The Shire Clerk
Hornsby Shire Council
296 Pacific Highway
HORNSEY NSW 2077

ATTENTION: MR. KEVIN SMITH

Dear Sir,

RE: REPORT ON GEOTECHNICAL INVESTIGATIONS, OLD MAN’S VALLEY, HORNSEBY

Please find enclosed our report on geotechnical investigations for the proposed filling at Old Man’s Valley, Hornsby.

Should you have any queries regarding this report please do not hesitate to contact Mr. Peter Volk or the undersigned.

For and on behalf of
COFFEY & PARTNERS PTY LTD

C.P. THORNE
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1.0 INTRODUCTION

This report presents the results of geotechnical investigations undertaken at the request of Hornsby Shire Council, at the site of the proposed playing field development at Old Man's Valley, Hornsby. The purpose of the investigations was to supplement earlier studies carried out in the area, the results of which were presented in Report No. S8463/2-AC, July 1989. These earlier studies indicated that the proposed fill batters would probably need to be flattened, from the original slope of 1.5:1 to possibly as flat as 3:1 and that additional work was necessary on foundation material properties, groundwater, and stability into the adjacent quarry.

The work was undertaken in general accordance with our proposal for additional geotechnical investigations, as outlined in Appendix D of the July, 1989 report. The work was commissioned by Hornsby Shire Council in a letter dated 4th October 1989.

It is understood that following our earlier report, the revised proposal for the development is to raise the existing playing field by some 10m to about R140, at the same time extending northwards the area of fill, to create a development area some 430m long by some 120m wide (see Figure 1).

The principal aims of the investigations reported herein were to supplement earlier work and hence to:

- establish whether the poor drainage conditions evident along the toe of the southern playing field extend northwards along the toe, and whether or not there is a dual or single groundwater regime;
- obtain additional strength data on fill, residual soil and highly weathered rock from the southern playing field area to check the applicability of the values previously obtained from further north;
- establish in the northern area, the depth of weathering, the actual groundwater regime, and strength parameters for the existing fill.

Previous investigations undertaken by Coffey & Partners Pty. Ltd. (CAP) in the vicinity of the proposed playing field development included reconnaissance geological mapping, drilling of eight boreholes, excavation of eight test pits, some triaxial and direct shear strength testing and subsequent analysis and reporting. The results of these investigations were presented in Report No. S8463/2-AC, July 1989. This report is supplementary to and should be read in conjunction with our previous report.

Subsequent to the July 1989 report, the following information was provided by Council during April 1990.

- Plan No. 428.28 Old Man's Valley - Hornsby. Revised Layout Incorporating 1 in 3 Batter.
  Sheet 1 - Plan, Scale 1:500
  Sheets 2,3,4,5 + 6 - Cross Sections Ch0 to Ch510, Scale 1:500
Concurrent with the recent geotechnical investigations for the proposed playing field development, CAP have undertaken a rock mechanics study in the vicinity of eastern quarry face of Hornsby Breccia Quarry. The results of this study are presented in Report No. SB463/4-AD, dated May 1990.

2.0 RECENT INVESTIGATIONS

2.1 Field Work

The field work for the recent investigation consisted of drilling 36 boreholes with piezometers installed in each. Borehole depths ranged from 2m to 63m with a total meterage drilled of approximately 440m. The drilling commenced on the 28th November 1989, and was completed on the 21st December 1989. Appendix A contains the borehole logs, together with explanation sheets defining the terms and symbols used in the preparation of the logs. The location of the boreholes is shown on Figure 1.

Following installation of the piezometers, recording of piezometric levels in each of the boreholes was commenced, with regular monitoring continuing over a three month interval from about mid December 1989, to mid March 1990. The results of this monitoring are presented in Appendix B. Since mid March 1990 piezometric levels have been recorded at irregular intervals.

In addition to the installation of piezometers, three test pits were excavated by backhoe near the toe of the proposed northern playing field to obtain undisturbed block samples for direct shear strength testing. The location of these test pits, TP9, TP10 and TP11 are shown on Figure 1.

As part of the rock mechanics study of the Hornsby Quarry area, three fully cored inclined boreholes 101, 102 and 103 were drilled. The logs of these boreholes, together with structural defect data, is presented in Report No. SB463/4-AD.

2.2 Laboratory Testing

During drilling of the boreholes, push tube samples were obtained from each of the major material types encountered on the site. The results of laboratory testing on these samples, which included six consolidated undrained triaxials and ten Atterberg limits are presented in Appendix C.

In addition to the above testing, two samples of breccia fill material, from the new fill area located to the south of the existing playing field, were tested in direct shear in standard sized shear box equipment. The results of this testing is presented in Appendix C.

To provide shear strength data on the extremely to highly weathered breccia, which is difficult to sample and test by normal methods, a number of undisturbed block samples of the material were obtained from test pits and subjected to direct shear testing. The results of this testing are presented in Appendix D, together with a brief description of the test procedures.
3.0 SITE DESCRIPTION

3.1 Surface Conditions

The proposed playing field development is located on Council land immediately east of the Hornsby breccia quarry (see Figure 1). The site is presently occupied by a filled area (southern playing field), to the north of which, at a lower elevation, is an area of dumped fill materials. At present, an access road leading from the quarry passes between these two areas.

The original landform of the site comprised a steep sandstone slope at the (east) of the site which fed a westwards flowing creek which ran through the northern half of the site. Subsequent filling has moved the course of this creek further to the north with most of the flow now collected and diverted by pipe to a westwards flowing creek located near the northern boundary of the proposed development. The upper reaches of this northern most creek have also been modified by filling.

Located along the toe of the existing playing field and filled areas, is a northwards flowing, in placed steep sided creek. This creek joins with a south-west flowing creek near the north-west corner of the development and is presently diverted beneath the adjacent quarry haul road into the quarry.

The proposed development is located above the breccia/sandstone contact zone (see Figure 1). This contact passes beneath the existing southern playing field along the eastern boundary of the proposed development, before trending westwards beneath the northwest filled area. Hawkesbury Sandstone outcrops on the slope above the eastern side of the development and in the creek bed at the northern end of the site. Although outcrops of breccia are limited, they were observed along the access track which passes through the site, as well as along several of the creek beds.

3.2 Subsurface Conditions

The site can be divided into four zones, with Zone 1 in the south, through to Zone 4 in the north. Reference should be made to Figure 1 to identify the features referred to.

Zone 1

This zone is underlain by sandstone and lies south of the breccia/sandstone boundary which passes NE-SW through the middle of the existing playing field. This zone consists of breccia fill up to about 10 metres thick overlying shallow residual sandy clays over weathered sandstone. No subsurface drainage was provided beneath the fill in this area.

To the immediate south of Chainage 110m, engineered fill is being placed over an area measuring some 2500m². Prior to fill placement in this latter area, subsoil drains were installed.
As indicated by borehole 11, the fill consists of a mixture of cobbles and boulders of breccia in a clayey sandy gravel matrix. The breccia boulders range in size up to about 0.5m across. The fines in the matrix are of medium plasticity. The sandstone underlying the fill is typically weathered for approximately the upper 2.5m, below which highly to moderately weathered sandstone occurs.

**Zone 2**

The second zone extends northwards from Zone 1 to near the access roadway at about Ch250m. In this zone, breccia underlies all but the easternmost part of the fill. Cross-sections at Ch215m and Ch230m given in Figure 4, show the stratigraphy below the playing field area, which consists of breccia fill overlying the natural breccia land surface, again with no subsurface drainage provisions.

It is understood from Hornsby Quarry personnel, that a "key trench", some 1.5m deep and 4.5m wide was excavated along the toe of the batter and backfilled with compacted fill. The dimensions or nature of this trench were not specifically investigated during the recent study.

Downslope of the fill batter, the creek (see Figures 1 and 4) has incised deeply into the weathered breccia, giving steep sides to the creek, with the fill batter and creek slope forming a more or less continuous slope from the top of the fill to the flat floored sandy creek bed. The lower part of the slope exposed in the bank of the creek, consists of extremely to highly weathered breccia.

**Zone 3**

The third zone extends northwards from the access roadway at about Ch250m to the east-west drainage course located near Ch335m. In this zone breccia underlies all but the easternmost part of the fill. Cross-sections at Ch310m and Ch330m given in Figures 4 and 5 show that up to about 10m of breccia fill overlies about 1.5m of residual sandy clay, before extremely to highly weathered breccia is encountered.

Prior to filling, a natural drainage depression ran from east to west at about chainage 310m (see Figure 1). Fill has been placed over this depression and the watercourse visible now is north of the natural one and marks the northern limit of the filling. It is understood that the drainage course was cleaned "to rock" prior to fill placement, although it has not been possible to confirm this. It is further understood that no attempt was made to provide any subsurface drainage measures in the depression.

The surface material to the west of the existing fill area consists of deeply weathered breccia at the southern end with sandy clay alluvium to the north-west (see Figure 1). The depth of fresh rock, as shown on cross-sections at Ch270 and Ch310, is near RL90m. The alluvium which generally consists of a sandy clay of low to medium plasticity is approximately 1m thick near borehole 41. Underlying the alluvium is a 1.1m thick layer of residual sandy clay which overlies weathered breccia.
Zone 4

The fourth zone comprises the area north of the east-west drainage depression located near Ch335m. This area is located on an east-west trending ridge and is underlain by residual clays overlying weathered breccia. Borehole 43 located on the ridge encountered at least 5.6m of extremely to highly weathered breccia. Borehole 44 on the midslope showed residual soil and EW breccia to 4.5m depth and "rock" strength HW/MW breccia from about 5.5m depth. Borehole 46 at the base of the slope, showed "rock" strength breccia at about 4m depth. Over most of the area, the residual sandy clay layer varies in thickness from about 0.6m to 1.3m.

To the north, in the northernmost gully, sandstone outcrops along the base of the northern drainage gully and to the east sandstone outcrops on the steeper hillside above the proposed playing field (Figure 1). To the west, a broad area of alluvium exists through which the creek has eroded exposing the underlying weathered breccia. Located between the creek and the quarry haul road is a relatively thin ridge of weathered breccia. The slightly weathered to fresh breccia occurs at about RL90m in the quarry as shown on the geological cross-sections.

3.3 Weathered Breccia Condition

In its fresh condition the breccia is very strong. However, the weathered zone is of considerably lower strength and is of great importance to the stability of the proposed fills. It should be noted that the terms moderately weathered (MW), highly weathered (HW), and extremely weathered (EW), used in this text have standard quantitative definitions which are given on Explanation Sheet 1 in Appendix A.

On the sloping parts of the site the uppermost red clay soils are the result of insitu weathering of the breccia. These residual soils are all of soil strength and show little rock structure. Typically these soils are 1 to 1.5m thick and are underlain by extremely weathered breccia.

The extremely weathered breccia has soil strengths but retains rock-like structure and has some pieces of weathered rock. As the depth increases the rock structure becomes more evident and the proportion of rock strength material increases until highly weathered breccia is encountered with essentially rock type strengths. This transition zone is of substantial thickness in the ridges, especially at BH14 at the southern end. In some instances there is an ordered transition. However, at others there are a series of bands of material alternating between extremely and highly weathered material.
3.4 Effective Strength Parameters

3.4.1 General

The materials tested in the laboratory consisted of breccia fill, residual soil derived from breccia, extremely weathered breccia, and extremely to highly weathered breccia. Details of the tests are given in Appendices C and D, and a general discussion of the types of test are given in Section 2.2. above.

The results of all tests are summarised in Table 1 subdivided into the various material types, and the results for each type are further summarised in Figures 6, 7 and 8.

Atterberg limit test results are also given in Table 1 both to assist in characterising the material and by published correlations of the angle of friction with plasticity index, as a check on the results of triaxial and shearbox tests.

3.4.2 Breccia Fill

As described in Section 3.2, the breccia fill consists of brown, clayey sandy gravel matrix with boulders up to about 500mm. The test results show the fine grained portion to be of medium plasticity with a liquid limit in the middle fourties, though it is likely that rather more plastic material will occur in some places. The results of the two shearbox tests were similar (see Figure 8) and design values of 10kPa cohesion and 30 degrees angle of friction have been adopted. This angle of friction is somewhat lower than the values of 30 to 33 degrees estimated from the plasticity index. A check was also made for stability assuming cohesionless fill as per sample 1-SE Field.

3.4.3 Residual Breccia Soils

The results of the tests on residual breccia soils are given in Figure 6. These soils are red or red and brown and vary in plasticity from medium to high plasticity with liquid limits as high as 77%, and plasticity indices of 23 to 45, which implies angles of friction of 26 to 29 degrees. The results of the laboratory testing fell into this range for the most part, except for the direct shear test on the block sample from TP1 where it is suspected that a gravel piece affected the test. The test results are closely grouped and a lower quartile value of 5kPa cohesion and 28.5 degrees angle of friction has been adopted for design.

3.4.4 Extremely and Highly Weathered Breccia

Tests on the extremely (EW) and extremely to highly weathered (EW/HW) breccia were difficult because of the rock-like structure. For this reason a number of large size shearbox tests were undertaken on block samples cut from test pits. There is a gradual change in the ground from the residual soil/extremely weathered breccia to highly weathered breccia, and this is reflected in the substantial scatter of the results. If the results from
test pit 10, which was on EW/HW material, are excluded, the lower quartile value is a cohesion of 20kPa and an angle of friction of 25 degrees. This value has been adopted for the general EW rock.

As a check, analyses have been made of existing weathered breccia slopes in the existing quarry. Strengths of the order given above are consistent with the existence of 20 to 30m high slopes at 50 degrees in the adjacent quarry, provided the slope is not subject to water pressures.

At the south end, especially on BH14, the HW and EW material is banded and in this area the average results have been adopted.

For the weaker highly weathered breccia and material marginal between highly and extremely weathered, with a low clay component and which breaks into essentially granular pieces, the values obtained from the material out of test pit 10 have been adopted i.e. $c' = 28kPa$, $\phi' = 39$ degrees.
The stronger highly weathered breccia has essentially rock properties and critical failure surfaces would not pass through this material.

3.4.5 Shale Fill

The same values were adopted for shale fill as was used in earlier reports (see Table 2).

3.4.6 Summary of Design Parameters

A summary of properties assumed in the analyses, including densities is given in Table 2.

**TABLE 2**

**SUMMARY OF PARAMETERS FOR STABILITY CALCULATIONS**

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>COHESION kPa</th>
<th>ANGLE OF FRICTION DEGREES</th>
<th>TOTAL DENSITY TONNES/M³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill</td>
<td>10.0</td>
<td>30.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Residual</td>
<td>5.0</td>
<td>28.5</td>
<td>1.95</td>
</tr>
<tr>
<td>EW Breccia</td>
<td>20.0</td>
<td>25.0</td>
<td>1.95</td>
</tr>
<tr>
<td>EW/IV Banded (south end)</td>
<td>30.0</td>
<td>27.0</td>
<td>1.95</td>
</tr>
<tr>
<td>HW Breccia*</td>
<td>28.0</td>
<td>39.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Shale Fill</td>
<td>25.0</td>
<td>25.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

* See text.

4.0 SURFACE AND SUBSURFACE WATER CONDITIONS

4.1 Surface and Subsurface Drainage

The surface runoff from the slope uphill (to the east) of the playing field development is intended to be intercepted by surface drains located along the base of the slope. These surface drains lead to a pipe which runs from about the centre of the site northwards to discharge into the valley to the north of the proposed fill area. It has been observed during wet periods that almost all of the flow from the centre and southern slope disappears south of the drain into the fill.
As noted in Section 3.1, the original landform of the site has been modified with drainage depressions being infilled. In particular, the main east-west drainage depression has been shifted north to its present location.

Following periods of heavy rainfall, seepage emerges from a number of locations throughout the site, particularly near the fill/natural surface interface. Significant flows were noted at the following locations:

- near the toe of the fill batter on the line of the old depression, i.e. at about Ch320. Flows from this area have been measured at 5 litres/sec, approximately 6 hours after rain had stopped;
- emerging along the western toe of the existing playing field, in particular, near Ch215; and
- emerging from halfway along the access road located at the northern end of the playing field. This access road is cut into natural soil on the uphill side over part of its length. The seepage from this particular area, as well as general seepage from along the northern toe of the fill area is presently collected by an unlined drain and led westwards to the north flowing creek.

4.2 Piezometer Readings

Appendix B presents the results of regular monitoring of piezometric levels in 37 boreholes over the period from about mid-December 1989 to mid-March 1990. Since mid-March 1990, piezometric levels have only been recorded at irregular intervals. Also included in Appendix B is a plot of rainfall registrations for the period of regular monitoring.

The rainfall readings are for Wahroonga, obtained from the Bulletin of Daily Metropolitan Rainfall prepared by the Bureau of Meteorology. All rainfall registrations are based on telegraphic reports.

Over the three month monitoring period the highest rainfall events took place on the following days:

<table>
<thead>
<tr>
<th>Date</th>
<th>Rainfall Registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/12/89</td>
<td>39mm</td>
</tr>
<tr>
<td>9/1/90</td>
<td>41mm</td>
</tr>
<tr>
<td>10/1/90</td>
<td>41mm</td>
</tr>
<tr>
<td>5/2/90</td>
<td>188mm</td>
</tr>
<tr>
<td>7/2/90</td>
<td>70mm</td>
</tr>
<tr>
<td>13/2/90</td>
<td>50mm</td>
</tr>
<tr>
<td>25/2/90</td>
<td>46mm</td>
</tr>
</tbody>
</table>

During the month of February 1990 a total of 430mm of rainfall was recorded at the Wahroonga Station.
4.3 Groundwater at Southern End

This section deals with the groundwater conditions at the southern end of the site i.e. Zones 1 and 2 as described in Section 3.2.

Figure 9 shows a diagrammatic representation of the groundwater system at the southern end of the site beneath the playing field. A proportion of the rain falling on the fill runs off as surface water and the remainder seeps into the fill. This water becomes ponded on the old land surface, and it appears that the residual soil is less permeable than the fill or underlying weathered breccia. The ponded water runs along the old land surface, following the old surface gradients, and emerges as seepage along the western and northern toes of the fill. Water levels in piezometers near the fill/residual soil interface showed response to rainfall events, with water ponding up to 2.2m deep over the old surface at BH13, and up to 0.5m deep at BH20. Piezometers at BH10 and BH7 were at levels close to the top of the residual soil, or were in the residual soil but exposed to fill above the old land surface levels near the toe, and these showed peak water levels approximating the old land surface level.

Piezometers actually within the residual breccia soil (BH15, BH17 and BH22) did not show any pore pressures, indicating that in this zone free vertical drainage was occurring.

Some water does penetrate though the residual soil into the extremely and highly weathered rock beneath, and there appears to be a second water table within the highly weathered breccia, with restricted drainage into the fresh rock beneath and also sideways drainage into the creek to the west. The water levels in these materials at the south end are shown in Figure 10 plotted as the depth of the water level beneath the natural surface versus the depth of the base of the piezometer below the natural surface. The plot shows the range of water levels recorded at each location and a study of the time plots show that in dry times between rainfall events the piezometers are often dry or close to it. The piezometers near the toe of the bank (BH9, BH14, BH16 and BH23) show a wide range of readings giving ground pressures up to about 5m head. Piezometers 12 and 19 are beneath the body of the fill and show a smaller response. It appears therefore that rainfall events create a greater flow in the weathered rock, resulting in steeper hydraulic gradients to the creek and a reduction in the unsaturated zone in that area (Figure 9).

The responses to rainfall in the HW rock were not very sharp and it is unlikely that the levels rose significantly above the recorded values. The rainfall in the period of observation was high, but higher could occur. In contrast with earlier work, recent research at the University of NSW with landslide areas, has assessed that correlation of groundwater levels with rainfall events cannot, at this time, be reliably undertaken. A conservative approach must therefore be undertaken.
For design purposes the following assumptions were adopted:

- **Fill:** water level 3m above the natural ground surface below the existing crest and further east, dropping to natural surface level at the existing toe.

- **Residual Soil:** water level as above.

- **EW rock:** natural surface level.

- **HW rock:** natural surface level but with a maximum water pressure of 5m.

These design values assume that the drainage measures described in later sections are implemented.

4.4 Groundwater in the Central Area

This section describes groundwater conditions in the central area, i.e. Zone 3 as defined in Section 3.2. This zone can be further subdivided into two sub-zones consisting of the main old gully which has been filled with up to 15 or more metres of fill, and the "flank" sub-zone which comprises the natural slope between the access road, the base of the existing fill and the creek.

In the "flank" sub-zone, none of the holes showed any water other than water introduced during drilling and this slowly dissipated. This includes BH26, BH32, BH33, BH35 and test pits TP3, 5, 8, 9 and 10. The deepest of these (BH32) extended to 7.1m below natural ground surface level into HW breccia and it is likely that a lower water level exists in the fresh rock as occurs elsewhere.

The main gully sub-zone encompasses the old watercourse which ran from between BH27 and 35, past BH36, 37/38 and passes out just north of BH39/40 and BH41/42 (see Figure 1). BH28 and the group BH29/30/31 are on the sides of the old gully but on the existing fill. The mechanisms at work here are similar to those described for the southern section.

The fill in the gully showed frequent water loss during drilling indicating permeable zones. All piezometers in the fill showed fluctuating water levels, which reached up to about 5m above natural surface near the centre of the gully and rather less at BH28. It is likely that the responses are rapid and the peak levels may not have been recorded. Further, it must be expected that rainfall events will occur in the life of the final construction that may result in greater depths of flow in the fill.

Piezometers in the filled area installed beneath the natural surface in the EW to HW breccia (BH30 and 37) showed very rapid response to the major rainfall event, with piezometric levels reaching 3.3 to 4.5m above the natural surface level, though these were still lower than the levels in the overlying fill. The piezometric level in the fresh rock 30m below the surface in BH29 was about 25m below the natural surface. It is concluded
that the water level in the fill is ponded on the EW/HW breccia in the same way as at the south end, with vertical drainage down to the fresh rock beneath and from there into the quarry.

Downhill from the fill in BH39/40 and BH41/42 there is a water level within the EW/HW breccia but this, too is perched as evidenced by the deep water level in the fresh breccia at BH41, where the water level is about 26m below the natural surface.

In this central area it is feasible to install drainage measures to control the groundwater levels in the fill, and in the design profiles water levels in the fill have been assumed taking into account the drainage measures described in Section 6.

In the weathered breccia, pore pressures can be assumed to drop from that associated with the piezometric head in the fill at the top of the weathered rock, decreasing to zero at a depth of about 10m below.

4.5 Groundwater in the Northern Area

The northern area comprises Zone 4 as described in Section 3.2 above. It's main components are the steep breccia ridge and the alluvial flat beneath.

Underdrainage is again apparent with gradients from the HW breccia down into the fresh rock at both BH44/45 and BH46/47. The water level in the EW/HW breccia in BH47 is actually lower than creek level.

It will also be feasible in this zone to install drainage measures. There will inevitably be some build up of water above the natural surface of the fill, and the water levels in the design profiles have assumed that the drainage measures described in Section 6 are installed.

5.0 STABILITY ANALYSES

5.1 General

The previous analysis presented in report S8463/2-AC, indicated that upper slopes of about 3:1 and a toe berm over most of the western side at 1.75:1. It was also suggested that some modification of the western slope of the existing playing field might be needed.

This section describes, firstly, the results of analyses of the layouts and batters proposed by Council following our earlier report and then examines variations to provide a basis for revised designs.

In judging the acceptability of designs, a minimum factor of safety of 1.5 has been adopted. This is consistent with the method of choosing the parameters and with conventional practice.
The stability of the proposed development can be considered in five different segments:

. A southern profile which encompasses Zones 1 and 2 as described in Section 3.2. The creek approaches closest to the toe at chainages 170 and 215m, the latter being slightly worse because the creek is lower at that location. The profile analysed corresponds to these sections, but draws on ground data from the full length.

. Ch270 where there will be relatively shallow fill over the residual slope and where it will be difficult to keep water levels low.

. Ch310 where the fill extends close to the existing creek.

. Ch330 where the greatest depth of fill occurs.

. Ch390 where the fill drops over the steep ridge onto the alluvial flat. This also serves to give guidance for the sections further round the ridge on the northern side.

5.2 Stability Analyses - West Facing Slope of Existing Fill

The section chosen for analysis has the profile below the toe of the fill corresponding to the closest approach of the creek. The breccia profile assumed was that found at BH14 which shows banded EW and EW/NW breccia to at least the drilling depth. This is worse than is found further to the north along the toe of the slope.

Figure 11 shows the results of the analysis of the existing circumstance which yielded a factor of safety of 1.31. Figure 12 shows that flattening the upper slope does not substantially improve this situation since it is the lower natural slope which is relatively unstable.

Figure 13 shows the result of adding a rockfill berm against the natural creek bank. The width of the berm at the base was chosen to pick a straight line between the western "ridges" along the creek bank (see Figure 31). This resulted in a factor of safety of 1.45 with the existing fill slope.

Figure 14 shows the result of flattening the upper slope to 1:2.5. This shows an acceptable factor of safety even when the additional fill was placed to the required design level.

Figures 16 and 17 show analyses corresponding to a cohesionless fill (c' = 0, $\phi'$ = 35 degrees) and a clay/shale fill (c' = 25kPa, $\phi'$ = 25 degrees). Both have acceptable factors of safety.

As noted, these analyses represent the situation as at BH14 for the strength of the breccia at the toe of the slope. If the moderately weathered and highly weathered breccia with rock properties occurs at a depth of about 5m at the toe of the fill slope, as is the case at BH16 and BH21, then the stability of the lower slope is not an issue. However, a similar slope is required in the fill as shown in Figure 15.
There are two locations where the bank steepens. If it can be shown that material with rock strength properties occurs in the breccia bank at high levels then no action is required for the lower slope. If this is not the case then the two hollows in the breccia bank should be filled with rockfill, as discussed in Section 6.8.

### 5.3 Stability Analyses at Central Drainage Depression

This section is based on the data at chainage 330m and represents the area with the greatest height of fill. The initial analysis is shown on Figure 18. The lower slope gave a factor of safety which was marginally too low. A second analysis, which is shown on Figure 19, gave acceptable factors of safety for an upper and lower slope of 2:1 with a 15m berm.

Two checks with alternative fill properties are given in Figures 20 and 21. Both showed acceptable factors of safety.

### 5.4 Stability Analyses Opposite Northern Ridge

Figure 22 shows the results of analysis of the present design slope at chainage 390m which is on the point of the northern ridge. The analysis indicated that there was an inadequate factor of safety for the lower slope which had only a thin veneer of fill over it.

Figure 23 shows the result of maintaining the lower slope at 1.75:1 but moving it westwards, together with an upper slope steepened to 2:1. The analysis indicated that while the upper slope had a reasonable factor of safety, the lower slope needed further flattening.

Figure 24 shows the result of flattening the lower slope to 2.5:1 and maintaining the upper slope at 2:1. This gave satisfactory results for the lower slope but the toe of the upper slope was brought close to the weaker residual soils and has an inadequate factor of safety.

Figure 25 shows the analysis of a slope with a 2.5:1 lower slope and a 2.25:1 upper slope, both of which showed acceptable factors of safety.

As a further check, three non-circular analyses were undertaken of the same configuration and these are shown in Figures 26, 27 and 28, all of which show acceptable factors of safety. One of these (Figure 27) models the effect of provision of a sand drainage blanket.

Figures 29 and 30 show analyses for granular and shale fill, both of which show acceptable factors of safety except for the lower slope on Figure 29 (F of S = 1.44) which considers purely granular fill. This highlights the need to avoid shallow fills over steep residual slopes and in future layouts, rather more cover should be provided.

### 5.5 General Conclusions from Stability Analyses

The analyses above indicate that, with the exception of the western facing slope of the existing playing fields, the slopes can be steepened from 3:1 to those described for the various sections.
Hemodialysis works for the west slope of the existing playing field involve flattening the existing slope to 2.5:1 and, depending on mapping, a rockfill support of the slope to the creek.

6.0 DRAINAGE MEASURES AND CONSTRUCTION PROVISIONS

6.1 Surface Drainage

Stability of the proposed fill is critically dependent on the provision of surface and subsurface drainage measures.

It must be recognised that the placement of fill over natural watercourses above the edge of an operating quarry is an inherently difficult and potentially dangerous undertaking, unless done in a carefully controlled manner.

Control of surface and subsurface drainage and close attention to fill quality will be essential.

If ever the drainage systems become inoperative, for example by blocking of drains above the slope, the potential exists for a flow slide to develop and hence ongoing maintenance is essential.

The surface drainage must prevent ponding of surface water and allow rapid runoff so as to reduce infiltration of water into the fill. Drainage at the rear (eastern) side of the site is inadequate in its present form and must be modified to divert surface water into the drain system. It will, as a minimum, be necessary to provide a concrete cutoff wall to rock along the western side of the lowest section of the N/S catch drain, near chainage 280m on the eastern side of the present access road, to divert the water which now enters the fill and, in the same location, to provide a lined drain to carry concentrated flows direct to the main drain (Figure 11). In addition, all entrances must be substantially upgraded and provided with measures to prevent blockage.

To reduce infiltration into the fill it is essential that the final design surface provide positive and effective surface drainage back from the crest of the fill slope into lined drainage systems.

As a further measure, the final fall of fill, excluding topsoil, is to be clay fill compacted to 100% of standard compaction. The purpose of this is to provide a relatively impermeable seal to the top of the fill. If services are planned which might penetrate this layer, than the layer should be deepened.

Surface drainage should be designed to cope with flows greater than usual and must prevent ponding of water near the crest of the fills in a 1 in 100 year event.
It has not been feasible to measure accurately all the observed seepages at the site, except for the major flow from the old central drainage depression, where 5 l/sec was measured some 6 hours after rain. The B-W drain at the toe of the existing fill (CD on Figure 31) flows at up to a litre or two per second.

The drainage has been designed by allocating catchment areas to each drain, taking conservative infiltration rates, and sizing them to accept flow rates for the 1 in 50, 12 hour duration storm.

6.2 Subsurface Drainage, Southern End

The layout and cross sections of subsurface drainage are shown on Figures 31 and 32. In the area of the eastern portion of the existing playing field there are stormwater drainage pipes which must be checked to see if they can sustain the additional loading from the weight of the additional fill and if not they must be modified to take the load or removed and other provisions made for surface drainage.

A subsoil drain should be provided at the base of the existing sandstone cuttings to the east of the playing field over the length of the cuttings where fill is to be placed against them (MN in Figure 31). Where the drain is placed on rock, the filter cloth should be omitted from the base of the drain. For protection, these should be filled over to a depth of 0.5m by sandy clay or gravelly sand fill as obtained from the adjacent quarry. These subsoil drains should be drained into the overall drainage system to the north and also linked to the new drains placed beneath the southern extension to the fill.

In areas where the sandstone cutting shows weathering or fracturing, vertical drainage wicks should be placed and joined into the horizontal drains. Wick drains should be Mebra wick drain 7007 or similar, fastened to the rock face. Alternatively, sand could be placed locally against the face, as has been done in the southernmost area. The locations of such drains should be decided by geotechnical viewing of the exposed faces. If the fill extends higher, additional contour and local drains will be required. The extent of these should be determined on site.

The seepage from the fill currently emerges at the western toe of the embankment. As noted in Section 4.1, this water is ponded on the residual soil. Deep excavation for drains is undesirable since this would encourage water to enter the underlying EW to MW rock and this would adversely affect the creek bank stability. Nevertheless, it is important to lead the seepage water away from the top of the creek bank, and hence a drain (ABC in Figure 31) is proposed to catch the emergent seepage and lead it away from the slope. The drain should be connected at it's northern end to the EW drain (DC on Figure 31) along the existing access road, and at its southern end to the outlet constructed for the new section of fill. To get
the required falls of 1%. It may prove necessary to provide other outlets leading to the creek in some locations and this is best determined on site at the time of construction. It will be essential to construct this drain in sections not longer than 5m and each section must be backfilled immediately after excavation because of the danger of causing instability in the overlying slope.

6.3 Subsurface Drainage, Central Area

The subsurface drainage measures proposed for this portion are typically as set out below. However, because the slopes are liable to alteration, this scheme can be considered as a general outline only and some further detailing will be required as the slopes are finalised and some aspects will be best finalised onsite as the work progresses.

- A drain along the southern side of the existing access road to intercept seepage from the existing fill (DC on Figure 31). An open drain currently exists in this area and it is intended that this drain be cleaned out and a subsurface drain installed as shown on Figure 31. A sand blanket 0.5m thick should also be placed up the existing slope to RL123m to lead emergent seepage into the drain, and the outlet of the drain should be led to the creek to the west.

- A drain along the southern side of the existing fill to intercept seepage from the slope above down to the creek (EF on Figure 31). This could probably share a common outlet to that above.

- Drains from the depressions above E on Figure 31, these were described in our letter dated 21st June 1990.

- A drain from point E along the existing creek line to the new central drain.

- A new central drain excavated to the old creek level as shown in Figure 31 from 0 to 0.

- A layered drain in the area of the existing alluvium, extending south as an underdrain to the existing access track. This rockfill drain is protected by graded sand filters above and below, and it has to be of high capacity to transmit the flows from the old creek area. The detail in the toe area will require further attention since the conceptual drawing of the fill outline results in an unusual arrangement in portions of the toe where it comes very close to the north south creek. If the stripping exposes relatively permeable fractured rock, a bitumen seal must be sprayed onto the surface to inhibit water flow into the rock below.

- Blanket drains immediately above the residual soil on the steeply sloping northern ridge.
6.4 Subsurface Drainage, Northern Area

The decision has still to be made as to whether the creek is to be piped in this area or not. Due to the steep natural slope, there are problems associated with the placement of a thin veneer of fill down it. For the option where the creek is piped and the fill is carried across to the northern bank, the extension of the pipe must have incorporated in the design a subsurface drain with a graded gravel surround. In the area where the fill extends up onto the opposite bank it is possible that the drainage blanket over the residual soil may be deleted. This will depend on the actual layout of fill batter slopes, since as discussed in Section 5, thin veneers of fill over such steep slopes should be avoided. Detail design of drains in this area is not feasible until the slope design is finalised.

6.5 General Subsoil Drain Detail

It is recommended that a non-woven needle punched geotextile be used as the filter cloth, such as BIDIM 334 or similar. Where the base for a drain is uneven, a sand layer should be used to provide an even bed for the fabric.

Drainage gravel should consist of durable 20mm stone satisfying the requirements for concrete aggregate. It should contain no more than 2% by weight finer than 5mm. Sand bed material must have less than 5% passing 75 microns.

Graded filter drain material for use in the alluvial area should also satisfy the durability for concrete aggregate and to the grading shown in Figure 34. The rock component of the drain may be sandstone provided it is checked and found to be sufficiently durable. Not all sandstone will satisfy this requirement, even when fresh.

If desired, graded filters may be used elsewhere to replace filter cloth.

At the exits of the main drains, a perforated pipe should be placed back into the drain for 5m and an outlet structure should be built at the end of the drain as in Figure 33. These structures are to facilitate cleaning to prevent blocking of the outlets.

6.6 Staging and Construction

Prior to placement of fill on the natural surface, all vegetation and topsoil should be removed and the surface graded to an even slope. Care must be taken not to excavate through the residual soils. This is to reduce the flow of water through to the lower fractured rock aquifer. Excessive water into this aquifer could affect the stability of the adjacent quarry.

The fill should be placed in layers and compacted to a minimum density ratio of 95% by standard compaction. The stability calculations assume the strength of either ripped sandstone or clay/shale fill compacted to this density, and failure to maintain this minimum standard will endanger stability. For the same reason, other forms of fill should not be used
without further consultation. Density tests to check fill compaction
should be undertaken in accordance with the publication "Guidelines for the
Specification and Testing of Earthworks" prepared by a sub-committee of the
Australian Geomechanics Society. In addition, periodic effective strength
tests should be done on the actual fill used to check design assumptions.

The staging of construction must be managed such that:

(a) surface water is diverted around and away from the fill and the
subsurface drains. Falls of 2% should be maintained on the general
fill surface to promote runoff; and

(b) the disposition of more permeable (e.g. sandstone) and less
permeable (e.g. clay) fill must be organised so that water cannot
build up within the permeable material. In particular, the
placement of more permeable fill behind (i.e. further from the toe)
impermeable fill must be avoided. If necessary, additional
subsurface drainage should be provided to drain permeable zones in
the fill.

The main central drain should be constructed prior to filling and be
covered by 1m of fill to protect it from erosion.

Similarly, the edge of drainage blankets must not be left exposed after
placement since otherwise they will feed water into the drainage system.

Monitoring of groundwater levels and flows from the outlets of drains
should be undertaken on a regular basis.

6.7 Western Facing Fill Slope at Southern End

As noted in Section 5.2 above, it will be necessary to provide a rockfill
berm to stabilise the creek bank at approximately chainages 170m and 215m.
It is therefore recommended that:

a) A slot be cleared at the centre of each of the "hollows" and the
condition of the breccia logged. If rock strength breccia is not
evident over most of the depth of the slope, then a rockfill berm
should be constructed as in b).

b) The slope should be cleared of brush and timber by cutting them off
at ground level, but no attempt should be made to remove the roots or
any grass cover. The alluvium at the base for the width of the berm,
which will vary from 0 to approximately 7m, should be stripped. The
berm should then be constructed with a slope of 1.5:1 against
gEOFabric laid up the natural slope. The rockfill should be from
75mm up to a maximum size of approximately 500mm (see Figure 33).

The existing and future fill slopes should be flattened to 2.5:1.
7.0 CONCLUSIONS

The additional work has shown that conditions at the site are for the most part somewhat more favourable than was assumed to be the case after the initial work. For this reason, steeper slopes can be used and the slopes concluded from the analyses described in Sections 5.3 and 5.4 may be used as a guide to develop new layouts. Attention should be given to the problems inherent in having thin veneers of fill over the breccia slopes. This occurs with the present design on the northern ridge and also in the vicinity of chainage 310m. With the steeper slopes now available it should be possible to avoid these occurrences.

For the same reason, it is likely to be advantageous to carry the fill at the northern end across to the opposite side of the east-west running creek.

It is not known what is intended along the eastern boundary and further advice should be sought concerning this area.

The western facing slope of the existing playing field requires remedial action as described in Sections 6.2 and 6.7.

It is recommended that once a new layout is devised, further consultation should occur and possibly some further stability analyses will be needed.

For and on behalf of
COFFEY & PARTNERS PTY LTD
More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

**A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS**

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include:
- the general nature of the structure involved, its size and configuration;
- the location of the structure on the site and its orientation;
- physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, your geotechnical engineering report should not be used:
- when the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

**MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES**

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the, unanticipated, but steps can be taken to help minimize their impact. For this reason, most experienced owners retain their geotechnical consultants through the construction stage, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

**SUBSURFACE CONDITIONS CAN CHANGE**

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time. Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

**GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS**

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.
A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT *

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, give contractors ready access to the complete geotechnical engineering report prepared or authorized for their use. Those who do not provide such access may proceed under the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are not exculpatory clauses designed to foist geotechnical engineers’ liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers’ responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by The Institution of Engineers Australia, National Headquarters, Canberra, 1987.

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APPENDIX A

BOREHOLE LOGS AND EXCAVATION LOGS
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<td>5.9</td>
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<tr>
<td>27</td>
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<td>1269911.4</td>
<td>114.3</td>
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<td>113.3</td>
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<tr>
<td>39</td>
<td>308553.3</td>
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<td>42</td>
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<td>94.9</td>
<td>3.35</td>
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<td>44</td>
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<td>1270007.8</td>
<td>104.7</td>
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<td>46</td>
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<tr>
<td>47</td>
<td>308551.7</td>
<td>1270018.1</td>
<td>93.4</td>
<td>3.5</td>
</tr>
</tbody>
</table>
**SOIL DESCRIPTIONS**

**Classification of Material**

Based on Unified Classification System (refer SAA Site Investigation Code AS1726-1975 Add. No. 1 Table D1).

**Moisture Condition**

- dry: Looks and feels dry; cohesive soils usually hard, powdery or friable, granular soils run freely through hands.
- moist: Soil feels cool, darkened in colour; cohesive soils usually weakened by moisture, granular soils tend to cohere, but one gets no free water on hands on remoulding.
- wet: Soil feels cool, darkened in colour; cohesive soils weakened, granular soils tend to cohere, free water collects on hands when remoulding.

**Consistency**

Based on unconfined compressive strength (Qu) (generally estimated or measured by hand penetrometer).

<table>
<thead>
<tr>
<th>term</th>
<th>very soft</th>
<th>soft</th>
<th>firm</th>
<th>stiff</th>
<th>very stiff</th>
<th>hard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qu kPa</td>
<td>25</td>
<td>50</td>
<td>100</td>
<td>200</td>
<td>400</td>
<td></td>
</tr>
</tbody>
</table>

If soil crumbles on test without meaningful result, it is described as friable.

**Density Index**

(generally estimated or based on penetrometer results).

<table>
<thead>
<tr>
<th>term</th>
<th>very loose</th>
<th>loose</th>
<th>medium dense</th>
<th>dense</th>
<th>very dense</th>
</tr>
</thead>
<tbody>
<tr>
<td>density index</td>
<td>15</td>
<td>35</td>
<td>65</td>
<td>85</td>
<td></td>
</tr>
</tbody>
</table>

**ROCK DESCRIPTIONS**

**Weathering**

Based on visual assessment:

- Fresh:
  - Rock substance unaffected by weathering.
- Slightly Weathered:
  - Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.
- Moderately Weathered:
  - Rock substance affected by weathering to the extent that staining extends throughout whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
- Highly Weathered:
  - Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and signs of chemical or physical decomposition of individual minerals are usually evident. Porosity and strength may be increased or decreased when compared to the fresh rock substance, usually as a result of the leaching or deposition of iron. The colour and strength of the original fresh rock substance is no longer recognisable.
- Extremely Weathered:
  - 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.

**Strength**

Based on point load strength index, corrected to 50 mm diameter - Is(50). (Refer E.S.R.M., Commission on Standardisation of Laboratory and Field Tests, Suggested Methods for Determining the Uniaxial Compressive Strength of Rock Materials and the Point Load Strength Index, Committee on Laboratory Tests, Document No. 11). (Generally estimated: x indicates test result).

<table>
<thead>
<tr>
<th>classification</th>
<th>extremely low</th>
<th>very low</th>
<th>low</th>
<th>medium</th>
<th>high</th>
<th>very high</th>
<th>extremely high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is (50) MPa</td>
<td>0.03</td>
<td>0.1</td>
<td>0.3</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

The unconfined compressive strength is typically about 20 x Is(50) but the multiplier may range, for different rock types, from as low as 4 to as high as 30.

**Defect Spacing**

<table>
<thead>
<tr>
<th>classification</th>
<th>extremely close</th>
<th>very close</th>
<th>close</th>
<th>medium</th>
<th>wide</th>
<th>very wide</th>
<th>extremely wide</th>
</tr>
</thead>
<tbody>
<tr>
<td>spacing m</td>
<td>0.03</td>
<td>0.1</td>
<td>0.3</td>
<td>1</td>
<td>3</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

**Defect Description**

Uses terms contained in AS1726 Table 2 to describe nature of defect (fault, joint, crushed zone, clay seam etc.) and character (roughness, extent, coating etc.).
### Soil Symbols

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalitic Concrete or Hotmix</td>
<td>![Asphalitic Concrete or Hotmix symbol]</td>
</tr>
<tr>
<td>Concrete</td>
<td>![Concrete symbol]</td>
</tr>
<tr>
<td>Topsoil</td>
<td>![Topsoil symbol]</td>
</tr>
<tr>
<td>Fill</td>
<td>![Fill symbol]</td>
</tr>
<tr>
<td>Peat, Organic Clays and Silts (Pt, OL, OH)</td>
<td>![Peat, Organic Clays and Silts symbol]</td>
</tr>
<tr>
<td>Clay (CL, CH)</td>
<td>![Clay symbol]</td>
</tr>
<tr>
<td>Silt (ML, MH)</td>
<td>![Silt symbol]</td>
</tr>
<tr>
<td>Sandy Clay (CL, CH)</td>
<td>![Sandy Clay symbol]</td>
</tr>
<tr>
<td>Silty Clay (CL, CH)</td>
<td>![Silty Clay symbol]</td>
</tr>
<tr>
<td>Gravelly Clay (CL, CH)</td>
<td>![Gravelly Clay symbol]</td>
</tr>
<tr>
<td>Sandy Silt (ML)</td>
<td>![Sandy Silt symbol]</td>
</tr>
<tr>
<td>Clayey Sand (SC)</td>
<td>![Clayey Sand symbol]</td>
</tr>
<tr>
<td>Silty Sand (SM)</td>
<td>![Silty Sand symbol]</td>
</tr>
<tr>
<td>Sand (SP, SW)</td>
<td>![Sand symbol]</td>
</tr>
<tr>
<td>Clayey Gravel (GC)</td>
<td>![Clayey Gravel symbol]</td>
</tr>
<tr>
<td>Silty Gravel (GM)</td>
<td>![Silty Gravel symbol]</td>
</tr>
<tr>
<td>Gravel (GP, GW)</td>
<td>![Gravel symbol]</td>
</tr>
</tbody>
</table>

### Rock Symbols

<table>
<thead>
<tr>
<th>Rock Type</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claystone (massive)</td>
<td>![Claystone symbol]</td>
</tr>
<tr>
<td>Siltstone (massive)</td>
<td>![Siltstone symbol]</td>
</tr>
<tr>
<td>Shale (laminated)</td>
<td>![Shale symbol]</td>
</tr>
<tr>
<td>Sandstone (undifferentiated)</td>
<td>![Sandstone symbol]</td>
</tr>
<tr>
<td>Sandstone, fine grained</td>
<td>![Sandstone fine grained symbol]</td>
</tr>
<tr>
<td>Sandstone, coarse grained</td>
<td>![Sandstone coarse grained symbol]</td>
</tr>
<tr>
<td>Conglomerate</td>
<td>![Conglomerate symbol]</td>
</tr>
<tr>
<td>Limestone</td>
<td>![Limestone symbol]</td>
</tr>
<tr>
<td>Coal</td>
<td>![Coal symbol]</td>
</tr>
<tr>
<td>Dolerite, Basalt</td>
<td>![Dolerite, Basalt symbol]</td>
</tr>
<tr>
<td>Tuff</td>
<td>![Tuff symbol]</td>
</tr>
<tr>
<td>Porphyry</td>
<td>![Porphyry symbol]</td>
</tr>
<tr>
<td>Granite</td>
<td>![Granite symbol]</td>
</tr>
<tr>
<td>Pegmatite</td>
<td>![Pegmatite symbol]</td>
</tr>
<tr>
<td>Schist</td>
<td>![Schist symbol]</td>
</tr>
<tr>
<td>Gneiss</td>
<td>![Gneiss symbol]</td>
</tr>
<tr>
<td>Quartzite</td>
<td>![Quartzite symbol]</td>
</tr>
<tr>
<td>Talus</td>
<td>![Talus symbol]</td>
</tr>
<tr>
<td>Alluvium</td>
<td>![Alluvium symbol]</td>
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### Seams Symbols

<table>
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<th>Description</th>
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<tbody>
<tr>
<td>![Seam symbol]</td>
<td>Seam &gt;0.1 m thick (on a scale 1:50)</td>
</tr>
<tr>
<td>![Seam symbol]</td>
<td>Seam 0.01 m to 0.1 m thick (on a scale 1:50)</td>
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### Inclusions Symbols

<table>
<thead>
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<tbody>
<tr>
<td>![Ironstone gravel, Laterite symbol]</td>
<td>Ironstone Gravel, Laterite</td>
</tr>
<tr>
<td>![Shale Breccia in Sandstone symbol]</td>
<td>Shale Breccia in Sandstone</td>
</tr>
</tbody>
</table>

### Water Level Symbols

<table>
<thead>
<tr>
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<th>Description</th>
</tr>
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<tbody>
<tr>
<td>![Water level symbol]</td>
<td>Water Level</td>
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### Surfaces Symbols

<table>
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<tr>
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<tbody>
<tr>
<td>![Known boundary symbol]</td>
<td>Known Boundary</td>
</tr>
<tr>
<td>![Probable boundary symbol]</td>
<td>Probable Boundary</td>
</tr>
<tr>
<td>![Possible boundary symbol]</td>
<td>Possible Boundary</td>
</tr>
</tbody>
</table>
# Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 300553.1 N 126973.16

**Drill Model and Mounting:** Edison 3000 Truck  
**Hole Diameter:** 100mm  
**Hole Diameter:** 100mm  
**Depth:** 116m  
**Consistency:** M  
**Method:** Support

<table>
<thead>
<tr>
<th>Method</th>
<th>Notes</th>
<th>Sampled, Test, etc</th>
<th>Support Value</th>
<th>Notes</th>
<th>Sampled, Test, etc</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Material:**  
- **Soil Type:** Clay  
- **Color:** Brown  
- **Texture:** Medium plasticity

**Consistency:** M  
**Consistency/Density Index:** VS  
**Notes:** Samples and tests  
- **USG:** Undisturbed sample 56 mm diameter  
- **D:** Disturbed sample  
- **N:** Standard penetration test  
- **N:** SPT + sample recovered  
- **RC:** SPT with solid cone  
- **V:** Vane shear  
- **P:** Pneumopermeometer  
- **Bd:** Bulk sample  
- **R:** Refusal  

**Classification Symbols and Soil Description:**  
- **Classification System:** Based on unified classification system  
- **Moisture:** Dry  
- **Silt:** Very silt  
- **Sand:** Medium sand  
- **Silt:** Silt  
- **Clay:** Clay  
- **Moist:** Moist  
- **Wet:** Wet  
- **Plastic Limit:** VD  

**Consistency:** M  
**Notes:** Consistency/density index  
- **VS:** Very soft  
- **S:** Soft  
- **S:** Silty  
- **VS:** Very soft  
- **S:** Silt  
- **S:** Sand  
- **Clay:** Clay  
- **Wet:** Wet  
- **Moist:** Moist  
- **Plastic Limit:** VD  

**Additional Observations:**  
- **Fill:** Slightly weathered, brown, medium to coarse grained clay
- **Residual?**
- **Sandstone:** Brown, medium grained, extensively to highly weathered  

**Borehole:**  
- **Depth:** 116m  
- **Piezometer:** 80mm, slotted at 80m (14m of sand), Bantrelite at 140m (200mm of Bantrelite pellets)
# Engineering Log - Borehole

**Client:** Hornsey Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** R 308513.3 N 1269732.8

**Drill Model and Method:** Edison 3000 Truck

<table>
<thead>
<tr>
<th>Method</th>
<th>Notes</th>
<th>Penetration</th>
<th>Water</th>
<th>Support</th>
<th>Notes</th>
<th>Classification</th>
<th>Consistency/Density Index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Notes:** Samples and tests  
- **Soil Type:** Plasticity or particle characteristics  
- **Structure and Additional Observations:**
  - Coarse of Breccia Throughout Till  
  - Soft Zone  
  - EW Sandstone

**Slope:** -90 Deg  
**R.L. Surface:** 118.9 m

**Borehole:** Terminated at 3.50m  
**Formation:**
- Parameter of 3.6m, 0.5m silts, 3.2m (9.8m of sand), Bentonite of 1.75m (0.42m of bentonite pellets), grout (cement & water) to surface

**R.L.:** Gravely sandy clay medium plasticity, coarse grained, angular, brown  
**Material:** Sandstone; light brown, medium grained, extremely weathered

**Temperature:**
- Water level  
- Water outflow  
- Water inflow

**Consistency/Density Index:**
- Very soft (VS)  
- Soft (S)  
- Firm (F)  
- Stiff (ST)  
- Very stiff (VST)  
- Hard (H)  
- Frothy (Fb)  
- Very loose (VL)  
- Loose (L)  
- Medium dense (MD)  
- Dense (D)  
- Very dense (VD)
# Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Principal:** Old Mans Valley  
**Borehole Location:** E 300997.7 N 1200765.5

**Drill Model and Mounting:** EDSON 3000 TRUCK  
**Hole Diameter:**

<table>
<thead>
<tr>
<th>Method</th>
<th>Penetration</th>
<th>Support</th>
<th>Notes</th>
<th>Sampled, Tested, etc</th>
<th>R.L. Depth</th>
<th>Notes</th>
<th>Material</th>
<th>Slope</th>
<th>Structure and Additional Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS</td>
<td>auger reaming</td>
<td>C-coating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fill, Sandy CLAY, medium plasticity, coarse grained, light brown</td>
<td>90°</td>
<td>Fill, with cobble and boulders of Breccia</td>
</tr>
<tr>
<td>AD</td>
<td>auger drilling</td>
<td>M-mud</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grey</td>
<td></td>
<td>Breccia boulder</td>
</tr>
<tr>
<td>R</td>
<td>rotor/tractor</td>
<td></td>
<td>Light brown</td>
<td></td>
<td>130</td>
<td></td>
<td></td>
<td></td>
<td>Breccia boulder</td>
</tr>
<tr>
<td>W</td>
<td>washbar</td>
<td></td>
<td>Grey</td>
<td></td>
<td>129</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td>cable tool</td>
<td></td>
<td>Light brown</td>
<td></td>
<td>128</td>
<td></td>
<td>Fill, Gravelly Sandy CLAY, medium plasticity, coarse grained, angular gravel, brown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HA</td>
<td>hand auger</td>
<td></td>
<td>SANDSTONE red-brown, medium grained, extremely weathered</td>
<td>127</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>disturbance</td>
<td></td>
<td></td>
<td></td>
<td>126</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;bit shown by suffix&quot;</td>
<td></td>
<td></td>
<td></td>
<td>125</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>blank bit</td>
<td></td>
<td></td>
<td></td>
<td>124</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;V&quot; bit</td>
<td></td>
<td></td>
<td></td>
<td>123</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Samples and Tests: UDO = undisturbed sample 50 mm diameter
- Symbols and Soil description: Based on unified classification system.

**Moisture:**
- D = dry  
- M = moist  
- W = wet  
- Wp = plastic limit

**Consistency/Density Index:**
- VS = very soft  
- S = soft  
- F = firm  
- S1 = stiff  
- VS1 = very stiff  
- H = hard  
- Fb = friable  
- VL = very loose  
- L = loose  
- MD = medium dense  
- D = dense  
- VD = very dense
Engineering Log - Cored Borehole

Client: Hornsby Shire Council
Project: Old Mans Valley

Drill Model and Mounting: Edson 3000 Truck

Drilling Information:

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Rock Substance</th>
<th>Substances Description</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>122</td>
<td>Sandstone</td>
<td>Medium grained, red</td>
<td>J1 30deg PL RO Fe</td>
</tr>
<tr>
<td>121</td>
<td></td>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>Light grey</td>
<td>Gaulting into cross</td>
<td></td>
</tr>
<tr>
<td>119</td>
<td>Red brown</td>
<td>Light grey</td>
<td></td>
</tr>
<tr>
<td>118</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>117</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>116</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>115</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

General Defect Description:

METHOD
- AS: Auger Screwing
- AD: Auger Drilling
- NM: NML Core Drilling
- NL: NQ Core Drilling
- C: Casing

Point Load Test:

<table>
<thead>
<tr>
<th>Water Level</th>
<th>Point Load Test</th>
<th>Weathering</th>
<th>Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-diametral</td>
<td>1400 (MPa)</td>
<td>SW</td>
<td>J1 30deg PL RO Fe</td>
</tr>
<tr>
<td>A-axial</td>
<td></td>
<td>SW</td>
<td></td>
</tr>
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Weathering:

<table>
<thead>
<tr>
<th>Water</th>
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<tbody>
<tr>
<td>SW</td>
<td>Weakly</td>
</tr>
<tr>
<td>MW</td>
<td>Moderately</td>
</tr>
<tr>
<td>FR</td>
<td>Fresh</td>
</tr>
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</table>

Defects:

<table>
<thead>
<tr>
<th>Defect</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>J1</td>
<td>30deg PL RO Fe</td>
</tr>
<tr>
<td>J2</td>
<td>60deg PL RO clay coated</td>
</tr>
<tr>
<td>J3</td>
<td>90deg IR RO clay coated</td>
</tr>
<tr>
<td>J4</td>
<td>120deg IR RO clay coated</td>
</tr>
<tr>
<td>J5</td>
<td>150deg PL RO clay coated</td>
</tr>
<tr>
<td>J6</td>
<td>180deg IR RO clay coated</td>
</tr>
<tr>
<td>J7</td>
<td>210deg PL RO clay coated</td>
</tr>
<tr>
<td>J8</td>
<td>240deg IR RO clay coated</td>
</tr>
<tr>
<td>J9</td>
<td>270deg PL RO clay coated</td>
</tr>
<tr>
<td>J10</td>
<td>300deg PL RO clay coated</td>
</tr>
<tr>
<td>J11</td>
<td>330deg IR RO clay coated</td>
</tr>
</tbody>
</table>

Graphic Log/CORE LOSS:

- Core recovered
- Partial loss
- Complete loss
- Material indication
- Drilling Water

Strength:

<table>
<thead>
<tr>
<th>Strength</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW</td>
<td>Very weakly</td>
</tr>
<tr>
<td>MW</td>
<td>Moderately</td>
</tr>
<tr>
<td>FR</td>
<td>Fresh</td>
</tr>
<tr>
<td>VH</td>
<td>Very highly</td>
</tr>
<tr>
<td>EH</td>
<td>Extremely high</td>
</tr>
</tbody>
</table>

Defects:

<table>
<thead>
<tr>
<th>Defect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1</td>
<td>30deg PL RO Fe</td>
</tr>
<tr>
<td>J2</td>
<td>60deg PL RO clay coated</td>
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<tr>
<td>J3</td>
<td>90deg IR RO clay coated</td>
</tr>
<tr>
<td>J4</td>
<td>120deg IR RO clay coated</td>
</tr>
<tr>
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<td>180deg IR RO clay coated</td>
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<tr>
<td>J7</td>
<td>210deg PL RO clay coated</td>
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<tr>
<td>J8</td>
<td>240deg IR RO clay coated</td>
</tr>
<tr>
<td>J9</td>
<td>270deg PL RO clay coated</td>
</tr>
<tr>
<td>J10</td>
<td>300deg PL RO clay coated</td>
</tr>
<tr>
<td>J11</td>
<td>330deg IR RO clay coated</td>
</tr>
</tbody>
</table>

Client: Hornsby Shire Council
Project: Old Mans Valley
# Engineering Log - Cored Borehole

**Client:** HORNSEY SHIRE COUNCIL  
**Project:** OLD MANS VALLEY  
**Borehole Location:** E 306599.71 N 126765.46

**Drill Model and make:** EDISON 3000 TRUCK  
**Fluid:** WATER  
**Diameter:** 3.6m  
**Depth (Feet):** 20.75m

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Type</th>
<th>Core Substance</th>
<th>Rock Type</th>
<th>Grain Characteristics</th>
<th>Colour, Structure, Matrix Components</th>
<th>Est. Strength</th>
<th>Point Load Test (MPa)</th>
<th>Defects</th>
<th>Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>114</td>
<td>1.7</td>
<td>SANDSTONE</td>
<td>medium grained, light grey, indurated bedding, cross bedded at 30deg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>J1 10deg PL RO clean</td>
</tr>
<tr>
<td>113</td>
<td>1.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>112</td>
<td>1.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>111</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>2.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## General Defect Description:

- **METHOD:**
  - AS: auger screwing  
  - AD: auger drilling  
  - R: rock/soil  
  - W: washouts  
  - NMLC: core drilling  
  - NQ/HC: core drilling  
  - C: casing used  
  - BW: bored withdrawal

- **POINT LOAD TEST:**
  - D: dominant  
  - A: altitudinal

- **WEATHERING:**
  - FR: fresh
  - SW: slightly weathered
  - MW: moderately weathered
  - HW: highly weathered
  - V: very low
  - L: low
  - M: medium
  - H: high
  - EH: extremely high

- **STRENGTH:**
  - E: extremely high
  - L: low
  - M: medium
  - H: high
  - EH: extremely high

- **DEFECTS:**
  - J1: joint  
  - PI: parting  
  - SM: smear  
  - C1: clay  
  - RO: reave

- **GRAPHIC LOG/CORE LOSS:**
  - Core recovered  
  - Battered indicates material
  - No core recovered

- **Drilling Water:**
  - Partial loss
  - Composite loss

- **Observations:**
  - Borehole 1 terminated at 20.75m
  - Rakeometer at 20.75m, 6m spaced  
  - Sand at 15.6m (89cm of sand)  
  - Borehole at 12.13m, 0.5m sized  
  - Benbow (200ml) 25 litres of cement-water grout
**Engineering Log - Borehole**

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 3380910 M 1269765.7  
**Drill Model and Number:** EDISON 3000 TRUCK

<table>
<thead>
<tr>
<th>Hole Diameter</th>
<th>Depth</th>
<th>Notes</th>
<th>Soil Type</th>
<th>Plasticity</th>
<th>Colour</th>
<th>Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>100mm</td>
<td>120</td>
<td>1</td>
<td>SANDSTONE medium grained, orange brown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>129</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>128</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>127</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>126</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>125</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>124</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>123</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Borehole terminated at 12.5m  
Piezometer of 0.5m, 0.5m Staffed, sond at 5.4m (1400g of cond), Borehole of 4.6m (0.5m of Borehole gaskets)  
15 slits of good (cement & water)

**Notes:**  
Samples and tests:  
USS undisturbed sample 50 mm diameter  
D disturbed sample  
N* standard penetration test  
Nc SPI + sample recovered  
V* SPI with solid cone  
V vane shear  
P pressmeter  
Bb bulk sample  
P refusal  

**Classification Symbols and Soil Description:**  
Based on unified classification system

**Moisture:**  
D dry  
M moist  
W wet  
Wp plastic limit

**Consistency/Density Index:**  
V6 very soft  
V5 soft  
S stiff  
YSY very stiff  
H hard  
Fb friable  
VL very loose  
L loose  
MD medium dense  
D dense  
VD very dense

*METHOD*
- AS auger sampling  
- AD auger drilling  
- R roller/hooses  
- W washbore  
- CT cable tool  
- HA hand auger  
- DT disturb  
- "bit shown by suffix"  
- V v bit  
- TC bit  
- AD1  

*Support*
- C casing  
- M mud  

*Penetration*
- No resistance  
- Tapping to refusal  

*Water*
- Not measured  
- Water level  
- Water outflow  
- Water inflow

*Notes*
- Samples and tests  
- USS undisturbed sample 50 mm diameter  
- D disturbed sample  
- N* standard penetration test  
- Nc SPI + sample recovered  
- V* SPI with solid cone  
- V vane shear  
- P pressmeter  
- Bb bulk sample  
- P refusal  

*Consistency/Density Index*
- V6 very soft  
- V5 soft  
- S stiff  
- YSY very stiff  
- H hard  
- Fb friable  
- VL very loose  
- L loose  
- MD medium dense  
- D dense  
- VD very dense
### Engineering Log - Borehole

**Client:** Horsley Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 306600.7 N 1269704.6

<table>
<thead>
<tr>
<th>Method</th>
<th>Notes</th>
<th>Depth (m)</th>
<th>Graphic Log</th>
<th>Soil Group</th>
<th>Material</th>
<th>Structure and Additional Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>128</td>
<td></td>
<td></td>
<td>FILL</td>
<td>Sand Gravel Clay medium plasticity, loose gravel, angular, brown course grained, sand</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>130</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>129</td>
<td></td>
<td></td>
<td>FILL</td>
<td>Sand Gravel Clay medium plasticity, loose gravel, angular, brown course grained, sand</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>127</td>
<td></td>
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<tr>
<td>5</td>
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<td>6</td>
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<td></td>
<td>123</td>
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</tr>
</tbody>
</table>

**Notes:**
- Borehole terminated at 3.00m
- penetrated 3.0m, 0.5m sludged sand, sand at 1.5m (1.5m of sand), 10cm of silty sand
- 10cm of gravel

**Additional Observations:**
- Small breccia cobbles in clay mixture, grey breccia

**Consistency/Density Index:**
- V.S. very soft
- S soft
- F firm
- DI stiff
- V.SI very stiff
- H hard
- Fd friable
- VL very loose
- LO loose
- MD medium dense
- D dense
- VD very dense
<table>
<thead>
<tr>
<th>Method</th>
<th>Notes samples, test, etc</th>
<th>Q.L.</th>
<th>Material</th>
<th>Material characteristics</th>
<th>Notation</th>
<th>Consistency/density index</th>
<th>Additional observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>117</td>
<td></td>
<td>RILL Breccia, brown grey</td>
<td></td>
<td>3.7</td>
<td>FILL Breccia boulders and cobbles through fill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>116</td>
<td></td>
<td>FILL gravel, sandy clay, medium plasticity, coarse grained, angular, brown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
<td>115</td>
<td></td>
<td>BRECCIA, light orange, extremely weathered</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Coiling Commenced at 2.2m
# Engineering Log - Cored Borehole

**Client:** HORNSBY SHIRE COUNCIL  
**Site:** OLD MANS VALLEY  
**Hole No.:** 19.12.89  
**Drill Model and Make:** EDSON 3500 TRUCK  
**Drill Type and Length:** RMLC 3.6m  
**Fluid:** WATER  
**Slope:** -90 DEG  
**R.L. Surface:** 117.7 m  
**Datum:** AH  

## Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Subgrade</th>
<th>Substance Description</th>
<th>Rock Type</th>
<th>Grain Characteristics</th>
<th>Colour</th>
<th>Structure</th>
<th>Minor Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>117</td>
<td>BRECCIA: medium grained, brown, with light brown, gritty, massive.</td>
<td>EW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>116</td>
<td>BRECCIA: medium grained, brown.</td>
<td>EW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Rock Mass Defects

- EW zone
- 30mm clay seam
- 350mm EW zone
- 100mm jointed zone clay until 350mm jointed zone clay until 350mm jointed zone clay until 450mm IR RO CL

### General Defect Description

J1 30mm 0-450deg IR RO CLAY

### Vegetation

**Method:** water level  
**Point Load Test:** D - diametral  
**Weathering:** FR = fresh  
**Strength:** EL = extremely low

### Graphic Log/Core Loss

- Core recovered (hatching indicates material)
- Partial loss
- Complete loss
- No core recovered
**Engineering Borehole - Old Man's Valley**

**Borehole 14**

**Location:**
- **No. of borehole:** 14
- **Date:** 3/3/87
- **Submissions:**
  - Rock mass description
  - Hole condition
  - N.E.C. 3.00% T.R.
  - Water table
  - Weathering

**Method:**
- **Core:** SRHL
- **Core loss:** water
- **Sampling:** water
- **Description:** water

**General Details Description**

<table>
<thead>
<tr>
<th>R</th>
<th>method</th>
<th>core SRHL</th>
<th>water</th>
<th>R.L.</th>
<th>depth metres</th>
<th>graphic log core lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>104</td>
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<tr>
<td>111</td>
<td></td>
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</tr>
</tbody>
</table>

**Substance description**

- **Rock type:** limestone, chalk, sandstone
- **Weathering:**
  - Hard
  - Medium
  - Soft

**Strength**

- **Grade:** medium
- **N.E.C. 3.00% T.R.:** 0.526

**Defects**

- **Type:** intact, fractured, weathered
- **Description:** general weathering, fractures, voids

**Core Loss**

- **Water:** 10.0%
- **Core Loss:** 2.0%

**Points Load Test**

- **Type:** not determined

**Weighing**

- **Type:** not determined

---

**Note:** Information provided is general and may require specific context or interpretation based on the actual content of the document.
**Engineering Log - Borehole**

**Client:** HORSESHIRE COUNCIL

**Principal:** OLD MANS VALLEY

**Borehole Location:** P 308559 N 126973.2

**Hole Diameter:** 105mm

**Material:**
- **Soil Type:** Clay, grey brown
- **Material:** Gravelly Sand Clay

**Additional Observations:**
- **Structure:** Residual Boulders and boulders of breccia with clay till

**METHOD**
- **AS:** Casing screwing
- **AD:** Casing driving
- **R:** Roller/Travex
- **W:** Vise
- **C:** Cable tool
- **HA:** Hand auger
- **DT:** Dredge
- **W:** Weight
- **T:** T.C. bit
- **B:** Blank bit

**Support:** Casing

**Penetration:**
- **N:** Standard penetration test
- **H:** SPI + sample recovered
- **No:** SPI with solids cone
- **V:** Vane shear
- **P:** Pressuremeter
- **G:** Bulk sample
- **R:** Refusal

**Notes:**
- **USD:** Undisturbed sample 10 mm diameter
- **D:** Disturbed sample
- **SI:** Sample size
- **SI:** Sample recovered
- **SI:** SPI with solids cone

**Classification:**
- **VS:** Very soft
- **S:** Soft
- **F:** Firm
- **ST:** stiff
- **S1:** Very stiff
- **VS1:** Hard
- **F1:** Very hard
- **T:** Medium
- **VL:** Very loose
- **L:** Loose
- **MD:** Medium dense
- **D:** Dense
- **VD:** Very dense

**Moisture:**
- **D:** Dry
- **M:** Moist
- **W:** Wet
- **W:** Plastic limit

**Consistency/Density Index:**

**Notes:**
- **F:** Full
- **B:** Blank
- **P:** Partial
- **W:** Water
- **O:** Overflow

**Additional:**
- **117:** 90 DEG
- **117.7 m:** R.L. Surface

**Details:**
- **Hole Terminated at 3.8m**
- **Piezometer at 3.6m, 0.5m below, 0.9m:** Borehole 1.35m (6.0m of bimodal grit & pellets) to surface (cement & water)
# Engineering Log - Borehole

**Client:** HORNSEY SHIRE COUNCIL  
**Principal:** OLD MANS VALLEY  
**Borehole Location:** E 305845.5 M N 266911.9

### Drill Model and Mounting
- **Model:** EDSON 3600 TRUCK
- **Drill Size:** 100mm
- **Slope:** -90 DEG
- **R.L. Surface:** 115.2 m

### Materials
- **Material:** Sandy clay: medium plasticity, coarse grained, red brown
- **Classification:** Sandy clay
- **Consistency/Density Index:** RESIDUAL

### Additional Observations
- Grading AW, many clay bands
- Grading into HW

### Support and Penetration
- **Notes:** Samples and tests
  - U3D: Undisturbed sample 50 mm diameter
  - D: Disturbed sample
  - N: Standard penetration test
  - N* = SPI + sample recovered
  - V: Vane shear
  - P: Pressuremeter
  - B: Bulk sample
  - R: Refusal

### Moisture
- **D:** Dry
- **M:** Moist
- **W:** Wet
- **Wp:** Plastic limit

### Notes
- **SUPPORT:** C casing
- **M:** Mud
- **METHOD:** Auger screening
- **Penetration:**
  - **Resistance:** No resistance to refusal
  - **Depth:** Measured water level
  - **Water:** Water outflow

### Consistency/Density Index
- **VS:** Very soft
- **S:** Soft
- **F:** Firm
- **S1:** Stiff
- **VS1:** Very stiff
- **H:** Hard
- **Fb:** Fimbriate
- **VL:** Very loose
- **L:** Loose
- **MD:** Medium dense
- **D:** Dense
- **VD:** Very dense
### Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 3385615 N 12695110  
**Drill Model and Mounting:** Edison 3000 Truck  
**Hole Diameter:** 102mm  
**Recovery Method:** Arm  

**Notes:**  
- BRECCIA: light brown  
- Borehole 16 terminated at 11.9m  
- Percussion of 6.0m in silty, Sand at 4.6m, 3.6m of sand, Bed. Stone at 7.4m  

<table>
<thead>
<tr>
<th>Method</th>
<th>Penetration</th>
<th>Water</th>
<th>Notes</th>
<th>PL</th>
<th>Depth</th>
<th>Material</th>
<th>Consistency/Density Index</th>
<th>Classification</th>
<th>Support</th>
<th>Notes</th>
<th>Consistency/Density Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>A5</td>
<td>1.5</td>
<td>1.15m</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>AD</td>
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<tr>
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<td>medium dense</td>
</tr>
<tr>
<td>T</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>very dense</td>
</tr>
</tbody>
</table>

**Geological Note:**  
- Water level not measured  
- Water inflow  
- Water outflow  
- No resistance ranging to refusal  
- Samples and tests:  
  - USO undisturbed sample 50 mm diameter  
  - D disturbed sample  
  - N standard penetration test  
  - N* SPT + sample recovered  
  - No SPT with solid cone  
  - V cone shear  
  - P pressuremeter  
  - Es bulk sample  
  - R refusal  

**Classification:**  
- Symbols and soil description: based on unified classification system  
- Moisture:  
  - D dry  
  - M moist  
  - W wet  
  - Wp plastic limit  

**Client:** Coffey & Partners Pty, Ltd.  
**Incorporated in Queensland.**
# Engineering Log - Borehole

**Client:** HORSBYS SHIRE COUNCIL  
**Project:** OLD MANS VALLEY  
**Borehole Location:** E 303517 N 12639137  
**Hole Commenced:** 20.12.89  
**Hole Completed:** 20.12.89  
**Logged by:** GJK  
**Checked by:** PLV  

## Drill Model and Mounting
EDSON 3000 TRUCK

## Notes
- **SL:** 115.0 m
- **Soil Type:** Sandy Clay, medium plasticity, fine grained, brown
- **Consistency:** Residual
- Borehole terminated at 200m
- Piezometer placed at 20m, 65m slotted sand at 135m (0.65m of sand), Bentonite at 11m, (0.25m of bentonite pellets)

## Method
- AS: auger sampling
- AD: auger drilling
- D: rod/riser
- W: washbore
- CT: cable tool
- HA: hand auger
- CT: dilator

## Support
- C: casing
- M: mud

## Penetration
1 2 3

## Water
- Not measured
- Water level
- Water outflow
- Water inflow

## Notes
- Samples and tests
- 55 mm diameter
- Undisturbed sample
- Standard penetration test
- SP1 = sample recovered
- SP1 with solid cone
- Vane shear
- P: piezometer
- Bs: bulk sample
- R: refuse

## Classification
- **VS:** very soft
- **S:** soft
- **St:** stiff
- **VS:** very stiff
- **H:** hard
- **F:** friable
- **VL:** very loose
- **LL:** loose
- **MD:** medium dense
- **DD:** dense
- **VD:** very dense

## Graphical Log

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Support</th>
<th>Penetration</th>
<th>Water</th>
<th>Notes</th>
<th>Classification</th>
</tr>
</thead>
</table>
| AS     | Auger Sampling | Casing | 1 2 3       | Not measured | Samples and tests | VS
| AD     | Auger Drilling | Casing | 1 2 3       | Water level | Standard penetration test | S
| D      | Rod/Riser     | M        | 1 2 3       | Water outflow | SP1, SP1 with solid cone | St
| W      | Washbore      | M        |             | Water inflow | Vane Shear | VS
| CT     | Cable Tool    | M        |             |          | Piezometer | MD
| HA     | Hand Auger    | M        |             |          | Bulk Sample | DD
| CT     | Dilator       | M        |             |          | Refuse | VD
# Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 305423.0 N 5968937.2

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Notes</th>
<th>Classification</th>
<th>Material</th>
<th>Soil Type/Plasticity or Particle Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 129</td>
<td>C</td>
<td>Penetration</td>
<td>D</td>
<td>Disturbed sample</td>
</tr>
<tr>
<td>129 - 129</td>
<td></td>
<td></td>
<td></td>
<td>Standard penetration test</td>
</tr>
<tr>
<td>129 - 129</td>
<td></td>
<td></td>
<td></td>
<td>SPT + sample recovered</td>
</tr>
<tr>
<td>129 - 129</td>
<td></td>
<td></td>
<td></td>
<td>SPT with solid cone</td>
</tr>
<tr>
<td>129 - 129</td>
<td></td>
<td></td>
<td></td>
<td>Vane shear</td>
</tr>
<tr>
<td>129 - 129</td>
<td></td>
<td></td>
<td></td>
<td>Pressure cell</td>
</tr>
<tr>
<td>129 - 129</td>
<td></td>
<td></td>
<td></td>
<td>Bulk sample</td>
</tr>
<tr>
<td>129 - 129</td>
<td></td>
<td></td>
<td></td>
<td>Refusal</td>
</tr>
</tbody>
</table>

**Method:**  
- **A5:** auger screwing  
- **A6:** auger drilling  
- **R:** rotation/hydraulic  
- **W:** wash bore  
- **C1:** cable tool  
- **HA:** hand auger  
- **DT:** dial tube  
- **TB:** testing bit  
- **ADT:** ABT

**Support:**  
- **C:** casing  
- **M:** mud

**Notes:**  
- U50 undisturbed sample 50 mm diameter  
- D: disturbed sample  
- N: standard penetration test  
- N5: SPT + sample recovered  
- NC: SPT with solid cone  
- V: vane shear  
- P: pressure cell  
- BS: bulk sample  
- R: refusal

**Classification:**  
- **SYMBOLS:** based on unified classification system
- **Soil Description:**
- **Moisture:**
  - D: dry  
  - W: wet  
  - WP: plastic limit
- **Consistency/Density Index:**
  - VS: very stiff  
  - S: soft  
  - F: firm  
  - SL: stiff  
  - VS1: very stiff  
  - H: hard  
  - Fb: fibrous  
  - VLF: very loose  
  - L: loose  
  - MD: medium dense  
  - D: dense  
  - VD: very dense
### Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 306423.0 M 1269837.2

**Drill Model and Mounting:** EDSON 3000 TRUCK  
**Hole Diameter:** 120mm  
**Depth Progress:**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Notes Sampled, Text, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>114</td>
<td>WATER not measured</td>
</tr>
<tr>
<td>115</td>
<td>WATER overflow</td>
</tr>
<tr>
<td>116</td>
<td>WATER inflow</td>
</tr>
<tr>
<td>117</td>
<td></td>
</tr>
<tr>
<td>118</td>
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<tr>
<td>119</td>
<td></td>
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<tr>
<td>120</td>
<td></td>
</tr>
<tr>
<td>121</td>
<td></td>
</tr>
</tbody>
</table>

**Material:** Silt Clay: low to medium plasticity, mattock brown and grey, trace of fine sand, some cementation  
**Hand Classification:** CL  
**Additional Observations:** BRECCIA highly weathered

**Continued on Cored Borehole Sheet**

---

**Method:**
- AS auger coring
- AD auger drilling
- R roller/riser cone
- W washhole
- C1 cable tool
- HA hand auger
- D1 driller

**Support:**
- C casing
- M mud

**Penetration:**
- 2 3 no resistance ranging to refusal

**Water:**
- Not measured
- Water level
- Water inflow

**Notes and Tests:**
- USC un السد sample 50 mm diameter
- D disturbed sample
- N standard penetration test
- N+ SPT + sample recovered
- Nc SPT with solid cone
- V vane shear
- P pressure meter
- Bn bulk sample
- R refusal

**Classification Symbols and Soil Description:**
- Based on unified classification system

**Moisture:**
- D dry
- M moist
- W wet

**Consistency/Density Index:**
- VS very soft
- S soft
- F firm
- St stiff
- VS1 very stiff
- H hard
- Fb friable
- VL very loose
- L loose
- MD medium dense
- D dense

---

**Additional Observations:**
- EW BRECCIA

---

**Office Job No:** S6463/3  
**Borehole No:** 18  
**Sheet:** 2 of 9
### Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mams Valley  
**Borehole Location:** N 34626.3 E 1206437.2

### Drilling Information
- **Drill Model and Mounting:** Edson 3000 Truck  
- **Barrel Type and Length:** NMLC - 3.0m  
- **Fluid:** Water  
- **Rope:** NMLC  
- **Scope:** VD0 Degree  
- **P.S. Surface:** 1298.0m

### Drilling Description
- **Substance Description:**
  - Rock Type: Grain characteristics, colour, structure, minor components
  - Subsidence: 
    - Breccia: Fine to coarse grained, brown, interbedded bedding.
    - Breccia: Fine to coarse grained, brown, interbedded bedding.

### Rock Mass Defects
- **Defect Description:**
  - Crushed: SM 25mm thick  
  - Vertical joint with numerous washed seams
  - EW SM 25mm thick
  - EW SM 20mm thick
  - EW SM 10mm thick
  - JT 45deg PL RO, ironstone
  - JT 45deg PL RO, ironstone

### General Defect Description:
- Faulting: 5-20deg PL to 10 generally to 4 to 5mm

### Method
- **AS:** Agger screwing  
- **AD:** Agger drilling  
- **R:** Roller/rolls  
- **W:** Washouts  
- **NMLC:** Core drilling  
- **NGHO:** Core drilling

### Point Load Test
- **D:** Diametral  
- **A:** Axial

### Weathering
- **FR:** Fresh  
- **SW:** Slightly weathered  
- **MW:** Moderately weathered  
- **HW:** Highly weathered  
- **DW:** Extremely weathered

### Strength
- **EL:** Extremely low  
- **VL:** Very low  
- **L:** Low  
- **M:** Moderate  
- **H:** High  
- **W:** Very high  
- **S:** Extremely high

### Defects
- **FT:** Faulting  
- **PT:** Pitting  
- **SM:** Seam  
- **CL:** Clay  
- **RO:** Rough  
- **DG:** Decomposed  
- **PL:** Pisolitic  
- **IR:** Irregular
### Drilling Information

<table>
<thead>
<tr>
<th>Method</th>
<th>Core</th>
<th>R.L.</th>
<th>Depth</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMLC</td>
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<td>115</td>
<td>112</td>
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</tr>
</tbody>
</table>

### Substance Description

- **BRECCIA**: fine to coarse grained, banded light grey, brown, indistinct bedding.

### General Defect Description:

- Partings, 0-20 deg PL to NR, generally Fe stained to 44m.

### Method

- **AS**: auger screening
- **AD**: auger drilling
- **P**: roller/ricoe
- **W**: washbore
- **NMLC**: core drilling
- **QHQC**: core coring
- **L**: casing used
- **B**: barrel withdrawn

### Water Level

- **V**: water level
- **<**: water inflow
- **<**: not measured

### Core Loss

- **<**: partial loss
- **<**: complete loss

### Weathering

- **FR**: fresh
- **SW**: slightly weathered
- **MW**: moderately weathered
- **HW**: highly weathered
- **EW**: extremely weathered
- **VL**: very low
- **L**: low
- **M**: medium
- **H**: high
- **VH**: very high

### Strength

- **IF**: extremely low
- **PL**: very low
- **BO**: low
- **DO**: medium
- **PO**: high
- **RO**: very high
- **PO**: extremely high

### Defects

- **JT**: joint
- **PL**: planar
- **SM**: smear
- **C1**: clay
- **BD**: decomposed
- **PL**: polygonal
- **IR**: irregular
### Engineering Log - Cored Borehole

**Client:** HORNESBY SHIRE COUNCIL  
**Project:** OLD MAINS VALLEY  
**Borehole Location:** E 3096238 N 1269372

**Drill Model and Mounting:** EDSON 3000 TRUCK  
**Bore Type and Length:** NMCL - 3.0m  
**Fluid:** WATER  
**Sealing:** +90 DEG R.L. Surface: 126.8 m

<table>
<thead>
<tr>
<th>Method</th>
<th>Core-off</th>
<th>R.L.</th>
<th>Depth (meters)</th>
<th>Graph Data</th>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMCL</td>
<td>105</td>
<td>25</td>
<td></td>
<td></td>
<td>BRECCLIA: fine to coarse grained, grey &amp; light grey, some brown, indistinct bedding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>104</td>
<td>26</td>
<td></td>
<td></td>
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<td>103</td>
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</tr>
<tr>
<td></td>
<td>102</td>
<td>29</td>
<td></td>
<td></td>
<td>BRECCLIA: fine to coarse grained, brown &amp; grey, indistinct bedding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>101</td>
<td>30</td>
<td></td>
<td></td>
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<td>98</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### General Defect Description:
Portlands, 0-200 gph. Pt. 1 to 8, generally Fe stained to 44m

#### Method
- **A5:** core screwing  
- **A1:** core drilling  
- **B:** roller/icone  
- **W:** washbores  
- **NMCL:** core drilling  
- **NC, HQ:** core conditioning  
- **C:** casing used  
- **D:** barrel withdrawn

#### Graphic Log/Core Loss
- **D:** diametric  
- **A:** axial  

#### Point Load Test
- **FR:** fresh  
- **SW:** slightly weathered

#### Weathering
- **EL:** extremely low  
- **VL:** very low  
- **L:** low  
- **M:** medium  
- **H:** high  
- **EH:** extremely high

#### Strength
- **JL:** joint  
- **PL:** plating  
- **SM:** sandy  
- **CL:** clay  
- **RH:** rough  
- **DC:** decomposed  
- **PL:** plowed  
- **SR:** regular

#### Defects
- Crushed SM 56mm  
- Crushed SM 56mm

- 27.19-27.69 numerous JTs 30-63deg ironstone with crushed & clay inerts
- JTs 60deg RO ironstone B crushed inelts
- JTs 45deg RO ironstone B crushed inelts
- Closed JT 75deg IR
- JT 45deg IR RO trace crushed inelts
### Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Borehole Location:** Old Mans Valley  
**Borehole Number:** E 309425, 0 N 1269437, 2

#### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Substrate Description</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>07</td>
<td>Breccia: fine to coarse grained, grey, bluish grey, some brown, interbedded sediment.</td>
<td>J1 90 deg IR RO ironstone</td>
</tr>
<tr>
<td>06</td>
<td>Breccia: fine to coarse grained, grey, bluish grey, some brown, interbedded sediment.</td>
<td>J1 45 deg PL RO ironstone</td>
</tr>
<tr>
<td>05</td>
<td>Breccia: fine to coarse grained, grey, bluish grey, some brown, interbedded sediment.</td>
<td>Clay SM 20 deg 01 mm thick</td>
</tr>
<tr>
<td>04</td>
<td>Breccia: fine to coarse grained, grey, bluish grey, some brown, interbedded sediment.</td>
<td>J1 45 deg PL RO ironstone</td>
</tr>
<tr>
<td>03</td>
<td>Breccia: fine to coarse grained, grey, bluish grey, some brown, interbedded sediment.</td>
<td>J1 45 deg PL RO ironstone</td>
</tr>
<tr>
<td>02</td>
<td>Breccia: fine to coarse grained, grey, bluish grey, some brown, interbedded sediment.</td>
<td>Crushed SM 01 mm thick</td>
</tr>
<tr>
<td>01</td>
<td>Breccia: fine to coarse grained, grey, bluish grey, some brown, interbedded sediment.</td>
<td>J1 45 deg PL RO ironstone</td>
</tr>
<tr>
<td>00</td>
<td>Breccia: fine to coarse grained, grey, bluish grey, some brown, interbedded sediment.</td>
<td>Crushed infill</td>
</tr>
<tr>
<td>00</td>
<td>Breccia: fine to coarse grained, grey, bluish grey, some brown, interbedded sediment.</td>
<td>J1 45 deg PL RO ironstone</td>
</tr>
<tr>
<td>00</td>
<td>Breccia: fine to coarse grained, grey, bluish grey, some brown, interbedded sediment.</td>
<td>J1 45 deg PL RO ironstone</td>
</tr>
<tr>
<td>00</td>
<td>Breccia: fine to coarse grained, grey, bluish grey, some brown, interbedded sediment.</td>
<td>J1 45 deg PL RO ironstone</td>
</tr>
</tbody>
</table>

#### General Defect Description:

Footing 0-20 deg PL to IR generally 90 deg to 45 deg

**METHOD:**  
- AS: auger screening  
- AD: auger drilling  
- W: water borehole  
- NMLC: core drilling  
- NO/NO: core drilling

**POINT LOAD TEST:**  
- D: diameter  
- A: axial  

**WEATHERING:**  
- FR: fresh  
- SW: slightly weathered  
- MW: moderately weathered  
- HW: highly weathered  
- VH: very high

**STRENGTH:**  
- E: extremely low  
- V: very low  
- L: low  
- M: medium  
- H: high  
- VH: very high  

**DEFECTS:**  
- JT: joint  
- PT: parting  
- SM: seam  
- CL: clay  
- RO: rock  
- PL: planar  
- IR: irregular
**Engineering Log - Cored Borehole**

**Client:** Hornsby Shire Council  
**Hole commenced:** 15.12.99  
**Hole completed:** 29.12.99  
**Logged by:** JAF  
**Checked by:** FLV

**Drill Model and Mounting:** Edson 3000 Truck  
**Borehole Location:** E 309523.6 N 1268883.2

**Drilling Information**

<table>
<thead>
<tr>
<th>Method</th>
<th>Date</th>
<th>R L</th>
<th>Rock Substance Description</th>
<th>Rock Type</th>
<th>Grain Characteristics</th>
<th>Colour, Structure, Minor Components</th>
<th>Estimated Strength (MPa)</th>
<th>Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMTC</td>
<td>07/02/90</td>
<td>49</td>
<td>BRECCIA, fine to coarse grained, grey &amp; light grey, some brown, distinct bedding</td>
<td>SW</td>
<td></td>
<td></td>
<td></td>
<td>JT 50deg IR RO iron stained</td>
</tr>
<tr>
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</tbody>
</table>

**General Defect Description:**

- JT 50deg IR RO iron stained
- JT 50deg PL RO iron stained
- JT 90deg IR RO iron stained
- JT 60deg IR RO iron stained
- crushed SM 50mm thick

**Method:**

- AS: auger coring
- AD: auger drilling
- B: roller/tonne
- W: washbar
- NMTC: core drilling
- NDHC: core drilling

**Weathering:**

- EL: extremely low
- LV: very low
- L: low
- M: medium
- H: high
- VH: very high

**Strength:**

- EL: extremely low
- LV: very low
- L: low
- M: medium
- H: high
- VH: very high

**Defects:**

- PL: planar
- IR: irregular
# Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 308623.9 N 1214037.2

**Drill Model and Type:** EDCO 3000 Truck  
**Barrel Type and Length:** NMCL - 3.0m  
**Fluid:** Water  
**Drilling Information:**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>R.L.</th>
<th>Substance Description</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td>49</td>
<td>BRECCIA, fine to coarse grained, grey, then light grey, indistinct bedding.</td>
<td>Crushed SM 25mm thick</td>
</tr>
<tr>
<td>80</td>
<td>50</td>
<td></td>
<td>Jointed crushed SM 21mm thick</td>
</tr>
<tr>
<td>79</td>
<td>51</td>
<td></td>
<td>Crushed SM 20mm thick</td>
</tr>
<tr>
<td>78</td>
<td>52</td>
<td></td>
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<tr>
<td>77</td>
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</tr>
<tr>
<td>74</td>
<td>56</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**General Defect Description:** Filling 0-30mm peg PL to IR

**Method:**

- AS: Auger screwing
- AD: Auger drilling
- P: rotary/sidecut
- W: Westbore
- NMCL: core drilling
- NDL: core drilling
- CSV: casing withdrawn

**Stress:**

- Water level
- Water inflow
- Not measured

**Point Load Test:**

- D - diameter
- A - axial

**Weathering:**

- FP - fresh
- SW - slightly weathered
- MV - moderately weathered
- HW - highly weathered
- EW - extremely weathered

**Strength:**

- EL - extremely low
- VL - very low
- L - low
- M - medium
- H - high
- VH - very high

**Defects:**

- PL - planar
- LR - irregular

**Drilling Water:**

- Partial loss
- Complete loss

**Graphic Log/CORE LOSS:**

- Core recovered (matching indicates material)
- No core recovered
# Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 339621.0, N 12646572  
**Diameter:** 609.6 mm  
**Total Depth:** 129.4 m  
**Date:** 15.12.89  
**Completed:** 20.12.89  
**Checked by:** PLV

### Drilling Information

<table>
<thead>
<tr>
<th>Method</th>
<th>Core-off</th>
<th>Water</th>
<th>R.L.</th>
<th>Depth Meters</th>
<th>Graphic Log Code</th>
<th>Rock Substance Description</th>
<th>Subsurface Characteristics</th>
<th>Est. Strength</th>
<th>Point Load Test (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NLNC</td>
<td>73</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>BREECAIiine to coarse grained, grey &amp; light grey, indistinct bedding</td>
<td>rock type, grain characteristics, colour, structure, minor components</td>
<td>12</td>
<td>2.3</td>
<td>1.5</td>
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<tr>
<td></td>
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<td>0.0</td>
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</tr>
</tbody>
</table>

**Borehole 19 Terminated at 63.00 m**  
Peacornite meeting 3m from 62 to 63m. Send to liths, substrata and ground to surface.

### Rock Mass Defects

- **J1 45deg IR RO clean**
- **J1 60deg PL RO clean**
- Crushed SM (30deg) 10mm thick
- Crushed SM (20deg) 5mm thick
- J1 45deg IR RO discontinuous
- Crushed SM 10mm thick
- J1 60deg IR RO clean
- Crushed SM 20mm thick
- 59.14 - 59.40m Vertical J1 IR RO clean
- J1 60deg IR PO clean
- 62.30 - 62.67m Vertical J1 IR RO clean

### General Defect Description

- Defects: Clay, silt, sand, gravel, and shale.

### Log/CORE LOSS

- **GRAPHIC LOG/CORE LOSS**
  - Core recovery (beneath indicates material)
  - Partial loss
  - Complete loss
  - No core recovered

### Weathering

- **WEATHERING**
  - RR - fresh
  - SW - slightly weak
  - MW - moderately weak
  - HW - highly weathered

### Strength

- **STRENGTH**
  - LL - extremely low
  - VL - very low
  - L - low
  - M - medium
  - H - high
  - VH - very high
  - EH - extremely high

### Objects

- **OBJECTS**
  - J1 - joint
  - PL - plane
  - SM - smear
  - CL - cleat
  - RO - rough
  - DC - discontinuity
  - PL - phreatic
# Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Principle:** Old Mams Valley  
**Borehole Location:** E 385653.2 N 126936.9

<table>
<thead>
<tr>
<th>Method</th>
<th>Support</th>
<th>Notes/Equipment</th>
<th>R.L.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
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<td>Casing</td>
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<td>DR</td>
<td>DR</td>
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<td>DR</td>
<td>DR</td>
</tr>
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<td>Cable Tool</td>
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<td>Cable Tool</td>
<td>Cable Tool</td>
</tr>
<tr>
<td>Hand Auger</td>
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<td>Hand Auger</td>
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<tr>
<td>D1</td>
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<td>D1</td>
<td>D1</td>
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<tr>
<td>Water</td>
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<td>Water</td>
<td>Water</td>
<td>Water</td>
</tr>
<tr>
<td>V1</td>
<td>V1</td>
<td>V1</td>
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<tr>
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<tr>
<td>D1</td>
<td>D1</td>
<td>D1</td>
<td>D1</td>
<td>D1</td>
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</tbody>
</table>

**Notes:**
- **Sampled and Tested:** Undisturbed sample 50 mm diameter.
- **Disturbed Sample:** Sample recovered.
- **Soil Type:** SPT + sample recovered.
- **Water Level:** Water table.
- **Water Flow:** Water inflow.

**Classification Symbols and Soil Description:**
- **CONSISTENCY/DENSITY INDEX:**
  - VS: very soft
  - S: soft
  - F: firm
  - SI: stiff
  - VSI: very stiff
  - H: hard
  - FD: firm dense
  - VL: very loose
  - L: loose
  - MD: medium dense
  - D: dense
  - VD: very dense

**Moisture:**
- D: dry
- M: moist
- W: wet
- Wp: plastic limit

**Structure and Additional Observations:**
- Borehole: Highly weathered breccia.
- Material: Clay, gravel, sand and boulders.
<table>
<thead>
<tr>
<th>depth (m)</th>
<th>material</th>
<th>mining condition</th>
<th>Geological note</th>
<th>structure and additional observations</th>
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<tbody>
<tr>
<td>9.0</td>
<td>BRECCIA, highly weathered</td>
<td>M</td>
<td>VD</td>
<td>NW BRECCIA</td>
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<tr>
<td>14.5</td>
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</tbody>
</table>

Borehole 19 Terminated at 11.5 m
Pluvosol slacking 2 m from 9.5 m
11.5 m. Sand to 7.5 m. Bentonite plug to 7.5 m.
# Engineering Log - Borehole

**Client:** HORNBY SHIRE COUNCIL  
**Principal:** OLD MANS VALLEY  
**Borehole Location:** E 339623.5 N 1269436.1

<table>
<thead>
<tr>
<th>Method</th>
<th>Penetration</th>
<th>Notes</th>
<th>R.L.</th>
<th>Soil Type/Notes</th>
<th>Additional Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>C</td>
<td></td>
<td></td>
<td>RILL: Clay with boulders and cobbles of Breccia</td>
<td>BRECCIA: extremely weathered</td>
</tr>
<tr>
<td>128</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
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<tr>
<td>121</td>
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</tbody>
</table>

**Notes:** Samples and tests
- U50 undisturbed sample 20 mm diameter
- D disturbed sample
- Q1 standard penetration test
- SPT + sample recovered
- Ko SPT with solid cone
- V vane shear
- P piezometer
- B1 bulk sample
- R refusal

**Classification Symbols and Soil Description:**
- Based on unified classification system

**Moisture:**
- D dry
- M moist
- W wet
- N plastic limit

**Consistency/Density Index:**
- VS very soft
- S soft
- F firm
- St stiff
- VS1 very stiff
- H hard
- FD fragile
- VL very loose
- L loose
- MD medium dense
- D dense
- VO very dense

**Borehole:** No. 20  
**Hole commenced:** 21.12.69  
**Hole completed:** 21.12.69  
**Checked by:** PLV  
**Date:** 129.9 m  
**R.L. Surface:** 129.9 m
## Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mams Valley  
**Borehole Location:** E 30°55.65 N 152°45.60  
**Drill Model and Mounting:** Edson 3600 Truck Mounted  
**Drill Diameter:** 100mm  
**Slope:** -90 Deg  
**R.L. Surface:** 112.6 m  
**Date:**  
**Logged By:** G.J.H  
**Checked By:** P.L.V

### Material

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>113</td>
<td>Clay: medium to high plasticity, orange brown, water saturated, trace of gravel, subangular.</td>
</tr>
<tr>
<td>112</td>
<td>Clay: medium to high plasticity, light brown, orange mottled, some gravel, angular.</td>
</tr>
</tbody>
</table>

### Additional Observations

- Clay contains residual root fibres.
- V bit was retrieved at 115m.

### Log Details

<table>
<thead>
<tr>
<th>Depth</th>
<th>Support</th>
<th>Water</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>113</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>112</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CONSISTENCY/DENSITY INDEX

- VS: Very Soft
- S: Soft
- F: Firm
- ST: Stiff
- VSf: Very Stiff
- H: Hard
- HD: Hard Drilled
- M: Medium
- L: Loose
- MD: Medium Dense
- D: Dense
- VD: Very Dense

### WATER LEVEL

- Lower than reference level.

### MOISTURE

- D: Dry
- M: Moist
- W: Wet
- WP: Plastic Limit

### CONSISTENCY

- No consistency details provided.

---

*Continued on Coated Borehole Sheet*
## Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Man's Valley  
**Borehole Location:** E 305856.55 N 1269949.69

**Drill Model and Manned:** EDSN 3000 Truck  
**Drill Type and Length:** NMLC 3.5m  
**Fluid:** Water  
**Bearing:** -90 Deg  
**Depth:** 122.6 m

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>113</td>
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<td>112</td>
<td>Continued from non-core borehole</td>
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<td>106</td>
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</table>

### Rock Substance

<table>
<thead>
<tr>
<th>Substance Description</th>
<th>Strength</th>
<th>Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breccia: fine to coarse grained, light brown, massive, some dark grey bands.</td>
<td>EW</td>
<td>Extremely weathered, Readily soli</td>
</tr>
<tr>
<td>Breccia: medium to coarse grained, light brown, massive, some dark grey bands.</td>
<td>EW</td>
<td></td>
</tr>
</tbody>
</table>

### General Defect Description

From 3.2m, Defects are joint 0-45deg planar, rough, round.

**METHOD**
- Auger screening  
- Auger coring  
- Core drilling  
- NMLC core drilling  
- NOXN core drilling  

**POINT LOAD TEST**
- D - diameter  
- A - axial

**WEATHERING**
- FL - fresh  
- VL - very low  
- L - low  
- M - medium  
- H - high  
- VH - very high

**STRENGTH**
- FL - extremely high  
- FL - extremely high  
- FL - extremely high

**DEFECTS**
- FL - planar  
- FL - planar  
- FL - planar  

**GRAPHIC LOG/CORE LOSS**
- Fabric: A - axial  
- Porosity: B - bentonite  
- Core Recovery: C - complete loss  
- Drilling Water: D - dry holes  
- Core Description: E - extreme loss

- A - axial  
- B - bentonite  
- C - complete loss  
- D - dry holes  
- E - extreme loss

**WEATHERING**
- FL - fresh  
- VL - very low  
- L - low  
- M - medium  
- H - high  
- VH - very high

**STRENGTH**
- FL - extremely high  
- FL - extremely high  
- FL - extremely high

**DEFECTS**
- FL - planar  
- FL - planar  
- FL - planar  

**REFERENCE**
- Coffey & Partners Pty Ltd  
- Located in Queensland  
- Office Reg. No.: 394782  
- Sheet 2 of 2
### Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Main Valley  
**Borehole Location:** 

| Drill Model and Mounting | NMCL 3.0m Truck  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance (m)</td>
<td>103</td>
</tr>
<tr>
<td>Description</td>
<td>BRECCIA: fine to medium grained, light brown, massive, some dark grey, gibbs</td>
</tr>
<tr>
<td>Substance Description</td>
<td>Rock type: grain characteristics, colour, structure, minor components</td>
</tr>
</tbody>
</table>
| Est. Strength | 7.5  
| Load Test | 14.5 |
| Detect Type | Limestone裂缝, fracture zone |
| Detect Details | Jointed, fractured, 5.5m long, 100mm crushed zone |

**General Detect Description:** Fractures, Joints, 5-10mm, Planar, Rough, Unweathered

**Method:** 
- AS: auger coring  
- AD: auger drilling  
- R: reamer/holes  
- T: twister  
- M: core drilling  
- Q: core sample  

**Point Load Test:** 
- D: diameter  
- FR: force |

**Weathering:** 
- SR: strongly  
- SW: slightly  
- MW: moderately  
- HW: highly  
- EW: extremely |

**Strength:** 
- J: joint  
- P: planar  
- S: seam  
- C: cleat  
- D: decomposed  
- PL: plastic  
- IR: irregular
# Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Man's Valley  
**Borehole Location:** S 33°56'55.66" E 150°04'49.89"

## Drill Model and Mounting
- EDSN 3300 TRUCK
- NM2C 3.0m

## Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Water Quality</th>
<th>Rock Substance Description</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>97</td>
<td>SW</td>
<td>Breccia: coarse grained, light grey, indistinct bedding, some calcite veining</td>
<td>35mm JI &amp; RO crushedobil</td>
</tr>
<tr>
<td>17</td>
<td>SW</td>
<td>Breccia: medium to coarse grained, light grey, indistinct bedding, some calcite veining</td>
<td>35mm JI &amp; RO clean</td>
</tr>
<tr>
<td>96</td>
<td>SW</td>
<td>Breccia: coarse grained, light grey, indistinct bedding, some calcite veining</td>
<td>150mm jointed, fractured zone</td>
</tr>
<tr>
<td>18</td>
<td>SW</td>
<td>Breccia: coarse grained, light grey, indistinct bedding, some calcite veining</td>
<td>150mm jointed, fractured zone</td>
</tr>
<tr>
<td>95</td>
<td>SW</td>
<td>Breccia: coarse grained, light grey, indistinct bedding, some calcite veining</td>
<td>200mm jointed, fractured zone</td>
</tr>
<tr>
<td>19</td>
<td>SW</td>
<td>Breccia: coarse grained, light grey, indistinct bedding, some calcite veining</td>
<td>50mm jointed zone</td>
</tr>
<tr>
<td>94</td>
<td>SW</td>
<td>Breccia: coarse grained, light grey, indistinct bedding, some calcite veining</td>
<td>Jointed cracked zone, resistance</td>
</tr>
<tr>
<td>20</td>
<td>FR</td>
<td>Breccia: coarse grained, light grey, indistinct bedding, some calcite veining</td>
<td>JI 30deg PL RO, nonstone</td>
</tr>
<tr>
<td>93</td>
<td>FR</td>
<td>Breccia: coarse grained, light grey, indistinct bedding, some calcite veining</td>
<td>2mm crushed seam</td>
</tr>
<tr>
<td>21</td>
<td>FR</td>
<td>Breccia: coarse grained, light grey, indistinct bedding, some calcite veining</td>
<td>PT 6deg PL RO clean</td>
</tr>
<tr>
<td>92</td>
<td>FR</td>
<td>Breccia: coarse grained, light grey, indistinct bedding, some calcite veining</td>
<td>PT 4deg PL RO clean</td>
</tr>
</tbody>
</table>

## Weathering

<table>
<thead>
<tr>
<th>Weathering</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>FE</td>
<td>Very low</td>
</tr>
<tr>
<td>SE</td>
<td>Slightly</td>
</tr>
<tr>
<td>MW</td>
<td>Moderately</td>
</tr>
<tr>
<td>HW</td>
<td>High</td>
</tr>
<tr>
<td>EW</td>
<td>Extremely</td>
</tr>
</tbody>
</table>

## Defects

- JI: Jointed  
- RO: Rock  
- PL: Plastic

## General Description
- Perings/Joists: 3-45deg, planet/rough, contained

## Method
- AS: Auger screwing  
- AD: Auger digging

## Graphical Log/Core Loss
- Diametral recovery (matching indicer)  
- Wetting

## Point Load Test
- Fracture toughness
### Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Hole Number:** 39.1189  
**Borehole Location:** E30535.09 N1269869.89  
**Check by:** PLY  
**Logging:** GJH/SIM  
**Date:** 21st May 1989

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>R.L.</th>
<th>Method</th>
<th>Substance Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.65</td>
<td>64</td>
<td>MMLC</td>
<td>Breccia: line to medium-grained; grey, indistinct bedding.</td>
</tr>
<tr>
<td>2.75</td>
<td>63</td>
<td>MMLC</td>
<td>Breccia: line to coarse-grained; grey, dark grey, thinly bedded, non-jointed, indistinct bedding.</td>
</tr>
<tr>
<td>3.32</td>
<td>62</td>
<td>MMLC</td>
<td>Breccia: line to coarse-grained; grey, dark grey, thinly bedded, non-jointed, indistinct bedding.</td>
</tr>
<tr>
<td>5.28</td>
<td>52</td>
<td>MMLC</td>
<td>Breccia: line to medium-grained; grey, indistinct bedding.</td>
</tr>
</tbody>
</table>

### General Description

Breccia: medium to coarse-grained, light grey to grey, some tabular jointed, indistinct bedding.

### Defects

- **Note:** Unless otherwise noted, defects follow general description below.

- **Breach:** 1 to 3 mm thick
- **Breach:** No movement, jointed, discontinuous
- **Breach:** OBS (differential movement) 50 mm, discontinuous
- **Breach:** Fractured, 40 mm, discontinuous

### Remarks

- **Breach:** Joint, 6-30 mm thick, discontinuous, jointed
- **Breach:** Joint, 6-30 mm thick, discontinuous, jointed
- **Breach:** Joint, 6-30 mm thick, discontinuous, jointed
- **Breach:** Joint, 6-30 mm thick, discontinuous, jointed

**METHOD**  
AD auger drilling  
R roller/tricone  
W wireline  
NMCL core drilling  
NOJ core drilling  
DR casing used  
BM barrel withdrawn  

**POINTER LOAD TEST**

- D - diameter
- V - axle

**WEATHERING**

- FE - fresh
- SW - slightly weathered
- MW - moderately weathered
- HW - highly weathered
- EW - extremely weathered

**STRENGTH**

- EL - extremely low
- VL - very low
- L - low
- M - medium
- H - high
- VH - very high
- EH - extremely high

**DEFECTS**

- JT - joint
- PL - plugging
- SM - seam
- CL - clay
- RO - rough
- DC - decomposed
- PL - planar
- IR - irregular
### Engineering Log - Cored Borehole

**Client:** HORNBY SHIRE COUNCIL  
**Project:** OLD MANS VALLEY  
**Borehole Location:** E 308565.65 N 1290249.69  
**Hole commenced:** 26.11.89  
**Hole completed:** 1.12.89  
**Logged by:** GJH/5RM  
**Checked by:** PLV

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Substance Description</th>
<th>Point Load Test (kN)</th>
<th>Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td>BRECCIA: fine to medium grained, grey, indistinct bedding.</td>
<td>EF 2.3</td>
<td>--</td>
</tr>
<tr>
<td>33</td>
<td>BRECCIA: fine to coarse grained, grey, to dark grey, bedding dipping about 45deg.</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>24</td>
<td>BRECCIA: fine to coarse grained, grey, to dark grey, bedding dipping about 45deg.</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>18</td>
<td>BRECCIA: fine to coarse grained, grey, to dark grey, bedding dipping about 45deg.</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>78</td>
<td>Borehole 21 Terminated at 55.30 m. Peacemaker placed at 35.60 m, an inclined Sand to 3.15m (3.4m of sand), 35 litres of bentonite, 79 litres of cement/water grout.</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

**General Defect Description:**

<table>
<thead>
<tr>
<th>METHOD</th>
<th>POINT LOAD TEST</th>
<th>WEATHERING</th>
<th>STRENGTH</th>
<th>DEFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD</td>
<td>water inflow</td>
<td>FR: --</td>
<td>EL: -extremely low</td>
<td>JT: joint</td>
</tr>
<tr>
<td>AS</td>
<td>water level</td>
<td>SW: --</td>
<td>VL: -very low</td>
<td>FT: -point</td>
</tr>
<tr>
<td>NMLC</td>
<td>not measured</td>
<td>L: -low</td>
<td>AM: -moderately</td>
<td>SM: -seams</td>
</tr>
<tr>
<td>NOCA</td>
<td>core recovered</td>
<td>MW: -highly</td>
<td>H: -high</td>
<td>CL: -clay</td>
</tr>
<tr>
<td></td>
<td>partial loss</td>
<td>HW: -highly</td>
<td>VH: -very high</td>
<td>RD: -rocks</td>
</tr>
<tr>
<td></td>
<td>complete loss</td>
<td>EW: -extremely</td>
<td>EH: -extremely high</td>
<td>DC: -decomposed</td>
</tr>
</tbody>
</table>

**Drilling Information:**  
- **Drill model and mounting:** EDESIN 3000 TRUCK  
- **Barrel type and length:** NMLC 3.0m  
- **Fluid:** WATER  
- **Reamer:** SR  
- **Defects:**  
  - JT 20deg PL RO Fe  
  - JT 55 - 20deg PL RO Fe  
  - JT 60deg PL RO  
  - JT 40deg PL RO  
  - calcite vein <1mm thick IR subvertical  
  - JT 60deg PL RO calcite  
  - JT 45deg PL RO calcite  
  - calcite vein 50deg PL thin thick  
  - PF 23deg PL
# Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 305565.0 N 1269551.9  
**Date of Completion:** 20/12/69  
**Logged By:** GJH  
**Checked By:** PLV

### Drill Model and Mounting
- **Model:** EDSON 3000 Truck
- **Hole Diameter:** 100mm
- **Tipping Angle:** -90 Deg
- **R.I. Surface:** 113.0 m
- **Slope:** 0 Deg

### Method
- **Penetration:**
  - 1: U90  
  - 2:  
  - 3:  

### Notes
- **Samples:** Sandy Clay, Bone
- **Additional Observations:** Trace of root fibres

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Material</th>
<th>Consistency/Density Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>111</td>
<td>Sandy Clay, Bone</td>
<td>RESIDUAL</td>
</tr>
</tbody>
</table>

**Borehole Description:**
- Terminated at 2.6m
- Piezometer of 2.6m, 2.5m fitted, Sand of 12m (6.4m of sand), Bunker of 1.05m (0.35m of bunker), Grout to 10m (3.3m of grout), Grout to 10m (3.3m of grout), Grout to 10m (3.3m of grout)

### Classification Symbols and Soil Description
- **Symbols:**
  - C: casing  
  - M: mud  
  - U: undisturbed sample 50 mm diameter
  - D: disturbed sample
  - N: standard penetration test
  - SP: SPT sample recovered
  - SP +: SPT with solid case
  - P: piezometer
  - B: bulk sample
  - R: refusal

- **Classification System:**
  - VS: very soft
  - S: soft
  - F: firm
  - SI: stiff
  - VSII: very stiff
  - H: hard
  - PI: plasticity index
  - VL: very loose
  - L: loose
  - MD: medium dense
  - D: dense
  - VD: very dense

### Water Level
- Not Measured
**Engineering Log - Borehole**

**Client:** HORNSBY SHIRE COUNCIL  
**Project:** OLD MANS VALLEY  
**Borehole Location:** E 309565.4 N 126948.7

<table>
<thead>
<tr>
<th>Hole Diameter:</th>
<th>88mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>1 2 3</td>
</tr>
<tr>
<td>Notes, Samples, Test, etc.</td>
<td>(113)</td>
</tr>
<tr>
<td>Material</td>
<td>CLAY: medium to high plasticity, brown with orange mottled, trace of gravel, sub angular</td>
</tr>
<tr>
<td>Notes</td>
<td>BRECCIA: grading into BW breccia brown grey</td>
</tr>
<tr>
<td>Notes</td>
<td>HW Breccia, grey, brown</td>
</tr>
<tr>
<td>Water</td>
<td>not measured</td>
</tr>
<tr>
<td>Water Level</td>
<td>(108)</td>
</tr>
<tr>
<td>Water Inflow</td>
<td>(107)</td>
</tr>
<tr>
<td>Water Outflow</td>
<td>(106)</td>
</tr>
<tr>
<td>Notes</td>
<td>samples and tests</td>
</tr>
<tr>
<td>Notes</td>
<td>undisturbed sample 50 mm diameter</td>
</tr>
<tr>
<td>Notes</td>
<td>disturbed sample</td>
</tr>
<tr>
<td>Notes</td>
<td>standard penetration test:</td>
</tr>
<tr>
<td>Notes</td>
<td>SPT + sample recovered</td>
</tr>
<tr>
<td>Notes</td>
<td>SPT with solid cone</td>
</tr>
<tr>
<td>Notes</td>
<td>vane shear</td>
</tr>
<tr>
<td>Notes</td>
<td>pressuremeter</td>
</tr>
<tr>
<td>Notes</td>
<td>bulk sample</td>
</tr>
<tr>
<td>Notes</td>
<td>refusal</td>
</tr>
<tr>
<td>Notes</td>
<td>very soft</td>
</tr>
<tr>
<td>Notes</td>
<td>soft</td>
</tr>
<tr>
<td>Notes</td>
<td>firm</td>
</tr>
<tr>
<td>Notes</td>
<td>stiff</td>
</tr>
<tr>
<td>Notes</td>
<td>very stiff</td>
</tr>
<tr>
<td>Notes</td>
<td>hard</td>
</tr>
<tr>
<td>Notes</td>
<td>firm</td>
</tr>
<tr>
<td>Notes</td>
<td>very loose</td>
</tr>
<tr>
<td>Notes</td>
<td>loose</td>
</tr>
<tr>
<td>Notes</td>
<td>medium dense</td>
</tr>
<tr>
<td>Notes</td>
<td>dense</td>
</tr>
<tr>
<td>Notes</td>
<td>very dense</td>
</tr>
</tbody>
</table>

**Classification Symbols and Soil Description**

- **MOISTURE:**
  - D: dry
  - M: moist
  - W: wet
  - Wo: plastic limit

- **CONSISTENCY/DENSITY INDEX:**
  - VS: very soft
  - S: soft
  - F: firm
  - SI: stiff
  - VSII: very stiff
  - H: hard
  - FP: firm
  - VL: very loose
  - L: loose
  - MD: medium dense
  - D: dense
  - VD: very dense
### Engineering Log - Borehole

#### Client: Hornsby Shire Council

#### Project: Old Mans Valley

#### Borehole Location: E 308564.4 N 1269645.7

#### Borehole No.: 23

#### Hole Diameter: 86mm

#### Slope: -50 Deg

#### R.L. Surface: 113.6 m

#### Date: And

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Soil Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.0</td>
<td>Breccia: HW, brown grey</td>
<td></td>
</tr>
</tbody>
</table>

- Borehole 23 terminated at 9.1m
- Piezometer placed at 9.1m, 15m screened, 2nd at 7.5m (45m of sand), Senility to surface.

#### Method
- A5: Auger sampling
- AD: Auger drilling
- B: Bulb bit
- CT: Cable tool
- HA: Hard auger
- DT: Ditch

#### Support
- C: Casing
- M: Mud

#### Notes
- Samples and Tests
- USO: Undisturbed sample 50 mm diameter
- D: Disturbed sample
- N: Standard penetration test
- N*: SP1 + sample recovered
- No: SP1 with solid cone
- V: Vane shear
- P: Pressuremeter
- Bs: Bulk sample
- R: Refusal

#### Classification
- Symbols and Soil Description: Based on Unified Classification System
- Consistency/Density Index
- VS: Very soft
- S: Soft
- F: Firm
- Stiff
- VS*: Very stiff
- H: Hard
- FD: Dense
- VL: Very dense
- L: Loose
- MD: Medium dense
- D: Dense
- W: Wet
- WP: Plastic limit

#### Additional Observations

---

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**Engineering Log - Borehole**

**Client:** Horsley Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 305502 N 17650370

**Drill Model and Mounting:** Edson 3000 Truck  
**Hole Diameter:** 100mm  
**Slope:** -90 Deg  
**R.L. Surface:** 1110 m  
**Datum:** AHD

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>FILL: Breccia breccia</td>
</tr>
<tr>
<td>109</td>
<td>CH: Sandy Clay: medium plasticity, coarse gravel, brown</td>
</tr>
<tr>
<td>105.5</td>
<td>Breccia: extremely weathered</td>
</tr>
</tbody>
</table>

**Method:**  
**Notes:** US0  
**Sample:** Undisturbed sample 50 mm diameter  
**Consistency/Density Index:** VS very soft  
**Classification:** Based on unified classification system  
**Moisture:** D dry  
**Consistency Index:** VL very loose

**Additional Observations:**  
**Structure:** MW Breccia  
**HW Breccia**

**Bolehole 26 Terminated at 5.95m:**  
Piezometer at 3.4m, 5m toffs, sand at 4.45m (1.45m of sand), Berlinita at 4.8m (0.25m of Berlinita) Grount to surface (cement & water).

---

**Additional Symbols and Soil Description:**

**Water:**  
- Not measured  
- Water level  
- Water outflow  
- Water inflow

**Penetration:**  
- No resistance ranging to refusal  
- 2-3

**Method:**  
- AS auger screening  
- AD auger drilling  
- DT displace  
- WC washboard  
- CT cable tool  
- HA hand auger  
- V V-bit  
- T T-bit

---

**Notes:**  
**Samples and Tests:** US0 undisturbed sample 50 mm diameter  
**Disturbed Sample:** D  
**Penetration Test:** N  
**SP1:** SPT + sample recovered  
**SP1 with solid core:** N  
**V Vane Shear:** V

---

**Classification Symbols and Soil:**

**MOISTURE:**  
- D dry  
- W wet  
- WP plastic limit

---

**Consistency/Density Index:**  
- VS very soft  
- S soft  
- F firm  
- SI stiff  
- VS1 very stiff  
- H hard  
- FH fragile  
- VL very loose  
- L loose  
- MD medium dense  
- D dense  
- VH very dense
## Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 335671.13 N 1269911.44

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Notes, Samples, Test, etc.</th>
<th>Depth</th>
<th>Classification Symbol</th>
<th>Material</th>
<th>Notes, Plasticity or Particle Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Hammering</td>
<td>C</td>
<td>0</td>
<td>M</td>
<td>G</td>
<td>Tertiary sediments, highly weathered sands.</td>
</tr>
<tr>
<td>B</td>
<td>Casing</td>
<td>Black</td>
<td>0.64</td>
<td>X</td>
<td>S</td>
<td>Weakly cemented sands, angular to subangular.</td>
</tr>
<tr>
<td>C</td>
<td>Drilling</td>
<td></td>
<td>1.14</td>
<td>G</td>
<td>G</td>
<td>Similar to previous, less cemented.</td>
</tr>
<tr>
<td>D</td>
<td>Hammering</td>
<td></td>
<td>2.14</td>
<td>G</td>
<td>G</td>
<td>Stiff, well-cemented sands.</td>
</tr>
<tr>
<td>E</td>
<td>Casing</td>
<td>Black</td>
<td>3.14</td>
<td>X</td>
<td>X</td>
<td>Similar to previous, slightly less cemented.</td>
</tr>
<tr>
<td>F</td>
<td>Drilling</td>
<td></td>
<td>4.14</td>
<td>X</td>
<td>X</td>
<td>Very weakly cemented sands.</td>
</tr>
<tr>
<td>G</td>
<td>Hammering</td>
<td></td>
<td>5.14</td>
<td>X</td>
<td>X</td>
<td>Well-cemented sands, angular to subangular.</td>
</tr>
<tr>
<td>H</td>
<td>Casing</td>
<td>Black</td>
<td>6.14</td>
<td>X</td>
<td>X</td>
<td>Similar to previous, slightly less cemented.</td>
</tr>
<tr>
<td>I</td>
<td>Drilling</td>
<td></td>
<td>7.14</td>
<td>X</td>
<td>X</td>
<td>Weakly cemented sands, angular to subangular.</td>
</tr>
</tbody>
</table>

**Borehole Notes:**  
- Borehole 27 Terminated at 7.36m  
- Prezometer placed at 6.98m, 2.5m screened length, read to 3.96m. Based on 5.97m bentonite plug, 635mm diameter, partially filled with cement and water.  
- PVC drilled 2.5m to stabilise the section of till where circulation was lost.  
- Very hard, friable, and highly weathered.  

**Classification:**  
- Symbols and Soil Description: Based on unified classification system.  
- Moisture: D - dry, V - very dry, M - moist, W - wet, Vo - very wet, P - plastic limit.  
**Engineering Log - Borehole**

**Client:** Hornery Shire Council  
**Borehole No.:** 28  
**Date:** 20.11.69

<table>
<thead>
<tr>
<th>Method</th>
<th>Support</th>
<th>Notes</th>
<th>Water</th>
<th>R.L</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U-penetration</td>
<td>samples, test, etc</td>
<td>water</td>
<td>113</td>
<td>Sandy Gravelly Clay medium plasticity, angular, medium grained, brown</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>112</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>111</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>109</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td>107</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>106</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** Borehole 28 Terminated at 7.25m. Parameter placed at 7.0m, 2.1m slotted length read to 3.6m (3.4m at sand). Bentonite of 3.15m (0.4m plug) & 6 litres of cement and water grout.

**Classification Symbols and Soil Description**

- **U:** Undisturbed sample 50 mm diameter
- **D:** disturbed sample
- **N:** standard penetration test
- **N*:** SPT + sample recovered
- **Sp:** with solid cone
- **V:** vane shear
- **B:** bulk sample
- **R:** refusal
- **W:** moist
- **V:** very loose
- **P:** loose
- **L:** medium dense
- **D:** dense
- **VD:** very dense

**R.L. Surface:** 113.3 m
**Engineering Log - Borehole**

**Client:** Hornsby Shire Council  
**Project:** Old Man's Valley  
**Borehole Location:** L 305937.4 N 12696919.0

**Drill Model and Mounting:** Edson 3600 Truck  
**Hole Diameter:** 105mm

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Soil Type/Description</th>
<th>Material Properties</th>
<th>Soil Type/Description</th>
<th>Material Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>FILL: Sandy, gravelly CLAY, medium plasticity, coarse grained, angular, sub-angular, brown</td>
<td>M</td>
<td>D</td>
<td>FILL: Both the gravel and clay layers had a greyish hue</td>
</tr>
<tr>
<td>1-2</td>
<td>FILL: Sandy clayey GRAVEL, angular, grey</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3</td>
<td>FILL: Sandy gravelly CLAY, medium plasticity, coarse grained, angular gravel, light brown</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>FILL: Brecciated cobble, massive, medium to coarse grained, grey and light grey</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-5</td>
<td>FILL: Sandstone, massive, fine to medium grained, light yellow</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-6</td>
<td>FILL: Breccia, evenly mixed, light grey</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-7</td>
<td>Breccia, RE/NE grey-light grey</td>
<td>M</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Method:**
- AS: auger screwing
- AD: auger drilling
- WA: washbore
- CT: cable rodding
- MA: hand auger
- BY: dibble

**Support:**
- C: casing
- M: mud

**Penetration:**
- 1: no resistance
- 2: slight resistance
- 3: moderate resistance

**Water:**
- *: not measured
- V: water level
- T: water outflow
- AD: water inflow

**Notes:**
- Samples and tests:
  - US5: undisturbed sample 50 mm diameter
  - D: disturbed sample
  - N: standard penetration test
  - N: SPT + sample recovered
  - V: vane shear
  - P: pressuremeter
  - BS: bulk sample
  - R: refusal

**Classification Symbols and Soil Description:**
- D: dry
- M: moist
- W: wet
- WP: plastic limit

**Consistency/Density Index:**
- VS: very soft
- S: soft
- F: firm
- B1: stiff
- VSI: very stiff
- H: hard
- D: dense
- PL: loose
- MD: medium dense
- VD: very dense

**Additional Observations:**
- Coring commenced at 4.5m with no core to 6.8m
- Breccia, RE/NE grey-light grey

**Date:**
- Hole commenced: 4/12/99
- Hole completed: 11/23/99
- Logged by: D.P.
- Checked by: M.M.
# Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 3860197.4 N 12569199.9  
**Hole Committed:** 4.12.90  
**Hole Completed:** 7.12.90  
**Logged By:** GMH  
**Checked By:** MLV

**Drill Model and Mounting:** Eddron 3000 HNUCK  
**Hole Diameter:** 105mm  
**Slope:** -90 DEG  
**RL Surface:** 112.6 m

### Materials
- Soil type:  
  - Plasticity or particle characteristics  
  - Colour, secondary and minor components

### Consistency and Density Index
- **VS:** Very soft  
- **S:** Soft  
- **F:** Firm  
- **VF:** Very firm  
- **VS:** Very stiff  
- **H:** Hard  
- **HF:** Very hard  
- **VL:** Very loose  
- **L:** Loose  
- **MD:** Medium dense  
- **D:** Dense  
- **VD:** Very dense

### Structure and Additional Observations
- **Breccia EW:** Grey tight grey  
- **JT:** Jdeed irregular, rough, clay matrix  
- **HR:** HR with BW and fractured zones  
- **50mm EW zone:** 50mm fractured jointed zone  
- Drilling water loss and recovery throughout the fill

---

**Continued on Cored Borehole Sheet**

---

### Support and Penetration
- **Support:** Casing  
- **Penetration:** No resistance ranging to refusal

### Water
- **Not measured**
  - Water level  
  - Water outflow  
  - Water inflow

### Notes and Tests
- **USG:** Undisturbed sample 50 mm diameter  
- **D:** Disturbed sample  
- **N:** Standard penetration test  
- **S:** Sert sand test  
- **SP:** SP test with solid zone  
- **V:** Vane shear  
- **R:** Refusal sample

---

### Classification
- **Moisture:**  
  - D: Dry  
  - M: Moist  
  - W: Wet  
  - Wo: Plastic limit

---

### Method
- **AS:** Auger screwing  
- **AD:** Auger drilling  
- **R:** Roller /picker  
- **W:** Wash bore  
- **CT:** Cable tool  
- **HA:** Hand auger  
- **DT:** Dibble

---

### Notes
- Continued on Cored Borehole Sheet
<table>
<thead>
<tr>
<th>BH29</th>
<th>S8463/3</th>
<th>FROM 4.65 m</th>
<th>TO 14.0 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>NO CORE</td>
<td>0.07 m</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1.83 m</td>
<td>ROCK ROLLER</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>NO CORE</td>
<td>0.6 m</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>3.13 m</td>
<td>ROCK ROLLER</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 308367 43 H 1369919.55

<table>
<thead>
<tr>
<th>Drill Model and Make</th>
<th>EDSON 3000 TRUCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barrels Type and Length</td>
<td>NMLC 3.0</td>
</tr>
<tr>
<td>Water</td>
<td>WATER</td>
</tr>
<tr>
<td>Bearing</td>
<td>Bearing</td>
</tr>
<tr>
<td>Slope</td>
<td>Slope</td>
</tr>
<tr>
<td>RL Surface</td>
<td>RL Surface</td>
</tr>
<tr>
<td>Depth</td>
<td>Depth</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rock Substance</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Type, Indication, Planarity, Roughness, Cooling, Thickness</td>
</tr>
<tr>
<td>Colour, Structure, Minor Components</td>
<td>Unless otherwise noted, defects follow general description below</td>
</tr>
<tr>
<td>Est. Strength</td>
<td>Detect Spacing (mm)</td>
</tr>
<tr>
<td>Peak Load Test</td>
<td>MPA</td>
</tr>
</tbody>
</table>

### Drilling Information

<table>
<thead>
<tr>
<th>Interval (m)</th>
<th>Core Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10</td>
<td>100%</td>
</tr>
<tr>
<td>10 - 20</td>
<td>90%</td>
</tr>
<tr>
<td>20 - 30</td>
<td>80%</td>
</tr>
<tr>
<td>30 - 40</td>
<td>70%</td>
</tr>
</tbody>
</table>

Continued from non-core borehole

**METHOD**

- Auger drilling
- Water borehole
- Core drilling
- No data provided

**WEATHERING**

- EL - extremely low
- VL - very low
- L - low
- M - medium
- H - high
- VH - very high

**STRENGTH**

- EL - extremely low
- P - poor
- SM - semi
- CL - clay
- RO - rough
- DC - decomposed
- PL - planer
- IR - irregular

**DEFECTS**

- 31 Dodeg IR RO sometimes
- 31 Dodeg IP RO sometimes
- 30mm EW zone
- 40mm EW zone
- PT IR RO sometimes
- 30mm EW - HW zone, jointed, broken
- 30mm clay seam surrounded by crushed zone
- 30mm crushed zone

**General Defect Description:**

- Water level: 413.57
- Water in borehole: not measured
- Drying Water: not measured
- Partial Loss: not measured
- Complete Loss: not measured
- Core Recovered: not measured
## Engineering Log - Cored Borehole

### Client: Horsham Shire Council

### Project: Old Mans Valley

### Borehole Location: 33°18'58.42" S 141°36'40.36"

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>R.L. Method</th>
<th>Sampled</th>
<th>Substrate Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>SW</td>
<td>MW</td>
<td>Breccia: fine grained, grey, muddy.</td>
</tr>
<tr>
<td>21</td>
<td>SW</td>
<td>MW</td>
<td>Breccia: medium to coarse grained, grey, with light brown, mottled.</td>
</tr>
<tr>
<td>22</td>
<td>SW</td>
<td>MW</td>
<td>Breccia: medium to coarse grained, brown, to grey, massive.</td>
</tr>
<tr>
<td>23</td>
<td>SW</td>
<td>MW</td>
<td>Breccia: fine grained, grey, massive.</td>
</tr>
</tbody>
</table>

### Rock Mass Defects

- 20mm jointed zone
- 100mm jointed, fractured zone
- 50mm fractured zone
- 150mm clay seam
- 100mm crushed zone
- 150mm clay seam

### General Defect Description:

- Breccia: medium to coarse grained, grey, with light brown, mottled.
- Breccia: fine grained, grey, massive.
- Breccia: medium to coarse grained, brown, to grey, massive.

### Methodology

- Core drilling
- Core recovered
- Dilution Water
- Partial recovery
- No core recovered

### Core Description

- Fine grained clasts to 100mm across

### Weathering

- SW: Slightly weathered
- MW: Moderately weathered
- HW: Highly weathered
- ER: Extremely weathered

### Strength

- ER: Extremely hard
- L: Low
- M: Medium
- H: Hard
- VH: Very hard
- EL: Extremely soft
- V: Very soft

### Defects

- JT: Jointed, fracturing
- 10deg: Joint orientation
- 20deg: 20mm jointed zone
- 30deg: 30mm jointed zone
- 40deg: 40mm jointed zone
- 50deg: 50mm jointed zone
- 60deg: 60mm jointed zone
- 70deg: 70mm jointed zone

---

*Note: This is a sample of a detailed borehole log used for geotechnical engineering purposes.*
# Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mams Valley  
**Borehole Location:** E 308587,43 N 1269919,56

## Drilling Information

<table>
<thead>
<tr>
<th>Method</th>
<th>Code</th>
<th>RCL</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMLC</td>
<td>66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Substance Description:**
- BRECCIA: medium to coarse grained, grey, with some brown, white, and red veining, massive.
- BRECCIA: fine grained, grey, massive.
- BRECCIA: medium to coarse grained, grey, massive.
- Trace of calcite veining.

## Rock Mass Defects

<table>
<thead>
<tr>
<th>Point</th>
<th>Test</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>67</td>
<td>90</td>
<td>J 1 0deg PL RO clean</td>
</tr>
<tr>
<td>112</td>
<td>90</td>
<td>J 1 0deg PL RO clean</td>
</tr>
<tr>
<td>112</td>
<td>90</td>
<td>J 1 30-60deg IR RO ironstone</td>
</tr>
</tbody>
</table>

**General Defect Description:**
- J 1 0deg PL RO clean
- J 1 0deg IR RO clean
- J 1 30-60deg IR RO ironstone
- J 1 0deg PL RO clean
- J 1 0deg PL RO clean
- J 1 45-90deg IR RO clean
- J 1 0deg PL RO clean
- J 1 0deg PL RO clean
- J 1 0deg IR RO clean
- J 1 10deg IR RO clean
- J 1 0deg IR RO calcite fill
- PL 0deg IR RO clean
- J 1 0deg IR RO ironstone

**Weathering:**
- FL - extremely low
- VL - very low
- L - low
- M - medium
- H - high
- VH - very high

**Strength:**
- EH - extremely high

**Defects:**
- J - jointed
- PL - planar
- SM - seam
- C - clay
- RO - rough
- DC - decomposed
- PL - planar
- IR - irregular

**Method:**
- AS - auger screwing
- AD - auger drilling
- M - mudstone
- NMLC - NMLC core drilling
- ND - NMLD core drilling

**Technical Details:**
- Water level:  
- Water flow:  
- Water level:  
- Water pressure:  
- Water temperature:  

**Environmental Parameters:**
- Core recovery:  
- Partial loss:  
- Complete loss:  

**Additional Notes:**
- Core recovered:  
- No core recovered:  

**Logging and Core:**
- Log method:  
- Core method:  
- Core recovery:  
- Core quality:  

**Site Conditions:**
- Depth:  
- Slope:  
- Bearing:  
- Distance:  

**Check:**
- Checked by:  

**Sheet:**
- Sheet:  
- Page:  

**Office No:**
- Office No:  

**Report Date:**
- Report Date:  

**Date:**
- Date:  

**Coffey:**
- Coffey
# Engineering Log - Cored Borehole

## Horsnby Shire Council

### Field Information
- **Client:** Horsnby Shire Council
- **Project:** Old Mans Valley
- **Borehole Location:** E 305587.43 N 1269919.86

### Drill Model and Mounting
- **Drill Model:** EDSOM 5000 Truck

### Barrel Type and Length
- **Barrel Type:** NMLC 3.0
- **Fluid:** Water
- **Drilling Method:** Truck

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Subsistence Description</th>
<th>Rock Type</th>
<th>Quality</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 30</td>
<td>BRECCIA: medium to coarse grained, grey, massive.</td>
<td>BRECCIA</td>
<td>FR</td>
<td>Clean</td>
</tr>
<tr>
<td>30 - 60</td>
<td>...</td>
<td>BRECCIA</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

**General Defect Description:**
- BRECCIA: coarse grained, coarse gravel to cobble sized grains

### Method
- **Method:** Core Drilling
- **Remarks:** Used

### Weathering
- **Weathering:**
  - FR - Fresh
  - VL - Very low
  - I - Low
  - MW - Moderately
  - HW - Highly
  - SW - Slightly
  - RJ - Rough
  - DC - Decayed

### Strength
- **Strength:**
  - DJ - Joint
  - FT - Fractured

### Defects
- **Defects:**
  - JT - Joint
  - PT - Pitted

### Core Recovery
- **Core Recovered:**
  - Complete Loss
  - Partial Loss
  - No Core Recovered

### Point Load Test
- **Test:**
  - 60 kg

### Graphical Log/Core Loss
- **Graphic Log/Core Loss:**
  - Core Recovered
  - No Core Recovered

---

*Note: The image contains detailed geological information and is slightly tilted, requiring manual alignment for full readability.*
# Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Muns Valley  
**Borehole Location:** E 2986674.4 M 12696910.86  
**Drill Model and Mounting:** EDSON 3000 TRUCK  
**Marker Type and Length:** NMLC 3.0  
**Drilling Information:**

<table>
<thead>
<tr>
<th>Method</th>
<th>Core Vented</th>
<th>Depth (m)</th>
<th>Log Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMLC</td>
<td>V</td>
<td>72</td>
<td>BRECCIA: coarse grained, coarse gravel to cobble sized grains</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>41</td>
<td>BRECCIA: medium to coarse grained, grey</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>71</td>
<td>BRECCIA: medium to coarse grained, grey</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>42</td>
<td>BRECCIA: medium to coarse grained, grey</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>70</td>
<td>Borehole 29 Terminated at 42.22 m</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>43</td>
<td>Piezometry at 42.5m, 5m skidded, Sand at 37.6m (2.5m of gravel), 30</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>69</td>
<td>Breeds of Bentonia Turf, 70</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>65</td>
<td>Breeds of gravel (cement and water)</td>
</tr>
</tbody>
</table>

**Defect Description:**

- JT 10deg IP RO clean  
- JT 10deg IP RO crushed fill, 10mm wide  
- JT 10deg PL RO clean  
- JT 10deg PL RO trace of instability

**General Defect Description:**
**Engineering Log - Borehole**

**Client:** Horsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E3955585 M1249912

<table>
<thead>
<tr>
<th>Hole Diameter:</th>
<th>83mm</th>
</tr>
</thead>
</table>

**Drill Model and Mounting:** EDSON 3000 Truck  
**Drill Method:**  
**Support:** C casing  
**Notes:** samples, test, etc.

**PENETRATION**  
**Consistency/Density Index:**

**Material:**  
Soil type/property/characteristics: Eolian deposits.  
**Classification Symbol:** CL

**Drill Depth:**  
**Surface:** 112.5 m

**Additional Observations:**  
- Fill, Sandy Gravelly Clay, medium plasticity, brown, gravel.  
- Gravel, angular, breccia

**Structure and Additional Observations:**  
- Breccia cobble  
- Intermittent water losses during drilling

**Classification Symbols and Soil Description:**

**Moisture:**  
- D dry  
- M moist  
- W wet

**Notes:** samples and tests  
- USO undisturbed sample 50 mm diameter  
- D disturbed sample  
- N standard penetration test  
- N' SPT + sample recovered  
- NC SPT with sonic cone  
- V vane shear  
- P pressuremeter  
- Bo bulk sample  
- R refusal

**Consistency/Density Index:**
- VS very soft  
- S soft  
- PL very loose  
- VL very loose
# Engineering Log - Borehole

**Client:** Horsley Shire Council  
**Borehole Location:** E 3005886 N 12399212  
**Drill Model and Mounting:** EDSION 3000 TRUCK  
**Hole Diameter:** 63mm  
**Hole Committed:** 5.12.99  
**Hole Completed:** 8.12.99  
**Logged by:** G.M.  
**Checked by:** H.V.  
**Sheet:** 2 of 2

## Method
- **AS:** Auger screwing*  
- **AD:** Auger drilling*  
- **W:** Roller/Tricone  
- **CT:** Cable tool  
- **HA:** Hard auger  
- **DT:** Digaug  
- **Blank:** Blanked  
- **V:** Vertical  
- **TC:** Tie in  
- **ADV:** ADV

## Support
- **C:** casing  
- **M:** mud

## Penetration
- **No resistance:** No resistance to refusal  
- **R:** refusal

## Water
- **Not measured:** Water level  
- **W:** Water inflow  
- **S:** Water outflow

## Notes
- **Sample:** Undisturbed sample 50mm diameter  
- **S:** Standard penetration test  
- **N:** SP$^2$ + sample recovered  
- **ND:** SP$^2$ with solid cone  
- **V:** Vane shear  
- **F:** Pressuremeter  
- **BS:** Bulk sample  
- **R:** Refusal

## Classification
- **VS:** Very soft  
- **S:** Soft  
- **SI:** Stiff  
- **VSI:** Very stiff  
- **H:** Hard  
- **F:** Fissile  
- **VL:** Very loose  
- **L:** Loose  
- **MD:** Medium dense  
- **D:** Dense  
- **VD:** Very dense

## Soil Description
- **Fill, sandy gravel, clay, medium plasticity, brown, gravel, loose, gravel, angular, boulders**  
- **Sandy Clay, high plasticity.**  
- **Residual loose of tail pipe.**  
- **Grading into SW to NW breccia.**

---

Borehole 20 terminated at 14.1m. Parameters plotted at 12.4m, dotted line to 15.3m (45m of sand). 22% of breccia. 4% of gravel to 10.9m.
engineering log - borehole

client: HORNSEY SHIRE COUNCIL
principal: OLD MANS VALLEY
project: E 308599 S 1269225
borehole location: 308599 S 1269225

hole diameter: 100mm
drill model and mounting: EDSON 3008 TRUCK

notes
samples, tests etc

material
classification
soil type/plasticity or particle characteristics
colour, secondary and minor components

bearing: -90 DEG
datum: AD 81

structure and additional observations
FILL, large Breccia cobbles
Mainly Breccia boulders with clay fill between

METHOD
AS auger screening
AD auger drilling
R raise/score
W washboard
CT cable tool
HA hand auger
dt ditches

SUPPORT
C casing
M mud

PENETRATION
no resistance ranging to

WATER
not measured
water level
water outflow
water inflow

CONSISTENCY/DENSITY INDEX
VS very soft
S soft
F firm
S1 stiff
VST very stiff
H hard
Rf rigid
VL very loose
Loose
MD medium dense
dense
VD very dense

NOTES samples and tests
U50 undisturbed sample 50 mm diameter
d disturbed sample
N standard penetration test
N* SPI + sample recovered
Rc SPI with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

EQUIPMENT
ADT

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
based on unified classification system
MOISTURE
# Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mains Valley  
**Borehole Location:** E 305660.5 N 1269926.4

<table>
<thead>
<tr>
<th>Hole Diameter: 100mm</th>
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<tbody>
<tr>
<td>Depth</td>
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</table>

**Drill Model and Mounting:** EDSON 3000 Truck

**Method:**
- **3:** drilling
- **2:** coring
- **1:** sampling, testing

**Notes:**
- 105: CH
- 104: USO
- 103: 25.3
- 101: 99

**Additional Observations:**
- RESIDUAL
- EW/HW BRECCIJA

**Borehole:**
- Terminated at 95m
- Piezometer placed at 7.5m, 1m supplied, 1m left in borehole at 95m (300mm of plastic sleeve)
- Grout to surface (cement & water)

**Consistency/Density Index:**
- **VS:** very soft
- **V:** soft
- **S:** stiff
- **VS:** very stiff
- **H:** hard
- **F:** friable
- **VL:** very loose
- **L:** loose
- **MD:** medium dense
- **D:** dense
- **VD:** very dense

**Symbols and Soil Description:**
- Based on unified classification system

**Moisture:**
- **O:** dry
- **M:** moist
- **W:** wet
- **WP:** plastic limit
## Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley

### Borehole Details
- **Borehole Location:** E 30°56'00" N 156°49'27.9"
- **Drill Model and Mounting:** Edison 3000 Truck
- **Drill Diameter:** 100mm
- **Top Datum:** 104.5 m
- **Slope:** -90 DEG

### Method

<table>
<thead>
<tr>
<th>Method</th>
<th>Notes</th>
<th>Sampled</th>
<th>Test, etc.</th>
<th>Graphic Log</th>
<th>Classification Symbol</th>
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</table>

### Material
- Soil type: plastoelastic or particle characteristics colour, secondary and minor components
- Soil type: sandy clay, medium plasticity, fine grained, slow

### Notes and Tests
- US9: Sample 50 mm diameter
- D: Disturbed sample
- N: Standard penetration test
- Sp: In situ sample recovered
- Vs: Sample with solid cone
- V: Vane shear
- P: Pressuremeter
- S: Bulk sample
- R: Refusal

### Classification
- **Symbols and Soil Description**
  - Classification System
- **Moisture**
  - D: dry
  - M: moist
  - W: wet
  - Wp: plastic limit

### Consistency/Density Index
- VS: very soft
- S: soft
- F: firm
- St: stiff
- VS1: very stiff
- H: hard
- Fb: failure
- VL: very loose
- L: loose
- MD: medium dense
- D: dense
- VD: very dense

### Additional Observations
- **Fill**
- **Residual**
- **Earth Breccia clay color?**

### Borehole Details (continued)
- **Termination:** 26.5 m
- **Pilemeter:** 2.5 m, 0.5 m, dotted, Sand of 12.5 m (0.5 m of sand), Silt clay of 1.1 m (0.5 m of bentonite pellets)
- **Sample:** 0.5 m, 0.5 m, dotted, Sand of 12.5 m (0.5 m of sand), Silt clay of 1.1 m (0.5 m of bentonite pellets)

---

**Note:** The image contains a detailed engineering log for a borehole, including geological observations, sample data, and additional notes. The table format provides a structured way to record various aspects of the borehole investigation.
## Engineering Log - Borehole

**Client:** Hornsey Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 308342.0 M 1269924.0  
**Drill Model and Mounting:** Edison 3000 Truck  
**Hole Diameter:** 100mm  
**Hole Depth:**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Notes</th>
<th>Soil Type</th>
<th>Penetration</th>
<th>Support</th>
<th>Notes</th>
<th>Classification</th>
<th>Consistency/Density Index</th>
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</thead>
<tbody>
<tr>
<td>0 - 0.1</td>
<td>Use</td>
<td>SANDY CLAY: low to medium plasticity, motillous light grey and light brown, sand is fine grained.</td>
<td>CL</td>
<td>M</td>
<td>MD</td>
<td>RESIDUAL</td>
<td>VS1</td>
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<td>0.1 - 1.5</td>
<td>Use</td>
<td>BRECCIA: highly weathered</td>
<td>B</td>
<td>M</td>
<td>D</td>
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<td>NW/SE BRECCIA</td>
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<td>Use</td>
<td>BRECCIA: moderately - slightly weathered</td>
<td>B</td>
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<td>2.0 - 2.5</td>
<td>Use</td>
<td>BRECCIA: moderately - slightly weathered</td>
<td>B</td>
<td>M</td>
<td>D</td>
<td>BRECCIA</td>
<td>NW/SE BRECCIA</td>
</tr>
<tr>
<td>2.5 - 3.0</td>
<td>Use</td>
<td>BRECCIA: moderately - slightly weathered</td>
<td>B</td>
<td>M</td>
<td>D</td>
<td>BRECCIA</td>
<td>NW/SE BRECCIA</td>
</tr>
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<td>3.0 - 3.5</td>
<td>Use</td>
<td>BRECCIA: moderately - slightly weathered</td>
<td>B</td>
<td>M</td>
<td>D</td>
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<td>NW/SE BRECCIA</td>
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<td>3.5 - 4.0</td>
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<td>B</td>
<td>M</td>
<td>D</td>
<td>BRECCIA</td>
<td>NW/SE BRECCIA</td>
</tr>
<tr>
<td>4.0 - 4.5</td>
<td>Use</td>
<td>BRECCIA: moderately - slightly weathered</td>
<td>B</td>
<td>M</td>
<td>D</td>
<td>BRECCIA</td>
<td>NW/SE BRECCIA</td>
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<td>4.5 - 5.0</td>
<td>Use</td>
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<td>B</td>
<td>M</td>
<td>D</td>
<td>BRECCIA</td>
<td>NW/SE BRECCIA</td>
</tr>
<tr>
<td>5.0 - 5.5</td>
<td>Use</td>
<td>BRECCIA: moderately - slightly weathered</td>
<td>B</td>
<td>M</td>
<td>D</td>
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<td>NW/SE BRECCIA</td>
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<td>D</td>
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<td>NW/SE BRECCIA</td>
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<td>6.0 - 6.5</td>
<td>Use</td>
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<td>B</td>
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<td>D</td>
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<td>D</td>
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<td>NW/SE BRECCIA</td>
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<td>B</td>
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<td>D</td>
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<td>B</td>
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<td>D</td>
<td>BRECCIA</td>
<td>NW/SE BRECCIA</td>
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<td>8.0 - 8.5</td>
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<td>B</td>
<td>M</td>
<td>D</td>
<td>BRECCIA</td>
<td>NW/SE BRECCIA</td>
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</tbody>
</table>

**Additional Observations:**
- Borehole 34 terminated at 2.5m below plato 2.25 m L70m (0.5m) sand to 1.4m, 40mm galvanized plastic plug into 1.1 m, rockfill and gravel.
# Engineering Log - Borehole

**Client:** HORNBY SHIRE COUNCIL  
**Principal:**  
**Project:** OLD MANS VALLEY  
**Borehole Location:** C306663.0 N 3264933.36  
**Borehole No.:** 35  
**Hole No.:** 353456/3  
**Hole Commenced:** 26.11.89  
**Hole Completed:** 26.11.89  
**Logged By:** GJH  
**Checked By:** PLV

<table>
<thead>
<tr>
<th>Method</th>
<th>Submethod</th>
<th>Water</th>
<th>Notes</th>
<th>R.L.</th>
<th>Depth</th>
<th>Material</th>
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<td>112</td>
<td>FILL, gravelly clay, medium plasticity, angular gravel, dark brown, trace of solid</td>
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<td></td>
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<td></td>
<td></td>
<td>111</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>109</td>
<td>FILL, sandy gravelly clay, medium plasticity, angular large gravel, dark brown</td>
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<tr>
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<td></td>
<td></td>
<td>105</td>
<td></td>
</tr>
</tbody>
</table>

**Additional Observations:**
- FILL, gravelly clay, medium plasticity, angular gravel, dark brown, trace of solid
- FILL, sandy gravelly clay, medium plasticity, angular large gravel, dark brown
- Fill is highly variable
- AI 4.5m possibly grading into SW Breccia

**Notes:**
- Borehole terminated at 5.00m
- Piezometer installed at 4.2m, 1.0m cased, bottom 600mm perforated
- Horizontally split below 4.2m, range to 2.8m (4.1m), bottom to 2.8m (500mm) grout to surface

**Classification Symbols and Soil Description:**
- Based on unified classification system

**Consistency/Density Index:**
- VS: very soft
- S: soft
- F: firm
- SI: stiff
- VSI: very stiff
- H: hard
- Fo: floccular
- VL: very loose
- L: loose
- MD: medium dense
- D: dense
- VD: very dense
### Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 389527.95 N 1709935.61

<table>
<thead>
<tr>
<th>Method</th>
<th>Support</th>
<th>Notes</th>
<th>Water</th>
<th>Material</th>
<th>Classification Symbols and Soil Description</th>
<th>Consistency/Density Index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td>Classifications: Plasticity or particle characteristics; colour, secondary and minor components.</td>
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<tr>
<td>A</td>
<td>C casing</td>
<td>M and H</td>
<td>ND</td>
<td>SAND: medium grained, light yellow, some gravel, angular</td>
<td>Based on unified classification system</td>
<td>VS: very soft</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>FILL: highly variable, consisting of clay to sandy boulders</td>
<td>MOISTURE: D: dry, M: moist, W: wet</td>
<td>S: soft</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FILL: gravelly clay, medium plasticity, angular gravel, light brown</td>
<td>WATER: not measured</td>
<td>F: firm</td>
</tr>
</tbody>
</table>

**Depth (m):**

- 113.3 m R.L. Surface
- Complete loss of drilling fluid

**Loose:** Fill, highly variable

**Borehole 26 Terminated at 500m**

- Piezometer placed at 500m, 1m diameter, length 3.5m, 13mm diaphragm
- Top of Bentonite at 3.50m (625th diag), 16 litres of cement and water.

**Consistency/Density Index:**
- VS: very soft
- S: soft
- F: firm
- St: stiff
- VS1: very stiff
- H: hard
- Fb: brittle
- VL: very loose
- MD: medium dense
- D: dense
- VD: very dense
# Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 285868.5 N 1269938.6  
**Dil model and Mounting:** EDSON 3000 TRUCK  
**Hole Diameter:** 76mm

## Data & Test Details

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Notes</th>
<th>L.L</th>
</tr>
</thead>
<tbody>
<tr>
<td>112</td>
<td>FILL SANDY GRAVELY CLAY, medium plasticity, coarse grained, angular gravel, brown.</td>
<td></td>
</tr>
<tr>
<td>111</td>
<td>FILL CLAY? SAND, light brown</td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>FILL Sandy Gravelly CLAY, as above</td>
<td></td>
</tr>
</tbody>
</table>

## Additional Observations

- FILL, large cobbles and boulders of breccia, variable fill.  
- Attempted USG, EW sandstone.
### Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 388666 Y N 12669338  
**Hole Committed:** 11.12.89  
**Logged by:** GH  
**Checked by:** PLY  
**Drill Model and Mounting:** Edson 3000 Truck  
**Slope:** -90 DEG  
**RL Surface:** 112.8 m  
**Hole Diameter:** 76mm  
**Borehole No.:** 37

<table>
<thead>
<tr>
<th>Method</th>
<th>Penetration</th>
<th>Support</th>
<th>Water</th>
<th>Notes</th>
<th>Samples</th>
<th>Test, etc</th>
<th>P.E.</th>
<th>Depth</th>
<th>Materials</th>
<th>Classification</th>
<th>Description</th>
<th>MOISTURE</th>
<th>CONSISTENCY/DENSITY INDEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td></td>
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<td></td>
<td></td>
<td>96</td>
<td></td>
<td></td>
<td>12.2</td>
<td>BRECCIA: EW - HW Breccia</td>
<td>RECLAMATION</td>
<td>RESIDUAL</td>
<td></td>
<td></td>
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</tbody>
</table>

Borehole 37 terminated 17.80m  
Piezometer at 17.9m. 1.5m shafted, sand at 16.5m (1.5m of Sand), 35 litres of bentonite (trentham), 43 litres of gravel (cement and water), bentonite at 13.3, bentonite into washed out sand.

**Notes:**  
- Samples and tests:  
  - UGC undisturbed sample 10 mm diameter.  
  - D disturbed sample.  
  - N standard penetration test.  
  - Nc SPI with solid cone.  
  - V帷橄榄.  
  - P pressuremeter.  
  - B3 bulk sample.  
  - R refusal.  

**Classification/Soil Description:**  
Based on unified classification system.

**Consistency/Density Index:**  
- VS very soft.  
- S soft.  
- F firm.  
- St stiff.  
- VSI very stiff.  
- H hard.  
- Fb friable.  
- KL very loose.  
- M medium dense.  
- D dense.  
- VD very dense.
# Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Principal:**  
**Project:** Old Man's Valley  
**Borehole Location:** E 305505.2 N 1265935.1

<table>
<thead>
<tr>
<th>Method</th>
<th>Support</th>
<th>Diameter</th>
<th>Notes Sample, Test, etc.</th>
<th>R.L. Depth</th>
<th>Description</th>
<th>Material</th>
</tr>
</thead>
</table>
| C      | Casing  | 112m     |                           | 112        | CL          | Fill: Sandy Gravelly Clay, medium plasticity, brown, gravel coarse grained angular, sand fine to coarse.  

Becoming more clayey with depth |

**Notes:** Samples and Tests  
**Classification:**  
**SUPPORT:** Casing  
**CONSISTENCY/DENSITY INDEX:** VS - very soft  
**SOIL:** M - mud  
**DESCRIPTION:**  
**WATER:** Not measured  
**MOISTURE:** D - dry  
**CONSISTENCY/DENSITY INDEX:** S - soft  
**SUPPORT:** Mud  
**MOISTURE:** M - moist  

---

**CONSISTENCY/DENSITY INDEX:** F - firm  
**WATER:**  
**CONSISTENCY/DENSITY INDEX:** S1 - stiff  
**MOISTURE:** L - loose  
**CONSISTENCY/DENSITY INDEX:** VS1 - very stiff  
**MOISTURE:** MD - medium dense  
**CONSISTENCY/DENSITY INDEX:** H - hard  
**MOISTURE:** D - dense  
**CONSISTENCY/DENSITY INDEX:** F0 - very loose  
**MOISTURE:** VD - very dense
## Engineering Log - Borehole

**Client:** HORNBY SHIRE COUNCIL  
**Principal:**  
**Project:** OLD MANS VALLEY  
**Borehole Location:** E 3886052 N 1269938.1  
**Drill Model and Mounting:** EDSON 3000 TRUCK  
**Hole Diameter:** 76mm  
**Slope:** -90 DEG  
**R.L. Surface:** 112.9 m  
**Datum:** AHD  

<table>
<thead>
<tr>
<th>Method</th>
<th>Penetration</th>
<th>Water</th>
<th>Notes samples, tests, etc</th>
<th>P &amp; L</th>
<th>Graphic Log</th>
<th>Material</th>
<th>Soil Type/Particle size or particle characteristics</th>
<th>Colour, secondary and minor components</th>
<th>Structure and additional observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fill: sandy gravelly clay, medium plasticity, brown, gravel, coarse grained, angular, sand fine to coarse</td>
</tr>
</tbody>
</table>

### Borehole 38 Terminated at 102m
- Diameter of 94mm, Skilled to 56m, 6.43m (1.43m of sand), 35m of sandstone. Sensitivity at surface with a cap of 8.5% when casing removed.
- 45m of gravel (boulders) and gravel (gravel).
### Engineering Log - Borehole

**Client:** HORSBY SHIRE COUNCIL  
**Project:** OLD MANS VALLEY  
**Borehole Location:** E 305533.2 N 1269954.6

**Drill Model and Mounting:** EDSON 3000 TRUCK  
**Hole Diameter:** 100mm  
**Hole Geometry:** L-shaped  
**Hole Commenced:** 14.12.99  
**Hole Completed:** 14.12.99  
**Logged By:** JAF  
**Checked By:** PLV

#### Notes and Measurements

<table>
<thead>
<tr>
<th>Depth (mm)</th>
<th>Material</th>
<th>Classification</th>
<th>Notes</th>
<th>Additional Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>97</td>
<td>FILL: Silt and sand</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>97</td>
<td>SANDY CLAY: low plasticity, moist</td>
<td>CL</td>
<td>Light brown and light grey, some silt, sand is fine to medium grained.</td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>SANDY CLAY: low to medium plasticity, motile red brown, light brown and light grey, some claysite. BRECCIA: highly weathered</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>BRECCIA: moderately to slightly weathered</td>
<td>M</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Borehole 39 Terminated at 4.10m**

- Pluviometer installed 6.5m from 4.19 to 3.49m. Seed to 5mm. Blasthole plug to 2.5m, backfill and grout.

**Method and Support**

- **AS:** auger screwing
- **AD:** auger drilling
- **CI:** cable tool
- **SA:** hand auger
- **PT:** proprietors' tool

**Penetration**

- **C:** casing
- **M:** mud

**Notes**

- Samples and Tests: U30 undisturbed sample 50 mm diameter
- D: disturbed sample
- N: standard penetration test
- N*: SP1 + sample recovered
- No SP1 with solid cone
- V: vane shear
- P: pressuremeter
- B: bulk sample
- R: refusal

**Classification Symbols and Soil Description**

- Based on unified classification system

**Moisture**

- D: dry
- M: moist
- W: wet
- Wp: plastic limit

**Consistency/Density Index**

- VS: very soft
- S: soft
- F: firm
- SI: stiff
- VSI: very stiff
- H: hard
- Fb: brittle
- VL: very loose
- L: loose
- MD: medium dense
- D: dense
- VD: very dense
# Engineering Log - Borehole

**Method**
- Project: Old Mans Valley
- Client: Hindu
- Borehole Location: E30844 N1269432

**SUPPORT**
- Water level: 1.2 m
- Water table: 2.5 m
- Water level: 7.0 m
- Water table: 9.0 m

**FACET**
- Soil type: Clay
- Soil color: Grey

**DESCRIPTION**
- 2.5 m to 4.0 m: Clayey sandy silt
- 4.0 m to 5.0 m: Sandy clay

**CONSISTENCY**
- Very dense
- Loose

**MOISTURE**
- Wet
- Moist

**CONSISTENCY/DENSITY INDEX**
- VD: Very dense
- LD: Loose

**CONSISTENCY/DENSITY INDEX**
- YS: Very stiff
- IS: Stiff

**AD**
- Depth: 1.0 m
- Moisture condition: Wet

**ADV**
- Depth: 2.0 m
- Moisture condition: Wet

**NOTES**
- Soil characteristics: Clayey sandy silt
- Soil color: Grey

**METHOD**
- Core sampling
- Photographic logging

**Additional Observations**
- Core integrity: Good
- Core recovery: 95%

**DRL**
- Depth: 10.0 m
- Moisture condition: Wet

**Additional Observations**
- Core integrity: Good
- Core recovery: 95%
### Engineering Log - Borehole

**Client:** Hornsey Shire Council  
**Principal:**  
**Project:** Old Mans Valley  
**Borehole Location:** E 108334.7 N 12699713  
**Borehole No.:** 41  
**Sheet 1 of 6**

<table>
<thead>
<tr>
<th>Method</th>
<th>Penetration</th>
<th>Support</th>
<th>Water</th>
<th>Notes</th>
<th>Sampled</th>
<th>Test, etc.</th>
<th>Graph Log</th>
<th>Description</th>
<th>Material</th>
<th>Core</th>
<th>Core</th>
<th>Water</th>
<th>Consistency/Density Index</th>
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<tr>
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</tbody>
</table>

### Notes
- Samples and tests: USD disturbed sample 50 mm diameter
- Disturbed sample
- Standard penetration test
- N' SPI + sample recovered
- No SPI with solid cone
- Vane shear
- Pressuremeter
- B3 bulk sample
- Refusal

### Classification Symbols and Soil Description
- Based on Unified Classification System
- Moisture: O = dry, M = moist, W = wet
- Clastic Limit: WP

### Consistency/Density Index
- VS = very soft
- S = soft
- F = firm
- Si = stiff
- VSI = very stiff
- H = hard
- Fb = firm
- VI = very loose
- VL = loose
- MD = medium dense
- D = dense
- VD = very dense

---

**Method:**
- **Penetration:** Sugar screwing*
- **Support:** Roller/rotary
- **Water:** Washboard
- **Note:** Hard auger
- **Core:** Cable tool
- **Test:** Hard auger
- **Sampled:** USD

**Material:**
- **Fill:** Sand, Clay, gravel and wood
- **Sandy clay:** Low medium plasticity, light brown, thin of roots and silt
- **Sandy clay:** Low plasticity, moistened grey and light brown, sand is fine to medium
- **Brecchia:** Highly weathered

**Structure and Additional Observations:**
- Alluvium: Attempted USG at 1.45m - No recovery
- Residual/W Brecchia
- HW Brecchia

**Consistency/Density Index:**
- VS = Very Soft
- S = Soft
- F = Firm
- Si = Stiff
- VSI = Very Stiff
- H = Hard
- Fb = Firm
- VI = Very Loose
- VL = Loose
- MD = Medium Dense
- D = Dense
- VD = Very Dense

**Notes:**
- Samples and tests: USD disturbed sample 50 mm diameter
- Disturbed sample
- Standard penetration test
- N' SPI + sample recovered
- No SPI with solid cone
- Vane shear
- Pressuremeter
- B3 bulk sample
- Refusal
### Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Location:** Old Mams Valley  
**Borehole Location:** E308534.74 N1259971.76

**Drill Model and Make:** EDSON 3000 Truck  
**Bored Type and Length:** NMCL 3.6m

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>substance description</th>
<th>rock substance</th>
<th>rock mass defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.91</td>
<td>BRECCIA: fine to coarse grained, brown, indistinct bedding.</td>
<td>Breccia</td>
<td>0.100 mm jointed zone, 0.100 mm jointed/crushed SM with clay</td>
</tr>
<tr>
<td>0.94</td>
<td>BRECCIA: fine to coarse grained, mottled grey, light grey, and brown, indistinct bedding.</td>
<td>Breccia</td>
<td>0.100 mm jointed/crushed SM with clay, clay/crushed SM 30 mm thick</td>
</tr>
<tr>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.97</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**General Defect Description:**
From 3.3m to 10.6m joints/partings generally at 0 to 30deg and ironstone

**WEATHERING**
- FR: fresh
- SW: slightly wet
- MW: moderately wet
- HW: highly wet
- LW: low wet

**STRENGTH**
- EL: extremely low
- VL: very low
- L: low
- M: medium
- H: high
- VH: very high
- EH: extremely high

**METHODS**
- AS: auger sampling
- AD: auger digging
- RD: roller/track
- W: washbore
- NMCL: NMCL core drilling
- NGHO: NGHO core drilling
- ESS: cased core barrel withdrawn

**GRAPHIC LOG/CORE LOSS**
- Core recovered (etching indicates material)
- Partial loss
- Complete loss
- No core recovered

**POINTER LOAD TEST**
- D: planar
- A: axial

**WEATHERING**
- FR: fresh
- SW: slightly wet
- MW: moderately wet
- HW: highly wet
- LW: low wet

**STRENGTH**
- EL: extremely low
- VL: very low
- L: low
- M: medium
- H: high
- VH: very high
- EH: extremely high

**DEFECTS**
- JT: joint
- PT: parting
- SM: seam
- CL: clay
- RO: rough
- DC: decomposed
- PL: planar
- IR: irregular
# Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 308534.74 N 1265971.78

<table>
<thead>
<tr>
<th>Hole Commination</th>
<th>Hole Completed</th>
<th>Logged By</th>
<th>Checked By</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.12.89</td>
<td>14.12.89</td>
<td>IAF</td>
<td>PLV</td>
</tr>
</tbody>
</table>

## Drilling Information
- **Method:** NMLC 3m  
- **Substance Description:**
  - BRECCIA: Fine to coarse grained, mottled grey, light grey, fine brown, indistinct bedding.
  - BRECCIA: Fine to coarse grained, mottled grey, light grey, indistinct bedding.
  - Clays/crushed SM, 35°, 15mm thick
  - Clay/crushed SM, 35°, 15mm thick

### Rock Mass Defects
- **Defect Description:**
  - Jointed zone 70mm thick  
  - Jointed zone 90mm thick  
  - Jointed zone 40mm thick  
  - Jointed zone 90mm thick  
  - Jointed zone 40mm thick  
  - Jointed zone 90mm thick  
  - Jointed zone 40mm thick  
  - Jointed zone 90mm thick  
  - Jointed zone 40mm thick  
  - Jointed zone 90mm thick  

## General Defect Description
- From 5m to 10m joints/partings are generally at 0 to 30° and irregular.

<table>
<thead>
<tr>
<th>Method</th>
<th>Point Load Test</th>
<th>Weathering</th>
<th>Strength</th>
<th>Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS</td>
<td>D - diametral</td>
<td>FR - fresh</td>
<td>EL - extremely low</td>
<td>J - joint</td>
</tr>
<tr>
<td>AD</td>
<td>A - axial</td>
<td>SV - slightly</td>
<td>V - very low</td>
<td>P - parting</td>
</tr>
<tr>
<td>R</td>
<td>not measured</td>
<td>MW - moderately</td>
<td>L - low</td>
<td>SM - seam</td>
</tr>
<tr>
<td>W</td>
<td>core drilled</td>
<td>HW - highly</td>
<td>M - medium</td>
<td>CL - clay</td>
</tr>
<tr>
<td>NMCL</td>
<td>Drilling Water</td>
<td>EH - extremely high</td>
<td>H - high</td>
<td>RO - rough</td>
</tr>
<tr>
<td>NOHO</td>
<td>Partial loss</td>
<td>EV - extremely high</td>
<td>VH - very high</td>
<td>DC - decomposed</td>
</tr>
<tr>
<td>NMLC</td>
<td>Complite loss</td>
<td>EN - extremely high</td>
<td>IR - irregular</td>
<td>Pt - planar</td>
</tr>
</tbody>
</table>

**Note:** Graphic log/core loss indicates core recovered (hatching indicates material).
### Engineering Log - Cored Borehole

#### Drilling Information
- **Drill model and mounting:** EDCON 3000 TRUCK
- **Borehole location:** E 20834.74 N 120997.76
- **Slope:** -90 DEG
- **Rock mass defects:**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Rock Mass</th>
<th>Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>78</td>
<td>BRECCIA</td>
<td>line to coarse grained, mottled grey, and light grey, indurated bedding.</td>
</tr>
<tr>
<td>77</td>
<td>BRECCIA</td>
<td>line to coarse grained, mottled grey, and light grey, indurated bedding.</td>
</tr>
<tr>
<td>76</td>
<td>BRECCIA</td>
<td>line to coarse grained, mottled grey, and light grey, indurated bedding.</td>
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<tr>
<td>75</td>
<td>BRECCIA</td>
<td>line to coarse grained, mottled grey, and light grey, indurated bedding.</td>
</tr>
<tr>
<td>74</td>
<td>BRECCIA</td>
<td>line to coarse grained, mottled grey, and light grey, indurated bedding.</td>
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<tr>
<td>73</td>
<td>BRECCIA</td>
<td>line to coarse grained, mottled grey, and light grey, indurated bedding.</td>
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<tr>
<td>72</td>
<td>BRECCIA</td>
<td>line to coarse grained, mottled grey, and light grey, indurated bedding.</td>
</tr>
<tr>
<td>71</td>
<td>BRECCIA</td>
<td>line to coarse grained, mottled grey, and light grey, indurated bedding.</td>
</tr>
</tbody>
</table>

#### Rock Substance
- **Rock type:**
  - BRECCIA: line to coarse grained, mottled grey, and light grey, indurated bedding.

#### Methodology
- **METHOD:**
  - Water level
  - Water level
  - Not measured

#### Point Load Test
- **D - dimentional**
  - A - axial

#### Graphical Log/Core Loss
- **Diluting Water**
  - Partial loss
  - Complete loss
- **Material:**
  - No core recovered
  - Core recovered
  - Material indicates material

#### Weathering
- **WEATHERING:**
  - FR - fresh
  - SW - slightly weathered
  - MW - moderately weathered
  - HW - highly weathered
  - EW - extremely weathered
  - VL - very low
  - L - low
  - M - medium
  - H - high
  - VH - very high
  - E - extremely high

#### Strength
- **STRENGTH:**
  - EL - extremely low
  - CL - clay
  - RO - rough
  - DC - decomposed
  - PL - planar
  - IR - irregular

#### Defects
- **J1:** Joint
- **J2:** Joint
- **J3:** Joint
- **J4:** Joint
### Engineering Log - Cored Borehole

**Client:** HORSBY SHIRE COUNCIL  
**Project:** OLD MANS VALLEY  
**Borehole Location:** E 30554574 N 126999172  
**Borehole No:** 41  
**Hole commenced:** 12.12.89  
**Hole completed:** 14.12.89  
** Logged by:** JAF  
**Checked by:** PLY

#### Drilling Information
- **Borehole Type:** R.D.S.A. 3000 Truck
- **Borehole Type and Length:** NMLC 3.6m
- **Slope:** -90 DEG
- **Surface:** 94.9 m
- **Column:** AHD

#### Rock Substance

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Substance Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>56-55</td>
<td>Breccia: Fine to coarse grained, mottled grey, and light grey, indistinct bedding.</td>
</tr>
<tr>
<td>55-56</td>
<td>Breccia: Fine to coarse grained, mottled grey, and light grey, indistinct bedding.</td>
</tr>
<tr>
<td>55-56</td>
<td>Breccia: Fine to coarse grained, mottled grey, and light grey, indistinct bedding.</td>
</tr>
<tr>
<td>56-57</td>
<td>Breccia: Fine to coarse grained, mottled grey, and light grey, indistinct bedding.</td>
</tr>
<tr>
<td>57-58</td>
<td>Breccia: Fine to coarse grained, mottled grey, and light grey, indistinct bedding.</td>
</tr>
<tr>
<td>58-59</td>
<td>Breccia: Fine to coarse grained, mottled grey, and light grey, indistinct bedding.</td>
</tr>
<tr>
<td>59-60</td>
<td>Breccia: Fine to coarse grained, mottled grey, and light grey, indistinct bedding.</td>
</tr>
<tr>
<td>60-61</td>
<td>Breccia: Fine to coarse grained, mottled grey, and light grey, indistinct bedding.</td>
</tr>
<tr>
<td>61-62</td>
<td>Breccia: Fine to coarse grained, mottled grey, and light grey, indistinct bedding.</td>
</tr>
</tbody>
</table>

**General Defect Description:** Joints / Partings at 2 to 3mSpacings

**Method:**
- **Coring:** using coring, auger coring, water injection, core drilling, NMLC, core coring, core drilling, coring used, barrel withdrawn.

**Point Load Test:**
- **Water Level:**
  - **Water Inflow:**
  - **Core Recovered:**
  - **Drilling Water:**

**Weathering:**
- **FR:** Fresh
- **SW:** Slightly weathered
- **MW:** Moderately weathered
- **HW:** Highly weathered
- **FW:** Extremely weathered

**Strength:**
- **RL:** Extremely low
- **VL:** Very low
- **L:** Low
- **M:** Medium
- **H:** High
- **VH:** Very high
- **EH:** Extremely high

**Defects:**
- **JT:** Joint
- **P1:** Parting
- **SM:** Seam
- **Cl:** Clay
- **RO:** Rock
- **DC:** Decomposed
- **PL:** Planar
- **IR:** Irregular
**Engineering Log - Borehole**

**Client:** Hornsey Shire Council  
**Project:** Old Man's Valley  
**Borehole Location:** X 389/334.5 N 1249912.9

| Hole Diameter (mm) | 100mm |

**Drill Model and Mounting:** Edison 3603 Truck  
**Slope:** -0 Deg  
**Surface:** 94.9 m

<table>
<thead>
<tr>
<th>Method</th>
<th>Notes</th>
<th>Samples</th>
<th>Test, etc.</th>
<th>R.L.</th>
<th>Depth (m)</th>
<th>Material</th>
<th>Penetration</th>
<th>Samples</th>
<th>Test, etc.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>C</td>
<td></td>
<td></td>
<td>94</td>
<td>1</td>
<td>Sandy Clay: low to medium plasticity, light brown some silt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>93</td>
<td>2</td>
<td>Sandy Clay: low plasticity, mottled grey and light brown, sand is fine to medium.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td>92</td>
<td>3</td>
<td>Breccia, highly weathered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Borehole 42 Terminated at 3.35m.  
Piezometer installed 0.6m from 3.35 to 2.75m. Sump to 2.36m. Bentonite pellet plug to 2.0m, Gravel to surface.

**Notes:**  
- Clayey sand, clay and gravel.  
- Sandy Clay: low plasticity, light brown some silt.  
- Sandy Clay: low plasticity, mottled grey and light brown, sand is fine to medium.  
- Breccia, highly weathered.

**Classification Symbols and Soil Description:**  
- Based on unified classification system.
- Moist, wet, dry.
- Plastic limit

**Consistency/Density Index:**  
- VS: very soft
- S: soft
- F: firm
- ST: stiff
- VS1: very stiff
- H: hard
- TB: brittle
- VE: very loose
- L: loose
- MD: medium dense
- D: dense
- VD: very dense

**Method:**  
- Drilling: auger drilling*
- Support: casing
- Penetration: no resistance to refusal

**Notes:**  
- Samples and tests: undisturbed sample 50 mm diameter.
- Standard penetration test: N Penetration.
- SPT + sample recovered.
- Borehole description: moist, wet, dry.
- Water level: not measured.

**Support:**  
- C: casing
- M: mud

**Water:**  
- Water level: not measured.
- Water outflow: water in.

**Classification:**  
- Based on unified classification system.

**Moisture:**  
- Dry, moist, wet.
- Plastic limit.

**Sample:**  
- Tests.

---

*Note: * indicates auger drilling method.
## Engineering Log - Borehole

### Details
- **Client:** Hornsby Shire Council
- **Project:** Old Man's Valley
- **Borehole Location:** E 309635, N 1272001
- **Drill Model and Mounting:** Edson 3000 Truck
- **Hole Diameter:** 100mm
- **Material:**
  - Soil: Plasticity or Particle Characteristics; Colour, Secondary and Minor Components

### Observations
- **Date:** 18.12.89
- **Logged by:** GJH
- **Checked by:** PV

### Borehole Summary
- **Depth:**
  - CH: Sandy Clay, medium to high plasticity; fine grained, brown soilified orange trace of angular gravel
  - BRECCIA: Extremely to heavily weathered

### Notes
- **Borehole 43 Terminated at 565m:**
  - Piezometer at 45m, lm slotted, Sand at 16m (1.5m of sand); resistance at 3.5m 450mm of basaltic pallasite. Group cement & water to surface.

### Diagram
- Diagram showing borehole locations and conditions.
- **GEOLOGY:**
  - Residual soil bands
  - EW Breccia
  - EW Breccia becoming dryer with depth

### Method
- **Support:**
  - C casing
  - M mud

### Water Levels
- **Water Level:**
  - Water level

### Classification
- **Consistency/Density Index:**
  - VS: Very soft
  - S: Soft
  - F: Firm
  - D: Stiff
  - VS: Very stiff
  - H: Hard
  - Fo: Stiff
  - VL: Very loose
  - L: Loose
  - MD: Medium dense
  - D: Dense
  - VD: Very dense

### Notes
- **Sample and Tests:**
  - U3D: Undisturbed sample 50 mm diameter
  - D: Disturbed sample
  - N: Standard penetration test
  - N*: SPI + sample recovery
  - NC: SPI with solid core
  - V: Vane shear
  - P: Pressuremeter
  - BS: Bulk sample
  - R: Refuse

### Moisture
- **Moisture:**
  - D: Dry
  - M: Moist
  - W: Wet
  - WP: Plastic limit

### Diagram Legend
- Symbols and Abbreviations:
- AS: Auger sampling
- AD: Auger drilling
- P: Percussion
- HA: Hardened
- DT: Ditch
- B: Blank
- V: V void
- T: TC drift
- e.g.: ADV
# Engineering Log - Cored Borehole

**Client:** HORNSEY SHIRE COUNCIL  
**Project:** OLD MANS VALLEY  
**Borehole Location:** E 205875.8' N 1270097.6'  
**Hole commenced:** 12.12.99  
**Hole completed:** 14.12.99  
**Logged by:** G.JH  
**Checked by:** P.LV

<table>
<thead>
<tr>
<th>Drill model and mounting</th>
<th>EDDON 3000 TRUCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borehole type and length</td>
<td>NMLC 3.6</td>
</tr>
<tr>
<td>Fluid</td>
<td>WATER</td>
</tr>
<tr>
<td>Bearing</td>
<td>-90 DEG</td>
</tr>
<tr>
<td>R.I. Surface</td>
<td>164.7 m</td>
</tr>
</tbody>
</table>

### Drilling Information

<table>
<thead>
<tr>
<th>R.L.</th>
<th>Rock Substance</th>
<th>Substance Description</th>
<th>Rock Type: Grain Characteristics</th>
<th>Core Recovered</th>
<th>Testing</th>
<th>Est. Strength</th>
<th>Defect Description</th>
<th>General Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>104</td>
<td>NO CORE</td>
<td>12m (Residual/Extremely weathered breccia)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>103</td>
<td>BRECCIA</td>
<td>Medium to coarse grained, brown, with light brown, grain massive.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>102</td>
<td>BRECCIA</td>
<td>as above</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>101</td>
<td>BRECCIA</td>
<td>as above</td>
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<tr>
<td>100</td>
<td>BRECCIA</td>
<td>as above</td>
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<tr>
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<td>Fine grained, brown, massive.</td>
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<td>98</td>
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<tr>
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<tr>
<td>94</td>
<td>BRECCIA</td>
<td>as above</td>
<td></td>
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<tr>
<td>93</td>
<td>BRECCIA</td>
<td>Fine grained, brown, massive.</td>
<td></td>
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<td>92</td>
<td>BRECCIA</td>
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<tr>
<td>91</td>
<td>BRECCIA</td>
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<td>89</td>
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<tr>
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<td>as above</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Engineering Log - Cored Borehole

**Client:** HORNBY SHIRE COUNCIL  
**Principal:** OLD MANS VALLEY  
**Project:**  
**Borehole Location:** E 305573.8 N 1270007.8  
**Drill Model and Mounting:** IDSON 3600 TRUCK  
**Barrel Type and Length:** NMRC 3.0  
**Borehole No.:** 44  
**Sheet 2 of 5**

### Drilling Information

<table>
<thead>
<tr>
<th>Method</th>
<th>Core-in</th>
<th>Water</th>
<th>SL</th>
<th>Drill</th>
<th>Depth</th>
<th>Substance Description</th>
<th>Core Spacing</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMHC</td>
<td>96</td>
<td></td>
<td>9</td>
<td></td>
<td></td>
<td>BRECCIA; medium to coarse grained, brown, with light brown, grain, massive.</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>96</td>
<td></td>
<td>10</td>
<td></td>
<td></td>
<td>BRECCIA; fine grained, light grey, with dark grey, grains, massive.</td>
<td>MW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>93</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO CORE: 0.4m</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>92</td>
<td></td>
<td>12</td>
<td></td>
<td></td>
<td>BRECCIA; as above</td>
<td>MW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BRECCIA; fine grained, light grey, with dark grey, grains, massive.</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BRECCIA; as above</td>
<td>MW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BRECCIA; fine grained, light grey, with dark grey, grains, massive.</td>
<td>MW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>trace of calcite veins</td>
<td>FR</td>
<td></td>
</tr>
</tbody>
</table>

### General Defect Description

- **Fittings of 8-20deg. PL-I**

### Method

- AS: auger screwing  
- AD: auger drilling  
- R: roller/slide  
- W: washbar  
- NMHC: core drilling  
- N: HQ: core drilling  
- C: casing used  
- B: barrel withdrawn

### Water Level

- Water level
- Water inflow
- Water level not measured

### Point Load Test

- D: diametral  
- A: axial

### Weathering

- IR: intact  
- SW: slightly  
- MW: moderately  
- HW: highly  
- SW: extremely

### Strength

- PL: extremely low  
- VI: very low  
- L: low  
- M: medium  
- H: high  
- VI: very high  
- EH: extremely high

### Defects

- JT: joint  
- PI: parting  
- SM: seam  
- CL: clay  
- RO: roach  
- DC: decomposed  
- PL: planar  
- R: irregular
### Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Man's Valley  
**Borehole Location:** E 30578.8 N 127009.4  
**Drill Model and Mounting:** EDSON 3030 Truck  
**Surface Bearing:** -90 Deg  
**Datum:** AHD 164.7 m  
**Logged by:** GJH  
**Checked by:** PLV

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Rock Substance Description</th>
<th>Rock Mass Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>Breccia, fine grained, light grey, with dark grey, massy.</td>
<td>100mm jointed zone 0 - 45deg IR RO Fe</td>
</tr>
<tr>
<td>45</td>
<td>Breccia, medium to coarse grained, light grey, to grey, massy.</td>
<td>120mm jointed zone 0 - 90deg IR RO Fe</td>
</tr>
<tr>
<td>45</td>
<td>Breccia, fine grained, light grey, massy.</td>
<td>120mm jointed folded zone Fe</td>
</tr>
<tr>
<td>45</td>
<td>Breccia, fine grained, light grey, massy.</td>
<td>150mm jointed zone IR RO Fe</td>
</tr>
<tr>
<td>45</td>
<td>Breccia, fine grained, light grey, massy.</td>
<td>150mm jointed folded zone Fe</td>
</tr>
<tr>
<td>45</td>
<td>Breccia, fine grained, light grey, massy.</td>
<td>180mm jointed zone RO Fe</td>
</tr>
<tr>
<td>45</td>
<td>Breccia, fine grained, light grey, massy.</td>
<td>180mm jointed folded zone Fe</td>
</tr>
<tr>
<td>45</td>
<td>Breccia, fine grained, light grey, massy.</td>
<td>180mm jointed folded zone Fe</td>
</tr>
<tr>
<td>45</td>
<td>Breccia, fine grained, light grey, massy.</td>
<td>180mm jointed folded zone Fe</td>
</tr>
</tbody>
</table>

### General Defect Description

- 100mm jointed zone 0 - 45deg IR RO Fe
- 120mm jointed zone 0 - 90deg IR RO Fe
- 120mm jointed folded zone Fe
- 150mm jointed zone IR RO Fe
- 150mm jointed folded zone Fe
- 180mm jointed zone RO Fe
- 180mm jointed folded zone Fe
- 180mm jointed folded zone Fe
- 180mm jointed folded zone Fe

### Method

- AS: auger screening  
- AD: auger drilling  
- D: core drilling  
- W: wash boring  
- M: core capping  
- C: core capping  
- NMLC: core capping  
- NMLC: core capping

### Water Level

- D: demeral  
- A: axial

### Weathering

- FR: fresh  
- VL: very low  
- L: low  
- M: medium  
- H: high  
- VH: very high

### Strength

- EL: extremely low  
- SM: soft  
- CL: clay  
- RO: rough  
- DC: decomposed  
- PL: planar  
- IR: irregular  

### Defects

- J1: joint  
- P1: pitting  
- SM: seam  
- CL: clay  
- RO: rough  
- DC: decomposed  
- PL: planar  
- IR: irregular
### Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 305957.6 M 1229032.5

**Drill Model and Method:** ESDON 3000 TRUCK  
**Barrel Type and Weight:** NMLC 3.0

#### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Rock Substance</th>
<th>Subsidence Description</th>
<th>Rock Mass Defects</th>
<th>Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>BRECCIA</td>
<td>medium to coarse grained, light grey, to grey, massive,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>BRECCIA</td>
<td>line grained,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>BRECCIA</td>
<td>medium to coarse grained, light grey, to grey, massive,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>BRECCIA</td>
<td>line grained, grey,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>BRECCIA</td>
<td>medium to coarse grained, light grey, to grey, massive,</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**General Defect Description:**  
Findings at 6-26m, PL-R

---

**METHOD:**  
AS - Auger sampling  
AD - Auger drilling  
R - Core/Incision  
W - Wash bore  
NMCL - Core Dulling  
NGMH - Core Drilling  
Coring Used  
Boreset Withdrawn

**DRAWING:**  
Water level  
Water Inflow

**POINT LOAD TEST:**  
D - Diameter  
A - Axial

**WEATHERING:**  
FR - Fresh  
SW - Slightly

**STRENGTH:**  
EL - Extremely Low  
VL - Very Low  
L - Low  
M - Medium  
H - High  
VH - Very High  
EH - Extremely High

**DEFECTS:**  
JT - Joint  
PL - Piling  
SM - Seam  
CL - Clay  
RO - Rough  
DC - Decomposed  
PL - Plane  
IR - Irregular
# Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council

**Project:** Old Mans Valley

**Borehole Location:** E 308573.5, N 1279075.5

**Date:** 12.12.86

**Logged by:** GJH

**Checked by:** PV

## Drilling Information

<table>
<thead>
<tr>
<th>Method</th>
<th>Core Site</th>
<th>D.L.</th>
<th>Depth</th>
<th>Graphic Log</th>
<th>Rock Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRM</td>
<td>72</td>
<td>33</td>
<td></td>
<td></td>
<td>Boorhole 44 Terminated at 32.35 m</td>
</tr>
<tr>
<td></td>
<td>71</td>
<td>34</td>
<td></td>
<td></td>
<td>18.4 m</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>35</td>
<td></td>
<td></td>
<td>15.5 m</td>
</tr>
<tr>
<td></td>
<td>69</td>
<td>36</td>
<td></td>
<td></td>
<td>12.6 m</td>
</tr>
<tr>
<td></td>
<td>68</td>
<td>37</td>
<td></td>
<td></td>
<td>9.7 m</td>
</tr>
<tr>
<td></td>
<td>67</td>
<td>38</td>
<td></td>
<td></td>
<td>6.8 m</td>
</tr>
<tr>
<td></td>
<td>66</td>
<td>39</td>
<td></td>
<td></td>
<td>3.9 m</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>40</td>
<td></td>
<td></td>
<td>1.0 m</td>
</tr>
</tbody>
</table>

**Substance Description:**
- Rock type: sandstone
- Grain characteristics: medium to coarse grained
- Colour: light grey
- Structure: massive
- Mineral components: flint, quartz

**Defect Description:**
- Type: interbedded clay and sand
- Indication: planar jointing
- Toughness: medium
- Thickness: 0.5 m

## Slip Log/Core Loss

**Weathering:**
- FR: fresh
- SW: slightly weathered
- MW: moderately weathered
- NVK: highly
- EW: extensively

**Strength:**
- H: extremely low
- VL: very low
- L: low
- MW: medium
- H: high

**Defects:**
- SF: joint
- PT: paring
- SM: seam
- CL: clay
- RO: rough
- DC: decomposed

**General Defect Description:**
- Thickening indicates planar jointing.
### Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 1085772 N 1270006.2

<table>
<thead>
<tr>
<th>Method</th>
<th>Support</th>
<th>Penetration</th>
<th>Notes, Samples, Test etc</th>
<th>Depth (m)</th>
<th>Material Details</th>
<th>Classification</th>
<th>Notes and Additional Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>C casing</td>
<td>M mud</td>
<td></td>
<td>102.3</td>
<td>Sandy Clay, medium plasticity, brown</td>
<td>SANDY CLAY</td>
<td>Residual</td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td></td>
<td></td>
<td>104.1</td>
<td>Breccia, extremely highly weathered, light brown</td>
<td>BRECCIA</td>
<td>Gradually breccia</td>
</tr>
</tbody>
</table>

Borehole 45 terminated at 105.0m

Parameter placed at 7.4m, 1m slotted, Bend at 5.5m (15cm of zand), Borehole of 4.29m (2.55m of Bentonite)

**Notes:**
- U30 undisturbed sample 50 mm diameter
- N standard penetration test
- SPT + sample recovered
- SPT with solid cone
- Vane shear

**Consistency/Density Index:**
- VS very soft
- S soft
- F firm
- S1 stiff
- VS1 very stiff
- H hard
- P0 plastic
- VL very loose
- L loose
- MD medium dense
- D dense
- VD very dense
### Engineering Log - Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mams Valley  
**Borehole Location:** E 3085516 N 1270026.6

**Drill Model and Mounting:** Edison 3000 Truck  
**W5:**  
**Method:** auger drilling

<table>
<thead>
<tr>
<th>Depth</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.93</td>
<td>C</td>
</tr>
<tr>
<td>1.01</td>
<td>USG</td>
</tr>
<tr>
<td>2.92</td>
<td>D</td>
</tr>
<tr>
<td>3.09</td>
<td>C</td>
</tr>
<tr>
<td>4.08</td>
<td>M</td>
</tr>
</tbody>
</table>

**Notes:**  
- **CL:** Fell Clay and Gravel  
- **SUCL:** Silty Clay: low to medium plasticity, red brown, some fine sand  
- **CL:** Sandy Clay: low to medium plasticity, mottled light brown & dark brown, some silt  
- **BRECCIA:** Highly weathered

**Consistency/Density Index:**
- VS: Very Soft  
- S: Soft  
- F: Firm  
- SI: Stiff  
- VSI: Very Stiff  
- H: Hard  
- Fa: Fissile  
- VL: Very Loose  
- L: Loose  
- MD: Medium Dense  
- D: Dense  
- VD: Very Dense

**Additional Observations:**
- Fell Residual  
- EW Breccia

**Classification Symbols and Soil Description:**
- Based on Unified classification system

**Moisture:**
- D: Dry  
- M: Moist  
- W: Wet  
- WP: Plastic limit

**Notes and Tests:**
- USO: Undisturbed sample 50 mm diameter
- D: Disturbed sample
- N*: SPT + Sample recovered
- NC: SPT with solid cone
- V: Vane shear
- P: Pressuremeter
- BS: Bulk sample
- R: Refusal

**Consistency/Density Index:**
- VS: Very Soft  
- S: Soft  
- F: Firm  
- SI: Stiff  
- VSI: Very Stiff  
- H: Hard  
- Fa: Fissile  
- VL: Very Loose  
- L: Loose  
- MD: Medium Dense  
- D: Dense  
- VD: Very Dense

**Notes:**
- Continued on Cored Borehole Sheet

**Additional Observations:**
- Fell Residual  
- EW Breccia

**Classification Symbols and Soil Description:**
- Based on Unified classification system

**Moisture:**
- D: Dry  
- M: Moist  
- W: Wet  
- WP: Plastic limit

**Notes and Tests:**
- USO: Undisturbed sample 50 mm diameter
- D: Disturbed sample
- N*: SPT + Sample recovered
- NC: SPT with solid cone
- V: Vane shear
- P: Pressuremeter
- BS: Bulk sample
- R: Refusal
### Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Principal:** Old Mans Valley  
**Project:**  
**Location:**  

**Drilling Information:**  
- **Drill Model and Mounting:** EDSON 2000 Truck  
- **Barrel Type and Length:** NMLC, 3.3m  
- **Fluid:** Water  
- **Logging:** JAF  
- **Checked By:** PLV  
- **Hole Number:**  
- **Hole Commencted:** 11.12.88  
- **Hole Completed:** 12.12.88  
- **Borehole:**  
- **Site:** -92 Deg  
- **R.L. Surface:** 93.5 m  
- **Depth:** 
  - 93  
  - 92  
  - 91  
  - 90  
  - 89  
  - 88  
  - 87  
  - 86  
  - 85  
  - 84  
  - 83  

### Rock Substance
- **Substance Description:**  
  - Rock Type: Grit Characteristics  
  - Colour, Structure, Minor Components  

### Rock Mass Defects
- **Defect Description:** Type, Inclination, Primarity, Roughness, Coating, Thickness  
- **General Description Below:**

<table>
<thead>
<tr>
<th>Method</th>
<th>Water Level</th>
<th>Water Inflow</th>
<th>Core Recovered</th>
<th>Weathing</th>
<th>Strength</th>
<th>Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS</td>
<td>D - diameter</td>
<td>A - axial</td>
<td>no measured</td>
<td>FR - fresh</td>
<td>EL - extremely low</td>
<td>JT - joint</td>
</tr>
<tr>
<td>AD</td>
<td>D - diameter</td>
<td>A - axial</td>
<td>not measured</td>
<td>SW - slightly</td>
<td>VL - very low</td>
<td>PT - parting</td>
</tr>
<tr>
<td>R</td>
<td>D - diameter</td>
<td>A - axial</td>
<td>partial loss</td>
<td>MW - moderately</td>
<td>L - low</td>
<td>SM - seam</td>
</tr>
<tr>
<td>W</td>
<td>D - diameter</td>
<td>A - axial</td>
<td>complete loss</td>
<td>HW - highly</td>
<td>M - medium</td>
<td>CL - clay</td>
</tr>
<tr>
<td>NMLC</td>
<td>D - diameter</td>
<td>A - axial</td>
<td>no core recovered</td>
<td>EH - extremely high</td>
<td>RH - rough</td>
<td>RO - rough</td>
</tr>
<tr>
<td>core drilling</td>
<td>D - diameter</td>
<td>A - axial</td>
<td>no measured</td>
<td>no core recovered</td>
<td>DC - decomposed</td>
<td>PL - planar</td>
</tr>
<tr>
<td>core drilling</td>
<td>D - diameter</td>
<td>A - axial</td>
<td>not measured</td>
<td>no core recovered</td>
<td>IR - irregular</td>
<td>I - irregular</td>
</tr>
<tr>
<td>casing used</td>
<td>D - diameter</td>
<td>A - axial</td>
<td>partial loss</td>
<td>no core recovered</td>
<td>no core recovered</td>
<td>no core recovered</td>
</tr>
<tr>
<td>barrel withdrawn</td>
<td>D - diameter</td>
<td>A - axial</td>
<td>complete loss</td>
<td>no core recovered</td>
<td>no core recovered</td>
<td>no core recovered</td>
</tr>
</tbody>
</table>

*General Defect Description: From 9.4 to 9.3m Joints / Partings are generally instanced to 30deg, with a trace of crushed infill.*
### Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Hole Number:** 55463/3  
**Date:** 11.12.99  
**Logged By:** JAF  
**Checked By:** PLL  
**Drill Model and Mounted:** EDSON 3000 Truck  
**Borehole Location:** E 308551.7 N 1270020.6  
**Slope:** -90 DEG  
**RL Surface:** 93.5 m  
**Barrel Type and Length:** NMCL 3.6m

<table>
<thead>
<tr>
<th>Method</th>
<th>Core barrel</th>
<th>Water</th>
<th>R.L.</th>
<th>Depth</th>
<th>Graph</th>
<th>Description</th>
<th>Weathering</th>
<th>Est. Strength</th>
<th>Point load test - f (MPa)</th>
<th>Defects Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMCL</td>
<td></td>
<td></td>
<td>17</td>
<td></td>
<td></td>
<td>BRECCIA: fine to coarse grained, matrix grey, light grey, indistinct bedding.</td>
<td>FR</td>
<td></td>
<td></td>
<td>17.65 - 18.15m jointed zone with numerous crushed SMs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17</td>
<td></td>
<td></td>
<td>BRECCIA: fine to coarse grained, matrix grey, light grey, indistinct bedding.</td>
<td>FR</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>17</td>
<td></td>
<td></td>
<td>BRECCIA: fine to coarse grained, matrix grey, light grey, indistinct bedding.</td>
<td>FR</td>
<td></td>
<td></td>
<td>17.65 - 18.15m jointed zone with numerous crushed SMs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17</td>
<td></td>
<td></td>
<td>BRECCIA: fine to coarse grained, matrix grey, light grey, indistinct bedding.</td>
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<td></td>
<td></td>
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<tr>
<td></td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>17</td>
<td></td>
<td></td>
<td>BRECCIA: fine to coarse grained, matrix grey, light grey, indistinct bedding.</td>
<td>FR</td>
<td></td>
<td></td>
<td>17.65 - 18.15m jointed zone with numerous crushed SMs</td>
</tr>
</tbody>
</table>

**General Defect Description:**

**Method:**
- AS: auger screwing  
- AD: auger drilling  
- R: roller/tricone  
- W: washbore  
- NMCL: core drilling  
- NQNO: core drilling  

**Point Load Test:**
- D: -diameter  
- A: -axis  
- GR: GRAPHIC LOG/CORE LOSS
  - Core recovered (hatching indicates material)
  - No core recovered

**Weathering:**
- FR: fresh  
- SW: slightly  
- MW: moderately  
- HW: highly

**Strength:**
- EL: extremely low  
- V: low  
- M: medium  
- H: high

**Defects:**
- J1: joint  
- P: parting  
- SM: seam  
- CL: clay  
- RO: root  
- DC: decomposed  
- PL: planar  
- IR: irregular
# Engineering Log - Cored Borehole

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Borehole Location:** E 39551.7 N 127022.6  
**Hole commenced:** 11.12.89  
**Hole completed:** 12.12.89  
**Logged by:** JAF  
**Checked by:** PLV

**Drill model and mounting:** EDSON 3000 TRUCK  
**Barrel type and length:** NMCL 3.0m  
**Fluid:** WATER  
**Slope:** -90 DEG  
**R.L. Surface:** 92.5 m

## Drilling Information

<table>
<thead>
<tr>
<th>Method</th>
<th>R.L.</th>
<th>Depth</th>
<th>Rock Substance</th>
<th>Description</th>
<th>Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMCL</td>
<td>69</td>
<td>25</td>
<td>Breccia</td>
<td>Fine to coarse grained, mottled light grey and light grey - green, indistinct bedding.</td>
<td>JT 90deg IR smooth clean</td>
</tr>
<tr>
<td></td>
<td>68</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>67</td>
<td>27</td>
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<td></td>
<td>62</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Borehole 46 Terminated at 27.90 m**  
Pipe metered 27.90 - 24.90m  
Sand to 24.30m, Bentonite plug to 24.15m, Cement grout to surface

### General Defect Description:

- **METHOD:**
  - AS: auger screwing
  - AD: auger drilling
  - R: roller/ticene
  - NMLC: core drilling
  - NMCL: core drilling
  - QHO: core drilling

- **POINT LOAD TEST:**
  - D: diametral
  - A: axial

- **WEATHERING:**
  - FR: fresh
  - SW: slightly wet
  - MW: moderately wet
  - HW: highly wet

- **STRENGTH:**
  - EL: extremely low
  - VL: very low
  - L: low
  - M: medium
  - H: high

- **DEFECTS:**
  - JF: joint
  - PI: pitting
  - SM: sound
  - CL: clay
  - RO: rough
  - DT: decomposed
  - IR: irregular

- **GRAPHIC LOG/CORE LOSS:**
  - Core recovered
  - Partial loss
  - Complete loss
  - No core recovered
### Engineering Log - Borehole

**Client:** Hornby Shire Council  
**Project:** Old Mains Valley  
**Borehole Location:** E 586551.2 N 1270618.1  
**Borehole Number:** 47  
**Hole Commenced:** 12.12.89  
**Hole Completed:** 12.12.89  
**Logged By:** JAF  
**Checked By:** PLY

#### Method

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.30</td>
<td>8.30</td>
<td>8.30</td>
<td>8.30</td>
</tr>
</tbody>
</table>

#### Notes

- EDSION 3000 Truck
- 100mm

#### Material

- **Soil Type:** Clay and gravel
- **Characteristics:** Low to medium plasticity, red brown, some fine sand

#### Structure and Additional Observations

- **Fill:** Clay and gravel
- **Residual:** EW Breccia
- **Highly weathered BRECCIA:**

---

**Borehole 47 Terminated at 8.30m**

**Penetrometer readings:** 5.0m from 8.30m - 2.0m. Borehole plug and grout.

---

**METHOD**

- AS: Auger screwing
- AD: Auger drilling
- R: Roll/lincrete
- W: Wearable
- C1: Cable tool
- H: Hand auger
- D1: Dibble
- B: Blank bit
- V: Y bit
- T: TC bit
- G: ADT

**SUPPORT**

- C: Casing
- M: Mud

**NOTES**

- **Samples and Tests:** Undisturbed sample 50 mm diameter
- **Disturbed Sample:**
- **Standard Penetration Test:**
- **SPT + Sample recovered:**
- **SPT with solid cone:**
- **Vane shear:**
- **Pressuremeter:**
- **Bulk Sample:**
- **Refusal:**

**CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION**

- **Based on unified classification system**

**MOISTURE**

- **D:** Dry
- **M:** Moist
- **W:** Wet

**CONSISTENCY/DENSITY INDEX**

- **VS:** Very soft
- **S:** Soft
- **F:** Firm
- **SL:** Stiff
- **VS:** Very stiff
- **H:** Hard
- **Fb:** Failable
- **VL:** Very loose
- **L:** Loose
- **MD:** Medium dense
- **D:** Dense
- **VD:** Very dense
### LIST OF EXCAVATIONS

<table>
<thead>
<tr>
<th>TEST PIT NO.</th>
<th>CO-ORDINATES</th>
<th>SURFACE RL(m)</th>
<th>DEPTH (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP9</td>
<td>308560</td>
<td>1269874</td>
<td>111.0</td>
</tr>
<tr>
<td>TP10</td>
<td>308544.5</td>
<td>1269921</td>
<td>102.5</td>
</tr>
<tr>
<td>TP11</td>
<td>308544.5</td>
<td>1269919.5</td>
<td>102.0</td>
</tr>
</tbody>
</table>
Engineering Log - Excavation

Client: Hornsey Shire Council

Project: Old Man's Valley

Pit Location: E308444.5 N 126V921

Equipment Type and Model: Backhoe

Excavation Dimensions: 4.0 m long, 10 m wide

Material:
- Sand/clay: high plasticity, mottled light brown grey
- Clay decreasing with depth
- Subrounded to angular fragments to bkm
- Breccia: highly weathered

Pit TP10 Terminated at 2.26 m

Penetration:
- No penetration

Water:
- None encountered
- Water level:
  - Water inflow
  - Water outflow

Notes and Tests:
- U50 undisturbed sample 50 mm diameter
- D disturbed sample
- N standard penetration test
- N* SPT + sample recovered
- Nc SPT with solid cone
- V vane shear
- P pressuremeter
- Ba bulk sample
- R refusal

Classification and Soil Description:
- Based on unified classification system

Moisture:
- D dry
- M moist
- W wet
- Wp plastic limit

Consistency/Density Index:
- VS very soft
- S soft
- F firm
- St stiff
- VS1 very stiff
- H hard
- Fb friable
- VL very loose
- L loose
- MD medium dense
- D dense
- VD very dense

Datum: AHD 102.5 m
### Engineering Log - Excavation

**Client:** Hornsby Shire Council  
**Project:** Old Mans Valley  
**Pit Location:** E 3086415.5  
**Log No:** 584653  
**Sheet:** 1 of 1  
**Pit No:** TP11

**Equipment Type and Make:** CASE 530 Backhoe

<table>
<thead>
<tr>
<th>Notes</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support</td>
<td>Water</td>
</tr>
<tr>
<td>Water</td>
<td>Water</td>
</tr>
</tbody>
</table>

**Excavation Dimensions:** 4.0 m long  
**5.0 m wide**  
**R.L. Surface:** 102.0 m

**Material:**  
- Soil type and plasticity or particle characteristics  
- Colour, secondary and minor components  
- Moisture condition  
- Consistency/density index

**Topsoil:** Silty Sand, fine to medium grained, brown, becoming clayey

**Sandy clay:** Yellow brown, sand & gravel, fine to coarse grained

**Breccia:** fine to coarse grained, brown, with corestones up to 300mm

**Breccia:** fine to coarse grained, brown

**Notations:**  
- PAT 511 Terminated at 1.90 m

**Classification Symbols and Soil Description:**

- Based on unified classification system

**Moisture:**  
- D: Dry  
- M: Moist  
- W: Wet  
- Wp: Plastic limit

**Consistency/Density Index:**  
- VS: Very soft  
- S: Soft  
- SI: Stiff  
- VSI: Very stiff  
- H: Hard  
- Fd: Fragile  
- VL: Very loose  
- L: Loose  
- MD: Medium dense  
- D: Dense  
- VD: Very dense
APPENDIX B

BOREHOLE PIEZOMETRIC LEVELS
NOTE 1) RAINFALL READINGS ARE FOR WAHROONGA, FROM THE BULLETIN OF DAILY METROPOLITAN RAINFALL PREPARED BY THE BUREAU OF METEOROLOGY.
2) ALL RAINFALL ARE BASED ON TELEGRAPHIC REPORTS
3) RAINFALLS ARE FOR THE 24 HOURS ENDED 9 A.M. ON THE DATE SHOWN.
PIEZOMETRIC LEVELS VERSUS TIME

R.L. DEPTH
(m) (m)
130.7 0
129.2 2.5
125.7 5.0
123.2 7.5

Approx. DECEMBER 1989 JANUARY 1990 FEBRUARY 1990 MARCH 1990
R.L. DEPTH (m) (m)
115.0 0
112.5 2.5
110.0 5.0
107.5 7.5

x-x BH 13 SLOTTED FROM 2.15m TO 3.0m

Dry Dry Dry

Dotted line: BH 17 SLOTTED FROM 1.50m TO 2.00m

Thin line: BH 16 SLOTTED FROM 7.80m TO 8.80m

Dry Dry
PIEZOMETRIC LEVELS VERSUS TIME

Approx.
R.L. DEPTH
(m) (m)
123.0- 7.5
120.5- 10.0
118.0- 12.5
115.5- 15.0

Approx.
R.L. DEPTH
(m) (m)
128.0- 2.5
125.5- 5.0
123.0- 7.5
120.5- 10.0

DECEMBER 1989  JANUARY 1990  FEBRUARY 1990  MARCH 1990

X——X BH II SLOTTED FROM 14-70m TO 20-70m
○—○ BH 19 SLOTTED FROM 9-20m TO 11-20m

Dry Dry Dry Dry

Δ——Δ BH 12 SLOTTED FROM 6-00m TO 6-50m
+——+ BH 20 SLOTTED FROM 4-60m TO 6-60m

DECEMBER 1989  JANUARY 1990  FEBRUARY 1990  MARCH 1990
PIEZOMETRIC LEVELS VERSUS TIME

- - - BH 27 SLOTTED FROM 4.40m TO 6.90m

BH 30 SLOTTED FROM 12.80m TO 13.80m

BH 31 SLOTTED FROM 5.40m TO 6.40m

R.L. DEPTH
(m) (m)

December 1989 | January 1990 | February 1990
PIEZOMETRIC LEVELS VERSUS TIME

Approx.
R.L. DEPTH
(m) (m)

113.5 0

111.0 2.5

108.5 5.0

106.0 7.5

DECEMBER 1989   JANUARY 1990   FEBRUARY 1990   MARCH 1990

BH 36 SLOTTED FROM 4.05m TO 5.05m
BH 22 SLOTTED FROM 1.50m TO 2.0m

Dry Dry Dry Dry

Dry Dry Dry

Dry Dry

BH 21 SLOTTED FROM 32.2m TO 35.2m
BH 29 SLOTTED FROM 37.5m TO 42.5m

Dry Dry

Dry Dry

Dry Dry

PIEZOMETRIC LEVELS VERSUS TIME

R.L. DEPTH (m) (m)
112.9 0
110.4 2.5
107.9 5.0
105.4 7.5

DECEMBER 1989 JANUARY 1990 FEBRUARY 1990 MARCH 1990

BH 35 SLOTTED FROM 3.20m TO 4.20m

R.L. DEPTH (m) (m)
105.3 7.5
102.8 10.0
100.3 12.50
97.8 15.0

DECEMBER 1989 JANUARY 1990 FEBRUARY 1990 MARCH 1990

BH 37 SLOTTED FROM 15:60 TO 17:10
BH 38 SLOTTED FROM 8:90 TO 9:90
PIEZOMETRIC LEVELS VERSUS TIME

Approx.
R.L. DEPTH
(m) (m)
111.0 2.5
108.5 5.0
106.0 7.5
103.5 10.0

DECEMBER 1989 JANUARY 1990 FEBRUARY 1990

BH 23 SLOTTED FROM 7.60m TO 9.10m
BH 28 SLOTTED FROM 4.50m TO 7.0m

Dry Dry Dry Dry

BH 26 SLOTTED FROM 4.90m TO 5.90m

Dry Dry Dry Dry

DECEMBER 1989 JANUARY 1990 FEBRUARY 1990
PIEZOMETRIC LEVELS VERSUS TIME

Approx.
R.L. DEPTH
(m) (m)
105.0 0
102.5 2.5
100.0 5.0
97.5 7.5

DECEMBER 1989 JANUARY 1990 FEBRUARY 1990 MARCH 1990

R.L. DEPTH
(m) (m)
102.5 0
100.0 2.5
97.5 5.0
95.0 7.5

- - - - BH 34 SLOTTED FROM 1.55m TO 2.05m
- - - - BH 33 SLOTTED FROM 1.55m TO 2.05m
- - - - BH 32 SLOTTED FROM 6.05m TO 7.05m
- - - - BH 45 SLOTTED FROM 6.40m TO 7.40m

Dry Dry Dry Dry Dry Dry Dry Dry

DECEMBER 1989 JANUARY 1990 FEBRUARY 1990 MARCH 1990
PIEZOMETRIC LEVELS VERSUS TIME

R.L. DEPTH
(m) (m)
97.5 0
95 2.5
92.5 5.0
90 7.5

Dry Dry Dry Dry Dry Dry Dry Dry Dry
Dry Dry Dry Dry

Approx. DECEMBER 1989 JANUARY 1990 FEBRUARY 1990 MARCH 1990

R.L. DEPTH
(m) (m)
70 25
87.5 27.5
85 30
82.5 32.5

DECEMBER 1989 JANUARY 1990 FEBRUARY 1990 MARCH 1990

□□□ BH 40 SLOTTED FROM 1.80m TO 2.80m
★★★ BH 39 SLOTTED FROM 3.60m TO 4.10m

▼▼▼ BH 41 SLOTTED FROM 30.00m TO 33.00mm
PIEZOMETRIC LEVELS VERSUS TIME

R.L. DEPTH
(m) (m)
950 0
925 2.5
900 5.0
875 7.5

DECEMBER 1989  JANUARY 1990  FEBRUARY 1990  MARCH 1990

R.L. DEPTH
(m) (m)
797 25.0
772 27.5
747 30.0
727 32.5

x---x BH 42 SLOTTED FROM 2.70m TO 3.20m

o---o BH 44 SLOTTED FROM 26.95m TO 31.95m
PIEZOMETRIC LEVELS VERSUS TIME

R.L. DEPTH
(m) (m)

810 12.5

785 15.0

760 17.5

735 20.0

DECEMBER 1989 JANUARY 1990 FEBRUARY 1990 MARCH 1990

x--x  BH 46 SLOTTED FROM 24.90m TO 27.90m

BH 47 SLOTTED FROM 2.00m TO 3.5m

Dry Dry Dry Dry

DECEMBER 1989 JANUARY 1990 FEBRUARY 1990 MARCH 1990
PIEZOMETRIC LEVELS VERSUS TIME

R.L. DEPTH
(m) (m)
79.8 50.0
77.3 52.5
74.8 55.0
72.3 57.5

x—x BH 18 SLOTTED FROM 60.00m TO 63.00m

x—x—x—x—x—x—x—50m—-----

DECEMBER 1989 | JANUARY 1990 | FEBRUARY 1990 | MARCH 1990
APPENDIX C

LABORATORY TEST RESULTS

BOREHOLE DATA
triangular shear test

CLIENT: HORNSBY SHIRE COUNCIL
PROJECT: OLD MAN'S VALLEY
LOCATION: HORNSBY

LABORATORY: SYDNEY
JOB NO: 58463/3
TESTED BY: GC
DATE: 13/02/00
TEST FILE #: 117

BOREHOLE: BH 16
DEPTH: 0.80 -
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO: 1.15

MATERIAL CLASSIFICATION:
(CH) Sandy CLAY - high plasticity, yellow brown, fine to coarse sand.

---

Graph showing shear stress vs. normal stress.

TYPE OF TEST: CONSOLIDATED UNDRAINED WITHORE PRESSURE MEASUREMENT

ANGLE OF FRICTION \(\phi'\): 29 deg.
MOISTURE CONTENTS

COHESION \(c'\): 75 kPa
INITIAL: 35.7%

WET DENSITY: 1.800 t/m³
FINAL - TOP: 35.1%
MIDDLE: 35.6%
BOTTOM: 35.4%

BACK PRESSURE: 200,000 kPa

STRAIN RATE: 0.004 XMin

DATA FROM TEST FILE No.s: 117 125 138

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triangular shear test

CLIENT: HORNSBY SHIRE COUNCIL
PRINCIPAL:
PROJECT: OLD MAN'S VALLEY
LOCATION: HORNSBY

BOREHOLE: 9H 16
DEPTH:
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO

MATERIAL CLASSIFICATION: (CH) Sandy CLAY - high plasticity, yellow brown, fine to coarse sand.

TYPE OF TEST: CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

ANGLE OF FRICTION (C') = 29 deg.
MOISTURE CONTENTS
COHESION (C' = 25 kPa
WET DENSITY: 1.800 t/m3
BACK PRESSURE: 200,000 kPa
STRAIN RATE: 8.004 X Min

DATA FROM TEST FILE NO.s: 117 126 138

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Authorised Signature
triangular shear test

CLIENT: HORNSBY SHIRE COUNCIL
JOB NO: SS483/3
PRINCIPAL:
PROJECT: OLD MAN'S VALLEY
LOCATION: HORNSBY
TESTED BY: GC
DATE: 13/02/00
TEST FILE #: 117

BOREHOLE: BH 16
DEPTH: 0.80 -
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO: 1.15

MATERIAL CLASSIFICATION: (CH) Sandy CLAY - high plasticity, yellow brown, fine to coarse sand.

P=(\sigma_1+\sigma_3)/2 (kPa)

Q=(\sigma_1-\sigma_3)/2 (kPa)

0 100 200 300 400 500 600 700

0 100 200 300 400 500 600

TYPE OF TEST: CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

ANGLE OF FRICTION (\phi): 29 deg.
MOISTURE CONTENTS

COHESION (c'): 25 kPa
INITIAL: 35.7 %

WET DENSITY: 1.800 t/m³
FINAL = TOP: 35.5 %

BACK PRESSURE: 200,000 kPa
MIDDLE: 35.6 %

STRAIN RATE: 0.004 XM/min
BOTTOM: 36.4 %

DATA FROM TEST FILE No. #: 117 126 138

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triaxial shear test

CLIENT: HORNSBY SHIRE COUNCIL
PRINCIPAL: TESTED BY: GC
PROJECT: OLD MAN’S VALLEY DATE: 28/02/80
LOCATION: HORNSBY TEST FILE #: 120

BOREHOLE: BH 26 DEPTH: 0.70 - 1.00
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO

MATERIAL CLASSIFICATION: (CH) CLAY - high plasticity, red yellow brown, some fine to coarse sand.

---

**Graph**

- **Type of Test:** Consolidated Undrained with Pore Pressure Measurement
- **Angle of Friction \( (\phi') \):** 29 deg.
- **Cohesion \( (c') \):** 11.5 kPa
- **Wet Density:** 1.830 t/m³
- **Back Pressure:** 200.000 kPa
- **Strain Rate:** 0.007 %/min

**Moisture Contents**
- **Initial:** 40.0 %
- **Final - Top:** 38.4 %
- **Final - Middle:** 37.4 %
- **Final - Bottom:** 39.1 %

**Data from Test File No.s:** 120 131 142

---

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Authorized Signature
**Triaxial Shear Test**

**Laboratory:** Sydney

**Client:** Hornsby Shire Council

**Job No.:** S8463/3

**Principal:** GC

**Project:** Old Man's Valley

**Location:** Hornsby

**Date:** 28/02/00

**Test File No.:** 120

**Borehole:** BH 20

**Depth:** 0.70 -

**Failure Criteria:** Peak Principal Stress Ratio

**Material Classification:** (CH) Clay - high plasticity, red yellow brown, some fine to coarse sand.

---

**Graph:**

- The graph shows the relationship between effective stress ratio ($\sigma_1 - \sigma_3$) and the effective mean stress ($\sigma_{avg}$).

**Type of Test:** Consolidated Undrained with Pore Pressure Measurement

**Angle of Friction ($\phi'$):** 29° deg.

**Cohesion ($C'$):** 11.6 kPa

**Wet Density:** 1.830 t/m³

**Back Pressure:** 200,000 kPa

**Strain Rate:** 0.007 x Min

**Moisture Contents:**
- Initial: 40.0%
- Top: 38.4%
- Middle: 37.8%
- Bottom: 39.1%

**Data from Test File No.:** 120 131 142

---

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Authorised Signature
triangular shear test

CLIENT : HORMSBY SHIRE COUNCIL
PRINCIPAL : 
PROJECT : OLD MAN'S VALLEY
LOCATION : HORMSBY

LABORATORY : SYDNEY
JOB NO : S8483/3
TESTED BY : GC
DATE : 29/02/00
TEST FILE #: 120

BOREHOLE : BH 26
DEPTH : 0.70 - 1.00

FAILURE CRITERIA : PEAK PRINCIPAL STRESS RATIO

MATERIAL CLASSIFICATION : (CH) CLAY - high plasticity, red yellow brown, some fine to coarse sand.

---

Type of Test : CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

Angle of Friction (Ø') : 29°

Cohesion (c') : 67.3 KPa

Wet Density : 1.838 k/m³

Back Pressure : 200.000 kPa

Strain Rate : 0.007 X Min

Moisture Contents

Initial : 40.0 %

Final - Top : 38.2 %

Final - Middle : 37.6 %

Final - Bottom : 39.1 %

Data from Test File No.s : 120 131 142

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Authorised Signature
## Triaxial Shear Test

**Laboratory: Sydney**

<table>
<thead>
<tr>
<th><strong>Client</strong></th>
<th>Hornsby Shire Council</th>
<th><strong>Job No</strong></th>
<th>38463/3</th>
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<tbody>
<tr>
<td><strong>Principal</strong></td>
<td></td>
<td><strong>Tested By</strong></td>
<td>GC</td>
</tr>
<tr>
<td><strong>Project</strong></td>
<td>Old Man's Valley</td>
<td><strong>Date</strong></td>
<td>27/02/90</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Hornsby</td>
<td><strong>Test File</strong></td>
<td>138</td>
</tr>
<tr>
<td><strong>Borehole</strong></td>
<td>BH 33</td>
<td><strong>Depth</strong></td>
<td>0.70 m</td>
</tr>
<tr>
<td><strong>Failure Criteria:</strong> Peak Principal Stress Ratio</td>
<td>0.95</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Material Classification:**

(CH) Clay - high plasticity, mottled yellow red grey brown, some fine to coarse sand.

---

### Graph

**Type of Test:** Consolidated Undrained with Pore Pressure Measurement

- **Angle of Friction (\(\phi\')):** 20°
- **Cohesion (\(c\')):** 21 kPa
- **Wet Density:** 1.748 t/m³
- **Back Pressure:** 200,000 kPa
- **Strain Rate:** 0.005 \(\times\) Min

**Moisture Contents:**
- Initial: 30.5\%±
- Final - Top: 37\%±
- Final - Middle: 34\%±
- Final - Bottom: 33\%±

**Data from Test File No.:** 138 154 168

---

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Authorised Signature
triaxial shear test

LABORATORY : SYDNEY

CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL : 
PROJECT : OLD MAN’S VALLEY
LOCATION : HORNSBY

JOB NO : S0463/3
TESTED BY : GC
DATE : 27/02/00
TEST FILE #: 136

BOREHOLE: BH 33
DEPTH : 0.70 -
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO : 0.85

MATERIAL CLASSIFICATION : (CH) CLAY - high plasticity, mottled yellow red grey brown, some fine to coarse sand.

---

P = (σ1 + σ3)/2 (kPa)
Q = (σ1 - σ3)/2 (kPa)

TYPE OF TEST : CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

ANGLE OF FRICTION (φ') : 20 deg.
COHESION (C') : 21 KPa
WET DENSITY : 1.740 t/m3
BACK PRESSURE : 200.000 kPa
STRAIN RATE : 0.006 %/min

MOISTURE CONTENTS
INITIAL : 30.5 %
TOP : 37.5 %
MIDDLE : 34.1 %
BOTTOM : 33.4 %

DATA FROM TEST FILE No. : 136 154 160

---

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Authorised Signature
# Triaxial Shear Test

**Client:** Hornsby Shire Council  
**Project:** Old Man's Valley  
**Location:** Hornsby

**Material Classification:** (CH) Clay - high plasticity, mottled yellow red grey brown, some fine to coarse sand.

**Laboratory:** Sydney

<table>
<thead>
<tr>
<th>Borehole: BH 33</th>
<th>Depth:</th>
<th>0.70 -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure Criteria: Peak Principal Stress Ratio</td>
<td>0.95</td>
<td></td>
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</table>

**Test File No.:** 136

**Job No.:** 58483/3

**Tested By:** GC

**Date:** 27/02/00

<table>
<thead>
<tr>
<th>Type of Test</th>
<th>Consolidated Undrained with Pore Pressure Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle of Friction ($\phi'$):</td>
<td>20 deg.</td>
</tr>
<tr>
<td>Cohesion ($c'$):</td>
<td>21 kPa</td>
</tr>
<tr>
<td>Wet Density:</td>
<td>1.748 t/m$^3$</td>
</tr>
<tr>
<td>Back Pressure:</td>
<td>200,000 kPa</td>
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<tr>
<td>Strain Rate:</td>
<td>0.005 %/min</td>
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</tbody>
</table>

**Moisture Contents:**
- Initial: 39.5%
- Top: 37.3%
- Middle: 36.1%
- Bottom: 33.4%

**Data from Test File No.:** 136 154 160

---

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Authorized Signature
triangular shear test

CLIENT: HORNSESBY SHIRE COUNCIL
PRINCIPAL: 
PROJECT: OLD MAN'S VALLEY
LOCATION: HORNSESBY

LABORATORY: SYDNEY
JOB NO: 58463/3
TESTED BY: GC
DATE: 01/05/90
TEST FILE #: 206

BOREHOLE: BH 41
DEPTH: 2.30
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO: 2.00

MATERIAL CLASSIFICATION: (CL) Sandy CLAY - medium plasticity, grey mottled yellow brown, fine to coarse sand.

---

TYPE OF TEST: CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

ANGLE OF FRICTION (Φ') : 28 deg.
COHESION (c') : 10 KPa
WET DENSITY : 2.028 t/m³
BACK PRESSURE : 200,000 kPa
STRAIN RATE : 0.000 XMin

MOISTURE CONTENTS
INITIAL : 19.1 %
FINAL - TOP : 16.0 %
FINAL - MIDDLE : 16.8 %
FINAL - BOTTOM : 16.7 %

DATA FROM TEST FILE No.s: 206 238 251

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---

1.1
### Triaxial Shear Test

**Laboratory:** Sydney

<table>
<thead>
<tr>
<th>Client</th>
<th>Job No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hornsby Shire Council</td>
<td>S8463/3</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Principal</th>
<th>Project</th>
<th>Location</th>
<th>Date</th>
<th>Test File</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Old Man's Valley</td>
<td>Hornsby</td>
<td>01/05/99</td>
<td>206</td>
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<table>
<thead>
<tr>
<th>Borehole</th>
<th>Depth</th>
</tr>
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<tbody>
<tr>
<td>BH 41</td>
<td>2.30 -</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Failure Criteria</th>
<th>Peak Principal Stress Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.00</td>
</tr>
</tbody>
</table>

**Material Classification:** (CL) Sandy Clay - medium plasticity, grey mottled yellow brown, fine to coarse sand

---

![Graph showing triaxial test results](image)

**Type of Test:** Consolidated Undrained with Pore Pressure Measurement

**Angle of Friction (\(\phi'\)):** 28°

**Cohesion (\(c'\)):** 10 kPa

**Wet Density:** 2.020 t/m³

**Back Pressure:** 200.00 kPa

**Strain Rate:** 0.000 \(\%\)/min

**Moisture Contents:**
- Initial: 19.1 %
- Final - Top: 16.0 %
- Final - Middle: 16.8 %
- Final - Bottom: 16.7 %

**Data from Test File No.:** 208 236 251

---

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Authorized Signature
triangular shear test

LABORATORY: SYDNEY

CLIENT: HORNESBY SHIRE COUNCIL
JOB NO: SS463/3
PRINCIPAL: GC
PROJECT: OLD MAN'S VALLEY
DATE: 01/05/00
LOCATION: HORNESBY
TEST FILE #: 208

BOREHOLE: BH 41
DEPTH: 2.30 -

FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO

MATERIAL CLASSIFICATION: CGL Sandy CLAY - medium plasticity, grey mottled yellow brown, fine to coarse sand

---

Type of Test: CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

Angle of Friction (C') = 28 deg.
Cohesion (C) = 10 kPa
Wet Density = 2.028 t/m3
Back Pressure = 200,000 kPa
Strain Rate = 8,000 mm/min

Moisture Contents

INITIAL: 19.1%
TOP: 16.9%
MIDDLE: 16.8%
BOTTOM: 16.7%

DATA FROM TEST FILE No.: 206 238 251

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Authorized Signature
triangular shear test

CLIENT: HORNBY SHIRE COUNCIL
PRINCIPAL:
PROJECT: OLD MANS VALLEY
LOCATION: HORNBY

LABORATORY: SYDNEY
JOB NO: S8463/3
TESTED BY: JR
DATE: 24/03/89
TEST FILE #: 176

BOREHOLE: BH 45
DEPTH: 0.80 - 1.15

FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO

MATERIAL CLASSIFICATION: (CH) Sandy CLAY - high plasticity, yellow red brown, fine to coarse sand, some fine gravel, (EH) BRECCIA

---

**Type of Test:** CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

**Angle of Friction** ($\phi'$): 34.5 deg.
**SHEAR STRESSES (kPa):**
- 1200
- 1000
- 800
- 600
- 400
- 200

**Normal Stress (kPa):**
- 0
- 200
- 400
- 600
- 800
- 1000
- 1200
- 1400
- 1600

**Cohesion** ($c'$): 30.2 kPa
**MOISTURE CONTENTS**
- INITIAL: 27.1%

**Wet Density:** 1.888 t/m³
**FINAL - TOP:** 32.2%
**FINAL - MIDDLE:** 30.8%
**FINAL - BOTTOM:** 30.3%

**BACK PRESSURE:** 200,000 kPa
**STRAIN RATE:** 0.006 %/min

DATA FROM TEST FILE No.s: 176 181 186

---

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triaxial shear test

CLIENT: HORNSBY SHIRE COUNCIL
JOB NO: 58463/3
PRINCIPAL:
PROJECT: OLD MANS VALLEY
LOCATION: HORNSBY
TESTED BY: JR
DATE: 24/03/98
TEST FILE #: 176

BOREHOLE: 9H 45
DEPTH: 0.80 -
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO: 1.15

MATERIAL CLASSIFICATION: (CH) Sandy CLAY - high plasticity, yellow red brown, fine to coarse sand, some fine gravel. (EM) BRECCIA

--- GRAPHIC DIAGRAM ---

P = (σ₁ + σ₀)/2 (kPa)
Q = (σ₁ - σ₀)/2 (kPa)

TYPE OF TEST: CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

ANGLE OF FRICTION (φ' ) = 34.5 deg
MOISTURE CONTENTS
INITIAL = 27.1

COHESION (C') = 13.5 kPa
FINAL - TOP = 32.2

WET DENSITY = 1.888 t/m³
MIDDLE = 32.2

BACK PRESSURE = 200,000 kPa
BOTTOM = 30.0

STRAIN RATE = 0.008 XMin

DATA FROM TEST FILE No.'s: 176 191 190

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Authorised Signature
triaxial shear test

CLIENT: HORNSBY SHIRE COUNCIL
PROJECT: OLD MANS VALLEY
LOCATION: HORNSBY

BOREHOLE: BH 45
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO

MATERIAL CLASSIFICATION: (CH) Sandy CLAY: high plasticity, yellow red brown, fine to coarse sand, some fine gravel. (CH) BRECCIA

LAbORATORY: SYDNEY
JOB NO: 58463/3
TESTED BY: JR
DATE: 24/03/80
TEST FILE #: 176

DEPTH: 0.80 - 1.15

Type of Test: CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

Angle of Friction (φ' ): 34.5 deg.
Cohesion (c' ): 13.3 kPa
Wet Density: 1.88 g/cm³
Back Pressure: 200,000 kPa
Strain Rate: 0.008 kN/min

Initial Moisture Contents: 22.1 %
Final - Top: 32.2 %
Final - Middle: 30.8 %
Final - Bottom: 30.9 %

Data from Test File No.: 176 191 198

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triaxial shear test

LABORATORY : SYDNEY

CLIENT : HORNSBY SHIRE COUNCIL
JOB NO : 9846S/3
PRINCIPAL : TESTED BY : JR
PROJECT : OLD MANS VALLEY DATE : 23/03/98
LOCATION : HORNSBY TEST FILE #: 174

BOREHOLE: BH48 DEPTH : 2.40 -
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO : 2.70

MATERIAL CLASSIFICATION : CCHD Sandy CLAY - high plasticity, mottled yellow red grey brown, fine to coarse sand, some fine gravel.

![Triaxial Test Diagram](image)

**TYPE OF TEST** : CONSOLIDATED UNDRAINED WITH POORE PRESSURE MEASUREMENT

**ANGLE OF FRICTION (Ø')** : 33.5. deg. **MOISTURE CONTENTS** :

**COHESION (C')** : 0.0 KPa **INITIAL** :

**WET DENSITY** : 1.870 t/m3 **FINAL - TOP** :

**BACK PRESSURE** : 200,000 kPa **MIDDLE** :

**STRAIN RATE** : 0.006 %/min **BOTTOM** :

**DATA FROM TEST FILE No.s** : 174 184 189

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(Authorised Signature)
# Triaxial Shear Test

**Client:** Hornsby Shire Council  
**Job No.:** 56463/3  
**Tested By:** JR  
**Date:** 23/03/90  
**Test File:** 174

**Borehole:** BH46  
**Depth:** 2.40  
**Peak Principal Stress Ratio:** 2.70

**Material Classification:** (CH) Sandy Clay—high plasticity, silted yellow red, grey brown, fine to coarse sand, some fine gravel.

<table>
<thead>
<tr>
<th><strong>P = (σ1 + σ3) / 2 (kPa)</strong></th>
<th><strong>Q = (σ1 - σ3) / 2 (kPa)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>300</td>
<td>400</td>
</tr>
<tr>
<td>500</td>
<td>600</td>
</tr>
<tr>
<td>700</td>
<td>800</td>
</tr>
</tbody>
</table>

**Type of Test:** Consolidated Undrained with Pore Pressure Measurement

- **Angle of Friction (ϕ'):** 33.5°  
- **Cohesion (c'):** 0 KPa
- **Wet Density:** 1.870 t/m3
- **Back Pressure:** 200,000 kPa
- **Strain Rate:** 0.006 %/min

**Moisture Contents:**
- **Initial:** 23.3 %
- **Final - Top:** 24.7 %
- **Middle:** 26.5 %
- **Bottom:** 28.8 %

**Data from Test File No.:** 174 184 189

---

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Authorized Signature
triangular shear test

LABORATORY: SYDNEY

CLIENT: HORNBY SHIRE COUNCIL
JOB NO: S8463/3
PRINCIPAL: TESTED BY: JR
PROJECT: OLD MANS VALLEY DATE: 23/03/90
LOCATION: HORNBY TEST FILE #: 174

BOREHOLE: BH48 DEPTH: 2.40 -
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO: 2.70

MATERIAL CLASSIFICATION: CHD Sandy CLAY - high plasticity, mottled yellow red grey brown, fine to coarse sand, some fine gravel.

Type of test: CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

ANGLE OF FRICTION (φ') = 33.5°, deg.
MOISTURE CONTENTS

COHESION (c') = 0 KPa
INITIAL = 23.3 %

WET DENSITY = 1.870 t/m³
FINAL - TOP = 24.7 %

BACK PRESSURE = 200,000 KPa
MIDDLE = 28.5 %

STRAIN RATE = 0.005  Min
BOTTOM = 28.8 %

DATA FROM TEST FILE No.s = 174 184 189

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test results

Client: HORNBY SHIRE COUNCIL  
Project: OLD MAN'S VALLEY  
Location: HORNBY  
Date: 9-3-90  
Job No: S8463/3

test procedure: AS1289 C1.1, C2.1, C3.1, C4.1 - 1977

<table>
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<tr>
<th>SAMPLE IDENTIFICATION</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>Linear Shrinkage</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH16 (Residual)</td>
<td>71</td>
<td>26</td>
<td>45</td>
<td>10.0</td>
</tr>
<tr>
<td>(0.8 - 1.15m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BH26 (Residual)</td>
<td>66</td>
<td>29</td>
<td>37</td>
<td>17.5</td>
</tr>
<tr>
<td>(0.7 - 1.0m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BH29 (Fill)</td>
<td>41</td>
<td>24</td>
<td>17</td>
<td>10.0</td>
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<tr>
<td>(1.1 - 1.28m)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BH29 (Residual)</td>
<td>49</td>
<td>31</td>
<td>18</td>
<td>11.0</td>
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<tr>
<td>10.8 - 11.15m</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>BH33 (EW)</td>
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<td>(0.7 - 0.95m)</td>
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<tr>
<td>BH37 (Fill)</td>
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<td>23</td>
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<td>20.5</td>
</tr>
<tr>
<td>(11.15 - 11.30m)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BH37 (Residual)</td>
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<td>22</td>
<td>8</td>
<td>5.5</td>
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<td>(15.55 - 15.80m)</td>
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test results

**principal/Client:** HORNSBY SHIRE COUNCIL  
**project:** OLD MAN'S VALLEY  
**location:** HORNSBY  
**date:** 6-6-90  
**job no:** S8463/3

**test procedure:** AS1289 Cl.1, C2.1, C3.1, C4.1 - 1977

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<th>Plastic Limit $w_p$</th>
<th>Plasticity Index $I_p$</th>
<th>Linear Shrinkage $L.SZ$</th>
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</thead>
<tbody>
<tr>
<td>BH41 (2.3-2.6m)</td>
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<td>15</td>
<td>23</td>
<td>10 **</td>
</tr>
<tr>
<td>(Residual/EW Breccia)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BH45 (0.8 - 1.15m)</td>
<td>49</td>
<td>29</td>
<td>20</td>
<td>10 ***</td>
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<tr>
<td>(EW Breccia)</td>
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<td></td>
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<tr>
<td>BH46 (2.4 - 2.7m)</td>
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<td>15</td>
<td>22</td>
<td>9 **</td>
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<tr>
<td>(EW Breccia)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** SAMPLE HISTORY AND PREPARATION

All samples dry sieved and oven dried,

* Standard Method used to obtain results

**LINEAR SHRINKAGE $L.SZ$**

Size of Mould = 250mm

** Curling occurred

*** Cracking occurred

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APPENDIX E

LABORATORY TEST RESULTS

DIRECT SHEAR TESTING
DIRECT SHEAR TEST - LABORATORY PROCEDURE

SAMPLE PREPARATION

Block samples of the extremely to highly weathered breccia were obtained from the base of test pits excavated by backhoe. The samples were trimmed by shovel and handpick prior to transportation to the testing laboratory. A total of five samples were selected for shear testing.

TEST PROCEDURE

The shearbox accommodated a maximum sample size of 300x300x150mm. Each test specimen was prepared by carefully trimming the block sample to a slightly smaller size (about 250x250mm) and mounting it in the shearbox. Plaster of Paris was used to fill gaps between the specimen and the base, sides and top cover of the box except for the zone to be sheared. The trimmed materials were retained for moisture content determination.

The required vertical load was applied and the specimen allowed to consolidate, a process which took several hours. The first two samples from TP10 were tested without water added to the apparatus, whereas the later three samples from TP11 were immersed in water.

Following consolidation the specimen was then sheared at a rate of 0.1mm/min. Peak shear strength was generally reached after 90 to 180 minutes at about 2% to 5% strain. Dial gauge readings were taken manually.

After completion of the test, the dimensions of the shear plane are measured prior to removal of the specimen from the shearbox. Some of the sample was retained for moisture content determination.
direct shear test

CLIENT: HORNSBY SHIRE COUNCIL
PRINCIPAL:
PROJECT: OLD MANS VALLEY
LOCATION: HORNSBY

TP10 - BLOCK SAMPLE
SHEAR STRESS: PEAK

DEPTH: 1.80 -

MATERIAL CLASSIFICATION: EW/HW BRECCIA, yellow red brown. BLOCK SAMPLES

DATA FROM TEST FILE No.: 113 114

SHEAR RATE: 0.100 mm/Min
WET DENSITY: 2.20 t/m3
INITIAL MOISTURE CONTENT: %

COHESION C: 28 kPa
ANGLE OF FRICTION: 39 deg.
direct shear test

CLIENT: HORNSBY SHIRE COUNCIL
PRINCIPAL: 
PROJECT: OLD MANS VALLEY
LOCATION: HORNSBY

LABORATORY: SYDNEY

JOB NO: S8463/3
TESTED BY: GC
DATE: 12/02/00
TEST FILE #: 113

TI10 - BLOCK SAMPLE
SHEAR STRESS: PEAK
DEPTH: 1.00 - 1.30

MATERIAL CLASSIFICATION: EW/HW BRECCIA, yellow red brown. BLOCK SAMPLES

---

**Graph Description:**
- **Shear Stress (kPa) vs. Strain (%):**
- **Shear Rate:** 0.100 mm/Min
- **Wet Density:** 2.20 t/m³
- **Initial Moisture Content:** %
- **Cohesion C:** 28 kPa
- **Angle of Friction:** 39 deg.

DATA FROM TEST FILE No. 113 114

---

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direct shear test

CLIENT: HORNSBY SHIRE COUNCIL
PROJECT: OLD MAN'S VALLEY
LOCATION: HORNSBY QUARRY

LABORATORY: SYDNEY
JOB NO: 28463/3
TESTED BY: SRM
DATE: 16/05/98

BOREHOLE: TP11 - Sample 1
SHEAR STRESS: PEAK
DEPTH: 1.20

MATERIAL CLASSIFICATION: (CL) Sandy Gravely CLAY, medium plasticity,
yellow brown. Gravel fine to coarse, Sand fine to coarse.

<table>
<thead>
<tr>
<th>Normal stress (kPa)</th>
<th>Shear stress (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>100</td>
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<td>150</td>
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<td>200</td>
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</tr>
<tr>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td>400</td>
<td>400</td>
</tr>
</tbody>
</table>

SHEAR RATE: 2.100 mm/Min
WET DENSITY: 2.13 t/m³
INITIAL MOISTURE CONTENT: 32.0%
FINAL MOISTURE CONTENT: 35.9%

DATA FROM TEST FILE No.s: 241 242

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Authorised Signature
direct shear test

CLIENT: HORNBY SHIRE COUNCIL  
PRINCIPAL: TESTED BY:  
PROJECT: OLD MAN'S VALLEY  
LOCATION: HORNBY QUARRY  
LABORATORY: SYDNEY  
JOB NO: S8488/3  
DATE: 15/05/90  
TEST FILE #: 241  
Borehole: TP11 - Sample 1  
Depth: 1.20  
Shear Stress: Peak: 1.50

Material Classification: (CL) Sandy Gravely CLAY, medium plasticity, yellow brown, Gravel fine to coarse, Sand fine to coarse.

Shear Stress (kPa)  
0 50 100 150 200 250 300 350  
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Shear Rate: 0.100 mm/Min
Wet Density: 2.13 t/m³
Initial Moisture Content: 32.0 %
Final Moisture Content: 35.9 %

Cohesion C: ........... kPa  
Angle of Friction: ........... deg.

Data from Test File No.: 241 242

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Authorized Signature
direct shear test

CLIENT: HORNSBY SHIRE COUNCIL  
PRINCIPAL:  
PROJECT: OLD MAN'S VALLEY  
LOCATION: HORNSBY QUARRY

LABORATORY: SYDNEY  
JOB NO: S9463/3  
TESTED BY: SRM  
DATE: 25/03/98

BOREHOLE: TP 11 - Sample 2  
DEPTH: 1.20 -  
SHEAR STRESS: PEAK  
DEPTH: 1.50

MATERIAL CLASSIFICATION: (CL) SANDY GRAVELLY CLAY, medium plasticity, yellow-brown, Gravel, fine to coarse, Sand, fine to coarse.

![Graph showing shear stress vs normal stress](image)

SHEAR RATE: 0.100 mm/Min  
WET DENSITY: 2.13 t/m³  
INITIAL MOISTURE CONTENT: 36.4 %  
FINAL MOISTURE CONTENT: 37.2

COHESION C: 25 kPa  
ANGLE OF FRICTION: 24.0°

DATA FROM TEST FILE: 177 178

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Authorised Signature
direct shear test

CLIENT: HORSNBY SHIRE COUNCIL
PRINCIPAL: OLD MAN'S VALLEY
LOCATION: HORSNBY QUARRY

LABORATORY: SYDNEY
JOB NO: 88463/3
TESTED BY: SRM
DATE: 25/03/98
TEST FILE #: 177

BOREHOLE: TP 11 - Sample 2
DEPTH: 1.28

SHEAR STRESS: PEAK
DEPTH: 1.58

MATERIAL CLASSIFICATION: (CL) Sandy Gravelly CLAY, medium plasticity,
yellow brown, Gravel fine to coarse; sand fine to coarse.

---

Shear stress (kPa)

Strain (%)

SHEAR RATE: 0.188 mm/Min
WET DENSITY: 2.13 t/m3
INITIAL MOISTURE CONTENT: 36.4%
FINAL MOISTURE CONTENT: 37.2%

COHESION C: 25 kPa
ANGLE OF FRICTION: 25.0 deg.

DATA FROM TEST FILE No.: 177 178

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direct shear test

CLIENT: HORNSBY SHIRE COUNCIL
JOB NO: S8483/3
PRINCIPAL: OLD MAN'S VALLEY
TESTED BY: SRM
PROJECT: HORNSBY QUARRY
DATE: 5/93
LOCATION: HORNSBY QUARRY

BOREHOLE: TP 11 Sample 3
DEPTH: 1.20 -

SHEAR STRESS: PEAK
DEPTH: 1.50

MATERIAL CLASSIFICATION: (CL) Sandy Gravelly CLAY, medium plasticity,
yellow brown, Gravel fine to coarse, sand fine to coarse.

Shear stress (kPa) vs Normal stress (kPa)

Shear rate: 0.188 mm/Min
Wet density: 2.13 t/m3
Initial moisture content: 28.80%
Final moisture content: 31.30%

Cohesion C: 40 kPa
Angle of friction: 24.0 deg.

DATA FROM TEST FILE No.: 245 246

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Authorised Signature
direct shear test

CLIENT: HORNESBY SHIRE COUNCIL
PRINCIPAL: OLD MAN'S VALLEY
PROJECT: HORNESBY QUARRY
LOCATION: HORNESBY QUARRY

LABORATORY: SYDNEY
JOB NO: 2458463/3
TESTED BY: SRM
DATE: 5/00
TEST FILE #: 245

BOREHOLE: TP 11
SHEAR STRESS: PEAK
DEPTH: 1.20 - 1.60

MATERIAL CLASSIFICATION: (CL) Sandy Gravelly CLAY, medium plasticity, yellow brown, Gravel fine to coarse, Sand fine to coarse.

DATA FROM TEST FILE No.1: 245 246

Shear stress (kPa) vs Strain (%)

SHEAR RATE: 0.100 mm/Min
WET DENSITY: 2.13 t/m³
INITIAL MOISTURE CONTENT: 20.80 %
FINAL MOISTURE CONTENT: 31.30%

COHESION C: ...40.00... kPa
ANGLE OF FRICTION: ...24.0... deg.
# Test Results

**Principal/Client:** Hornsby Shire Council  
**Project:** Old Man's Valley  
**Location:** Hornsby  
**Date:** 6-6-90  
**Job No.:** S8463/3

**Test Procedure:** AS1289 B1.1 - 1977

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>Moisture Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1 (Before Test)</td>
<td>32.0</td>
</tr>
<tr>
<td>Sample 1 (After Test)</td>
<td>35.9</td>
</tr>
<tr>
<td>Sample 2 (Before Test)</td>
<td>36.4</td>
</tr>
<tr>
<td>Sample 2 (After Test)</td>
<td>37.2</td>
</tr>
<tr>
<td>Sample 3 (Before Test)</td>
<td>29.9</td>
</tr>
<tr>
<td>Sample 3 (After Test)</td>
<td>31.3</td>
</tr>
</tbody>
</table>

**Note:** All Moistures from Direct Shear Samples from TP11.
direct shear test

CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MAN'S VALLEY
LOCATION : HORNBY

LABORATORY : SYDNEY
JOB NO : 58463/2
TESTED BY : GC
DATE : 21/09/89

SAMPLE : #1 SE OF FIELD
SHEAR STRESS : PEAK
DEPTH : 0.00 -

MATERIAL CLASSIFICATION : (SC) Clayey GRAVELLY SAND - fine to coarse, yellow brown, fine to coarse gravel, fines of medium plasticity.

0 100 200 300 400 500 600 700 800
Normal stress (kPa)

0 100 200 300 400 500 600 700 800
Shear stress (kPa)

SHEAR RATE : 0.005 mm/Min
WET DENSITY : 1.96 t/m3
INITIAL MOISTURE CONTENT : 20.70%

COHESION C : 0 kPa
ANGLE OF FRICTION : 35.0 deg.

DATA FROM TEST FILE No. 8 : 868 924

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Authorised Signature
direct shear test

CLIENT: HORNSBY SHIRE COUNCIL
PRINCIPAL:
PROJECT: OLD MAN'S VALLEY
LOCATION: HORNSBY

SAMPLE: SE OF FIELD
SHEAR STRESS: PEAK

DEPTH: 0.00 - 0.00

MATERIAL CLASSIFICATION: (SC) Clayey GRAVELLY SAND - fine to coarse, yellow brown, fine to coarse gravel, fines of medium plasticity.

Shear Stress (kPa)

0 100 200 300 400 500 600 700

Strain (%)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

SHEAR RATE: 0.005 mm/Min
WET DENSITY: 1.96 t/m³
INITIAL MOISTURE CONTENT: 20.70%
COHESION C: 0.00 kPa
ANGLE OF FRICITION: 30.5°

DATA FROM TEST FILE No. 6: 888 924

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Authorised Signature
direct shear test

CLIENT: HORNSBY SHIRE COUNCIL
PRINCIPAL:
PROJECT: OLD MAN'S VALLEY
LOCATION: HORNSBY

SAMPLE: SE OF FIELD
SHEAR STRESS: RESIDUAL
DEPTH: 0.00 - 0.80

MATERIAL CLASSIFICATION: (SC) Clayey GRAVELLY SAND - fine to coarse, yellow brown, fine to coarse gravel, fines of medium plasticity.

LABORATORY: SYDNEY
JOB NO: 88463/2
TESTED BY: GC
DATE: 23/09/89

DATA FROM TEST FILE No. 870 877 879

SHEAR RATE: 0.016 m/s
WET DENSITY: 1.96 t/m³
INITIAL MOISTURE CONTENT: 20.9%

COHESION: 0 kPa
ANGLE OF FRICITION: 31 deg.

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# Direct Shear Test

**Client:** Hornsby Shire Council  
**Principal:**  
**Project:** Old Man's Valley  
**Location:** Hornsby  
**Job No.:** S8483/2  
**Tested by:** GC  
**Date:** 23/08/88  
**Test File #:** 870  
**Sample Site:** SE of Field  
**Shear Stress:** Residual  
**Depth:** 0.00 -  
**Material Classification:** (SC) Clayey gravelly sand - fine to coarse, yellow brown, fine to coarse gravel, fines of medium plasticity.

<table>
<thead>
<tr>
<th>Shear Stress (kPa)</th>
<th>Strain (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>200</td>
<td>1 - 2</td>
</tr>
<tr>
<td>300</td>
<td>3 - 4</td>
</tr>
<tr>
<td>400</td>
<td>5 - 6</td>
</tr>
<tr>
<td>500</td>
<td>7 - 8</td>
</tr>
<tr>
<td>600</td>
<td>9 - 10</td>
</tr>
<tr>
<td>700</td>
<td>11 - 12</td>
</tr>
</tbody>
</table>

- **Shear Rate:** 0.016 mm/Min  
- **Wet Density:** 1.86 t/m³  
- **Initial Moisture Content:** 20.9%  
- **Cohesion:** C  
- **Angle of Friction:** 31.0°  

**Data from Test File No.:** 870 877 879

---

This laboratory is registered by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with the terms of registration. This document shall not be reproduced except in full without the prior approval of the laboratory.

[Signature]

Authorised Signature
direct shear test

CLIENT : HORNŞBY SHIRE COUNCIL
PRINCIPAL : 
PROJECT : OLD MAN'S VALLEY
LOCATION : HORNŞBY

SAMPLE : #2 STOCKPILE
SHEAR STRESS : PEAK

DEPTH : 0.00 -

MATERIAL CLASSIFICATION : (GC) Clayey SANDY GRAVEL - fine to coarse, yellow brown, fines of medium plasticity, fine to coarse sand.

---

SHEAR RATE : 0.085 mm/MIn
WET DENSITY : 1.98 t/m³
INITIAL MOISTURE CONTENT : 18.70 %

COHESION C : 15 kPa
ANGLE OF FRICTION : 29.5 deg.

DATA FROM TEST FILE No.s : 871 914

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Authorised Signature
direct shear test

CLIENT: HORNSBY SHIRE COUNCIL
PRINCIPAL: STOCKPILE
PROJECT: OLD MAN'S VALLEY
LOCATION: HORNSBY

SAMPLE: #2 STOCKPILE
DEPTH: 0.00 -
SHEAR STRESS: PEAK
DEPTH: 0.00

MATERIAL CLASSIFICATION: (GC) Claysy SANDY GRAVEL - fine to coarse, yellow brown, fines of medium plasticity, fine to coarse sand.

LABORATORY: SYDNEY
JOB NO: S8463/2
TESTED BY: GC
DATE: 04/10/89
TEST FILE #: 871

SHEAR RATE: 0.005 mm/Min
WET DENSITY: 1.96 t/m³
INITIAL MOISTURE CONTENT: 19.70 %

COHESION C: 15 kPa
ANGLE OF FRICTION: 29.5 deg.

DATA FROM TEST FILE No.: 871 914
direct shear test

CLIENT : HORNBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MAN'S VALLEY
LOCATION : HORNBY

JOB NO : S8463/2
TESTED BY : GC
DATE : 06/10/89

SAMPLE #: STOCKPILE
SHEAR STRESS : RESIDUAL
DEPTH : 0.00 -

MATERIAL CLASSIFICATION : (GC) Clayey SANDY GRAVEL - fine to coarse, yellow brown, fines of medium plasticity, fine to coarse sand.

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DATA FROM TEST FILE No.s : 875 876 878
direct shear test

CLIENT: HORNSSY SHIRE COUNCIL
PRINCIPAL:
PROJECT: OLD MAN'S VALLEY
LOCATION: HORNSSY

SAMPLE: 42 STOCKPILE
SHEAR STRESS: RESIDUAL

MATERIAL CLASSIFICATION: (GC) Clayey SANDY GRAVEL - fine to coarse, yellow brown, fines of medium plasticity, fine to coarse sand.

LABORATORY: SYDNEY
JOB NO: 88463/2
TESTED BY: GC
DATE: 06/10/89
TEST FILE #: 875

DEPTH: 0.00 -

SHEAR RATE: 0.027 mm/Min
WET DENSITY: 1.98 t/m³
INITIAL MOISTURE CONTENT: 19.7%

COHESION C: 0 kPa
ANGLE OF FRICTION: 31°

DATA FROM TEST FILE No. #: 875 876 878

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Authorised Signature
particle size distribution

client: HORNSBY SHIRE COUNCIL
principal: OLD MAN'S VALLEY
project: HORNSBY
location: STOCKPILE

sample identification: #2
test procedure: AS1289 C1.1, C2.1, C3.1, C4.1, C6.1 - 1977

<table>
<thead>
<tr>
<th>AS sieve size</th>
<th>75um</th>
<th>150um</th>
<th>300um</th>
<th>425um</th>
<th>600um</th>
<th>1.18mm</th>
<th>2.36mm</th>
<th>4.75mm</th>
<th>9.5mm</th>
<th>19mm</th>
<th>31.5mm</th>
<th>63mm</th>
<th>150mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>percentage finer than size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

clay | silt | sand | gravel | cobbles
fine | medium | coarse | fine | medium | coarse | fine | medium | coarse |

0.002 0.06 2.0 60

liquid limit % | 46
plastic limit % | 24
plasticity index % | 22
linear shrinkage % | 10.5
particle density t/m³ | | | |

classification

(GC) CLAYEY SANDY GRAVEL, fine to coarse, yellow-brown, fines of medium plasticity, fine to coarse sand.

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particle size distribution

client: HORSBY SHIRE COUNCIL
principal: OLD MAN'S VALLEY
project: HORSBY

sample identification: #1 - SE of field
test procedure: AS1289 C1.1, C2.1, C3.1, C4.1, C6.1 - 1977

<table>
<thead>
<tr>
<th>AS sieve size</th>
<th>75μm/m</th>
<th>150μm/m</th>
<th>300μm/m</th>
<th>600μm/m</th>
<th>1.18mm</th>
<th>2.36mm</th>
<th>4.75mm</th>
<th>6.75mm</th>
<th>9.55mm</th>
<th>13.2mm</th>
<th>19.0mm</th>
<th>26.5mm</th>
<th>37.5mm</th>
<th>52.5mm</th>
<th>75mm</th>
<th>100mm</th>
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<tbody>
<tr>
<td>percentage finer than size</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
<td>40</td>
<td>30</td>
<td>20</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

particle size - millimetres

clay

silt

sand

gravel

cobbles

0.002
0.05
0.2
2.0
50

liquid limit % 44
plastic limit % 22
plasticity index % 22
linear shrinkage % 10.5
particle density t/m³
natural moisture %

classification
(SC) CLAYEY GRAVELLY SAND, fine to coarse, yellow-brown, fine to coarse gravel, fines of medium plasticity.
**Test Results**

**Principal/Client:** HORNSBY SHIRE COUNCIL  
**Project:** OLD MAN'S VALLEY  
**Location:** HORNSBY  
**Date:** 20-9-90  
**Job No.:** S8463/2

**Test Procedure:** AS1289 E1.1 - 1977

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>Maximum Dry Density</th>
<th>Optimum Moisture Content</th>
</tr>
</thead>
<tbody>
<tr>
<td># 1 SE of Field</td>
<td>1.74 t/m³</td>
<td>18.5 %</td>
</tr>
<tr>
<td># 2 Stockpile</td>
<td>1.77 t/m³</td>
<td>18.0 %</td>
</tr>
</tbody>
</table>
LEGEND
• BH16 0.8 - 1.15 m TRIAXIAL
Δ BH26 0.7 - 1.0 m TRIAXIAL
▽ BH6 1.5 - 1.85 m TRIAXIAL
X BH41 2.3 - 2.6 m TRIAXIAL
+ TPI 0.4 m SHEARBOX
LEGEND

X  SAMPLE 1 - SE OF FIELD SAT DIRECT SHEAR

V  SAMPLE 2 - STOCKPILE SAT DIRECT SHEAR

C' = 10 kPa  $\phi' = 30^\circ$

SHEAR STRESS (kPa)

EFFECTIVE NORMAL STRESS (kPa)
DEPTH FROM NATURAL SURFACE TO GROUNDWATER LEVEL (m)

DEPTH OF BASE OF PIEZOMETER BELOW NATURAL GROUND LEVEL (m)

12
9 (SANDSTONE)

14 - NEAR BRECCIA/SANDSTONE INTERFACE

INSTALLATION EFFECT

8
16
23

LINE OF ZERO POKE PRESSURE

Coffey & Partners Pty Ltd Consulting Engineers in the geotechnical sciences

HORNSBY SHIRE COUNCIL
OLD MANS VALLEY
SOUTH END - PIEZOMETER READINGS IN EW & HW ROCK

FIGURE 10
OLD MAN'S VALLEY, STABILITY OF PROPOSED FILL

<table>
<thead>
<tr>
<th>LAYER #</th>
<th>C (kPa)</th>
<th>PHI</th>
<th>RU</th>
<th>RHO (1/m3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.0</td>
<td>30.0</td>
<td>-1.00</td>
<td>2.00</td>
</tr>
<tr>
<td>2</td>
<td>10.0</td>
<td>30.0</td>
<td>-1.00</td>
<td>2.00</td>
</tr>
<tr>
<td>3</td>
<td>5.0</td>
<td>28.5</td>
<td>-2.00</td>
<td>1.95</td>
</tr>
<tr>
<td>4</td>
<td>20.0</td>
<td>25.0</td>
<td>-2.00</td>
<td>1.95</td>
</tr>
<tr>
<td>5</td>
<td>30.0</td>
<td>27.0</td>
<td>-2.00</td>
<td>1.95</td>
</tr>
<tr>
<td>6</td>
<td>30.0</td>
<td>27.0</td>
<td>50.00</td>
<td>1.95</td>
</tr>
</tbody>
</table>
OLD MAN'S VALLEY, STABILITY OF PROPOSED FILL

<table>
<thead>
<tr>
<th>LAYER #</th>
<th>C (kPa)</th>
<th>PH</th>
<th>RU</th>
<th>RHO (1/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.0</td>
<td>30.0</td>
<td>-1.00</td>
<td>2.00</td>
</tr>
<tr>
<td>2</td>
<td>10.0</td>
<td>30.0</td>
<td>-1.00</td>
<td>2.00</td>
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<tr>
<td>3</td>
<td>5.0</td>
<td>28.5</td>
<td>-2.00</td>
<td>1.95</td>
</tr>
<tr>
<td>4</td>
<td>20.0</td>
<td>25.0</td>
<td>-2.00</td>
<td>1.95</td>
</tr>
<tr>
<td>5</td>
<td>30.0</td>
<td>27.0</td>
<td>-2.00</td>
<td>1.95</td>
</tr>
<tr>
<td>6</td>
<td>30.0</td>
<td>27.0</td>
<td>50.0</td>
<td>1.95</td>
</tr>
</tbody>
</table>

CH215B  SCALE 1: 1000.  - CH 215, SLOPE FLATTENED TO GIVE FOS OF 1.5
OLD MAN'S VALLEY, STABILITY OF PROPOSED FILL

<table>
<thead>
<tr>
<th>LAYER #</th>
<th>C(kPa)</th>
<th>PHI</th>
<th>RU</th>
<th>RHO(1/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.0</td>
<td>30.0</td>
<td>-1.00</td>
<td>2.00</td>
</tr>
<tr>
<td>2</td>
<td>10.0</td>
<td>30.0</td>
<td>-1.00</td>
<td>2.00</td>
</tr>
<tr>
<td>3</td>
<td>5.0</td>
<td>28.5</td>
<td>-2.00</td>
<td>1.95</td>
</tr>
<tr>
<td>4</td>
<td>20.0</td>
<td>25.0</td>
<td>-2.00</td>
<td>1.95</td>
</tr>
<tr>
<td>5</td>
<td>30.0</td>
<td>27.0</td>
<td>-2.00</td>
<td>1.95</td>
</tr>
<tr>
<td>6</td>
<td>30.0</td>
<td>27.0</td>
<td>50.00</td>
<td>1.95</td>
</tr>
</tbody>
</table>

CH215D    SCALE 1: 1000. - CH 215, SLOPE FLATTENED AT THE TOE 1(V):1.5(H)
OLD MAN'S VALLEY, STABILITY OF PROPOSED FILL, CH 215

<table>
<thead>
<tr>
<th>LAYER #</th>
<th>C (kPa)</th>
<th>PH</th>
<th>RU</th>
<th>RHOF (t/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>30.0</td>
<td>-1.00</td>
<td>2.00</td>
</tr>
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<td>2</td>
<td>10.0</td>
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<td>3</td>
<td>5.0</td>
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<td>4</td>
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<td>1.95</td>
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<td>5</td>
<td>30.0</td>
<td>27.0</td>
<td>-2.00</td>
<td>1.95</td>
</tr>
<tr>
<td>6</td>
<td>30.0</td>
<td>27.0</td>
<td>50.00</td>
<td>1.95</td>
</tr>
</tbody>
</table>

FIGURE 14

CH215F  SCALE 1:1000.  SLOPE FLATTENED AT THE TOE 1(V):1.5(H).
      FALL SLOPE 1(V):2.5(H)
OLD MAN'S VALLEY, CH 215, DIFFERENT FILL PARAMETERS

<table>
<thead>
<tr>
<th>LAYER #</th>
<th>C (kPa)</th>
<th>PH</th>
<th>RU</th>
<th>RHO (1/m³)</th>
</tr>
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<td>27.0</td>
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</table>

CH215G  SCALE 1: 1000. - SLOPE FLATTENED AT THE TOE 1(V):1.5(H), FILL SLOPE 1(V):2.5(H) FINAL DESIGN
OLD MAN'S VALLEY, STABILITY OF PROPOSED FILL, CH 330

<table>
<thead>
<tr>
<th>LAYER #</th>
<th>C (kPa)</th>
<th>PHI</th>
<th>RU</th>
<th>RHO (1/m³)</th>
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<tbody>
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<td>1.95</td>
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</tr>
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</table>

CH330A  SCALE 1: 1000. - 1(V):2(H) TOE SLOPE, 1(V):2(H) UPPER SLOPE
OLD MAN'S VALLEY, CH 330, DIFFERENT FILL PARAMETERS, FINAL DESIGN

<table>
<thead>
<tr>
<th>LAYER #</th>
<th>C(kPa)</th>
<th>PHI</th>
<th>RU</th>
<th>RHO(t/m³)</th>
</tr>
</thead>
<tbody>
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<tr>
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</tr>
</tbody>
</table>

FIGURE 20

CH330A   SCALE 1:1000. - 1(V):2(H) TOE SLOPE, 1(V):2(H) UPPER SLOPE
OLD MAN'S VALLEY, STABILITY OF PROPOSED FILL

<table>
<thead>
<tr>
<th>LAYER #</th>
<th>C (kPa)</th>
<th>PH</th>
<th>RU</th>
<th>RHOf(t/m³)</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
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<td>40.0</td>
<td>-1.00</td>
<td>2.00</td>
</tr>
<tr>
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<td>28.5</td>
<td>-1.00</td>
<td>1.95</td>
</tr>
<tr>
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<td>20.0</td>
<td>25.0</td>
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<td>1.95</td>
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<tr>
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<td>50.0</td>
<td>0.00</td>
<td>1.95</td>
</tr>
</tbody>
</table>

SCALE 1: 1000. - CH 390, TOE FILL SLOPE \( V:2.5\, (H) \),
UPPER SLOPE \( V:2.25\, (H) \)
### Old Man's Valley, CH390, Non-Circular, Sand Drian

<table>
<thead>
<tr>
<th>Layer #</th>
<th>C (kPa)</th>
<th>PH</th>
<th>RU</th>
<th>Rho (t/m³)</th>
</tr>
</thead>
<tbody>
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<td>30.0</td>
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<td>25.0</td>
<td>10.00</td>
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<tr>
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<td>100.0</td>
<td>50.0</td>
<td>0.00</td>
<td>1.95</td>
</tr>
</tbody>
</table>

**Diagram:**
- **Legend:**
  - Solid line: 1 (V:2.5(H), Upper Slope 1(V):2.25(H))
  - Dotted line: 2 (V:2.5(H), Upper Slope 1(V):2.25(H))

**Scale:** 1:1000

**Notes:**
- **Toe Slope:** 1(V):2.5(H)
OUTLET AT "P"
(SEE FIGURE 31)
NOTE - LOCATION TO BE DECIDED AFTER STRIPPING
(Scale 1:100)

OUTLET FOR OTHER PIPES - eg EF & DC
(Scale 1:100)

SECTION 7-7
(Scale 1:200)

CUT TREES & SHRUBS OFF LEVEL WITH EXISTING SURFACE - DO NOT REMOVE ROOTS OR GRASS

GEOFABRIC LAID OVER EXISTING SLOPE

1:5

EXISTING SLOPE

STRIP TO BASE OF ALUMINIUM IN 5m LONG N/S SECTIONS

COFFEY & PARTNERS Pty Ltd Consulting Engineers in the geotechnical sciences
HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
SUBSOIL DRAIN OUTLET STRUCTURES & ROCKFILL BERM

FIGURE 33
Job no S8463/3
Graded filters, sand blanket material and gravel for geofabric drains shall conform to the requirements for concrete aggregate AS2758.1 except that grading shall be as shown above.