrabrook	NEWC19S-02942	Rhyodacite - competent	220	229	4	18						48							
ARDG-DDH11	31.00	56.00	25.00	HQ3 Core	16-Apr-19	Coffey - Warrabrook	NEWC19S-02943	Rhyodacite - competent	219	230	5	17						46							
ARDG-DDH11	56.00	81.00	25.00	HQ3 Core	16-Apr-19	Coffey - Warrabrook	NEWC19S-02944	Rhyodacite - competent	240	250	4	17						42							
ARDG-DDH15	0.90	22.00	21.10	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03172	Rhyodacite - fractured and/or brecciated and laumontite veined - Central Fault	163	218	25							53							
ARDG-DDH15	22.00	43.00	21.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03173	Rhyodacite - fractured and/or brecciated and laumontite veined - Central Fault	169	217	22							52							
ARDG-DDH15	43.00	65.00	22.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03174	Rhyodacite - fractured and/or brecciated and laumontite veined - Central Fault	86	112	23														
ARDG-DDH15	65.00	90.00	25.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03175	Rhyodacite - competent	161	243	34							53							
ARDG-DDH15	90.00	111.20	21.20	HQ3 Core	26-Apr-19	Coffey - Warrabrook	NEWC19S-03176	Rhyodacite - competent	214	231	7							51							
ARDG-DDH15	114.20	129.20	15.00	HQ3 Core	26-Apr-19	Coffey - Warrabrook	NEWC19S-03177	Dacite - altered	39	153	75														
ARDG-DDH16	17.00	42.00	25.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03169	Rhyodacite	214	235	9	17						49							
ARDG-DDH16	42.00	67.00	25.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03170	Rhyodacite	220	243	9	18						46							
ARDG-DDH16	67.00	92.40	25.40	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03171	Rhyodacite	225	234	4	16						47							

ARDG-DDH17	0.00	3.30	3.30	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01146	Clay																	
ARDG-DDH17	3.30	6.40	3.10	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01147	Clay to 4.7 m; Sandstone - extremely to highly weathered from 4.7 - 6.4 m.																	
ARDG-DDH17	6.40	12.60	6.20	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01148	Clay																	
ARDG-DDH17	12.60	16.20	3.60	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01149	Sandstone / Siltstone - extremely to highly weathered																	
ARDG-DDH17	16.20	20.85	4.65	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01150	Sandstone / Siltstone - generally moderately weathered																	
ARDG-DDH17	20.85	22.77	1.92	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01151	Sandstone / Siltstone - generally moderately weathered																	
ARDG-DDH17	22.77	25.40	2.63	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01152	Sandstone / Siltstone - generally moderately weathered																	
ARDG-DDH17	25.40	27.20	1.80	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01153	Sandstone / Siltstone - generally moderately weathered																	
ARDG-DDH17	34.00	34.96	0.96	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01154	Sandstone / Siltstone - generally moderately weathered																	

= meets all product requirements	= mostly compliant; improved shape / blending should achieve full compliance
= meets most product requirements	= non compliant; improved shape / blending should achieve full compliance
= non compliant	= non compliant; improved shape / blending should achieve partial compliance

Product	Wet Strength (kN)	Dry Strength (kN)	WDSV (%)	Los Angeles Value (%)	Sodium Sulphate Soundness (% loss)	Chlorides (%)	Sulphates (% as SO3)	Light Particles (%)	Weak Particles (%)	PAFV	Resistance to Stripping (%)	Initial Bitumen Adhesion (%)	No fly-ash	25% fly-ash	% Passing 75µm by washing (A)	MBV ISSA (B)	Deleterious Fines Index (=A x B)
Concrete Coarse Aggregates - Standard Exposure (A1, A2) (AS2758.1 - 2014) [#1]	≥ 50		≤ 45	≤ 35	≤ 12	≤ 0.01	≤ 5	≤ 1	≤ 0.5								
Concrete Coarse Aggregates - Moderate Exposure (B1, B2) (AS2758.1 - 2014) [#1]	≥ 80		≤ 35	≤ 30	≤ 9	≤ 0.01	≤ 5	≤ 1	≤ 0.5								
Concrete Coarse Aggregates - Severe Exposure (C) (AS2758.1 - 2014) [#1]	≥ 100		≤ 25	≤ 30	≤ 6	≤ 0.01	≤ 5	≤ 1	≤ 0.5								
Concrete Fine Aggregates (<5mm) (AS2758.1 - 2014)	≥ 100		≤ 25	≤ 30	≤ 6	≤ 0.01	≤ 5								< 14 *	< 7 *	≤ 150
Coarse Asphalt Aggregate (AS2758.5 - 2009) (RMS3152)	≥ 150 [#2]		≤ 35	< 35	≤ 12				≤ 1	≥ 48 [#3]	≤ 10	≤ 10					
Asphalt Fine Aggregates (RMS3152)					≤ 12										< 12 *	< 8 *	
Sealing Coarse Aggregates (AS2758.2 - 2009) (RMS3151)	≥ 150		≤ 35		≤ 12				≤ 1	≥ 44 [#4]	≤ 10	≤ 10					
Railway Ballast (AS2758.7 - 2015) [#5]				≤ 25					< 5								
Aggregates for Gabion Baskets and Wire Mattreses (AS2758.4 - 2017)	≥ 100		≤ 35						≤ 1								
Armourstone (AS2758.6 - 2008)	≥ 150 [#6]		≤ 25 [#6]		≤ 6												
Roadbase RMS DGB20 (Heavy Duty) (RMS3051)	≥ 100		≤ 35														

Notes:

#1 Durability assessment under AS2758.1 was undertaken using Wet Strength and Wet Dry Strength Variation (WDSV).

#2 AS2758.5 requires a minimum Wet Strength of 150 kN for aggregates used in open grade mixes and not less than 100 kN for all other mixes.

#3 RMS3152 specification relevant to course asphalt aggregate used in wearing course. All other applications must have a PAFV ≥ 44.

#4 RMS specification relevant to Wearing Course. AS2758.2 does not specify frictional values

#5 Durability assessment under AS2758.7 undertaken using Aggregate Crushing Value (ACV) and Los Angeles value (LA).

#6 AS 2758.6 permits a wet strength of ≥ 100kN and WDSV of ≤ 30% for 'moderate risk areas', and wet strength of ≥ 80kN and WDSV of ≤ 35% for 'low risk areas'.

Australian Resource Development Group Pty Limited (ARDG) **TABLE 8-3**

Stone Ridge Quarry Project - Source Rock Testing Program and Results

Hole	From (m)	To (m)	Interval (m)	Sample Type	Date Submitted	Laboratory	Coffey Laboratory Sample ID	Rock Type	Atterberg Limits				Product Suitability										
									AS1289.3.1.1	AS1289.3.2.1	AS1289.3.3.1	AS1289.3.4.1	AS2758.1 - 2014	AS2758.1 - 2014	AS2758.1 - 2014	AS2758.1 - 2014	AS2758.5 - 2009 RMS3152	RMS3152	AS2758.2 - 2009 RMS3151	AS2758.7 - 2015	AS2758.4 - 2017	AS2758.6 - 2008	RMS HD
									Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Concrete Coarse Aggregates - Standard Exposure (A1, A2)	Concrete Coarse Aggregates - Moderate Exposure (B1, B2)	Concrete Coarse Aggregates - Severe Exposure	Concrete Fine Aggregates (<5mm)	Coarse Asphalt Aggregate	Asphalt Fine Aggregates	Sealing Coarse Aggregates	Railway Ballast	Aggregates for Gabion Baskets and Wire Mattreses	Armour-stone	Roadbase (Coarse Aggregate Component)
ARDG-DDH01	19.00	46.19	27.19	HQ3 Core	14-Mar-18	Coffey - Warrabrook	NEWC18S-02733	Rhyodacite - competent															
ARDG-DDH03	18.68	35.80	17.12	HQ3 Core	19-Mar-18	Coffey - Warrabrook	NEWC18S-02907	Dacite															
ARDG-DDH03	41.70	71.80	30.10	HQ3 Core	14-Mar-18	Coffey - Warrabrook	NEWC18S-02734	Dacite - competent															
ARDG-DDH04	4.03	21.20	17.17	HQ3 Core	19-Mar-18	Coffey - Warrabrook	NEWC18S-02908	Rhyodacite - fractured / marginal to Central Fault									test required		test required				
ARDG-DDH04	40.03	55.90	15.87	HQ3 Core	19-Mar-18	Coffey - Warrabrook	NEWC18S-02909	Rhyodacite - competent															
ARDG-DDH04	55.90	81.10	25.20	HQ3 Core	12-Apr-18	Coffey - Warrabrook	NEWC18S-03894	Rhyodacite - competent															
ARDG-DDH04	81.10	105.10	24.00	HQ3 Core	12-Apr-18	Coffey - Warrabrook	NEWC18S-03895	Rhyodacite - competent															
ARDG-DDH04	105.10	130.40	25.30	HQ3 Core	12-Apr-18	Coffey - Warrabrook	NEWC18S-03896	Rhyodacite - competent															
ARDG-DDH05	20.00	40.00	20.00	HQ3 Core	17-Apr-18	Coffey - Warrabrook	NEWC18S-04317	Rhyodacite - brecciated / laumontite veined marginal to Central Fault															
ARDG-DDH05	59.20	89.70	30.50	HQ3 Core	17-Apr-18	Coffey - Warrabrook	NEWC18S-04318	Rhyodacite - competent															
ARDG-DDH06	25.10	51.30	26.20	HQ3 Core	4-May-18	Coffey - Warrabrook	NEWC18S-04824	Rhyodacite - competent- lithic fragmental sericite															
ARDG-DDH06	51.30	78.20	26.90	HQ3 Core	20-Aug-18	Coffey - Warrabrook	NEWC18S-07588	Rhyodacite - competent															
ARDG-DDH07	0.55	17.90	17.35	HQ3 Core	26-Apr-18	Coffey - Warrabrook	NEWC18S-04440	Rhyodacite - competent															
ARDG-DDH07	17.90	48.93	31.03	HQ3 Core	26-Apr-18	Coffey - Warrabrook	NEWC18S-04441	Rhyodacite - competent															
ARDG-DDH07	48.93	72.20	23.27	HQ3 Core	20-Aug-18	Coffey - Warrabrook	NEWC18S-07589	Rhyodacite - competent															
ARDG-DDH07	72.20	95.90	23.70	HQ3 Core	20-Aug-18	Coffey - Warrabrook	NEWC18S-07590	Rhyodacite - competent															
ARDG-DDH07	95.90	111.20	15.30	HQ3 Core	29-Aug-18	Coffey - Warrabrook	NEWC18S-07987	Rhyodacite - competent															
ARDG-DDH08	24.30	54.40	30.10	HQ3 Core	4-May-18	Coffey - Warrabrook	NEWC18S-04825	Volcanic breccia															
ARDG-DDH08	102.47	117.30	14.83	HQ3 Core	4-May-18	Coffey - Warrabrook	NEWC18S-04826	Dolerite															
ARDG-DDH11	6.00	31.00	25.00	HQ3 Core	16-Apr-19	Coffey - Warrabrook	NEWC19S-02942	Rhyodacite - competent															
ARDG-DDH11	31.00	56.00	25.00	HQ3 Core	16-Apr-19	Coffey - Warrabrook	NEWC19S-02943	Rhyodacite - competent															
ARDG-DDH11	56.00	81.00	25.00	HQ3 Core	16-Apr-19	Coffey - Warrabrook	NEWC19S-02944	Rhyodacite - competent															
ARDG-DDH15	0.90	22.00	21.10	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03172	Rhyodacite - fractured and/or brecciated and laumontite veined - Central Fault															
ARDG-DDH15	22.00	43.00	21.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03173	Rhyodacite - fractured and/or brecciated and laumontite veined - Central Fault															
ARDG-DDH15	43.00	65.00	22.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03174	Rhyodacite - fractured and/or brecciated and laumontite veined - Central Fault															
ARDG-DDH15	65.00	90.00	25.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03175	Rhyodacite - competent															
ARDG-DDH15	90.00	111.20	21.20	HQ3 Core	26-Apr-19	Coffey - Warrabrook	NEWC19S-03176	Rhyodacite - competent															
ARDG-DDH15	114.20	129.20	15.00	HQ3 Core	26-Apr-19	Coffey - Warrabrook	NEWC19S-03177	Dacite - altered															
ARDG-DDH16	17.00	42.00	25.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03169	Rhyodacite															
ARDG-DDH16	42.00	67.00	25.00	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03170	Rhyodacite															
ARDG-DDH16	67.00	92.40	25.40	HQ3 Core	24-Apr-19	Coffey - Warrabrook	NEWC19S-03171	Rhyodacite															

ARDG-DDH17	0.00	3.30	3.30	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01146	Clay	36	22	14	8.0
ARDG-DDH17	3.30	6.40	3.10	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01147	Clay to 4.7 m; Sandstone - extremely to highly weathered from 4.7 - 6.4 m.	46	22	24	9.0
ARDG-DDH17	6.40	12.60	6.20	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01148	Clay	47	27	20	6.0
ARDG-DDH17	12.60	16.20	3.60	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01149	Sandstone / Siltsone - extremely to highly weathered	27	22	5	1.5
ARDG-DDH17	16.20	20.85	4.65	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01150	Sandstone / Siltsone - generally moderately weathered	32	17	15	5.5
ARDG-DDH17	20.85	22.77	1.92	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01151	Sandstone / Siltsone - generally moderately weathered	29	18	11	5.5
ARDG-DDH17	22.77	25.40	2.63	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01152	Sandstone / Siltsone - generally moderately weathered	23	22	1	2.5
ARDG-DDH17	25.40	27.20	1.80	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01153	Sandstone / Siltsone - generally moderately weathered	28	18	10	4.0
ARDG-DDH17	34.00	34.96	0.96	HQ3 Core	4-Feb-20	Coffey - Warrabrook	NEW20S-01154	Sandstone / Siltsone - generally moderately weathered	53	N/A	NP	9.0

= meets all product requirements

= meets most product requirements

= non compliant

= Non-compliant; compliant with blending

Concrete Coarse Aggregates - Standard Exposure (A1, A2) (AS2758.1 - 2014) #1
Concrete Coarse Aggregates - Moderate Exposure (B1, B2) (AS2758.1 - 2014) #1
Concrete Coarse Aggregates - Severe Exposure (C) (AS2758.1 - 2014) #1
Concrete Fine Aggregates (<5mm) (AS2758.1 - 2014)
Coarse Asphalt Aggregate (AS2758.5 - 2009) (RMS3152)
Asphalt Fine Aggregates (RMS3152)
Sealing Coarse Aggregates (AS2758.2 - 2009) (RMS3151)
Railway Ballast (AS2758.7 - 2015) #5
Aggregates for Gabion Baskets and Wire Mattreses (AS2758.4 - 2017)
Armourstone (AS2758.6 - 2008)
Roadbase RMS DGB20 (Heavy Duty) (RMS3051)

Notes:

#1 Durability assessment under AS2758.1 was undertaken using Wet Strength and Wet Dry Strength Variation (WDSV).

#2 AS2758.5 requires a minimum Wet Strength of 150 kN for aggregates used in open grade mixes and not less than 100 kN for all other mixes.

#3 RMS3152 specification relevant to course asphalt aggregate used in wearing course. All other applications must have a PAFV ≥ 44.

#4 RMS specification relevant to Wearing Course. AS2758.2 does not specify frictional values

#5 Durability assessment under AS2758.7 undertaken using Aggregate Crushing Value (ACV) and Los Angeles value (LA).

#6 AS 2758.6 permits a wet strength of ≥ 100kN and WDSV of ≤ 30% for 'moderate risk areas', and wet strength of ≥ 80kN and WDSV of ≤ 35% for 'low risk areas'.

8.3 Particle Density and Water Absorption

Thirty-one (31) samples were submitted for coarse particle density and water absorption testing in accordance with AS1141.6. The relationship between particle density and water absorption results for all test samples is illustrated on **Figure 15**, along with relevant threshold limits for determining quarry product suitability.

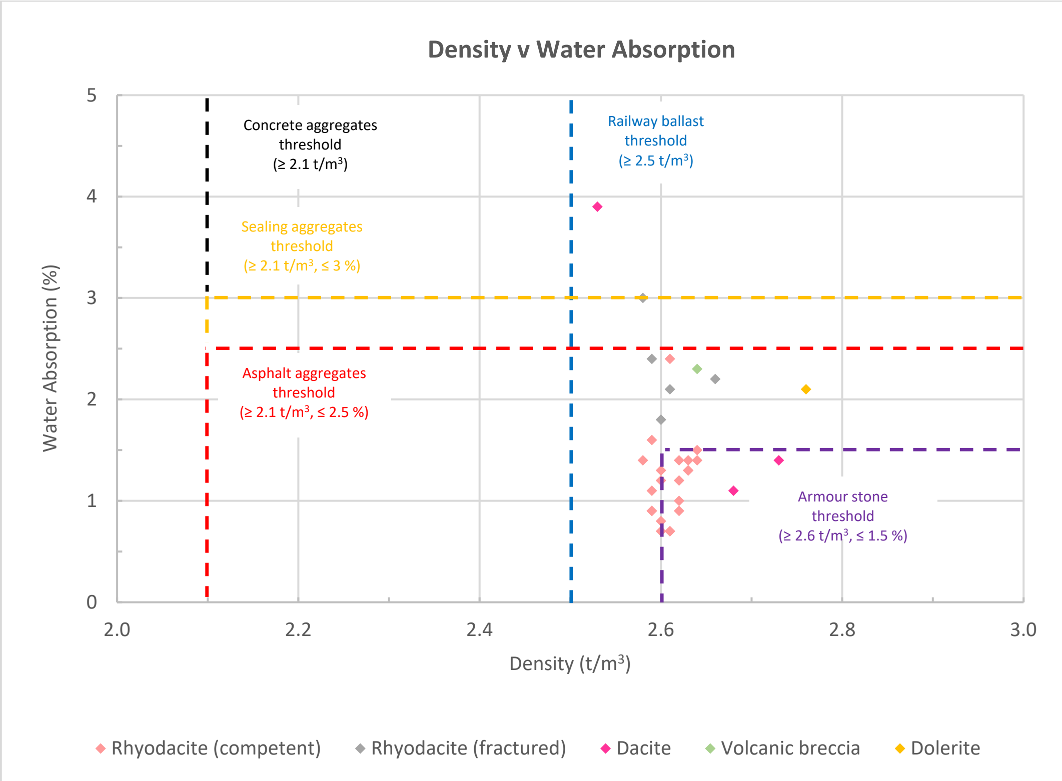

Figure 15 – Density vs water absorption test results for diamond core samples

8.3.1 Rhyodacite

Twenty-one (21) samples of competent rhyodacite produced particle densities ranging from 2.58-2.64 t/m^3, with a mean of 2.61 t/m^3. Corresponding water absorption results ranged from 0.7-2.4 %, with a mean of 1.2 %.

Five (5) samples of fractured and/or brecciated and laumontite veined rhyodacite associated with the Central Fault produced particle densities ranging from 2.58-2.66 t/m^3, with a mean of 2.61 t/m^3. Corresponding water absorption results ranged from 1.8-3.0 %, with a mean of 2.3 %.

8.3.2 Dacite

Two (2) samples of dacite from hole ARDG-DDH03 yielded particle densities of 2.73 t/m^3 and 2.68 t/m^3, and respective water absorptions of 1.4 % and 1.1 %. The altered dacite sample from hole ARDG-DDH15 yielded a particle density of 2.66 t/m^3 and water absorptions of 3.9 %.