BREAKWATER STONE QUARRY SITE
INVESTIGATIONS IN THE BYRON BAY - BRUNSWICK HEADS AREA

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SH 56/3
9640 - IV - N
9640 - IV - S

Accompanying Plans: Plans 1-6 in separate pocket

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ABSTRACT

(For GS indexing purposes)

Geological reconnaissance investigations in the Brunswick Heads - Byron Bay area delineated all feasible breakwater stone quarry sites, subject to a limitation imposed by transport distance from proposed points of use. Six sites were selected for diamond drilling, three of which were drilled in detail. Two sites, known as Borrowdales and Myocum, have been proved with a high degree of confidence to satisfy required reserves volume, block size, and rock quality criteria. At both sites the rock consists mainly of fresh, columnar jointed, basalt.
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CONCLUSIONS

Geological reconnaissance investigations in the Brunswick Heads – Byron Bay area delineated all feasible breakwater stone quarry sites, subject to a limitation imposed by transport distance from proposed points of use. Six sites were selected for diamond drilling, three of which were drilled in detail. The geological assessment carried out to date is considered, with a high degree of confidence, sufficient to indicate that at two sites, known as Myocum and Borrowdales, available rock satisfies reserves volume, block size, and rock quality criteria. Conversely it can be stated that there are no other potentially suitable sites in the area, within the imposed limitations and requirements. Detailed planning and purchase of appropriate areas could now proceed.

The Borrowdales site is a proposed south to south-west extension from an existing quarry face. The former quarry provided stone for Brunswick Heads breakwater. The rock is a columnar jointed basalt, with columns up to 2m across, which in the visible face is demonstrably suitable. Diamond drilling has proved large reserves of what is considered to be comparable rock through the proposed site area. The poor rock encountered in DDH 107 places limitations on potential western development, and in the south-eastern corner of the proposed site, DDH 105 reveals the presence of several metres of overburden.

Myocum site has no artificial exposures; however, the limited but promising outcrop indicates that good quality, relatively massive columnar jointed basalt occurs through the potentially quarryable zone of the hill. Diamond drilling has proven substantial reserves of what is considered to be suitable rock, with minimal overburden. The southern end of the feature as revealed by DDH 101 however, was disappointing. In terms of potential block size this site is probably marginally inferior to Borrowdales site.

Physical testing has shown rock from both sites to be excellent in terms of quality. Drilling has shown that in both sites a face height of over 20m is possible.
INTRODUCTION

Background and Purpose of Project

Recent studies carried out by the NSW Department of Public Works have indicated that one of the engineering options for reducing coastal erosion in the Byron Bay - Brunswick Heads area is to construct groynes at either or both Byron Bay and New Brighton (immediately north of Brunswick Heads). Also the existing major breakwater system at the entrance of the Brunswick River at Brunswick Heads could be expected to require supplementation and repair in the future.

The existing quarry at Borrowdales (and the only major hard rock quarry in the area studied) which was used for construction of the Brunswick Heads breakwater, has been nearly completely exploited, unless further private land is purchased. It was apparent that this would be an environmentally sensitive issue.

The Department of Public Works would like to establish either a centrally located potential quarry site to both areas of likely use, or two separate sites respectively close to each area. The potential site/sites would be considered as long term, major rock reserves. They need to be established as soon as possible because there are rapidly increasing environmental constraints due to population growth in this very pleasant, rural, coastal region. All potential sites require the purchase of relatively high value private land, and are environmentally sensitive to a greater or lesser degree. Therefore any proposed actions must be based on sound geological knowledge.

The Lismore District office of the Department of Public Works requested the NSW Geological Survey to supervise appropriate engineering geological studies in relation to potential quarry sites.

Location

The area studied is on the far North Coast of N.S.W., and extends from New Brighton to south of Byron Bay (see fig. 1). The economics of the proposed engineering works are such that relatively short transport distances are required (preferably less than 10km). Hence as a general guide, sites further west than a line drawn approximately north-south through Mullum-bimby were discounted.
Map and Air Photo Coverage

The area studied is covered by the Brunswick Heads 1:25000 topographic sheet (9640-IV-N), and by the northern part of the Byron Bay 1:25000 sheet (9640-IV-S) and the eastern part of the Huonbrook 1:25000 sheet (9540-1-N). Air photo coverage available was the 1966 Dept of Lands Lismore - Ballina 1466 Series, Runs 1 to 5, at a scale of about 1:44,000.

Rock Requirements

The rock at potential breakwater stone quarry sites should be capable of producing at least 10% of block production up to 20 tonne size, and a substantial proportion in the 5-10 tonne range (up to about 1.5m size). The rock must be strong, hard, fresh and preferably finegrained. It must be able to withstand the physical pressures of wave action and be chemically stable in a marine environment. Weathered rock overburden should be minimal. If rock substance quality is good then defect spacing is of critical importance in assessing whether block size requirements will be met.

Long term reserves of the order of 200,000 to 300,000 m$^3$ (over half a million tonnes) are required.

Previous Work

Chesnut (1972) carried out a regional study of potential breakwater sites between Brunswick Heads and Ballina. This report suggested a number of sites for further investigation, and his sites A, 1, 2, 3, 4, 5, 6, 7, 11, 13 and 14 are relevant to this particular area. However, subsequent inspection has downgraded all these except for A and 1 (Borrowdales and Myocum - see below) because of distance/access problems, and/or probable overburden and rock quality problems.

A local study for aggregate quarry sites was conducted by Chesnut and Crawford (1970) around Byron Bay. This report concluded that only one site, Ewingsdale (see below) could be recommended as a potential aggregate quarry.
Aim of Geological Investigations

The aims of the geological investigations were to:

1) Identify all potential geologically feasible breakwater quarry sites in the nominated region, with emphasis on sites closer than 10km to proposed points of use.

2) Then after application of engineering factors to establish those sites which satisfy project criteria, to carry out limited subsurface work to indicate rock quality at those sites.

3) At promising sites carry out enough subsurface work to establish adequate probable reserves of suitable work.

Terminology

Appendix 1 documents terminology relating to defects, defect spacing, weathering, and rock strength used in this report.

REGIONAL GEOLOGY

The geology of the Byron Bay - Brunswick Heads district is shown on the Tweed Heads 1:250,000 geological sheet (Brunker, 1972) - see fig. 2. The area is underlain by Palaeozoic metasediments of the Neranleigh - Fernvale Group. This unit consists of a monotonous sequence of interbedded shales, siltstones and sandstones, with subordinate more massive cherts and quartzites, together with minor acid volcanics. The sequence has been tightly folded, and typically has a "slaty" appearance due to the cleavage planes developed in the finer grained rocks. The rocks have closely spaced jointing. Apart from the more siliceous rocks, and outcrop along the coastline, the sequence is usually deeply weathered. The unit outcrops in the Cape Byron region and in the areas north and west of Brunswick Heads. The unit can be discounted as a source of breakwater stone in this area.

South-west of Byron Bay an isolated inlier of massive, Triassic, pebbly sandstone and conglomerate occurs in the lower part of the escarpment. This sequence is the most eastern remnant of the Clarence - Moreton Basin, and is between 10 and 20m thick.
Apart from the fact that this unit occurs in an environmentally sensitive area, it is probably not suitable for breakwater stone because of its relatively low strength and likely susceptibility to disaggregation.

Both the above units are overlain by the extensive basic lava flows of the Lismore Basalt unit, which covered the area in Tertiary time. This unit covers most of the area under consideration, except for the 2-3km wide coastal belt. The individual flows range from under 3m thickness to over 30m and form a variable sequence, comprising finegrained, massive and columnar jointed varieties, medium grained and porphyritic varieties, as well as vesicular and amygdaloidal types. The total thickness of the sequence varies considerably and is related to the topography prior to eruption. Typically the sequence is deeply weathered, with overburden many metres thick. However, some of the outcropping flows in the sequence have relatively shallow weathering depths, and consist of rock which is potentially very suitable for breakwater stone.

The coastline areas, between isolated basement headlands, are covered with extensive Quaternary coastal deposits.

**SUMMARY OF GEOLOGICAL INVESTIGATIONS**

**Geological Reconnaissance**

Within the nominated region, map and air photo studies were carried out, which were followed by ground checking through all areas of interest. The sites selected by Chesnut (1972) were re-examined, and an attempt was made to locate additional sites much closer to the coast.

For the purpose of discussion volcanic rock is present in the following areas close to the coast:

1) the ridge line that Borrowdales Quarry is sited in, plus Andersons Ridge.

2) the area between Myocum and Tyagarah

3) the area surrounded by Ewingsdale - Bangalow - Byron Bay

4) the Hilans Corner ridge area, west of Ocean Shores.
These areas were inspected in detail to firstly ascertain areas where the rock was thought to be potentially suitable. Then consideration was given to potential quarry layout feasibility, taking into account volumes required at each site, in order to guide the exploration drilling program. It was realised that some of the sites selected had little chance of meeting requirements, but policy required examination of all possibilities.

Potential quarry sites for detailed testing were selected at Borrowdales (extension of existing quarry) and Hayters (Area 1 above), Myocum and Tyagarah (Area 2 above), Ewingsdale (Area 3 above and Hilans Corner (Area 4 above). The location of these sites is shown on Plan 1. These sites are considered to cover all the available options in the coastal areas. As mentioned previously even the best of the more inland sites do not have the geological potential to warrant further investigation when the distance and access factors are considered.

**Diamond Drilling**

Diamond drilling was carried out at six sites: Hilans Corner, Ewingsdale, Tyagarah, Myocum, Borrowdales and Hayters. The drilling was to definitively prove rock quality, and also in the case of the latter three sites, rock reserves.

All holes were drilled using a Jacro 350 rig, NX size core barrel, and double tube, 3m long barrels. Drill hole details are tabulated in Table 1, geological logs are given in Appendix 2b, and core photos are shown in Plates 1-20. The location of drill holes is shown on Plans 2-4. Appendix 2a presents a summary of the drilling results, while Plans 5 and 6 show cross-sections through the Myocum and Borrowdales sites.

Other forms of sub-surface investigation such as refraction seismic and auger drilling were considered, but not employed. This was because in general, at the selected sites, outcrop is prominent and hence overburden is not considered to be a major problem. Defect spacing in the rock is the major factor in this area which requires investigation with regard to rock quality/block size. Because of the prevalence of columnar jointing in the volcanic rock flows in the district, all holes were angled.
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to intersect all major joint sets. Two holes were drilled at Hilans Corner, and one each at Ewingsdale and Tyagarah, totalling 58m. These sites were shown by drilling to be quite clearly unsuitable in terms of rock quality and sizing.

Six holes were drilled in the Hayters site (see Plan 2) totalling 177m. Initial results were promising but deterioration was found to the north in the main body of the feature, and the site has been discounted. An additional hole drilled well to the east of the above drilling (DDH 107) encountered very poor quality rock.

At the Borrowdales site (see Plan 3) seven holes were drilled totalling 176m. Generally results were good.

At Myocum (see Plan 4) five diamond drill holes totalling 184m were drilled and again results were generally good.

Petrology

Limited petrological assessment (see Appendix 3) was carried out. Results were good, and although the petrological report raises slight doubts about some of the matrix alteration to possible clay minerals, all other indications are that this will present no problems in the proposed use of the rock.

Strength Testing

A sample from a central locality at each of Myocum and Borrowdales sites was tested by Manly Vale Geomechanics Laboratory for; density, sodium sulphate soundness, and point load strength (see Appendix 4). Results of this programme indicate that fresh rock quality is excellent in both cases.
INDIVIDUAL SITES AND DRILLING RESULTS

Ewingsdale

This site is located at GR 549338 Brunswick Heads 1:25000, and is part of a flat-topped northwards trending spur. Another similar spur occurs 300-400m westwards beyond a creek. A railway line passes about 40m north of the end of the spur. A face about 50m long at the north end has been worked to a very limited extent and is about 5-6m high. The face contains moderately to highly weathered basalt and is overgrown with vegetation. The exposed rock is exfoliated along what appear to be closely spaced joints. (100-200mm in places). The joints are "cubical", mainly horizontal and vertical.

A major flat outcrop about 60m across occurs on the top of the ridge about 100m NE of the house and there are also isolated smaller outcrops. Similar outcrops can be seen on the western spur. There are also considerable amounts of small scree scattered over the area. The outcrop and scree indicate that the bulk of the spur is probably not deeply weathered. In the outcrops hexagonal jointing can be seen in the flat exposed surfaces, and has diameters ranging from 200-500mm, usually 300mm. The rock is a fresh, dark, finegrained basalt.

At the end of the spur, on the western side, good outcrops occur in an area which seems to have been worked in a very minor, random fashion. The rock here seems to be more massive than indicated in other areas, with irregularly shaped blocky joints suggesting block sizes ranging up to 1m$^3$ could be obtained. Further south along this side of the spur, outcrops continue but deteriorate in prominence and potential block size reduces to only up to $\frac{1}{2}$m$^3$, though the jointing is variable.

The area at the northwest end of the spur would be the best site area, and a face up to 15m high could be obtained fairly readily. However, indications were that while fresh good quality rock would be obtained, block size would be small (at best 1m$^3$ with potential for much smaller sizes). Environmentally the site is reasonable. The nearest house is 200m away and there is an adjacent swampy area for dumping overburden.

The proximity of the site to potential use areas for stone warranted drilling being carried out to further assess block size.
One hole was drilled inclined at $45^\circ$, from the top to the base of the preferred site and bearing towards the potential face. Results were poor, the rock having closely spaced defects with heavily ironstained faces, and also occasional intervals of extreme weathering. The hole was located at GR 54853377.

**Tyagarah**

This site is located on a long isolated spur in the coastal hinterland area, at about GR544 364 Brunswick Heads 1:25000. The hillsides are covered with abundant scrubby vegetation. There were also potential sites on the main ridge, particularly to the north-east of a derelict house (GR 542 361). The northwestern face of the isolated spur was the preferred site as it is not visible from the sea or houses to the south (300 - 500m away), and faces a swampy area. Uniformly sized blocks of basaltic rock (from $\frac{1}{2}$ to 1m size) form abundant scree across the hillslope. These gave indications of a medium block size being available, in the $1m^3$ range, and overburden being of shallow depth. The rock is a coarsely crystalline variety similar to the Borrowdales rock. A face up to 20m high could probably be obtained fairly readily.

A hole inclined at $45^\circ$ was drilled from the western end of the spur towards the east. Its collar elevation was probably at a level about a half to two-thirds of the total relief from the flat surrounding plain to the top of the knoll. It confirmed that the coarsely crystalline rock was in fact only a relatively thin capping, and that the bulk of the lower area of the feature consists of finegrained, low density, probably deeply weathered, poor quality rock. As this lower area contains the major volume, this feature (and adjacent features) are clearly not suitable for any major quarry development. The hole was located at GR 54403642.
Hilans Corner Area

In the area to the southeast of Mt Chincogan (located GR479438 Huonbrook 1:25,000), it was established that metasediments exist to at least RL 140 and probably quite higher. (Access was gained along a track from GR 489427 Brunswick Heads 1:25,000). This, together with other observations along the highway, rules out any possible sites in this locality or within the large "amphitheatre" type feature which occurs south and west of Hilans Corner. At this stage the high ridge line which runs from Mt Chinocogan to the north-west (which does consist of basic rock cappings and/or intrusions of basic rock) has been ruled out on environmental and access grounds and not examined further.

The Hilans Corner ridge is covered (not continuously) west of the railway line by a relatively thin basaltic type rock capping. The "basalt" overlies metasediments, which appear to have been topographically irregular prior to extrusive flows. It was anticipated that the basaltic rock is probably columnar jointed and some of it at least seems to have a similar composition to the rock at Borrowdales. The first major basalt capping (west of the railway) occurs on the knoll, east of the derelict house, and has a base RL of about 80. Limited exposures of highly weathered basic rock occur around the lower levels and most of the feature is soil covered with only scattered small size surface blocks. A small "scrape" on the eastern side of the ridge near the top of the knoll, shows only extremely to highly weathered material. These observations downgrade this feature from the point of view of available block size and likely rock quality.

To the west, the old house is sited on metasediments, though immediately to the north-west of the house is another small basaltic knoll which is probably much thinner than the feature discussed above. West for 300-400m, the top of the ridge-line consists of metasediments, then it becomes progressively higher and is basalt covered for about 600m, then falls away again. Initially the basalt slopes are mainly soil covered but at the highest levels at the western end, occasional clusters of relatively large surface blocks occur (to .75m size) and the slopes are covered by smaller blocks in the .3 to .5m size range. The rock making up these blocks is fresh and hard. Two holes were sited in this area, about 200m apart, at GR 487450 and 489450.
Huonbrook 1:25,000, drilled with inclinations of 45° and 60° East (along the orientation of the ridge line). Results were not expected to be very good, though it was hoped that at least the rock would be fresh. However, the rock was usually highly to extremely weathered, with a very close defect spacing.

**Borrowdales Site**

1. **Existing Quarry**

The quarry has in the past been used to construct the Brunswick Heads breakwaters. About 120,000m³ of rock was quarried between 1960 and 62. Stone used in the seawards end of the wall varied in size from 5-12 tons and probably averaged between 8-10 tons.

The quarry is illustrated by Plates 21 and 22. The bulk of the exposed quarry face consists of very strong, fresh, porphyritic, basaltic type rock. The rock is part of an essentially horizontal igneous flow. It exhibits prominent columnar jointing, the vertical joints of which constitute the only defects in the rock. This joint spacing ranges from less than 1m to occasionally greater than 2m, with possibly about 1.5m spacing being most common. The southeast end of the quarry passes into poor quality weathered basalt which would be totally unsuitable for breakwater stone. There is also firm indication that rock quality deteriorates badly beneath the gully containing the two large trees to the north of the quarry.

The quarry has driven mainly westwards into a hillside and has an arc length of about 120m. The face is 20m high in the centre, 8-9m high at the extreme western end and probably averages about 15m. A very poorly developed and presently inaccessible "bench" about 4m wide runs along part of the southwestern face.

Previously quarried material lying on the floor indicates that 8m³ (say 20 tonne) blocks are the exception, with typical block size being from 1 to 1.5m³ (say 3 to 10 tonnes). The block size is controlled by the columnar jointing and an inspection of the face indicates that there are areas capable of producing considerable quantities of 8m³ blocks. These would have to be stockpiled during quarry operations to provide armour blocks for the most exposed areas of the breakwaters. The quarry produces a minimal amount of fines.
2. Development Situation

All field indications are that to advance the existing face south-westerly would be the optimum way of re-opening the quarry. This ultimately would involve the purchase of three houses, and a road and power line relocation. Seven diamond drill holes, generally inclined at 45° in the direction of proposed working, were completed to confirm reserves for this course of action. Diamond drilling has confirmed that large reserves of good quality rock exist in this general direction. However, DDH 107 results were disappointing and place limitations on quarry development to the west. It should also be noted that at DDH 105 there is several metres of overburden.

As discussed in Appendix 5, it is defect spacing which is of critical importance in assessing whether a suitable product size will be obtained. The exposed face has columnar jointing ranging from less than 1m spacing to occasionally greater than 2m, with possibly about 1.5m spacings being most common. It is known that this situation produces good product size. Likely product size in the extension has been assessed on the basis of drill core (leaving out DDH 106 which is too short, and DDH 107 which is of poor quality) by calculating the percentage of core lengths greater than 1m and 2m in the fresh to slightly weathered rock sequence. This has been done by only taking into account what are considered natural defects, and leaving aside all drilling breaks and assumed drilling breaks. The results of this assessment are shown below.

<table>
<thead>
<tr>
<th>DDH No.</th>
<th>Core lengths &gt;1m (%)</th>
<th>Core lengths &gt;2m (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>43</td>
<td>10</td>
</tr>
<tr>
<td>102</td>
<td>76</td>
<td>31</td>
</tr>
<tr>
<td>103</td>
<td>70</td>
<td>27</td>
</tr>
<tr>
<td>104</td>
<td>75</td>
<td>46</td>
</tr>
<tr>
<td>105</td>
<td>48</td>
<td>0</td>
</tr>
</tbody>
</table>

These figures seem to indicate that a comparable situation to the present face exists back through most of the site area, that is, yield could have a maximum product size of about 15 to 20 tonnes, with some 50% of production volume exceeding 5 tonnes.
Other Sites in this Area (apart from Hayters - see below)

The entire major ridge line in which Borrowdales quarry is sited, has been examined. South of the Mullumbimby Road the basalt sequence demonstrably thins quite dramatically, and forms only a thin capping clearly unsuitable for large scale quarry development. North of the quarry, the Pacific Highway comes quite close to any potential sites on the eastern side of the ridge. In any case the limited information that can be obtained from surface indications in this area suggest a deterioration in rock quality to the north and also an increase in overburden thickness. North of the Mullumbimby Road, along the western side of the feature, surface indications are again not promising, and also overburden could be substantial. Any quarry development on this side of the ridge has the added disadvantage of being in full view of Mullumbimby, some 2-3km away.

Hayters Site

Immediately to the north of the existing quarry, across a small gully, is a long gentle slope with minimal soil development. In places fairly smooth patches of columnar jointed basalt outcrop (see Plate 23). This area presented an obvious site for northward development, though the potential face height would be slightly lower than at the existing quarry. A possibility to increase the face height was to cut a slot in the existing floor and start development below the existing lower land level.

One shallow hole was drilled in the existing floor, and five holes drilled in the potential site area. All holes were inclined at 45°, generally northwards.

The existing floor was found to have reasonable quality rock only to about 7m depth, and appears to be more closely jointed than in the quarry face itself. DDHs 102 and 103 were promising, but further to the north the floor level of good rock rises quite distinctly. This irregularity in the floor of any proposed development, and the associated reduction in maximum face height severely downgrades this site.

A single hole (DDH107) was also drilled well to the east of the above holes, on the same general topographic feature and this hole encountered very poor rock with major core losses.
Myocum Site

This site is located at the eastern end of a major ridge line at GR 492 351 Brunswick Heads 1:25000. The site is faced by a high ridge line (escarpment face) about 1km to the south, on which there are several houses. The site has also been described by Chesnut (1972). Plate 24 shows the view across to the proposed site from this ridgeline.

A natural starting point for any quarry operation is via a re-entrant which occurs some 200m west along the southern side of the ridge, from the eastern end. By working in a generally north-easterly direction, and leaving perimeter buffers, a nearly completely enclosed quarry could be formed. Five drillholes inclined at 45° were drilled, with DDH 101 being at the extreme south of the potential site and directed easterly, DDHs 102-104 directed north-easterly along the centreline of possible development, and DDH 105 sited to the north of this line and inclined northwesterly.

Field indications are that this site contains good, relatively massive rock. There is substantial outcrop around the edge of the hill, particularly the eastern side. DDHs 102 to 105 in the main body of the hill all revealed good rock; however, DDH 101, at the southern end of the feature was disappointing. The outcrop is not uniformly columnar jointed as at Borrowdales, and from the relatively limited amount of exposure it is difficult to assess block size from the irregular jointing.

The drill core has been assessed (except the poor quality DDH 101) in a similar fashion to that for the Borrowdales site on the basis of defect spacing and the results are listed below.

<table>
<thead>
<tr>
<th>Myocum Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDH</td>
</tr>
<tr>
<td>102</td>
</tr>
<tr>
<td>103</td>
</tr>
<tr>
<td>104</td>
</tr>
<tr>
<td>105</td>
</tr>
</tbody>
</table>

It is considered that these results indicate that a satisfactory product size will be produced.
REFERENCES


APPENDIX 1

Definitions of Terminology

This appendix lists standard definitions used in this report relating to rock weathering and defect spacing, etc.

1. Spacing of Defects.
2. Description of Rock Substance Weathering.
3. Rock Strength.
4. Some Defect Nomenclature.
1. Spacing of Defects.

<table>
<thead>
<tr>
<th>TERM</th>
<th>SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very widely spaced</td>
<td>&gt;2 m</td>
</tr>
<tr>
<td>Widely spaced</td>
<td>600 mm - 2 m</td>
</tr>
<tr>
<td>Moderately widely spaced</td>
<td>200 mm - 600 mm</td>
</tr>
<tr>
<td>Closely spaced</td>
<td>60 mm - 200 mm</td>
</tr>
<tr>
<td>Very closely spaced</td>
<td>20 mm - 60 mm</td>
</tr>
<tr>
<td>Extremely closely spaced</td>
<td>&lt;20 mm</td>
</tr>
</tbody>
</table>

2. Description of Rock Substance Weathering

| Extremely Weathered       | EW          |
|                          |            |
|                          |            |
| Rock substance affected by weathering to the extent that the rock exhibits soil properties, i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident. |

| Highly Weathered          | HW         |
|                          |            |
|                          |            |
| Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original fresh rock substance is no longer recognisable. |

| Moderately Weathered      | MW         |
|                          |            |
|                          |            |
| Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock substance and the original colour of the fresh rock is no longer recognisable. |

| Slightly Weathered        | SW         |
|                          |            |
|                          |            |
| Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable. |

| Fresh                     | F          |
|                          |            |
|                          |            |
| Rock substance unaffected by weathering. |
3. Rock strength

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the bedding. The test procedure is described by the International Society of Rock Mechanics (1972).

<table>
<thead>
<tr>
<th>Term</th>
<th>Is(50) MPa</th>
<th>Field guide</th>
<th>Approx. qu MPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Weak</td>
<td>0.03</td>
<td>Easily remoulded by hand to a material with soil properties</td>
<td>0.7</td>
</tr>
<tr>
<td>Very Weak</td>
<td>0.1</td>
<td>May be crumbled in the hand. Sandstone is &quot;sugary&quot; and friable.</td>
<td>2.4</td>
</tr>
<tr>
<td>Weak</td>
<td>0.3</td>
<td>A piece of core 150 mm long x 50 mm dia, may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.</td>
<td>7</td>
</tr>
<tr>
<td>Medium Strong</td>
<td>1</td>
<td>A piece of core 150 mm x 50 mm dia. can be broken by hand with considerable difficulty. Readily scored with knife.</td>
<td>24</td>
</tr>
<tr>
<td>Strong</td>
<td>3</td>
<td>A piece of core 150 mm long x 50 mm dia. core cannot be broken by unaided hands, can be slightly scratched or scored with knife.</td>
<td>70</td>
</tr>
<tr>
<td>Very Strong</td>
<td>10</td>
<td>A piece of core 150 mm dia. may be broken readily with hand held hammer. Cannot be scratched with pen knife.</td>
<td>240</td>
</tr>
<tr>
<td>Extremely Strong</td>
<td></td>
<td>A piece of core 150 mm long x 50 mm dia. is difficult to break when struck with a hammer.</td>
<td></td>
</tr>
</tbody>
</table>

* The approximate unconfined compressive strength (qu) shown in the table is based on an assumed ratio to the point load index of 24.1. This ratio may vary widely.
4. Some Defect Nomenclature

A joint is a discontinuity in the rock mass which has negligible displacement, and which arises from shearing or extension failure, induced by stresses associated with either 1) tectonic movements such as folding, 2) stress relief 3) cooling shrinkage.

A shear zone is a zone with distinct parallel planar boundaries in which a series of closely spaced joints occur. A crush zone is similar except that it is usually composed of angular disoriented fragments of the host rock.

A fault is a major shear zone on which appreciable displacement has occurred.

Angles of joint inclination (and other geological structures and drillholes) are angles between the feature and a horizontal plane. In core, angles of joints (and other geological structures) are angles between the structure and the plane normal to the axis of the core. In vertical holes these angles are then the true inclination (dip) of the structure.
APPENDIX 2a

Summary of Diamond Drill
Cores DDHs Myocum 101 - 105 and
Borrowdales 101 - 107.
### SUMMARY OF DIAMOND DRILL CORE LOGS

#### Myocum Site

<table>
<thead>
<tr>
<th>Hole Number</th>
<th>Rock Type</th>
<th>Depth</th>
<th>Weathering</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDH 101</td>
<td>Porphyritic basalt</td>
<td>OTR to 3.03m</td>
<td>HW to EW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.03-5</td>
<td>SW but some core loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-7.5</td>
<td>HW to EW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.5-11.27</td>
<td>Mainly SW-MW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.27-14.3</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14.3-15.1</td>
<td>Core loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15.1-15.9</td>
<td>HW</td>
</tr>
<tr>
<td>DDH 102</td>
<td>Porphyritic basalt</td>
<td>OTR to 1.05</td>
<td>SW-MW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.05-2.80</td>
<td>F-SW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.80-5.82</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.82-32.4</td>
<td>MW</td>
</tr>
<tr>
<td></td>
<td>Red vesicular low density flow (&quot;Bole&quot;)</td>
<td>32.4-33.22</td>
<td>21m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>33.22-35.57</td>
<td>HW to EW</td>
</tr>
<tr>
<td>DDH 103</td>
<td>Porphyritic basalt</td>
<td>OTR to .75</td>
<td>SW</td>
</tr>
<tr>
<td></td>
<td>Honeycomb dolerite</td>
<td></td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>Red clay</td>
<td></td>
<td>MW-HW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>42-43.34</td>
<td>29m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>43.54-43.58</td>
<td>EW</td>
</tr>
<tr>
<td>DDH 104</td>
<td>Grey porphyritic basalt</td>
<td>OTR to 1.24</td>
<td>F, very minor SW areas</td>
</tr>
<tr>
<td></td>
<td>Honeycomb, low density flow</td>
<td></td>
<td>2B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.24-41.7</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>41.7-42.8</td>
<td>MW-HW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>42.8-43.92</td>
<td>HW-EW</td>
</tr>
<tr>
<td>DDH 105</td>
<td>Grey porphyritic basalt</td>
<td>OTR to .64</td>
<td>SW to MW</td>
</tr>
<tr>
<td></td>
<td>Honeycomb, low density flow, red.</td>
<td></td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>64-2.22</td>
<td>MW-EW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.22-44.3</td>
<td>30m</td>
</tr>
</tbody>
</table>

Maximum face height in fresh to slightly weathered rock.
<table>
<thead>
<tr>
<th>Hole Number</th>
<th>Rock Type</th>
<th>Depth</th>
<th>Weathering</th>
<th>Maximum face height in fresh to slightly weathered rock</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDH 101</td>
<td>Porphyritic grey basalt</td>
<td>OTR to 1.37</td>
<td>SW-HW + some core loss</td>
<td>At least 25m</td>
</tr>
<tr>
<td>(Inclined 45°)</td>
<td>Fine grained basalt with only occasional phenocrysts and subdued layers of segregated dark minerals, horizontal originally.</td>
<td>1.37 to 3.15, 3.15-21.5</td>
<td>F</td>
<td>18m</td>
</tr>
<tr>
<td>DDH 102</td>
<td>Porphyritic grey basalt</td>
<td>OTR to .15</td>
<td>F</td>
<td>At least 25m</td>
</tr>
<tr>
<td>(inclined 45°)</td>
<td>Coarse Sandstone and conglomerate</td>
<td>29.15-31.12</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>DDH 103</td>
<td>Porphyritic grey basalt</td>
<td>OTR to 2.3</td>
<td>SW-MW</td>
<td>At least 20m</td>
</tr>
<tr>
<td>(Inclined 45°)</td>
<td>Grey porphyritic basalt</td>
<td>2.3-3.18, 3.18-32.6</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>DDH 104</td>
<td>Grey porphyritic basalt</td>
<td>OTR to 1.31</td>
<td>F</td>
<td>At least 24m</td>
</tr>
<tr>
<td>(Inclined 45°)</td>
<td>Grey porphyritic basalt</td>
<td>1.31-36.19</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>DDH 105</td>
<td>Grey porphyritic basalt</td>
<td>OTR to 6.56</td>
<td>HW-SW, some core loss</td>
<td>At least 10m</td>
</tr>
<tr>
<td>(Inclined 45°)</td>
<td>Similar, but less phenocrysts and slightly inferior rock</td>
<td>6.56-8.26</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>DDH 106</td>
<td>Grey porphyritic basalt</td>
<td>OTR to 1.52</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>(Inclined 45°)</td>
<td>Grey porphyritic basalt</td>
<td>1.52-4.64</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>DDH 107</td>
<td>Grey porphyritic basalt</td>
<td>OTR to 3.14</td>
<td>MW-HW with some core loss</td>
<td></td>
</tr>
<tr>
<td>(Inclined 45°)</td>
<td>Grey porphyritic basalt, but finer grained than normal</td>
<td>3.14 to 8.05</td>
<td>SW-MW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.05-11.15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 2b

### Geological Survey of New South Wales

#### Engineering Geology Log

<table>
<thead>
<tr>
<th>Depth (metres)</th>
<th>Description</th>
<th>Weathering</th>
<th>Weakening Strength</th>
<th>Defect Spacing (m.m)</th>
<th>Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-1.13</td>
<td>Core Loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.13</td>
<td>Basalt; fine-grained, dark; very poor quality.</td>
<td>HW to EW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Core Loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>As above</td>
<td>HW to EW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Core Loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>As above</td>
<td>HW to EW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Core Loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>As above</td>
<td>HW</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Tests**
- Fragmented
- 100-150 mm spacing

**Remarks**

**References**
- 14-3-74 water level date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refer to description

**Logged by** JMN
**Date** July 79
**Site** WC

---

**Engineerino Geology**

<table>
<thead>
<tr>
<th>Project Location</th>
<th>H.O. Byron Bay, B/W Quarry E1730</th>
<th>C.O. Ilkley L Collar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawn to Scale</td>
<td>1:25,000</td>
<td>East 45°</td>
</tr>
<tr>
<td>Datum</td>
<td>H.O. Byron Bay, B/W Quarry E1730</td>
<td></td>
</tr>
<tr>
<td>Bearing</td>
<td>East 45°</td>
<td></td>
</tr>
<tr>
<td>Inclination</td>
<td>45°</td>
<td></td>
</tr>
</tbody>
</table>

**Site Information**

**Rock Substance**
- Soil
- Basalt; fine-grained, dark; very poor quality.

**Rock Mass Defects**
- Core Loss
- As above

**Graphical Log**

**Additional Notes**

**Log Details**

**Barrel Type & Length**
- NX Double tube, 3m

**Driller**
- Soil Test

**Commenced**
- 8-6-79

**Completed**
- 9-6-79
### DRILLING INFORMATION

<table>
<thead>
<tr>
<th>DEPTH (metres)</th>
<th>ADDITIONAL DATA</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td></td>
<td>Mainly core loss. Traces of low density, vesicular type basalt.</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>END 9.50</td>
</tr>
</tbody>
</table>

### ROCK SUBSTANCE

<table>
<thead>
<tr>
<th>ROCK SUBSTANCE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Including - NAME, texture, grain size, colour, composition, hardness, bedding, foliation</td>
</tr>
</tbody>
</table>

### ROCK MASS DEFECTS

<table>
<thead>
<tr>
<th>DEFECT SPACING (m.m)</th>
<th>DEFECT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Including - type, coatings or infillings, thickness, inclination, roughness, planarity</td>
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</tbody>
</table>

### TESTS

<table>
<thead>
<tr>
<th>TESTING</th>
<th>SPECIFIC</th>
<th>GENERAL</th>
</tr>
</thead>
</table>

### REFERENCE

1. 3.74 water level date shown
2. Water inflow
3. Partial drilling water loss
4. Complete drilling water loss
5. Alteration refer to description

### REMARKS

<table>
<thead>
<tr>
<th>F</th>
<th>Fresh</th>
<th>EW</th>
<th>Extremely weak</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW</td>
<td>Slightly weathered</td>
<td>VW</td>
<td>Very weak</td>
</tr>
<tr>
<td>MW</td>
<td>Moderately weathered</td>
<td>M</td>
<td>Moderately strong</td>
</tr>
<tr>
<td>HW</td>
<td>Highly weathered</td>
<td>S</td>
<td>Strong</td>
</tr>
<tr>
<td>EW</td>
<td>Extremely weathered</td>
<td>VS</td>
<td>Very strong</td>
</tr>
<tr>
<td>ES</td>
<td>Extremely strong</td>
<td></td>
<td>Date</td>
</tr>
</tbody>
</table>

ENGINEERING GEOLOGY

Logged by: [Name]

Date: [Date]

Site: [Site]

Supervisor: [Name]
## Geological Survey of New South Wales

### Engineering Geology Log

**Hole No.**

| Hole | 107 |

**Project:**

- Brunswick Heads - Byron Bay
- B.M. Quarry

**Location:**

- H.L.A.N. E.R. 4870, 4880, 4890
- Datum: East
- Bearing: East
- Inclination: 60°

**Drill Barrels Type & Length:**

- N.X. Double Tube

**Drill Barrels Data:**

- **Date:** 1.8.79
- **Commenced:** 12.6.79
- **Completed:** 12.8.79

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>R.L.</th>
<th>Addl. Data</th>
<th>Weathering Alteration</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>Soil</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>Basalt grey</td>
<td>Core loss</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
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<td>6</td>
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<td>7</td>
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<td></td>
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<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Description:** Including NAME, texture, grain size, colour, composition, hardness, bedding, foliation.
- **Weathering Alteration:** Estimated strength.
- **Defects Spacing (m):**
- **Defect Description:** Including - type, coatings or infillings, thickness, inclination, roughness, planarity.

**Comments:**

- Well broken, occasional pieces to 200 mm.
- Fragmented

**Reference:**

- 1.3.74 water level date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refer to description

**Remarks:**

- See below

**Engineering Geology:**

- Extremely weak
- Very weak
- Weak
- Moderately weak
- Moderately strong
- Strong
- Extremely weak
- Very strong
- Extremely strong

**Logged by:**

- JMH

**Date:**

- July 79

**Site Supervisor:**

- WC
Deeply weathered brown to olivine, formerly vesicular basalt. Soft and weak ("Rotten rock")

Closely to very closely jointed. Lower area decomposed.
## Geological Survey of New South Wales

### Engineering Geology Log

#### Project: Brunswick Heads - Byron Bay Bluff Quarry Sites RL Collar

#### Location: Tyagarah, CR. 5440, 3642

#### Datum: East

#### Hole No: Tyagarah 101

#### Drilled: 350m

#### Driller: Soil test

#### Committed: 17.5.79

#### Barrel Type & Length: NX, double tube, 3m

#### Completed: 18.5.79

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (meters)</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description</td>
<td>Weathering Alteration</td>
</tr>
<tr>
<td>1</td>
<td>Soil</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Core Loss</td>
<td>F</td>
</tr>
<tr>
<td>5</td>
<td>As above</td>
<td>F</td>
</tr>
<tr>
<td>6</td>
<td>Core Loss</td>
<td>F</td>
</tr>
<tr>
<td>7</td>
<td>As above</td>
<td>F</td>
</tr>
</tbody>
</table>

### Rock Substance

- Basalt, grey, massive, porphyritic

### Weathering Alteration

- F: Fresh
- V: Very weak
- W: Weak
- M: Moderately weathered
- H: Highly weathered
- E: Extremely weathered

### Defect Spacing

- Specific: 0.5m
- General: 0.5m

### Remark

- Includes: type, coatings or infillings, thickness, inclination, roughness, planarity

### Reference

- 14-3/74 water level
- Water level shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refers to description

### Engineering Geology

- Logged by: JMK
- Date: July 79
- Site: LC
- Supervisor: WC
<table>
<thead>
<tr>
<th>DEPTH (metres)</th>
<th>DESCRIPTION</th>
<th>WEATHERING</th>
<th>DEFECT SPACING (mm)</th>
<th>DEFECT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Brown clay</td>
<td>EW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Basalt; low density, fringes, yellow to brown</td>
<td>HW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Clay</td>
<td>EW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Basalt; dark grey clay; low density, fractures</td>
<td>HW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Clay rich material</td>
<td>EW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Clay</td>
<td>EW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>END 14.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**REFERENCE**
- F Fresh
- EW Extremely weak

**ENGINEERING GEOLOGY**
- Logged by
- Date
- Site
- Supervisor
### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Addit Data</th>
<th>Casings</th>
<th>Graphic Log</th>
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<tbody>
<tr>
<td>1</td>
<td>DSD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>DSD</td>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>DSD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DSD</td>
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<tr>
<td>5</td>
<td>DSD</td>
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</tr>
<tr>
<td>6</td>
<td>DSD</td>
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<td></td>
</tr>
<tr>
<td>7</td>
<td>DSD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Rock Substance

<table>
<thead>
<tr>
<th>Description</th>
<th>Weathering Alteration</th>
<th>Estimated Strength</th>
<th>Defect Spacing (m)</th>
<th>Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basalt</td>
<td>Finegrained grey</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Rock Mass Defects

- Core Loss
- Broken, from 50 to 200 mm
- Broken, 50 - 150 mm
- Defects Fest

### Reference

- F: Fresh
- SW: Slightly weathered
- MW: Moderately weathered
- HW: Highly weathered
- EW: Extremely weathered
- VW: Very weak
- W: Weak
- MS: Moderately strong
- S: Strong
- VS: Very strong
- ES: Extremely strong

### Remarks

- Alteration, refer to description

### Engineering Geology

- Logged by: JMN
- Date: July 79
- Site: Ewingdale
- Supervisor: WC
**ENGINEERING GEOLOGY LOG**

**PROJECT**: R.L. COLLAR

**LOCATION**: DATUM BEARING INCLINATION

**HOLE NO**: EWINGS DALE 101

**DRILL**: R.L. COLLAR

**BARREL TYPE & LENGTH**: COMMENCED COMPLETED

<table>
<thead>
<tr>
<th>DEPTH (meters)</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DESCRIPTION</td>
<td>WEATHERING</td>
</tr>
<tr>
<td></td>
<td>Including - NAME, texture, grain size, colour, composition, hardness, bedding, foliation</td>
<td>ALTERATION Estimated STRENGTH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DEFECT SPACING (m.m)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DEFECT DESCRIPTION</td>
</tr>
</tbody>
</table>

- As above.
- Broken, mainly from, some 150
- Fragmented
- Defects mainly 45°, planar and faces altered to clay, with up to 10 mm affected on each side

**REFERENCE**

- F Fresh
- EW Extremely weak
- SW Slightly weathered
- VV Very weak
- HW Highly weathered
- MW Moderately weathered
- MV Very moderate
- MS Moderately strong
- VS Very strong
- EW Extremely weathered
- ES Extremely strong

**ENGINEERING GEOLOGY**

- Logged by
- Date
- Site
- Supervisor

**REMARKS**
**ENGINEERING GEOLOGY LOG**

**PROJECT**

**LOCATION**

**HOLE NO**

**DATE**

**SITE**

**SUPERVISOR**

**REFERENCE**

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>DESCRIPTION</th>
<th>WEATHERING ALTERATION</th>
<th>DEFECT SPACING (m)</th>
<th>ROCK MASS DEFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END 18.26</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DEFECT DESCRIPTION**

- Dito above
- Fragmented

**REMINDERS**

- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

**REFERENCE**

- F Fresh
- EW Extremely weak
- VV Very weak
- W Weak
- MW Moderately weak
- MH Moderately weathered
- HW Highly weathered
- S Strong
- VS Very strong
- ES Extremely strong

**ENGINEERING GEOLOGY**

- Logged by
- Date
- Site
- Supervisor
### Project: Brunnswick Heads - Byron Bay, SW Quarry Sites

#### Engineering Geology Log

**HOLE NO.** Hayters 101

**Location:** Hayters, G.R. 51/40, 4166...1:25,000

**Datum:** 040 M

**Bearings:** 45°

**Inclination:**

**Drill Date:** 7.5.79

**Barrel Type & Length:** NX, double tube

**Driller:** Soiltest

**Commenced:** 17.5.79

**Completed:** 21.5.79

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Rock Substance Description</th>
<th>Weathering Alteration</th>
<th>Weathering Strength</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 1</td>
<td>Basalt, grey, porphyritic</td>
<td></td>
<td>F</td>
<td>Fe st, broken.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Broken, sl. Fe st</td>
</tr>
<tr>
<td>1 - 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Less phenocrysts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 - 7</td>
<td>Fine grained with</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>segregations, probably</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>horizontal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Defects**
- Often 30-45°
- S, irreg, sl.  rough and have sl. coatings

**Remarks:** Drilling breaks and suspected drilling breaks have not been included on Hayters DDH 101-107.

**Engineer Geology:**
- Logged by: Jim
- Date: July 79
- Site: WC

**Reference:**
- 1a-3-7a water level date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refers to description

**Engineering Geology Log**

- Fresh
- Slightly weathered
- Moderately weathered
- Highly weathered
- Extremely weathered
- Very weak
- Weak
- Moderately strong
- Strong
- Very strong
- Extremely strong
### DRILLING INFORMATION
- **Depth (meters)**: 0
- **Added Data**: 
- **Logging**: 

### ROCK SUBSTANCE
- **Description**: 
  - Basalt, becomes darker and very fine-grained.
  - Dark, honeycomb, vesicular, low density
  - Becomes more massive.

### ROCK MASS DEFECTS
- **Defect Spacing (m.m)**: 
- **Defect Description**: 
  - Ditto above
  - Fragmented with contact faces
  - Broken

### REFERENCE
- **Measured:** 14-3-7 Water level
date shown
Water inflow
Partial drilling water loss
Complete drilling water loss
Alteration, refer to description

### ENG/INEERING GEOLOGY
- **Logged by**: 
- **Date**: 
- **Site**: 
- **Supervisor**: 

### REMARKS
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DESCRIPTION</td>
<td>DEFECT SPACING (m)</td>
</tr>
<tr>
<td></td>
<td>Including - NAME, texture, grain size, colour, composition, hardness, bedding, foliation</td>
<td>including - type, coatings or infillings, thickness, inclination, roughness, planarity</td>
</tr>
</tbody>
</table>

**Specific**

- **Defects**
  - 2a-45°, planed, smooth to sl. rough, some with slight coatings.

**General**

- **As above.**

**Tests**

- **Core loss**

**REFERENCE**

- F Fresh
- EW Extremely weak
- WW Very weak
- W Weak
- MS Moderately strong
- S Strong
- VS Very strong
- ES Extremely strong

**ENGINEERING GEOLOGY**

- Logged by
- Date
- Site
- Supervisor

**REMARKS**

- 14-3.74 water level dare shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refer to description
**GEOLOGICAL SURVEY OF NEW SOUTH WALES**

**ENGINEERING GEOLOGY LOG**

<table>
<thead>
<tr>
<th>HOE NO</th>
<th>HAYTERS 102</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION</td>
<td>HAYTERS, 5R 5100 3971</td>
</tr>
<tr>
<td>DATUM</td>
<td>3/5 M</td>
</tr>
<tr>
<td>BEARING</td>
<td>45°</td>
</tr>
<tr>
<td>INCLINATION</td>
<td>45°</td>
</tr>
<tr>
<td>DRILLER</td>
<td>Soil fast</td>
</tr>
<tr>
<td>COMMENCED</td>
<td>22.5.79</td>
</tr>
<tr>
<td>COMPLETED</td>
<td>23.5.79</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>DESCRIPTION</th>
<th>WEATHERING STRENGTH</th>
<th>DEFECT SPACING (m)</th>
<th>DEFECT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basalt, grey, porphyritic.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3</td>
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<td>4</td>
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<td>5</td>
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<td>6</td>
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<td>7</td>
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</tr>
<tr>
<td>8</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

**Tests**

- Specific
- General

**REMARKS**

- Fresh
- Slightly weathered
- Moderately weathered
- Highly weathered
- Extremely weathered
- Very weak
- Weak
- Moderately strong
- Strong
- Very strong
- Extremely strong

**REFERENCE**

- 14-3-74 water level
- Date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

**ENGINEERING GEOLOGY**

- Logged by: John H
- Date: July 79
- Site: HAYTERS
- Supervisor: WC
**ENGINEERING GEOLOGY LOG**

**PROJECT:**
- R L COLLAR

**LOCATION:**
- DATUM
- REARING
- INCLINATION

**DRILL TYPE & LENGTH:**
- DRILLER
- COMMENCED
- COMPLETED

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>DESCRIPTION</th>
<th>WEATHERING</th>
<th>DEFECT SPACING (m)</th>
<th>DEFECT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>16</td>
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</tr>
</tbody>
</table>

**DEFECT DESCRIPTION**:
- Including - type, coatings or infillings, thickness, inclination, roughness, planarity

**REFERENCE**
- 14-3-74 water level
- Date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration - refer to description

**ENGINEERING GEOLOGY**

**Remarks**
**GEOLOGICAL SURVEY OF NEW SOUTH WALES**

**ENGINEERING GEOLOGY LOG**

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>LOCATION</th>
<th>DRILL</th>
<th>DRILLER</th>
<th>COMMENCED</th>
<th>COMPLETED</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.L. COLLAR</td>
<td>DATUM BEARING</td>
<td>INCLINATION</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEPTH (metres)</th>
<th>DESCRIPTION</th>
<th>WEATHERING ALTERNATION</th>
<th>WEATHERING STRENGTH</th>
<th>DEFECT SPACING (m.m)</th>
<th>DEFECT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Less phenocrysts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Phenocrysts start to be replaced by dark, thin, segregational blebs, originally probably horizontal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Uniformly finegrained, with only thin segregational stringers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Broken, related to 70° joint</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ROCK SUBSTANCE**

Including - NAME, texture, grain size, colour, composition, hardness, bedding, foliation.

**ROCK MASS DEFECTS**

Including - type, coatings or infillings, thickness, inclination, roughness, planarity.

**REFERENCE**

- 14:3:14 water level
- date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Altered, referred to description

**ENGINEERING GEOLOGY**

Logged by
Date
Site
Supervisor
## Engineering Geology Log

### General Information
- **Project:**
- **Location:**
- **Driller:**
- **Commenced:**
- **Completed:**

### Drilling Information
- **Depth:**
- **Description:**
- **Weathering:**
- **Defects:**
  - **Defect Spacing:**
  - **Defect Description:**

### Rock Substance
- **Description:**
  - Basalt, darker, denser, finer, slightly weathered.
  - Contact met. area.
  - Conglomerate with grit, clay, fines with depth.
  - White clay rich material - soft and weak.

### Rock Mass Defects
- **Defect Description:**

### Test Reference
- **F:** Fresh
- **EW:** Extremely weak
- **SW:** Slightly weathered
- **VW:** Very weak
- **M:** Moderately weathered
- **S:** Strong
- **VS:** Very strong
- **MS:** Moderately strong
- **ES:** Extremely strong

### Remarks
- **Alteration refer to description**

### Engineering Geology
- **Logged by:**
- **Date:**
- **Site:**
- **Supervisor:**
**GEOLOGICAL SURVEY OF NEW SOUTH WALES**

**ENGINEERING GEOLOGY LOG**

**PROJECT:**

**LOCATION:**

**HOLE NO:** Hayters 102

**LABELS:**

**PROJECT:**

**LOCATION:**

**DRILL, BARREL TYPE & LENGTH:**

**DRILLER:**

**COMMENCED:**

**COMPLETED:**

**DEPTH (meters):**

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>As above</td>
</tr>
<tr>
<td>34</td>
<td>As above</td>
</tr>
<tr>
<td>35</td>
<td>As above</td>
</tr>
<tr>
<td>36</td>
<td>As above</td>
</tr>
</tbody>
</table>

**REFERENCE:**

- F: Fresh
- EW: Extremely weak
- VW: Very weak
- W: Weak
- MW: Moderately weathered
- MS: Moderately strong
- HW: Highly weathered
- S: Strong
- EW: Extremely weathered
- VS: Very strong
- ES: Extremely strong

**ENGINEERING GEOLOGY:**

**Logged by:**

**Date:**

**Site:**

**Supervisor:**

**Remarks:**
### GEOLOGICAL SURVEY OF NEW SOUTH WALES

**ENGINEERING GEOLOGY LOG**

**HOLE NO**

**PROJECT**

**LOCATION**

**DATE**

**BEARING**

**INCLINATION**

**DRILL BARREL TYPE & LENGTH**

**DRILLER**

**COMMENCED**

**COMPLETED**

<table>
<thead>
<tr>
<th>DEPTH (meters)</th>
<th>Addition Data</th>
<th>ROCK SUBSTANCE</th>
<th>DESCRIPTION</th>
<th>WEATHERING WEAKNESS</th>
<th>WEATHERING STRENGTH</th>
<th>DEFECT SPACING (m.m)</th>
<th>DEFECT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>BASALT grey, porphyritic.</td>
<td>SW</td>
<td></td>
<td></td>
<td></td>
<td>Broken</td>
</tr>
</tbody>
</table>

**REFERENCE**

- 1d-3.7d water level data shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

**ENGINEERING GEOLOGY**

- Logged by: JH
- Date: July '79
- Site: WC
# Geological Survey of New South Wales

## Engineering Geology Log

<table>
<thead>
<tr>
<th>Project</th>
<th>R.L. Collar</th>
<th>Location</th>
<th>Datum</th>
<th>Bearing</th>
<th>Inclination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Drilling Information

- **Depth (metres)**
- **Add. Data Sheet**
- **R.L.**
- **Collar**
- **Commenced**
- **Completed**

### Rock Substance

- **Description**
  - Including: NAME, texture, grain size, colour, composition, hardness, bedding, foliation.
- **Weathering**
  - **Weathering Alteration**
    - **Estimated Strength**
    - **Defect Spacing (m.m.)**

### Rock Mass Defects

- **Defect**
- **Description**
  - Including: type, coatings or infillings, thickness, inclination, toughness, planarity.

### Rock Substance Example

- **Fracture**
- **As above**

### Reference

- 16-3rd water level date shown
- Water inflow
- Partial drilling water flow
- Complete drilling water flow
- Alteration, refer to description

### Remarks

- **ENGINEERING GEOLOGY**
- **Logged by**
- **Date**
- **Site**
- **Supervisor**

---

**Log Sheet 3 of 5**

---
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>R.L.</th>
<th>COLLAR</th>
<th>DATE</th>
<th>BEARING</th>
<th>INCLINATION</th>
<th>R.L. COLLAR</th>
<th>DATE</th>
<th>BEARING</th>
<th>INCLINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
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<td></td>
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<tr>
<td>27</td>
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<td></td>
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<tr>
<td>28</td>
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<td>30</td>
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<tr>
<td>31</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rock Substance**

- Basalt becomes finer, less phenocrysts
- Some segregation and layering of dark minerals

**Rock Mass Defects**

- Weathering Alteration
- Estimated Strength
- Defect Spacing (m/m)
- Defect Description

**Tests**

- Specific
- General

**References**

- Fresh
- Very weak
- Weak
- Moderately strong
- Strong
- Very strong
- Extremely strong

**Remarks**

- Logging reference: Fresh
- Water level shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refers to description
GEOLOGICAL SURVEY OF NEW SOUTH WALES
ENGINEERING GEOLOGY LOG

PROJECT: R.L. COLLAR: 
LOCATION: DATUM: 
B. E:A:NG IN CL1:
R:£:N:AL: INCLINATION: 
DRILL: DRILLER: COMMENCED: 
BARREL TYPE & LENGTH: COMPLETED: 

DRILLING INFORMATION

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>ADD'L. DATA</th>
<th>DRILLING LOG</th>
<th>DESCRIPTION</th>
<th>WEATHERING ALTERATION</th>
<th>DEFECT SPACING (mm)</th>
<th>DEFECT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td></td>
<td></td>
<td>Basalt, virtually no phenocrysts. Fine, uniform, with thin dark segregations presumably originally horizontal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td></td>
<td></td>
<td>Gray, very uniform, fine grained, no segregations.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END 39.32

REFERENCE
Alteration, refer to description.

REMARKS

ENGINEERING GEOLOGY
Logged by: 
Date: 
Site: 
Supervisor: 

Rocks: F Fresh, EW Extremely weak, SW Slightly weathered, VW Very weak, MW Moderately weathered, MS Moderately strong, HW Highly weathered, S Strong, EW Extremely weathered, VS Very strong, ES Extremely strong.
**ENGINEERING GEOLOGY LOG**

**PROJECT:** BRUNSWICK MEADS-BYRON BAY... B/W, QUARRY, SITES

**LOCATION:** HAYTERS... G.R., SIBO... SIBO...

**R.L. COLLAR:** 102.2

**DATUM:** 20.3

**BEARING:** 45°

**INCLINATION:** 95°

**COMPLETED:** 18.6.79

**COMMENCED:** 14.6.79

**DRILLER:** Soil fast

**BARREL TYPE & LENGTH:** 6m, diameter 35.5mm

### DRILLING INFORMATION

<table>
<thead>
<tr>
<th>DEPTH (meters)</th>
<th>土壤</th>
<th>砂岩</th>
<th>特性</th>
<th>强度</th>
<th>损害描述</th>
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<tbody>
<tr>
<td>1</td>
<td>Soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DESCRIPTION:**
- Soil
- Small piece of sand and clay
- Typical loss of core
- Basalt, grey, porphyritic, very hard.

**WEATHERING STRENGTH:**
- Soil
- Sandstone

**DEFECT DESCRIPTION:**
- Soil
- SANDY SANDSTONE

**DEFECT SPACING (m):**
- Soil
- Sandstone

**REMARKS:**
- Fresh
- Very weak
- Weak
- Moderately strong
- Strong
- Extremely strong

**DATE:** July 79

**ENGINEERING GEOLOGY**

Logged by: John

Site: WC
**Engineering Geology Log**

<table>
<thead>
<tr>
<th>Depth (meters)</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Series of coated breaks.</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Description**
- Less phenocrysts
- Fine grained with no phenocrysts, possibly slightly less dense
- Random defect pattern

**Tests**
- Specific
- General

**Remark**
- As above

**Reference**
- 14-3-4 water level date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

**Engineering Geology**
- Logged by
- Date
- Site
- Supervisor
## GEOLOGICAL SURVEY OF NEW SOUTH WALES

### ENGINEERING GEOLOGY LOG

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>LOCATION</th>
<th>HOLE NO</th>
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<tbody>
<tr>
<td>R L COLLAR</td>
<td>R L COLLAR</td>
<td>Neatars</td>
</tr>
<tr>
<td>DATUM</td>
<td>BEARING</td>
<td>104</td>
</tr>
<tr>
<td>INCLINATION</td>
<td></td>
<td></td>
</tr>
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<table>
<thead>
<tr>
<th>DRILL</th>
<th>DRILLER</th>
<th>COMMENCED</th>
<th>COMPLETED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| BARREL TYPE & LENGTH | | | |
|-----------------------|----------|------------------|
| | | |

### DRILLING INFORMATION

<table>
<thead>
<tr>
<th>DEPTH (metres)</th>
<th>GRAPHIC LOG</th>
<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **At above.**
- **Very finegrained and dark coloured.**
- **Broken in layers to small pieces.**
- **Well broken up into 50-150 mm pieces.**
- **Mainly 50mm spacing and very variable.**
- **Defects steep and faulted.**

### ROCK SUBSTANCE

- **Very finegrained and dark coloured.**
- **Broken in layers to small pieces.**
- **Well broken up into 50-150 mm pieces.**
- **Mainly 50mm spacing and very variable.**
- **Defects steep and faulted.**

### ROCK MASS DEFECTS

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>GRAPHIC LOG</th>
<th>WEATHERING ALTERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Almost unweathered.**
- **Slight weathering only.**
- **Moderate weathering.**
- **Strongly weathered.**
- **Extremely weathered.**

### REFERENCE

- **1a-3.74 water level.**
- **Date shown.**
- **Water inflow.**
- **Partial drilling water loss.**
- **Complete drilling water loss.**
- **Alteration refer to description.**

### REMARKS

- **Very finegrained and dark coloured.**
- **Broken in layers to small pieces.**
- **Well broken up into 50-150 mm pieces.**
- **Mainly 50mm spacing and very variable.**
- **Defects steep and faulted.**

### ENGINEERING GEOLOGY

- **Logged by:** [Signature]
- **Date:** [Date]
- **Site:** [Site]
- **Supervisor:** [Signature]
### Geological Survey of New South Wales

#### Engineering Geology Log

<table>
<thead>
<tr>
<th>HOLE NO</th>
<th>Hayters 104</th>
</tr>
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</table>

### Project Location

<table>
<thead>
<tr>
<th>Location</th>
<th>R.L. Collar</th>
<th>Datum</th>
<th>Bearing</th>
<th>Inclination</th>
</tr>
</thead>
</table>

### Drilling Information

<table>
<thead>
<tr>
<th>Drilling Information</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth and R.L. (m)</td>
<td>Description</td>
<td>Defect Spacing (m)</td>
</tr>
<tr>
<td>Add' Fatigue Resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graphic Log</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Massive pale grey to white, 50% rich coarse silt to fine grt. (? Alluv.)**
- **Fine grn, 30% gyx, 70% silt.**

- **Mainly core loss.**
- **Quartz clasts to 50-40mm**

**END 29.45**

### Rock Mass Defects

- **Defect Description:** Widely spaced irregular breaks.

### Engineering Geology

- **Logged by:**
- **Date:**
- **Site:**
- **Supervisor:**

### Reference

- **Fresh:** F
- **Very Weak:** VW
- **Weak:** W
- **Moderately Weak:** MW
- **Moderate to Strong:** MS
- **Strong:** S
- **Very Strong:** VS
- **Extremely Strong:** ES

### Remarks

- **Alteration:**
- **Complete drilling water loss:**
- **Partial drilling water loss:**
- **Water inflow:**

**ENGINEERING GEOLOGY LOG**
### Geological Survey of New South Wales

#### Engineering Geology Log

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Basalt, grey, porphyric</td>
<td></td>
<td>Piece 50-150 mm. Somes of 90° joints, rough, irreg, sl. coating.</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5</td>
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<td></td>
<td></td>
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<tr>
<td>6</td>
<td></td>
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<tr>
<td>7</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Table:

<table>
<thead>
<tr>
<th>DEFECT SPACING (m)</th>
<th>DEFECT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Including - type, coatings or infillings, thickness, inclination, roughness, planarity</td>
</tr>
</tbody>
</table>

#### Notes:

- **REFERENCE**
  - 14-3-74 water level date shown
  - Water inflow
  - Partial drilling water loss
  - Complete drilling water loss
  - Alteration refer to description

- **ENGINEERING GEOLOGY**
  - Logged by Joe
  - Date July 79
  - Site charge
  - Supervisor WI

#### Tests:

- Specific
- General
### Geological Survey of New South Wales

#### Engineering Geology Log

**Hole No.** Hayters 105

**Location:** [Partial location text]

**Project:** [Partial project text]

**Driller:** [Partial driller text]

**Drill Type & Length:** [Partial drill type and length text]

**Commenced:** [Partial commence date]

**Completed:** [Partial complete date]

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basalt becomes finer grained, with less phenocrystals.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Black segregations presumably horizonal and related to flows. Finer material does not seem to be columnar jointed. Defects of variable orientation.</td>
<td></td>
</tr>
</tbody>
</table>

**REFERENCE**

- F Fresh
- VW Very weak
- W Weak
- MS Moderately strong
- S Strong
- VS Very strong
- ES Extremely strong

**Remarks**

**Engineer in charge:** [Name]

**Logged by:** [Name]

**Site:** [Location]

**Supervisor:** [Name]
# GEOLOGICAL SURVEY OF NEW SOUTH WALES

## ENGINEERING GEOLOGY LOG

### HOLE NO.
Hayfers 105

### PROJECT
RL COLLAR

### LOCATION

### DATUM

### REARING

### INCLINATION

### DRILL, BARREL TYPE & LENGTH

### DRILLER

### COMMENCED

### COMPLETED

### DRILLING INFORMATION

<table>
<thead>
<tr>
<th>DEPTH (metres)</th>
<th>ROCK SUBSTANCE</th>
<th>WEATHERING</th>
<th>DEFECT SPACING (m m)</th>
<th>DEFECT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

### ROCK SUBSTANCE

- **Descript**
  - Basalt; very fine-grained, probably lower density than above
  - Grey basic material

### WEATHERING

- **Descript**
  - F Fresh
  - SW Slightly weathered
  - MW Moderately weathered
  - HW Highly weathered
  - EW Extremely weathered

### DEFECT SPACING

- **Descript**
  - F to Sw

### DEFECT DESCRIPTION

- **Descript**
  - Wall broken, with coated planar smooth defects.

### CORE LOSS

### REFERENCE

- 14.374 water level date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

### REMARKS

<table>
<thead>
<tr>
<th>ENGINEERING GEOLOGY</th>
<th>Log in by</th>
<th>Date</th>
<th>Site</th>
<th>Supervisor</th>
</tr>
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<tbody>
<tr>
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<tr>
<td>HOLE NO</td>
<td>Hayters 105</td>
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**Geological Survey of New South Wales**

**Engineering Geology Log**

<table>
<thead>
<tr>
<th>Project</th>
<th>R.L. Collar</th>
<th>Datum</th>
<th>Bearing</th>
<th>Inclination</th>
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<tbody>
<tr>
<td>Location</td>
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**Drilling Information**

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**Rock Substance**

<table>
<thead>
<tr>
<th>Rock Substance</th>
<th>Description</th>
<th>Weathering Alteration</th>
<th>Estimated Water Resistance</th>
<th>Defect Spacing (m/m)</th>
<th>Defect Description</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><em>Mainly core loss.</em></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td><em>End 25.76</em></td>
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**Rock Mass Defects**

<table>
<thead>
<tr>
<th>Rock Mass Defects</th>
<th>Specific</th>
<th>General</th>
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**Tests**

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**Remarks**

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**Reference**

- F: Fresh
- EW: Extremely weak
- V: Very weak
- W: Weak
- M: Moderately weathered
- Moderately strong
- S: Strong
- V: Very strong
- ES: Extremely strong

**Logging Details**

- Logged by: [Name]
- Date: [Date]
- Site: [Site]
- Supervisor: [Name]
# Geological Survey of New South Wales

## Engineering Geology Log

**Hole No:** HAVERCS 106

**Location:** Hayters, N.S.W.

**Datum:** 0.20 M.

**Drill:** Jaeger 3/6

**Driller:** Soethurst

**Barrel Type & Length:** AX, double tube.

**Project:**

**Commenced:** 22.6.79

**Completed:** 23.6.79

## Drilling Information

<table>
<thead>
<tr>
<th>Depth (Metres)</th>
<th>DRILLING INFORMATION</th>
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<tr>
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<td>8</td>
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</table>

## Rock Substance

**Soil**

1. Basalt; grey, pumphite; SW

**Core Loss**

- As above

**Soil**

2. Basalt.

**Core Loss**

- As above


**Core Loss**

- As above


**Electrical Conductivity**

- Fragmented

- Well broken, largest piece 150 mm.

## Rock Mass Defects

**Defect Spacing (mm):**

- 0.00

**Defect Description:**

- Including - type, coatings or infillings, thickness, inclination, roughness, planarity

## Tests

**Specific Gravity**

- General

**Remarks**

- Reference

- Fresh 14-3-74 water level date shown

- Water inflow

- Partial drilling water loss

- Complete drilling water loss

- Alteration, refer to description

**Engineering Geology**

- Logged by: John

- Date: July 79

- Site: WC
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
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<tbody>
<tr>
<td></td>
<td>DESCRIPTION</td>
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<td></td>
<td>Including - NAME, texture, grain size, colour, composition, hardness, bedding, foliation</td>
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<tr>
<td></td>
<td>WEATHERING ALTERATION</td>
<td></td>
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<td></td>
<td>Estimation of WEATHERING STRENGTH</td>
<td></td>
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<tr>
<td></td>
<td>SPACING (m/m)</td>
<td></td>
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<tr>
<td></td>
<td>DEFECT DESCRIPTION</td>
<td>Including - type, coatings or infillings, thickness, inclination, roughness, planarity</td>
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<td>16</td>
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</table>

**REFERENCE**
- F Fresh
- EW Extremely weak
- VW Very weak
- W Weak
- MW Moderately weathered
- MS Moderately strong
- HW Highly weathered
- S Strong
- EW Extremely weathered
- VS Very strong
- ES Extremely strong

**ENGINEERING GEOLOGY**
- Logged by
- Date
- Site
- Supervisor
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>DESCRIPTION</th>
<th>ROCK SUBSTANCE</th>
<th>DRILLER</th>
<th>PROJECT</th>
<th>LOCATION</th>
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</thead>
<tbody>
<tr>
<td>25</td>
<td>As above</td>
<td>Massive grey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td>claystone</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>27</td>
<td></td>
<td>basaltic rock</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>END 27.46</td>
<td></td>
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</tr>
</tbody>
</table>

**REMARKS**

- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

**REFERENCE**

- F Fresh
- SW Slightly weathered
- MW Moderately weathered
- EW Extremely weathered
- VW Very weak
- W Weak
- MS Moderately strong
- S Strong
- VS Very strong
- ES Extremely strong

**ENGINEERING GEOLOGY**

- Logged by
- Date
- Site
- Supervisor
# Geological Survey of New South Wales

## Engineering Geology Log

### Hole No. 107

**Project:** Byrons Head-Byron Bay Quarry Sites

**Location:** Hayters, NR. 5210.3466, 1125.000

**Datum:** O.D. 95' M

**Bearing:** 095°

**Inclination:** 45°

**Drill Type & Length:** 350, Drill Test

**Driller:** Soil Test

**Commenced:** 27.6.79

**Completed:** 27.6.79

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Graphic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basalt, Juyo, porphyrite, strong</td>
</tr>
<tr>
<td>2</td>
<td>Soil, EW</td>
</tr>
<tr>
<td>3</td>
<td>Soil, EW</td>
</tr>
<tr>
<td>4</td>
<td>Soil, EW</td>
</tr>
<tr>
<td>5</td>
<td>Soil, EW</td>
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<tr>
<td>6</td>
<td>Soil, EW</td>
</tr>
<tr>
<td>7</td>
<td>Soil, EW</td>
</tr>
<tr>
<td>8</td>
<td>Soil, EW</td>
</tr>
</tbody>
</table>

### Rock Substance

- **Description:** Including - Name, texture, grain size, colour, composition, hardness, bedding, foliation

### Rock Mass Defects

- **Defect Spacing (m):**
- **Defect Description:** Including - type, coatings or infillings, thickness, inclination, roughness, planarity

### Engineering Geology

**Logged by:** [Name]

**Date:** July 79

**Site:** [Site Name]

**Supervisor:** [Supervisor Name]
## Geological Survey of New South Wales
### Engineering Geology Log

**HOLE NO**: Hayters 107

**LOCATION**: Sheet 2 of 2

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Adit Data</th>
<th>R.L.</th>
<th>Coating</th>
<th>Barrel Type &amp; Length</th>
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</thead>
<tbody>
<tr>
<td>9</td>
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</table>

### Rock Substance

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
<th>Weathering Strength</th>
<th>Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Basalt, dark grey, strong</td>
<td>Hv</td>
<td>CORE LOSS</td>
</tr>
<tr>
<td>10</td>
<td>Vesicular dolerite</td>
<td>Hv</td>
<td>CORE LOSS</td>
</tr>
<tr>
<td>11</td>
<td>Basalt, strong</td>
<td>Sw</td>
<td>CORE LOSS</td>
</tr>
<tr>
<td>12</td>
<td>Weak, grey, basalt</td>
<td>Hv to Erw</td>
<td>CORE LOSS</td>
</tr>
<tr>
<td>13</td>
<td>Ditto, strong</td>
<td>Sw</td>
<td>CORE LOSS</td>
</tr>
<tr>
<td>14</td>
<td>Basalt, weak</td>
<td>F</td>
<td>CORE LOSS</td>
</tr>
<tr>
<td>15</td>
<td>Weak basalt</td>
<td>Hv</td>
<td>CORE LOSS</td>
</tr>
<tr>
<td>16</td>
<td>Basalt, Fingemined</td>
<td>Sw</td>
<td>CORE LOSS</td>
</tr>
</tbody>
</table>

**END 16.05**

###岩层缺陷

- **Depth (m)**
- **Description**: Basalt, dark grey, strong
- **Weathering Strength**: Hv
- **Defects**: CORE LOSS

###其他信息

- **REMARKS**: 14-3-74 water level, date shown
- **ENGINEERING GEOLOGY**
  - Logged by
  - Date
  - Site
  - Supervisor
**GEOLOGICAL SURVEY OF NEW SOUTH WALES**

**ENGINEERING GEOLOGY LOG**

- **HOLE NO:** Borrowdale
- **LOCATION:** Borrowdale, GR. 572 376, H: 2500, Bearing 215° M, Datum 25.00
- **INCLINATION:** 45°
- **DRILL TYPE & LENGTH:** N.D. double tube 57mm
- **COMMENCED:** 31/3/79
- **COMPLETED:** 30/5/79

<table>
<thead>
<tr>
<th>DEPTH (meters)</th>
<th>ROCK SUBSTANCE</th>
<th>WEATHERING DEGREE</th>
<th>SPACING (m.m)</th>
<th>DEFECT DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Soil</td>
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</tr>
<tr>
<td>1</td>
<td>Basalt, grey, periphery</td>
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<td>Broken</td>
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<td>2</td>
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</tbody>
</table>

**REMARKS**

Drilling breaks and suspected drilling breaks have been excluded from logs of DDH Borrowdale 101-107.

**REFERENCE**

- F Fresh
- EW Extremely weak
- VW Very weak
- W Weak
- WS Moderately weak
- MS Moderately strong
- S Strong
- VS Very strong
- ES Extremely strong

**ENGINEERING GEOLOGY**

- Logged by: John
- Date: July 79
- Site: Borrowdale
- Supervisor: WC
### Geology Log for Hole No. 8

#### Project:
- R.L. COLLAR

#### Location:
- Site Supervisor

#### Drilling Information:
- Driller: 101
- Commenced: [Date]
- Completed: [Date]

#### Rock Substance:
- **Description**:
  - Basalt, as shown

#### Rock Mass Defects:
- **Defect Description**:
  - Specific
  - General

#### Drilling Information Table:

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Graphic Log</th>
<th>Rock Substance</th>
<th>Weakening Alteration</th>
<th>Defect Spacing (mm)</th>
<th>Defect Description</th>
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<tr>
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<td>Basalt, as shown</td>
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</tbody>
</table>

#### Remarks:
- Fresh, as shown

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**Reference**
- 14-3-74 water level
- Date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refers to description

**ENGINEERING GEOLOGY**
- Logged by
- Date
- Site
- Supervisor
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>DEPTH (RL)</th>
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<th>CAPPING</th>
<th>Barcode</th>
<th>GRAPHIC LOG</th>
<th>DESCRIPTION</th>
<th>WEATHERING ALTERNATION</th>
<th>WEATHERING SPACING (m)</th>
<th>WEATHERING STRENGTH</th>
<th>DEFECT SPACING (m)</th>
<th>DEFECT DESCRIPTION</th>
<th>TESTS</th>
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<tbody>
<tr>
<td>17</td>
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<td></td>
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<td>Basalt, as above</td>
<td>F</td>
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<td></td>
<td>Broken</td>
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<td>19</td>
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<td></td>
<td></td>
<td></td>
<td>Less phenocrysts</td>
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<tr>
<td>20</td>
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<td></td>
<td>Fine-grained with only occasional phenocrysts</td>
<td>F</td>
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<tr>
<td>21</td>
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<td></td>
<td></td>
<td>Subdued layers of dark segregations, probably original banded</td>
<td>F</td>
<td></td>
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</tbody>
</table>

**REFERENCE**

1. 43-74 water level date shown
2. Water inflow
3. Partial drilling water loss
4. Complete drilling water loss
5. Alteration refer to description

**REMARKS**

ENGINEERING GEOLOGY

- Fresh (F)
- Slightly weathered (SW)
- Moderately weathered (MW)
- Highly weathered (HW)
- Extremely weathered (EW)
- Very weak (VW)
- Weak (W)
- Moderately strong (MS)
- Strong (S)
- Very strong (VS)
- Extremely strong (ES)

Logged by [Name]
Date [Date]
Site [Site]
Supervisor [Supervisor]
## GEOLOGICAL SURVEY OF NEW SOUTH WALES
### ENGINEERING GEOLOGY LOG

**HOLE NO**

**BORROWDALE**

**PROJECT**

**BUNJUMBURLA - BOWEN BAY - BUW SURVEY SITES**

**COLLAR**

107.9

**LOCATION**

**BORROWDALE**

**R. L.**

3166.3953

**DATE**

11.25.1980

**BEARING**

230° M.

**INCLINATION**

45°

**DRILL**

**300 M**

**DRILLER**

**SOUTH TEST**

**COMPLETED**

28.6.79

**BARREL TYPE & LENGTH**

**M**

**COMPLETED**

4.7.79

### DRILLING INFORMATION

<table>
<thead>
<tr>
<th>DEPTH (metres)</th>
<th>R.L.</th>
<th>Casing</th>
<th>Graphic Log</th>
<th>DESCRIPTION</th>
<th>WETTING ALTERATION</th>
<th>DEFECT SPACING (m.m)</th>
<th>DEFECT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R.L.</td>
<td></td>
<td></td>
<td>BASALT; gray, porphyritic</td>
<td></td>
<td></td>
<td>45° slight (R.E.), 50-150 mm.</td>
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</tr>
</tbody>
</table>

### ROCK SUBSTANCE

- **NAME**: BASALT
- **Texture**: Gray, porphyritic
- **Grain Size**: Medium
- **Colour**: Gray
- **Composition**: Basaltic
- **Hardness**: Medium
- **Bedding**: None
- **Foliation**: None

### ROCK MASS DEFECTS

- **SPECIFIC DESCRIPTION**
  - 45° slight (R.E.), 50-150 mm.

### ENGINEERING GEOLOGY

- **Logged by**: J.H.
- **Date**: July 79
- **Site**: WC
- **Supervisor**: WC

### REMARKS

- **Drill Information**
  - 14-374 water level
  - Date shown
  - Water inflow
  - Partial drilling water loss
  - Complete drilling water loss
  - Alteration, refer to description

- **Tests**
  - Fresh (F)
  - Extremely weak (EW)
  - Very weak (VW)
  - Weak (W)
  - Moderately weathered (MW)
  - Slightly weathered (SW)
  - Highly weathered (HW)
  - Extremely weathered (EW)
  - Strong (S)
  - Very strong (VS)
  - Extremely strong (ES)
# Geological Survey of New South Wales

## Engineering Geology Log

**Hole No.** 162  
**Date** July 19**

### Drilling Information

<table>
<thead>
<tr>
<th>Depth</th>
<th>Add. Data</th>
<th>Water</th>
<th>Graphic LOG</th>
<th>Rock Substance</th>
<th>Weathering Alteration</th>
<th>Rock Mass Defects</th>
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### Remarks

- As above.

### Reference

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<td>F</td>
<td>Fresh</td>
</tr>
<tr>
<td>SW</td>
<td>Slightly weathered</td>
</tr>
<tr>
<td>VW</td>
<td>Very weak</td>
</tr>
<tr>
<td>M</td>
<td>Weak</td>
</tr>
<tr>
<td>MS</td>
<td>Moderately strong</td>
</tr>
<tr>
<td>S</td>
<td>Strong</td>
</tr>
<tr>
<td>VS</td>
<td>Very strong</td>
</tr>
<tr>
<td>ES</td>
<td>Extremely strong</td>
</tr>
</tbody>
</table>

### Tests

- Specific General

---

**Engineered Geology**

Logged by  
Date  
Site  
Supervisor
# Geological Survey of New South Wales

## Engineering Geology Log

**Project:**
- R.L. Collar

**Location:**
- Datum
- Bearing
- Inclination

**Drill:**
- Driller
- Commenced
- Completed

<table>
<thead>
<tr>
<th>Hole No</th>
<th>B' Dale 102</th>
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<tbody>
<tr>
<td>Sheet</td>
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## Drilling Information

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<th>Depth (metres)</th>
<th>Additional Data</th>
<th>Method</th>
<th>Graphic Log</th>
<th>Description</th>
<th>Weathering Alteration</th>
<th>Weath. Est. Strength</th>
<th>Defect Spacing (m.m)</th>
<th>Defect Description</th>
<th>Tests</th>
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**Remarks:**

- A as above

### Rock Substance

<table>
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<th>Description</th>
<th>Weathering Alteration</th>
<th>Est. Strength</th>
<th>Defect Spacing</th>
<th>Defect Description</th>
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<tbody>
<tr>
<td>Fresh</td>
<td>Extremley weak</td>
<td>EWS</td>
<td></td>
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<tr>
<td>Slightly</td>
<td>Very weak</td>
<td>WWS</td>
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<tr>
<td>Moderately</td>
<td>Weak</td>
<td>WMS</td>
<td></td>
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<tr>
<td>Highly</td>
<td>Strong</td>
<td>SMS</td>
<td></td>
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<tr>
<td>Extremely</td>
<td>Very strong</td>
<td>VMS</td>
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<tr>
<td>Extremely</td>
<td>Strong</td>
<td>ESMS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Reference**

- Fresh
- Slightly weathered
- Moderately weathered
- Highly weathered
- Extremely weathered

**Tests**

- Specific
- General

## Rock Mass Defects

- Incl. - type, coatings or infillings, thickness, inclination, roughness, planarity

### Reference

- 14.374 water level
- Date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Attention refers to description

### Remarks

- A as above

---

**Engineering Geology**

- Logged by
- Date
- Site
- Supervisor
## Geological Survey of New South Wales

### Engineering Geology Log

<table>
<thead>
<tr>
<th>Hole No</th>
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#### Project

<table>
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#### Location

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#### Drilling Information

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<th>Depth (m)</th>
<th>R.L. Collar</th>
<th>Date of RL</th>
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#### Rock Substance

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
</tr>
</thead>
</table>

- **Including**: Name, texture, grain size, colour, composition, hardness, bedding, foliation

#### Rock Mass Defects

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Weathering Alteration</th>
<th>Estimated Strength</th>
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</table>

- **Defect Spacing (m.m)**

<table>
<thead>
<tr>
<th>Defect Description</th>
</tr>
</thead>
</table>

- **Including**: Type, coatings or infillings, thickness, inclination, roughness, planarity

#### Tests

<table>
<thead>
<tr>
<th>Specific</th>
<th>General</th>
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</thead>
</table>

**As above**

### Reference

- 1-4.74 water level
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

### Remarks

#### Engineering Geology

<table>
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</tr>
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<table>
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<table>
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<th>Site</th>
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</table>

<table>
<thead>
<tr>
<th>Supervisor</th>
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</table>
## Geological Survey of New South Wales

### Engineering Geology Log

**Hole No.** 8'Dales 102

**Project.**

**Location.**

**Drill.**

**Barrel Type & Length.**

**Driller.**

**Commenced.**

**Completed.**

<table>
<thead>
<tr>
<th>Drilling Information</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
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<tbody>
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<td>Depth (meters)</td>
<td>Description</td>
<td>Defect</td>
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<tr>
<td></td>
<td>Including NAME, texture, grain size, color, composition, hardness, bedding, foliation</td>
<td>Spacing (m)</td>
</tr>
<tr>
<td></td>
<td>Weathering</td>
<td>Defect Description</td>
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<td>Estimated Strength</td>
<td>Including type, coatings or infillings, thickness, inclination, roughness, planarity</td>
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**Tests:**

- Specific
- General

**Remarks:**

- End 36:55

**Reference:**

- F Fresh
- EW Extremely weak
- 1d-3-74 water level
- Water inflow
- Partial drilling water inflow
- Complete drilling water loss

**Engineerin Geology:**

Logged by

Date

Site

Supervisor

**Knots:**

- As above

**Graph:**

- Sulfur

---

*Note: The image contains a detailed geological log with various entries and data points related to drilling information, rock description, weathering, defect spacing, and defect description.*
**GEOLOGICAL SURVEY OF NEW SOUTH WALES**

**ENGINEERING GEOLOGY LOG**

| PROJECT | BUNYIP HEADS-BURNETT. S.W. Quarry. Site R.L. Collar | 107.2 |
| LOCATION | BUNYIP HEADS, S.W. Quarry. | 43.160, 2963 |
| DATUM | 240.0 |
| BEARING | N 95 |
| INCLINATION | 103 |

**DRILLING INFORMATION**

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**ROCK SUBSTANCE**

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<tr>
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<th>WEATHERING INDEX</th>
<th>WEATHERING T. EST.</th>
<th>SPACING</th>
<th>DEFECT DESCRIPTION</th>
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<tbody>
<tr>
<td>Basalt, grey, porphyritic</td>
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<td></td>
<td></td>
<td>Broken, with extensive test on faces.</td>
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**ROCK MASS DEFECTS**

<table>
<thead>
<tr>
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<td>(m.m)</td>
<td>Including - type, coatings or infillings, thickness, inclination, roughness, planarity</td>
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**REFERENCE**

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<td>MW</td>
<td>Moderately weathered</td>
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<td>HW</td>
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</tr>
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<td>EW</td>
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</tr>
<tr>
<td>V</td>
<td>Very weak</td>
</tr>
<tr>
<td>W</td>
<td>Weak</td>
</tr>
<tr>
<td>M</td>
<td>Moderately strong</td>
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<td>S</td>
<td>Strong</td>
</tr>
<tr>
<td>V</td>
<td>Very strong</td>
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**ENGINEERING GEOLOGY**

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<td>WJS</td>
<td>WC</td>
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<td>GRAPHIC LOG</td>
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</table>

**DEFECT DESCRIPTION**
- Type, coatings or infillings
- Thickness, inclination, roughness, planarity

**ROCK MASS DEFECTS**
- Type, coatings or infillings
- Thickness, inclination, roughness, planarity

**ENGINEERING GEOLOGY**
- Extremely weak
- Very weak
- Weak
- Moderately strong
- Strong
- Very strong
- Extremely strong

**REFERENCE**
- Fresh
- Slightly weathered
- Moderately weathered
- Highly weathered
- Extremely weathered

**NOTES**
- Water inflow
- Partial drilling water loss
- Complete drilling water loss

**REMARDS**
- Alteration refer to description

**ENGINEERING GEOLOGY LOGGED BY**
- Date
- Site
- Supervisor
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
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<th>ROCK MASS DEFECTS</th>
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</table>

**REFERENCE**
- F Fresh
- EW Extremely weak
- VS Very strong
- V Very weak
- H Highly weathered
- M Moderately weathered
- WS Weak
- S Strong
- N Moderately strong
- E Extremely strong

**DEFECT SPACING (m)**
- F

**DEFECT DESCRIPTION**
- Specific
- General

---

**ENGINEERING GEOLOGY**
- Logged by
- Date
- Site
- Supervisor
<table>
<thead>
<tr>
<th>DEPTH (metres)</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Basalt, As above</td>
<td></td>
</tr>
<tr>
<td>26</td>
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</tr>
<tr>
<td>27</td>
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<td>31</td>
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</tr>
<tr>
<td>32</td>
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<td></td>
</tr>
</tbody>
</table>

**REFERENCE**
- F Fresh
- VW Very weak
- EW Extremely weak
- SW Slightly weathered
- MW Moderately weathered
- HW Highly weathered
- HS Very strong
- ES Extremely strong

**ENGINEERING GEOLOGY**
- Logged by
- Date
- Site
- Supervisor
# Geological Survey of New South Wales

## Engineering Geology Log

**Project:** Brunswick Heads-Brydon Bay Blm Quarry Sites  
**Location:** Borrowdale G.R. 3161 3157 1:25,000

**Hole No.** Borrowdale  
**Datum:** 230 M  
**Inclination:** 95°

**Drill:**  
**Barrel Type & Length:** N/P, double tube, 3m  
**Commenced:** 6/7/79  
**Completed:** 7/7/79

<table>
<thead>
<tr>
<th>Depth (meters)</th>
<th>Rock Substance</th>
<th>Description</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soil</td>
<td>Basalt; grey, porphyritic.</td>
<td></td>
</tr>
</tbody>
</table>

**Drilling Information**  
**Barrel Type & Length:** N/P, double tube, 3m  
**Committed:** 6/7/79  
**Completed:** 7/7/79

**Rock Mass Defects**  
**Defect Spacing:** Including - type, coatings or infillings, thickness, inclination, roughness, planarity

**Tests**  
**Specific** | **General**

**Remarks**  
**Alteration:** refer to description

**Reference**  
14-3-74 water level  
date shown  
Water inflow  
Partial drilling water loss  
Complete drilling water loss  
A alteration, refer to description

**Engineering Geology**  
Logged by: J. M.  
Date: July 79  
Site: Borrowdale  
Supervisor: WC
# Geological Survey of New South Wales

## Geological Survey of New South Wales

### Engineering Geology Log

<table>
<thead>
<tr>
<th>Depth (metres)</th>
<th>Graphic Log</th>
<th>Drilling Information</th>
<th>Rock Substance</th>
<th>Drilling Information</th>
<th>Rock Mass Defects</th>
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<tr>
<td>9</td>
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<td></td>
<td>Basalt; as above</td>
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<td>16</td>
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</tr>
</tbody>
</table>

### Rock Substances

- **Basalt**: as above

### Rock Mass Defects

- **Defect Spacing (m.m)**:...
- **Defect Description**:...

### Tests

- **Specific**:...
- **General**:...

### Remarks

- **Alteration**: refer to description

### Reference

- 14-374 date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss

### Engineering Geology

- **Logged by**:...
- **Date**:...
- **Site**:...
- **Supervisor**:...
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>DESCRIPTION</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
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</thead>
<tbody>
<tr>
<td>Basalt, as above</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ROCK SUBSTANCE
- Basalt, as above

### ROCK MASS DEFECTS
- **WEATHERING ALTERNATION**
- **WEATHERING SPACING**
- **WEATHERING DENSITY**
- **WEATHERING STRENGTH**

### DEFECT DESCRIPTION
- **DEFECT SPACING** (m)
- **DEFECT DESCRIPTION**
  - Including - type, coatings or infillings, thickness, inclination, roughness, planarity

### TESTS
- **SPECIAL**
- **GENERAL**
- **ENGINEERING GEOLOGY**

### OTHER
- **REFERENCE**
  - Fresh
  - Slightly weathered
  - Moderately weathered
  - Highly weathered
  - Extremely weathered
  - Extremely weak
  - Very weak
  - Weak
  - Moderately strong
  - Strong
  - Very strong
  - Extremely strong

**ENGINEERING GEOLOGY**
- Logged by
- Date
- Site
- Supervisor
**GEOLOGICAL SURVEY OF NEW SOUTH WALES**

**ENGINEERING GEOLOGY LOG**

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>LOCATION</th>
<th>R.L COLLAR</th>
<th>DRILL</th>
<th>DRILLER</th>
<th>COMMENCED</th>
<th>COMPLETED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>DATUM</td>
<td>BEARING INCLINATION</td>
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<th>OATUM</th>
<th>LOCATION</th>
<th>BEARING</th>
<th>INCLINATION</th>
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<th>SHEET</th>
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<td>104</td>
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<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
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<tr>
<td>DEPTH (meters)</td>
<td>DESCRIPTION</td>
<td>DEFECT SPACING (m.m)</td>
</tr>
<tr>
<td>Addl. Data</td>
<td>Including - NAME, texture, grainsize, colour, composition, hardness, bedding, foliation</td>
<td>Including - type, coatings or infillings, thickness, inclination, roughness, planarity</td>
</tr>
<tr>
<td>R.L Collar</td>
<td></td>
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</tr>
<tr>
<td>Oatum</td>
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<td>Location</td>
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<tr>
<th>DEPTH (meters)</th>
<th>Basalt, As above</th>
<th>DEFECT SPACING (m.m)</th>
<th>DEFECT DESCRIPTION</th>
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<tbody>
<tr>
<td>24</td>
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</table>

**REFERENCE**

- 14-374 water level date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

**REMARKS**

**ENGINEERING GEOLOGY**

Logged by
Date
Site
Supervisor
<table>
<thead>
<tr>
<th>DEPTH (metres)</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
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<tr>
<td></td>
<td>Basalt</td>
<td>As above</td>
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</table>

### ROCK SUBSTANCE
- **DESCRIPTION**
  - Including: NAME, texture, grainsize, colour, composition, hardness, bedding, foliation

### ROCK MASS DEFECTS
- **DEFECT SPACING** (m.m)
- **DEFECT DESCRIPTION**
  - Including: type, coatings or infillings, thickness, inclination, roughness, planarity

### REFERENCE
- **F** Fresh
- **EW** Extremely weak
- **VW** Very weak
- **W** Weak
- **MW** Moderately weathered
- **MS** Moderately strong
- **SW** Slightly weathered
- **H** High
- **W** Weak
- **MEM** Very strong
- **ES** Extremely strong
- **Als** Alteration, refer to description

### REMARKS
- As above
**GEOLOGICAL SURVEY OF NEW SOUTH WALES**

**ENGINEERING GEOLOGY LOG**

<table>
<thead>
<tr>
<th>PROJECT</th>
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<td>INCLINATION</td>
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<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
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</thead>
<tbody>
<tr>
<td>DEPTH (metres) and DATE sh own</td>
<td>DESCRIPTION</td>
<td>INCLUDING - NAME, texture, grain size, colour, composition, hardness, bedding, foliation</td>
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<tr>
<td>-----------------------</td>
<td>----------------</td>
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</table>

**REFERENCE**

- 14-3-74 water level
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refers to description

**REMARKS**

- Fresh
- Extremely weak
- Very weak
- Weak
- Moderately weak
- Moderately weathered
- High weathered
- Very strong
- Strong
- Extremely weathered

**ENGINEERING GEOLOGY**

Logged by

Date

Site

Supervisor
### Geological Survey of New South Wales

**Engineering Geology Log**

**Location:** Borrow Dales, 62.5183, 37.47

**Datum:** 45°

**Drill Type & Length:** MX, double tube, 3 m

**Drilled by:** Sol. Test.

**Commenced:** 10.7.79

**Completed:** 11.7.79

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
<th>Rock Mass Defects</th>
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</thead>
<tbody>
<tr>
<td>7</td>
<td>Basalt</td>
<td>CORE LOSS</td>
</tr>
<tr>
<td></td>
<td>Basalt, decomposed, retro to core</td>
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</tbody>
</table>

**REFERENCE**

- 1:4:3-74 water level
- date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

**ENGINEERING GEOLOGY**

- Logged by: Jim
- Date: July 79
- Site: SW
- Supervisor: WC

**Tests**

- Defect Type: Including - type, coatings or infillings, thickness, inclination, roughness, planarity
- Specificity: General
GEOLOGICAL SURVEY OF NEW SOUTH WALES

ENGINEERING GEOLOGY LOG

<table>
<thead>
<tr>
<th>HOLE NO</th>
<th>B3 DALES 105</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet</td>
<td>2 of 3</td>
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</tbody>
</table>

**PROJECT**

**LOCATION**

**RL COLLAR**

**DATUM**

**BEARING**

**INCLINATION**

**DRILLING INFORMATION**

**ROCK SUBSTANCE**

**ROCK MASS DEFECTS**

<table>
<thead>
<tr>
<th>DEPTH (metres)</th>
<th>ROCK SUBSTANCE DESCRIPTION</th>
<th>WEATHERING (Estimated Strength)</th>
<th>DEFECT SPACING (m.m)</th>
<th>DEFECT DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>14-1</td>
<td>Basalt, grey, porphyritic.</td>
<td>SW</td>
<td>45°, slight alteration</td>
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**REFERENCE**

<table>
<thead>
<tr>
<th>WATER LEVEL</th>
<th>F Fresh</th>
<th>EW Extremely weak</th>
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<tbody>
<tr>
<td>Water inflow</td>
<td>SW Slightly weathered</td>
<td>VW Very weak</td>
</tr>
<tr>
<td>Partial drilling water loss</td>
<td>MW Moderately weathered</td>
<td>WS Weak</td>
</tr>
<tr>
<td>Complete drilling water loss</td>
<td>HW Highly weathered</td>
<td>S Strong</td>
</tr>
<tr>
<td>Alteration refer to description</td>
<td>EW Extremely weathered</td>
<td>VS Very strong</td>
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**ENGINEERING GEOLOGY**

Logged by

Date

Site

Supervisor

**REMARKS**
<table>
<thead>
<tr>
<th>DEPTH (metres)</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basalt, as above</td>
<td></td>
</tr>
</tbody>
</table>

- Slightly less phenocrypts and they are smaller size.

**END 23.34**

**REFERENCE**
- F Fresh
- EW Extremely weak
- VW Very weak
- V Weak
- MS Moderately strong
- S Strong
- V5 Very strong
- ES Extremely strong

**ENGINEERING GEOLOGY**
- Logged by
- Date
- Site
- Supervisor

**REMARKS**
- 14.3-14.74 water level
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refer to description
**Engineering Geology Log**

**Location:** Borrowdale, GR 9183 3755

**Drill:** 35a 3m

**Driller:** J. H. Test

**Commenced:** 11.7.79

**Completed:** 11.7.79

### Rock Substance

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Rock Substance</th>
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<tbody>
<tr>
<td>0-1</td>
<td>Soil</td>
</tr>
<tr>
<td>1-2</td>
<td>Basalt; grey, porphyritic</td>
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<tr>
<td>2-3</td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td>4-5</td>
<td></td>
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<td>5</td>
<td>End 4.64</td>
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</table>

### Rock Mass Defects

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Defect Description</th>
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</table>

### Additional Information

- **R.L. Collar:** 105.5
- **Datum:** 25.00
- **Inclination:** 45°
- **Borehole Log:**
- **Logging:**
- **Supervisor:** W.C.

**Remark:**

- **Removal:** Alteration, refer to description

---

**Reference:**

- **F:** Fresh
- **SW:** Slightly weathered
- **MW:** Moderately weathered
- **HW:** Highly weathered
- **EW:** Extremely weathered
- **VW:** Very weak
- **MS:** Moderately strong
- **S:** Strong
- **VS:** Very strong
- **ES:** Extremely strong

**Engineer Geology:**

- **Logged by:** J. H.
- **Date:** July 79
- **Site:** Borrowdale
- **Supervisor:** W.C.
**PROJECT**
Brunswick Heads - Byron Bay, Baw Baw, Sites.

**LOCATION**
Baw Baw, Site 1076.

**DATE**
12/7/79

**ENGINEERING GEOLOGY LOG**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

**REFERENCE**
- F: Fresh
- EW: Extremely weak
- SW: Slightly weathered
- M: Medium
- V: Very
- W: Weak
- HS: Highly weathered
- MS: Moderately strong
- VS: Very strong
- X: Extreme

**ENGINEERING GEOLOGY**
Logged by
Date
Site
Supervisor

**REMARKS**
### Geological Survey of New South Wales

**Engineering Geology Log**

<table>
<thead>
<tr>
<th>Project</th>
<th>R.L. Collar</th>
<th>Location</th>
<th>Datum</th>
<th>Bearing</th>
<th>Inclination</th>
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<tbody>
<tr>
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**Hole No.**

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<table>
<thead>
<tr>
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<th>Rock Mass Defects</th>
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<tbody>
<tr>
<td>Depth (meters)</td>
<td>Description</td>
<td>Weathering (m.m)</td>
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<tr>
<td>Add. Date</td>
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<td></td>
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<tr>
<td>Graphic Log</td>
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</tr>
<tr>
<td>R.L. Number</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Be salts, dark grey. Seems to be fine grained than normal type. Number of irregular incipient fractures.
- NW: Closely jointed to small pieces. Less Fe staining than above.
- Defects 100-200 mm, variable and irregular.
- Fragmented, just very indistinct.

**Remarks**

- End 11-15

**REFERENCE**

- 14.3-14 water level, date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refer to description

**ENGINEERING GEOLOGY**

Logged by

Date

Site

Supervisor

**DEFECT DESCRIPTION**

Including type, coatings or infillings, thickness, inclination, roughness, planarity

<table>
<thead>
<tr>
<th>F</th>
<th>Fresh</th>
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<tbody>
<tr>
<td>E</td>
<td>Extremely weak</td>
</tr>
<tr>
<td>V</td>
<td>Very weak</td>
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<tr>
<td>W</td>
<td>Weak</td>
</tr>
<tr>
<td>M</td>
<td>Moderately weathered</td>
</tr>
<tr>
<td>H</td>
<td>Highly weathered</td>
</tr>
<tr>
<td>S</td>
<td>Strong</td>
</tr>
<tr>
<td>V</td>
<td>Very strong</td>
</tr>
<tr>
<td>E</td>
<td>Extremely strong</td>
</tr>
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<table>
<thead>
<tr>
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<th>1B</th>
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</table>
GEOLOGICAL SURVEY OF NEW SOUTH WALES
ENGINEERING GEOLOGY LOG

PROJECT: Brunswick Heads-Byron Bay. Blow Gully Site  R.L. COLLAR... 991
LOCATION: MYOCUM E. 4912.35I. EL. 25,000
DATE:  2-10-79
BEARING: 120° M.
INCLINATION: 45°

DRILL: 350 MM
BARREL TYPE & LENGTH: MX, Double Tube, SW

COMMENCED 2-6-79
COMPLETED 5-6-79

DEEP Meters

DRILL INFORMATION

DEPTH

Inch

Description

Including - NAME, texture, grain size, colour, composition, hardness, bedding, foliation

WEATHERING

WEATHERING ALTERATION

WEATHERING SPACING (m.m)

DEFECT DESCRIPTION

involving type, coatings or infillings, thickness, inclination, roughness, planarity

Specimen General

REFERENCE

14-3-74 Water level, date shown
Water inflow
Partial drilling water loss
Complete drilling water loss
Alterations refer to description

ENGINEERING GEOLOGY

Logged by
Date
Site
Supervisor

REMARKS: DRILLING BREAKS AND SUSPECTED DRILLING BREAKS HAVE BEEN EXCLUDED FROM LOSSES OF HOLE MYOCUM 101-105.
**ENGINEERING GEOLOGY LOG**

部位:... 位置:...

孔号:...

起始日期:...

**钻孔信息**

<table>
<thead>
<tr>
<th>深度（米）</th>
<th>孔径</th>
<th>孔长</th>
<th>描述</th>
<th>腐蚀类型</th>
<th>腐蚀强度</th>
<th>腐蚀类型</th>
<th>腐蚀强度</th>
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<tr>
<td>9</td>
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<td></td>
<td>Basalt</td>
<td>Ew</td>
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**备注**

14-3.74水位水平面标记
水位线
部分钻孔水位损失
完全钻孔水位损失

**参考**

F: Fresh
SW: Slightly weathered
W: Weak
MW: Moderately weathered
H: Highly weathered
EW: Extremely weathered

EW: Extremely weak
VW: Very weak
W: Weak
MS: Moderately strong
S: Strong
VS: Very strong
ES: Extremely strong

**工程地质**

Logger:
日期:
监督员:

**特别**

Disintegrated
Fragmented
Core loss
Fawn

**测试**

- 特殊
- 一般
# Geological Survey of New South Wales

## Engineering Geology Log

### Project
Brunswick Heads - Byron Bay, Blu. Quarry Sites

### Location
Myocum, 6R, 4920, 3513, 1:25,000

### Datum
070° 00' 45°

### Drill Information
- **Type and Length**: N.K., double tube, 3m
- **Driller**: Soil Test
- **Commenced**: 5.6.79
- **Completed**: 5.6.79

### Drilling Information
<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>Basalt, grey, porphyritic</td>
<td>Well broken, mainly 65mm, 38mm defects.</td>
</tr>
<tr>
<td>2.00</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td>3.00</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td>4.00</td>
<td>SW</td>
<td>F, 40, 50</td>
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<tr>
<td>5.00</td>
<td>SW</td>
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<td>6.00</td>
<td>SW</td>
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<tr>
<td>7.00</td>
<td>SW</td>
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</tr>
</tbody>
</table>

### Rock Mass Defects
- **Defect Description**
  - Defects generally 95°, plane to sl. angle, sliding to planes, slight coating on some

### Reference
- 14-374 water level data shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

### Remarks
- Logged by: [Name]
- Date: July 79
- Site: Myocum
- Supervisor: WC
<table>
<thead>
<tr>
<th>DEPTH (metres)</th>
<th>DRILLING INFORMATION</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Depth Date</td>
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<td>DESCRIPTION</td>
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<td>Basalt, as above</td>
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<td>1.0</td>
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<td>2.0</td>
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<td>16.0</td>
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</tbody>
</table>

**REFERENCE**

- Fresh (F)
- Slightly weathered (SW)
- Modestly weathered (MW)
- Moderately weathered (MW)
- Highly weathered (HW)
- Extremely weathered (EW)
- Extremely weak (EW)
- Very weak (VW)
- Weak (W)
- Moderately strong (MS)
- Moderate (M)
- Strong (S)
- Very strong (VS)
- Extremely strong (ES)

**ENGINEERING GEOLGY**

- Logged by
- Date
- Site
- Supervisor

**REMARKS**

- 14.3/4 water level
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description
# Geological Survey of New South Wales

## Engineering Geology Log

### Hole No.
Myocum 102 (Sheet 3 of 5)

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m A.D.)</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basalt, as above</td>
<td></td>
</tr>
</tbody>
</table>

### Drilling Information

- **LOCATION**: Myocum 102
- **PROJECT**: R.L. Collar
- **DATE**: 1974
- **SITING**: Fresh

### Rock Substance

- **NAME**: Basalt
- **Texture**
- **Grain size**: Moderately fine
- **Colour**: Black
- **Composition**: Trachytic basalt
- **Hardness**: Medium
- **Bedding**: None
- **Foliation**: None

### Rock Mass Defects

- **Type**: Alteration
- **Coatings or Inclusions**: None
- **Thickness**: 0.5 m
- **Inclination**: 0 degrees
- **Planarity**: Perfect

### Remarks

- **Alteration**: Moderately weathered
- **Strength**: Moderately strong

### Engineering Geology

Logged by: Logged by
Date: Date
Site: Site
Supervisor: Supervisor
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>DRILLING INFORMATION</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
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<tbody>
<tr>
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<td>38</td>
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</tbody>
</table>

**REFERENCE**
- 14-374 water level
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration: refer to description

**REMARKS**
- Basalt, as above
- Broken

**DEFECT DESCRIPTION**
- Fresh (F)
- Extremely weak (EW)
- Very weak (VW)
- Weak (W)
- Moderately weak (MW)
- Moderately weathered (MW)
- Highly weathered (HW)
- Extremely weathered (EW)

**DEFECT SPACING**
- Estimated strength
- Including - type, coatings or infillings, thickness, inclination, roughness, planarity
**ENGINEERING GEOLOGY LOG**

**HOLE NO**

**RL COLLAR**

**LOCATION**

**BEARING**

**INCLINATION**

**ENGINEERING GEOLOGY LOG**

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>Basalt, as above</td>
<td>F</td>
</tr>
<tr>
<td>34</td>
<td>Basalt; lower layers, vesicular with vugs</td>
<td>MW</td>
</tr>
<tr>
<td>36</td>
<td>Rock intensely weathered &quot;bole&quot; vesicular former flow</td>
<td>HW to EW</td>
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</tbody>
</table>

**END 35.57**

**REFERENCE**

<table>
<thead>
<tr>
<th>Water level</th>
<th>Fresh</th>
<th>Extremely weak</th>
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</thead>
<tbody>
<tr>
<td>VW</td>
<td>Very weak</td>
<td>Weak</td>
</tr>
<tr>
<td>MS</td>
<td>Moderately strong</td>
<td>Strong</td>
</tr>
<tr>
<td>HW</td>
<td>Highly weathered</td>
<td>Very strong</td>
</tr>
<tr>
<td>ES</td>
<td>Extremely weathered</td>
<td>Extremely strong</td>
</tr>
</tbody>
</table>

**ENGINEERING GEOLOGY**

<table>
<thead>
<tr>
<th>Logged by</th>
<th>Date</th>
<th>Site</th>
<th>Supervisor</th>
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</table>

**REMARKS**

Well broken up.
**Geological Survey of New South Wales**

**Engineering Geology Log**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
<th>Weathering Alteration</th>
<th>Weathering Strength</th>
<th>Rock Mass Defects</th>
<th>Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Soil</td>
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<tr>
<td>1-2</td>
<td>Basalt, grey porphyritic.</td>
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<td></td>
<td>Broken mainly on 45°, faces lightly to 100-250 mm.</td>
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<td>2-3</td>
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<td>6-7</td>
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</table>

**Remarks**

- Defects appear slight coatings of all kinds.

**Reference**

- F Fresh
- SW Slightly weathered
- MW Moderately weathered
- HW Highly weathered
- EW Extremely weathered
- VW Very weak
- W Weak
- MW Moderately strong
- S Strong
- VS Very strong
- ES Extremely strong

**Logbook Information**

- Project: Brunswick Heads - Byron Bay
- Location: Myocum, G.B. 4924, S35
- Datum: BEARING 070°, M INCLINATION 45°
- Driller: Soil Test
- Commenced: 13.7.79
- Completed: 14.7.79

**Notes**

- Water level
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

**Engineer**

- Sup: WC
- Date: July 79

**Supervisor**

- Sup: WC
**ENGINEERING GEOLOGY LOG**

<table>
<thead>
<tr>
<th>DEPTH (meters)</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
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<tr>
<td></td>
<td>DESCRIPTION</td>
<td>WEATHERING ESTIMATED</td>
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<td>Including - NAME, texture, grain size, colour, composition, hardness, bedding, foliation</td>
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<tr>
<td>6</td>
<td>Basalt, above</td>
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**REFERENCE**

<table>
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<th>DESCRIPTION</th>
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<tr>
<td>F</td>
<td>Fresh</td>
</tr>
<tr>
<td>EW</td>
<td>Extremely weak</td>
</tr>
<tr>
<td>VW</td>
<td>Very weak</td>
</tr>
<tr>
<td>W</td>
<td>Weak</td>
</tr>
<tr>
<td>MW</td>
<td>Moderately weathered</td>
</tr>
<tr>
<td>MS</td>
<td>Moderately strong</td>
</tr>
<tr>
<td>HW</td>
<td>Highly weathered</td>
</tr>
<tr>
<td>VS</td>
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<tr>
<td>S</td>
<td>Strong</td>
</tr>
<tr>
<td>ES</td>
<td>Extremely strong</td>
</tr>
</tbody>
</table>

**REMARKS**

- 14-3-74 water level shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refer to description
### GEOLOGICAL SURVEY OF NEW SOUTH WALES

#### ENGINEERING GEOLOGY LOG

**PROJECT**

**LOCATION**

**R L COLLAR**

**DATUM**

**BEARING**

**INCLINATION**

**DRILLER**

**COMMENCED**

**COMPLETED**

**BARREL TYPE & LENGTH**

### DRILLING INFORMATION

<table>
<thead>
<tr>
<th>Depth (meters)</th>
<th>R L</th>
<th>Collar</th>
<th>Casing</th>
<th>Graphic Log</th>
<th>Weathering alteration</th>
<th>Estimated Strength</th>
<th>Rock Mass Defects</th>
<th>Defect Spacing (mm)</th>
<th>Defect Description</th>
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</tbody>
</table>

#### DESCRIPTION

- Basalt, as above

#### REMARKS

- REFERENCE
  - 14.37 water level
  - Water inflow
  - Partial drilling water loss
  - Complete drilling water loss
  - Alteration, refer to description

#### REFERENCE

**ENGINEERING GEOLOGY**

Logged by: [Name]
Date: [Date]
Site: [Site]
Supervisor: [Name]
# Engineering Geology Log

**Project:**

**Location:**

**Datum:**

**Bearing:**

**Inclination:**

**Hole No:** MYOCUM 103

**Drill:**

**Driller:**

**Commenced:**

**Completed:**

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (meters)</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basalt, as above</td>
<td></td>
</tr>
</tbody>
</table>

### Rock Substance

- **Description:** Including - Name, texture, grain size, colour, composition, hardness, bedding, foliation.

### Weathering Strength

- **Estimated Strength:**

### Defect Spacing

- **Defect Description:** Including - type, coatings or infillings, thickness, inclination, roughness, planarity.

### Tests

- **Specific**
- **General**

### Table of Weathering Strength

- F: Fresh
- SW: Slightly weathered
- MW: Moderately weathered
- HW: Highly weathered
- EW: Extremely weathered
- VW: Very weak
- W: Weak
- MS: Moderately strong
- S: Strong
- VS: Very strong
- ES: Extremely strong

### Reference

- 14.3.74: Water level data shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

### Remarks

- As above
<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>R.L.</th>
<th>Addl. Data</th>
<th>Collar</th>
<th>Graphic Log</th>
<th>Description</th>
<th>Weathering Alteration</th>
<th>Weathered Strength (m.m)</th>
<th>Defect Spacing</th>
<th>Defect Description</th>
<th>Tests</th>
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<tbody>
<tr>
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<td>CM</td>
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</tbody>
</table>

**REFERENCE**
- F: Fresh
- E: Extremely weak
- V: Very weak
- W: Weak
- M: Moderately weak
- H: Moderately strong
- S: Strong
- V: Very strong
- E: Extremely strong

**REMARKS**
- Water level shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

**ENGINEERING GEOLOGY**
- Logged by
- Date
- Site
- Supervisor
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
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<th>ROCK MASS DEFECTS</th>
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<td>43</td>
<td>Basalt starts to develop honeycomb structure, phenocrysts larger and more abundant</td>
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<td>44</td>
<td>Red clay</td>
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**REFERENCE**
- EW Extremely weak
- SW Slightly weathered
- VW Very weak
- MW Moderately weathered
- W Weak
- HW Highly weathered
- VS Very strong
- ES Extremely strong
- FS Extremely strong

**ENGINEERING GEOLOGY**
- Logged by
- Date
- Site
- Supervisor
| Depth (m) | R.L. | Add. Data | Comment | Graphic
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**Rock Substance**
- Soil

**Rock Mass Defects**
- Basalt, grey, porphyritic
  - Weathered
  - Defect: Fragmented
  - Inclination: 45°
  - Description: Slight weathering and coatings of all minerals

**Tests**

**Reference**
- 14-3-74 water level
date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration: refer to description

**Remarks**

**Engineering Geology**
- Logged by
- Date
- Site
- Supervisor
GEOLOGICAL SURVEY OF NEW SOUTH WALES
ENGINEERING GEOLOGY LOG

PROJECT: ..................................................
LOCATION: ..................................................
Datum: ..................................................
Bearing: ..................................................
Inclination: ..................................................

HOLE NO: Myocum 104
Sheet 2 of 6

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Table notes:
- F Fresh
- SW Slightly weathered
- VW Very weak
- W Weak
- MW Moderately weathered
- MS Moderately strong
- HW Highly weathered
- VS Very strong
- ES Extremely strong

Remarks:
- Fresh
- Slightly weathered
- Very weak
- Weak
- Moderately weathered
- Moderately strong
- Highly weathered
- Very strong
- Extremely strong

Tests:
- As above
- Broken, Test

REFERENCE:
- 14.3.74 water level
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration, refer to description

ENGINEERING GEOLGY LOGGED BY
Logged by
Date
Site
Supervisor
## GEOLOGICAL SURVEY OF NEW SOUTH WALES
### ENGINEERING GEOLOGY LOG

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<td>24</td>
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</table>

### DESCRIPTION
- Including NAME, texture, grain size, colour, composition, hardness, bedding, foliation

### WEATHERING ALTERATION
- Estimated STRENGTH

### DEFECT DESCRIPTION
- Including type, coatings or infillings, thickness, inclination, roughness, planarity

### DEFECT SPACING (m.m)

### REMARKS
- Fresh
- Slightly weathered
- Moderately weathered
- Highly weathered
- Extremely weathered

### ENGINEERING GEOLOGY
- Logged by
- Date
- Site
- Supervisor

### REFERENCE
- Fresh
- Slightly weathered
- Moderately weathered
- Highly weathered
- Extremely weathered
- Extremely weak
- Very weak
- Weak
- Moderately strong
- Strong
- Very strong
- Extremely strong

### DEFECT DESCRIPTION
- As above
**ENGINEERING GEOLOGY LOG**

<table>
<thead>
<tr>
<th>DRILLING INFORMATION</th>
<th>ROCK SUBSTANCE</th>
<th>ROCK MASS DEFECTS</th>
</tr>
</thead>
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<tr>
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<td>DESCRIPTION</td>
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<td>Addl. Data</td>
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<td>Est. Strength</td>
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<tr>
<td>R.L. Casing</td>
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</tr>
<tr>
<td>Graphic</td>
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</table>

### REFERENCE

- **F**: Fresh
- **EW**: Extremely weak
- **VW**: Very weak
- **W**: Weak
- **MS**: Moderately strong
- **S**: Strong
- **V5**: Very strong
- **ES**: Extremely strong

### ENGINEERING GEOLOGY LOG

- **Logged by**
- **Date**
- **Site**
- **Supervisor**

### REMARKS

- As above
## Geological Survey of New South Wales

### Engineering Geology Log

**Project**: R.L. Collar  
**Location**:  
**Datum**:  
**Bearing**:  
**Inclination**:  
**Commenced**:  
**Completed**:  
**Sheet**: 5 of 6

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
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</thead>
<tbody>
<tr>
<td>14-27.4</td>
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<td></td>
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</table>

### Rock Substance

- **Description**: Including NAME, texture, grain size, colour, composition, hardness, bedding, foliation

### Rock Mass Defects

- **Defect Spacing**: (m.m)
- **Defect Description**: Including - type, coatings or infillings, thickness, inclination, roughness, planarity

### Reference

- 14-27.4 water level date shown
- Water inflow
- Partial drilling water loss
- Complete drilling water loss

### Remarks

- Alteration, refer to description

### Engineering Geology Log

- Logged by:  
- Date:  
- Site:  
- Supervisor:
GEOLOGICAL SURVEY OF NEW SOUTH WALES
ENGINEERING GEOLOGY LOG

PROJECT: Brunswick Heads - Byron Bay, Blue Quandong Sites
LOCATION: Myocum, St. 4920...3522...1...25,000
DATE: 105
BEARING: INCLINATION:

DRILL: Size: 3/8" DRILLER: Soil Test
BARREL Type & Length: NX, double tube, 3m.

COMMENCED: COMPLETED:

DRILLING INFORMATION ROCK SUBSTANCE ROCK MASS DEFECTS

DEPTH (meters) R.L. Depth Data & Coring Barrels Graphic Code Description

WEATHERING

DEFECT

SPACING (m.m)

DEFECT DESCRIPTION

Including - NAME, texture, grain size, colour, composition, hardness, bedding, foliation

Including - type, coatings or infillings, thickness, inclination, roughness, planarity

Specific General

0 1 2 3 4 5 6 7 8

SOIL

Basalt; grey, porphyritic

Sw

40

mw

Broken to 50-150mm. Faces test + slightly altered.

F

Defects generally 45° with slight coating

REFERENCES

F Fresh

SW Slightly weathered

VW Very weak

EW Extremely weak

MV Moderately weak

M Medium weak

MWS Moderately strong

H Weak

MW Moderately weathered

HWW Highly weathered

S Strong

EW Extremely weathered

VS Very strong

ES Extremely strong

REMARKS

ENGINEERING GEOLOGY

Logged by: Tim H
Date: July 79
Site: Myocum
Supervisor: WC
### Geological Survey of New South Wales

**Engineering Geology Log**

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**Defect Description**
- Type, coatings or infillings,
- Thickness, inclination, roughness,
- Planarity

**Tests**

**Remarks**

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<th>W Weak</th>
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<th>S Strong</th>
<th>VS Very strong</th>
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**Logged by**

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**Sheet 2 of 6**

**Engineer**

R L. Collar

**Location**

Datum

**Inclination**

**Commenced**

Completed
## Geological Survey of New South Wales

### Engineering Geology Log

**Hole No.** Myocum 105

**Sheet 3 of 6**

**Project**

**Location**

**Datum**

**Inclination**

**Drill**

**Barrel Type & Length**

**Driller**

**Commenced**

**Completed**

### Drilling Information

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### Rock Substance

- **Description:** Including NAME, texture, grain size, colour, composition, hardness, bedding, foliation.

### Rock Mass Defects

- **Defect Spacing:** (m/m)
- **Defect Description:** Including type, coatings or infillings, thickness, inclination, roughness, planarity.

### Rock Mass Defects Description

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### Remarks

- Alteration refer to description

### Engineering Geology

- **Logged by:**
- **Date:**
- **Site:**
- **Supervisor:**

---

### Reference

- 14-374 water level
- Water inflow
- Partial drilling water loss
- Complete drilling water loss
- Alteration refer to description

- **F** Fresh
- **EW** Extremely weak
- **VW** Very weak
- **W** Weak
- **MS** Moderately strong
- **S** Strong
- **VS** Very strong
- **ES** Extremely strong

---
# Geological Survey of New South Wales

## Engineering Geology Log

### Project:
RL Collar

### Location:
Datum Bearing

### Drill Information:
Barrel Type & Length

### Driller:
Commenced Completed

### Rock Substance

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### Rock Mass Defects

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### Remarks

- Fresh
- Slightly weathered
- Moderately weathered
- Highly weathered
- Extremely weathered
- Very weak
- Weak
- Moderately strong
- Strong
- Very strong
- Extremely strong

---

**Date**

**Site**

**Supervisor**
## GEOLICAL SURVEY OF NEW SOUTH WALES

**ENGINEERING GEOLOGY LOG**

### PROJECT

### R L COLLAR

### LOCATION

### DATUM

### BEARING

### INCLINATION

### HOLE NO

### MYOCUM

### SHEET 5 of 6

### DRILLING INFORMATION

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### ROCK MASS DEFECTS

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<td>Fresh, very weak, weak, moderately weak, moderately strong, strong, very strong, extremely strong</td>
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### REFERENCE

- [E] - Engineering Geology

### ENGINEERING GEOLOGY

Logged by

Date

Site

Supervisor

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**REMARS**

- Alteration, refer to description

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**TESTS**

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## ENGINEERING GEOLOGY LOG

### PROJECT
- R.L. COLLAR

### LOCATION
- DATE
- READING
- INCLINATION

### DRILLING INFORMATION
- DRILLER
- COMMENCED
- COMPLETED

### ROCK SUBSTANCE
- DESCRIPTION
  - Including - NAME, texture, grain size, colour, composition, hardness, bedding, foliation

### ROCK MASS DEFECTS
- DEFECT SPACING (m)
- DEFECT DESCRIPTION
  - Including - type, coatings or infillings, thickness, inclination, roughness, planarity

### REFERENCE
- F Fresh
- EW Extremely weak

### DELINEATION
- SW Slightly weathered
- VW Very weak
- MW Moderately weathered
- HW Highly weathered
- MS Moderately strong
- EW Extremely weathered
- S Strong
- VS Very strong
- ES Extremely strong

### ENGINEERING GEOLOGY
- Logged by
- Date
- Site
- Supervisor
APPENDIX THREE

Petrological Descriptions
PETROLOGICAL DESCRIPTIONS

The following descriptions have been carried out by Dr L.M. Barron and are from Geological Survey Reports Nos 1979/112 and 1979/271.

**Locality**

Hand specimen from Borrowdales quarry (T37026)

**Description**

Plagioclase augite (hypersthene) porphyritic olivine basalt, subophitic, microlitic and glass (5%), trace of nepheline and analcite; mildly replaced by iddingsite after olivine and glass. The rock is reasonably fresh but there is pervasive alteration of the matrix. The alteration could cause some problems because some clay is usually present in iddingsite. There is no flow alignment in the matrix so there will be no weaker orientation in the rock substance.

Coarsely An$_{60}$ augite porphyritic olivine ophitic microdolerite; moderately replaced by iddingsite and chlorite and rare albite. Augite may be titaniferous.

Mildly An$_{60}$ porphyritic augite? alkali olivine flow banded basalt ?lava/?dyke subophitic; traces of sanidine, nepheline and ?glass; strongly replaced by iddingsite and clay and ?zeolites. Augite may be titaniferous.

Both of the above two samples are free of weathering but both have suffered pervasive alteration of olivine in the matrix to iddingsite. Clay is a minor constituent of iddingsite so that both rocks could react to prolonged exposure to seawater. T37332 is strongly flowbanded so that the alteration domains link up and may result in partings and a decrease in bulk strength. T37331 has separated alteration patches and is not flow aligned in the matrix so it should retain high bulk strength, and would be suitable for rip-rap.
APPENDIX FOUR

Strength Testing Results

1. Introduction

Manly Geomechanics Laboratory received two boxes of rock core samples on 12th September, 1979 from potential quarry sites in the Brunswick-Byron area. Your office requested assessment of this material for use in river and foreshore protection works.

The boxes were labelled as follows:

- **Borrowdale BH 101**: Box 3: 16.33 m to 20.12 m
- **Myocum BH 103**: Box 3: 14.62 m to 19.01 m.

Tests undertaken on the selected core were:

1. Point load strength test.
2. Sodium sulphate soundness.
3. Density.

2. Test Results

2.1 Samples

Samples were selected from the two boxes for density and soundness testing. For identification purposes, these samples were labelled as below:

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<td>101</td>
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<td>17.2 - 17.3</td>
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<tr>
<td>1C</td>
<td>&quot;</td>
<td>18.1 - 18.2</td>
</tr>
<tr>
<td>1D</td>
<td>&quot;</td>
<td>18.7 - 18.8</td>
</tr>
<tr>
<td>1E</td>
<td>&quot;</td>
<td>19.3 - 19.4</td>
</tr>
<tr>
<td>2A</td>
<td>103</td>
<td>14.8 - 14.9</td>
</tr>
<tr>
<td>2B</td>
<td>&quot;</td>
<td>15.6 - 15.7</td>
</tr>
<tr>
<td>2C</td>
<td>&quot;</td>
<td>16.8 - 16.9</td>
</tr>
<tr>
<td>2D</td>
<td>&quot;</td>
<td>17.8 - 17.9</td>
</tr>
<tr>
<td>2E</td>
<td>&quot;</td>
<td>18.8 - 18.9</td>
</tr>
</tbody>
</table>
2.2 Densities

Densities were calculated on the ten selected samples. The following table shows the individual densities and the average for each bore.

<table>
<thead>
<tr>
<th>No.</th>
<th>BH</th>
<th>Wet Density (T/m³)</th>
<th>Mean Density (T/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>101</td>
<td>2.754</td>
<td></td>
</tr>
<tr>
<td>1B</td>
<td></td>
<td>2.747</td>
<td></td>
</tr>
<tr>
<td>1C</td>
<td></td>
<td>2.728</td>
<td></td>
</tr>
<tr>
<td>1D</td>
<td></td>
<td>2.757</td>
<td></td>
</tr>
<tr>
<td>1E</td>
<td></td>
<td>2.748</td>
<td>2.75</td>
</tr>
<tr>
<td>2A</td>
<td>103</td>
<td>2.711</td>
<td></td>
</tr>
<tr>
<td>2B</td>
<td></td>
<td>2.683</td>
<td></td>
</tr>
<tr>
<td>2C</td>
<td></td>
<td>2.699</td>
<td></td>
</tr>
<tr>
<td>2D</td>
<td></td>
<td>2.684</td>
<td></td>
</tr>
<tr>
<td>2E</td>
<td></td>
<td>2.710</td>
<td>2.70</td>
</tr>
</tbody>
</table>

2.3 Sodium Sulphate Soundness

Sodium sulphate soundness tests for the above ten samples were undertaken by B.M.I. Laboratories. The results of these tests are attached. Of the cores tested, the maximum loss under severe conditions was 0.5%, indicating excellent resistance to simulated long term weathering effects.

2.4 Point Load Testing

Point load strength tests were performed on selected sections of core from both holes in order to obtain an indication of rock strength. This test gives a Point Load Index for each sample and this can be correlated to a value for Unconfined Compressive Strength.

The samples chosen were from 16.7 to 19.5 m in BH 101 (10 samples) and from 14.9 m to 17.4 m in BH 103 (11 samples). The Point Load Index and correlated Unconfined Compressive Strength values are listed on the attached result sheet. In summary, all samples exhibited very high compressive strengths, the values ranging from 91.2 MPa to 268.8 MPa. The lower values recorded were the result of fracture planes in the core (refer to Results sheets).
Manly Geomechanics Laboratory : Design Control Branch
Brunswick-Byron Quarry Investigation : Rock Core Testing : Report No. 79108

3. Conclusions

The rock core submitted for testing is a hard durable basalt. On the basis of the hardness and soundness testing performed, the material will be acceptable for use in structures of the type proposed. The natural density of the material is medium to high (2.70 and 2.75 Tonnes/m$^3$ for Bores 103 and 101) and the correlated Unconfined Compressive Strengths are very high (minimum of 90 MPa). The material's resistance to weathering (sulphate soundness) is also very high, the maximum test loss being 0.5%.

It is anticipated that no problems will be encountered with obtaining rockfill densities or strengths. Similarly the rock is extremely resistant to sulphate weathering.

A Los Angeles Abrasion test was not performed as rock chips are required, so it is recommended that this be undertaken at a later date and prior to actual construction work. Visual inspection and assessment of the material however indicates that high abrasion losses should not be expected, but this should be confirmed by testing.

Comments on the rock's fracturing properties cannot be made on the information available and it is recommended that this be referred to the Department of Mineral Resources (Mr. J. Hawke - Geological Survey)

Rock cores are being retained at the Geomechanics Laboratory until further notice.

Any further enquiries should be directed to the Supervising Engineer, Manly Geomechanics Laboratory Telephone No. (02) 949-2233.

Principal Engineer,
Design Control Branch

per: [Signature]

R. Tadanier,
Supervising Engineer,
Geomechanics Laboratory.

District Engineer,
Lismore.

5/11/79.
TEST REPORT

Client: DEPARTMENT OF PUBLIC WORKS

Project: SODIUM SULPHATE SOUNDNESS OF ROCK CORE MATERIAL

Sample: 50mm DIAMETER IGNEOUS ROCK CORES

Test procedure: PROCEDURE FOR TESTING CORES AS FOR AS 1141-1974-SECTION 24 (SEVERE CONDITIONS)

Ten 50mm diameter igneous rock cores from prospective quarry sites in the Brunswick Byron Area were submitted on the 18th September, 1979.

The cores were tested in accordance with AS 1141-1974 and the results were as follows:

<table>
<thead>
<tr>
<th>FIELD NO.</th>
<th>LAB. NO.</th>
<th>SOD. SULPHATE SOUNDNESS (SEVERE CONDITIONS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>3632</td>
<td>0.3% Loss</td>
</tr>
<tr>
<td>1B</td>
<td>3633</td>
<td>0.4% Loss</td>
</tr>
<tr>
<td>1C</td>
<td>3634</td>
<td>0.4% Loss</td>
</tr>
<tr>
<td>1D</td>
<td>3635</td>
<td>0.4% Loss</td>
</tr>
<tr>
<td>1E</td>
<td>3636</td>
<td>0.4% Loss</td>
</tr>
<tr>
<td>2A</td>
<td>3637</td>
<td>0.4% Loss</td>
</tr>
<tr>
<td>2B</td>
<td>3638</td>
<td>0.4% Loss</td>
</tr>
<tr>
<td>2C</td>
<td>3639</td>
<td>0.5% Loss</td>
</tr>
<tr>
<td>2D</td>
<td>3640</td>
<td>0.4% Loss</td>
</tr>
<tr>
<td>2E</td>
<td>3641</td>
<td>0.3% Loss</td>
</tr>
</tbody>
</table>

The core samples are returned for visual inspection after being subjected to the above tests.

CAG:eb 28.9.79
Mr. C. Karwaj
C/c: File R27/79

G. N. WEST
MATERIALS ENGINEER
<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>BORE DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>16.7 to 16.75</td>
</tr>
<tr>
<td>17.35 to 17.65</td>
<td></td>
</tr>
<tr>
<td>18.05 to 18.15</td>
<td></td>
</tr>
<tr>
<td>18.9 to 19.05 (L=52.5)</td>
<td></td>
</tr>
<tr>
<td>19.05 (L=49)</td>
<td></td>
</tr>
<tr>
<td>19.3 to 19.45</td>
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</table>

<table>
<thead>
<tr>
<th>MOISTURE CONTENT</th>
<th>SPECIMEN D-1</th>
<th>DIA. D/N (mm)</th>
<th>GAUGE PRESSURE</th>
<th>I_s (MN/m^2)</th>
<th>I_s (50)</th>
<th>UNCONFINED COMPRESSION STRENGTH CORRELATION</th>
<th>FRACTURE PLANE DETAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MPA (MPa)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>47.4</td>
<td>D</td>
<td>13.9</td>
<td>8.9</td>
<td>8.6</td>
<td>206.4</td>
<td></td>
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<td>&quot;</td>
<td>15.8</td>
<td>10.1</td>
<td>9.7</td>
<td>232.8</td>
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<tr>
<td></td>
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<td>&quot;</td>
<td>13.7</td>
<td>8.8</td>
<td>8.5</td>
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<tr>
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<td>&quot;</td>
<td>12.2</td>
<td>7.8</td>
<td>7.6</td>
<td>182.4</td>
<td>FRACTURE PLANE EVIDENT</td>
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<td>&quot;</td>
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<td>18.0</td>
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<td>11.2</td>
<td>268.8</td>
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</tr>
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<td>&quot;</td>
<td>18</td>
<td>10.1</td>
<td>9.7</td>
<td>232.8</td>
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</tr>
<tr>
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<td>&quot;</td>
<td>16.8</td>
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<td>10.4</td>
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</tr>
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<td>D</td>
<td>10.8</td>
<td>6.9</td>
<td>6.7</td>
<td>160.8</td>
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<td>&quot;</td>
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<td>10.9</td>
<td>10.5</td>
<td>252.0</td>
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</tr>
<tr>
<td>No</td>
<td>No</td>
<td>m</td>
<td>%</td>
<td>Diam.</td>
<td>P/NorD/AMN/m²</td>
<td>Gauge Pressure</td>
<td>I_s</td>
</tr>
<tr>
<td>----</td>
<td>----</td>
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</tr>
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<td>1</td>
<td>14.9</td>
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<td>9.3</td>
</tr>
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<td>4</td>
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<td>8</td>
<td>15.0</td>
<td>9.6</td>
<td>9.3</td>
</tr>
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<td>9.3</td>
</tr>
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<td>6</td>
<td>16.35</td>
<td></td>
<td>10</td>
<td>15.0</td>
<td>9.6</td>
<td>9.3</td>
</tr>
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<td>12</td>
<td>12</td>
<td>15.0</td>
<td>9.6</td>
<td>9.3</td>
</tr>
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<td>9</td>
<td>17.4</td>
<td>13</td>
<td>13</td>
<td>15.0</td>
<td>9.6</td>
<td>9.3</td>
</tr>
</tbody>
</table>
APPENDIX FIVE

Block size assessment (from core)
Block Size Assessment (From core)

In a situation where defects are moderately widely to widely spaced (200mm to 2m), then if individual defects are strongly developed or even slightly open to open, blasting will disrupt the rock on those defect planes. If the defects are tight and cemented, or incipient, or of very short length, then blasting will preferentially cause disruption on defect planes but many of the defects will remain intact. Some disruption of the rock substance will occur. In the areas under discussion, the spacing of the major defects is of most importance for assessing block size. The situation allows variation in blasting techniques to only partly control block sizes. If defects are very widely spaced (> 2m) then blasting is required to actually disrupt the rock substance in some zones, as opposed to the rock mass, and large block sizes may be produced.

Rock with closely to moderately widely spaced defects (60 - 600mm) is usually unsuitable for breakwater stone.

Diamond drilling imposes relatively high stresses on core, and tends to cause separation on most defects, plus actual rock substance breakage from time to time. Providing the hole inclination is such that major joint set directions are intersected, it is generally reasonable to assume the "stick" length represents the minimum block size likely to be obtained in quarry operations. (Note that "stick length" is the length of intact core sticks as retrieved, less the breaks at each end, prior to boxing). In fact block size is usually somewhat larger than that directly indicated by the core stick lengths.

In uniform, columnar jointed rock, an inclined hole will only penetrate the full thickness of individual columns in about 50% of cases, due to the hexagonal pattern in plan view. Of course if the hole is inclined at 45° stick length has to be reduced by a factor of 0.7 to obtain true block width (assuming the major defects are the column joints).
Plate 18a DDH Myocum 103

Myocum
DDH 103
7.6 - 13.7 M

GS1979/336
Plate 24  Myocum Quarry Site

From S-W.

From S-E.
FIGURE 2
REGIONAL GEOLOGY
Tweed Heads SH 56-3 (1:250,000)
Geological Sheet (Brunker et al 1972)

REFERENCE

Quaternary
Lismore Basalt
Neranleigh - Fernvale Group
Triassic - Jurassic Sedimentary Rocks

Geological Survey of N.S.W.
Dept of Mineral Resources
Report by J. Hawke
Date 14/4/80

SCALE
10 5 0 10
Kilometres
FIGURE 2
REGIONAL GEOLOGY
Tweed Heads SH 56-3 (1:250,000)
Geological Sheet (Brunner et al. 1972)

REFERENCE

Quaternary
Lismore Basalt
Neranleigh - Fernvale Group
Triassic - Jurassic Sedimentary Rocks
1660

SCALE
10 5 0 10
Kilometres

Geological Survey of N.S.W.
Dept of Mineral Resources
Report by J. Hawke
Date 14/4/80
FIGURE I

LOCALITY PLAN

SCALE

10
5
0
10

Kilometres

AREA UNDER CONSIDERATION

11659
PLAN 4

Shire of Byron
Parish of Brunswick
County of Rous

DETAILS OF AMENDMENTS

APPROVED

DIAGRAM "A"

NOT TO SCALE

SCALE

DATE

30

2000

M. M.

DEPARTMENT OF PUBLIC WORKS N.S.W.

W.J. HILTON CHIEF ENGINEER

PL. CARTER CHIEF CARTOGRAPHER

IDATUM: ASSUMED DATUM

ORIGIN OF LEVELS: B.M. No16 CUT ON ROCK RL10000 (ADOPTED)

AZIMUTH OF SURVEY BETWEEN STATIONS "A" AND "B" BEARING IS 053°00'00" (COMPASS BEARING)

PLAN SHOWS LOCALITIES OF CROSS-SECTION A-A' (see Plan 6)

PLAN 4 SHOWS LOCALITIES OF CROSS-SECTION A-A' (see Plan 6)

BRUNSWICK-BYRON QUARRY

INVESTIGATION

MYOCUM SITE

BORE HOLE LOCATIONS

FILE 724237
A1/787/394
DRAWING

ALL LEVELS ARE IN METRES
ALL OTHER DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE

COUNTY OF ROUS

2000

M. M.

DEPARTMENT OF PUBLIC WORKS N.S.W.

W.J. HILTON CHIEF ENGINEER

PL. CARTER CHIEF CARTOGRAPHER

IDATUM: ASSUMED DATUM

ORIGIN OF LEVELS: B.M. No16 CUT ON ROCK RL10000 (ADOPTED)

AZIMUTH OF SURVEY BETWEEN STATIONS "A" AND "B" BEARING IS 053°00'00" (COMPASS BEARING)

PLAN SHOWS LOCALITIES OF CROSS-SECTION A-A' (see Plan 6)

PLAN 4 SHOWS LOCALITIES OF CROSS-SECTION A-A' (see Plan 6)

BRUNSWICK-BYRON QUARRY

INVESTIGATION

MYOCUM SITE

BORE HOLE LOCATIONS

FILE 724237
A1/787/394
DRAWING

ALL LEVELS ARE IN METRES
ALL OTHER DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE

COUNTY OF ROUS

2000

M. M.
Plan 3

Datum Assumed Datum

Datum of levels 8.m. MSL; CEC in SE Corner of site.

Azimuth of survey between stations t and 8; 267°00'00" (Compass Bearing)


Brunswick-Byron Quarry Investigation
Mullumbimby Site (Borrowdales)
Bore Hole Locations

All levels are in metres, all other dimensions are in tens of metres, unless stated otherwise.
Shire of Byron
Parish of Brunswick
County of Rous

PLAN 2

DATUM: ASSUMED DATUM
ORIGIN OF LEVELS: B.M. CUT IN SE CORNER OF CONCRETE BLOCK 11,0000 (ADOPTED)

SCALE: 1:500

DEPARTMENT OF PUBLIC WORKS N.S.W.

BRUNSWICK-BYRON QUARRY
INVESTIGATION
MULLUMBIMBY SITE HUNTERTS
BOREHOLE LOCATIONS

FILE R 1154/1173
03-7972-S06
DRAWING