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REPORT
PHASE 2 MINE SUBSIDENCE
RISK ASSESSMENT

PROPOSED RESIDENTIAL SUBDIVISION
CATHERINE HILL BAY

Prepared for

COAL & ALLIED INDUSTRIES LTD

Project 39662.07

OCTOBER 2010

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REPORT
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PROPOSED RESIDENTIAL SUBDIVISION
CATHERINE HILL BAY

1. INTRODUCTION

This report presents preliminary results of ongoing Phase 2 Mine Subsidence investigations at the proposed residential development at Catherine Hill Bay (Middle Camp). The assessment was carried out at the request of Coal & Allied Industries Ltd, in consultation with Catylis Pty Ltd.

The site has been subject to a Phase 1 desktop mine subsidence assessment (Ref 1). That assessment provided information on the depth of cover to the mine workings and the approximate locations of mine features such as shafts and potholes.

The purpose of the subsurface assessment was to confirm the following information:

- The mapped edge of workings;
- Depth of cover to the workings, in particular the 20 m cover line;
- Assessment of the rock over the seam and the height of the workings to see if the depth of cover restrictions are appropriate;
- The layout and size/volume of the workings;
- Location and assessment of the conditions of shaft and tunnel entry capping / backfilling.

2. PROPOSED DEVELOPMENT

It is proposed that the entire Catherine Hill Bay (Middle Camp) site, owned by Coal & Allied Industries Limited (Coal & Allied) be rezoned / listed as a 'State Significant Site' in Schedule 3 of State Environmental Planning Policy (SEPP) (Major Development). A draft Schedule 3 listing will be prepared with the Concept Plan Application.

The Concept Plan for a residential subdivision and conservation land transfer of the Catherine Hill Bay (Middle Camp) site will apply to the entire 569 ha Catherine Hill Bay (Middle Camp) site. The key parameters for the proposed development of the site are as follows:

- Dedication of 526.58 ha of conservation land to the New South Wales Government (NSWG) that is identified in the Lower Hunter Regional Strategy and Lower Hunter Regional Conservation Plan, comprising approximately 93% of the Catherine Hill Bay (Middle Camp) site;
- Maximum dwelling yield of 222 dwellings (including 57 integrated housing lots) and three super lots over 28.2 ha;
- Two developable areas are identified under the Concept Plan located to the north of the Middle Camp heritage township:
  - Developable area A (northeast) = 7.32 ha;
  - Developable area B (northwest) = 20.88 ha.
- Indicative development staging. The number of lots and extent of staging for release areas will be largely dictated by the service infrastructure requirements as well as responding to market forces;
- The provision of associated infrastructure;
- Torrens title subdivision of the Catherine Hill Bay (Middle Camp) site. The Torrens title subdivision and boundary realignment of Coal & Allied land will enable the following:
  - Transfer of land 526.58 ha in area that is owned by Coal & Allied to be excised and to be dedicated to NSWG for conservation land;
  - Transfer of land 1.6 ha in area that is owned by Coal & Allied, located between the cemetery and the oval and including the adjacent car park to Lake Macquarie City Council;

- Enable land 12.38 ha in area that is owned by Coal & Allied comprising four houses north-west of Northwood Road and land 0.17 ha east of Flowers Drive, to be retained by Coal & Allied post transfer of the conservation land.

Approval will not be sought under the Concept Plan for a specific lot or road layout. An indicative lot layout will indicate how the dwelling yield of 222 dwellings could be achieved on the site.

Similarly, approval will not be sought under the Concept Plan for subdivision or construction of individual houses. However, the desired future character of the proposed concept plan will be included in Urban Design Guidelines. Urban Design Guidelines will be prepared to inform the Concept Plan in respect of urban form, built form, open space and landscape, access and movement and visual impact for the site.

It is proposed to dedicate land for conservation purposes as part of the Major Project Application via a Voluntary Planning Agreement between Coal & Allied and the NSWG in accordance with s.93F of the Environmental Planning & Assessment Act, 1979.

The proposed Concept Plan and a Plan showing the proposed development areas and conservation areas are included in the Preliminary Environmental Assessment prepared by Urbis.

3. SITE IDENTIFICATION

This report comprises an assessment of the proposed development areas which are within Part Lot 223, DP 110298, within the Lake Macquarie City Council area.

The extent of each of the potential development areas is shown on Figure 1 below. Each area is described as follows:

- ***Area A:*** This is an area at the north of the overall site, on the eastern side of Flowers Drive with an overall area of 7.32 ha;

- ***Area B:*** this includes the former Pit E and is situated north of the Middle Camp township on the western side of Flowers Drive. The area has an irregular shape with an overall area of about 20.88 ha.

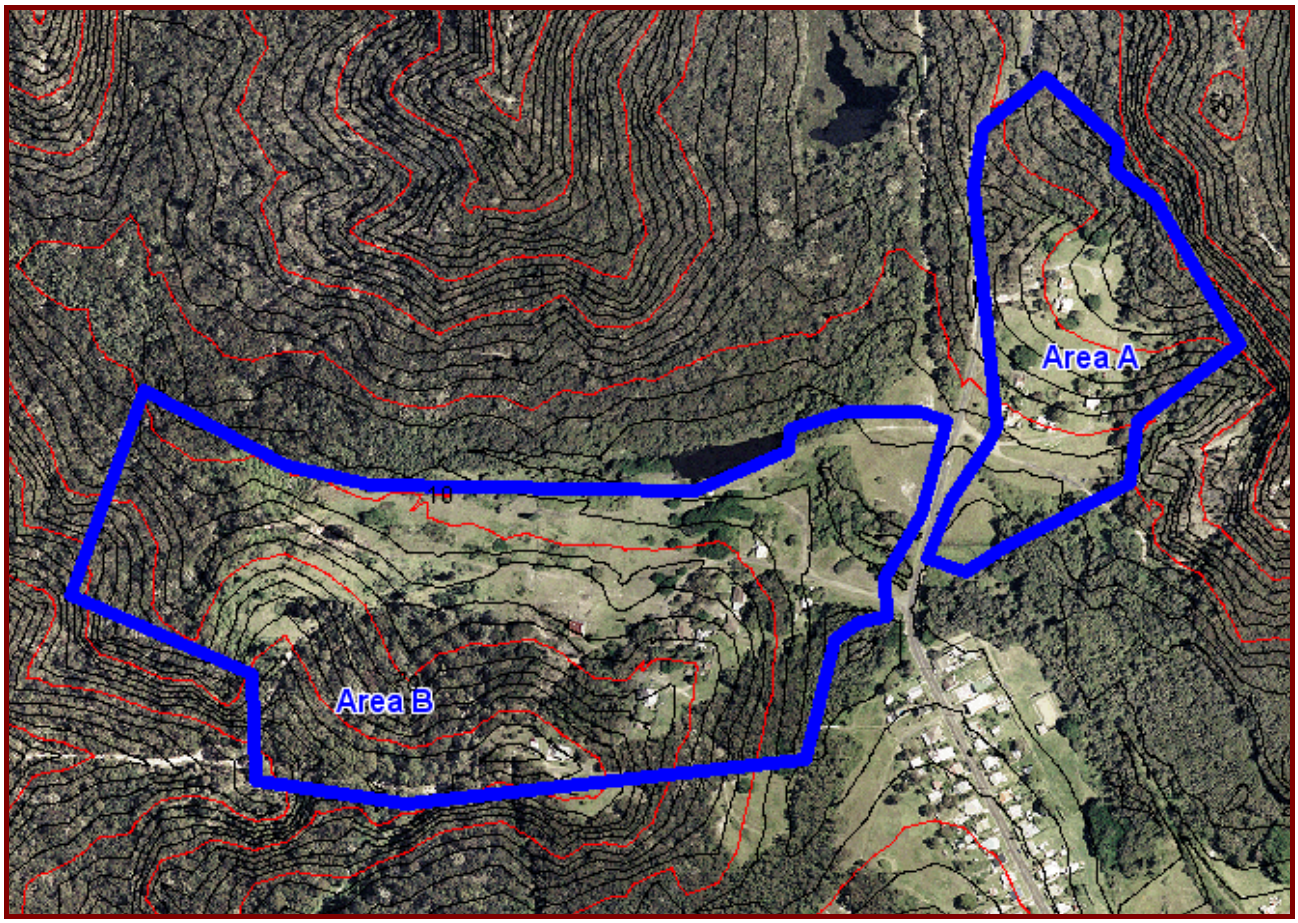


Figure 1 – Proposed Development Areas

4. DESKTOP ASSESSMENT

Record traces of former mine workings were sourced from the Department of Primary Industries – Minerals and indicate that the site is underlain by coal mine workings in two seams, the Wallarah and the Great Northern Seams.

The record traces indicate the following:

Great Northern Seam RT 739

Only the south-western corner of Area B (Pit E area) is underlain by workings in the Great Northern Seam. The RT indicates base of seam levels in the order of -40 m AHD in this area with a dip (increasing depth) to the south. Therefore the depth of cover is more than 50 m. The workings in this area were undertaken in 1996 and comprise bord and pillar workings with extensive pillar extraction. Bore logs on the RT indicate a seam thickness in the range 3.3 m to 3.5 m. Area A indicates no mapped workings.

Wallarah Seam RT 295

The Wallarah Seam is the upper seam and was worked from Pit E, located in Area B. The workings comprised bord and pillar workings with pillar extraction in some areas. Workings in the vicinity of Pit E were completed in the period 1896 to 1903, with the workings beneath the southern portions of the site continuing up to about 1935. The seam thickness shown on the RTs ranged from 2.8 m to 3.5 m. Details of the working section (mined coal thickness) were not provided.

The record traces indicate that there was no mining on the eastern side of Flowers Drive (Area A). There was also no mining along the base of the gully feature in Area B as the depth of cover was very shallow.

There is also an area of workings mapped to the east of Area A as shown on Drawing 1.

Consultations

Consultations were undertaken with Mr Greg Cole-Clark of the Mine Subsidence Board in January 2007. Mr Cole Clark indicated the following:

- The risk of pothole subsidence should be based on the history of potholes in the area as well as subsurface investigations and empirical methods. Where there is a risk of pothole subsidence, typically for less than about 20 m cover, development in such areas would probably only be possible if grouting of the workings was undertaken;
- Where the depth of cover is between 20 m and 50 m depth of cover, development in such areas would probably be restricted to one storey brick veneer. It may be possible to obtain a less onerous restriction subject to site investigation and detailed risk assessment. Areas of pillar extraction where the workings had fully collapsed would be included in this category;
- For areas where there is more than 50 m cover to mine workings, the traditional development guidelines would have allowed two storey brick veneer style development. However for this development, a detailed risk assessment would be required to support this. If there was a moderate to high risk of mine subsidence, then it would be necessary to predict worst case subsidence parameters. For predicted subsidence parameters, exceeding the following, development would be restricted to single storey brick veneer or similar;
- Maximum subsidence= 400 mm;
- Strains = ± 3mm/m;
- Tilts = 4 mm/m.

5. SITE FEATURES

The site was the subject of a comprehensive site walk-over survey and history review as part of associated geotechnical and contamination investigations, details of which are presented in Reference 1, which should be read in conjunction with this report.

The walk over assessment identified a mine subsidence pothole with overall dimension of about 8 m by 13 m and 3 to 4 m deep (Photo 1) and number of likely potholes (Photo 2) on the western parts of Area B. The approximate location of the pothole is shown on Drawing 1.

Photo 1 – Pothole

Photo 2 – Possible pothole

6. METHODOLOGY

Confirm 20 m Depth of Cover Line

From the desktop study the approximate contour of 20 m cover to the workings was interpreted from available data. There was some discrepancy between the contour line suggested from the interpretation and the contour line suggested by the MSB.

Therefore a series of bores (Bores 1 to 3 and 8) were drilled along the interpreted 20 m contour line to confirm the interpretation. The bores were generally cored from the depth of auger refusal.

The bores were targeted to intersect roadways in order to provide additional data on the geometry of the workings.

Confirm Extent and Geometry of Workings

The extent of the workings is important, especially in areas with low depth of cover which may impose severe restrictions on development. Therefore a series of bores was drilled along the mapped edge of the workings (Bores 5 to 8) in Area B.

The bores were targeted to intersect a roadway about 3 m from the end of the roadway. Downhole camera and ultrasound was then used to verify the roadway end as well as provide information on the geometry of the workings. As necessary, additional bores were drilled to a) locate the roadway if a pillar was encountered in the first instance and b) to confirm the presence of unmined coal beyond the end of the roadway.

Geometry of Workings

The width of the bords measured from the record traces is approximate and experience has shown that the actual widths may vary from those shown. As the width of the workings is important for assessment of pillar stability and estimating for potential volumes required for grouting of the workings, a component of the investigation was aimed at measuring the width of the bords (roadways).

The workings at the site were dry and therefore down hole tilt up camera in conjunction with ultrasound were used to map the geometry of the working in locations where bores intersected mine voids. The ultrasound measurements were taken using calibrated SICK UM30 ultrasonic sensor with a range of 1.0 m to 6.3 m.

Areas of Pillar Extraction

A part of Area B, between 20 m and 50 m of cover, is underlain by mapped areas of full pillar extraction. It was considered likely that these areas had collapsed, in which case it may have been possible to reduce the development restrictions on these parts of the site.

In order to demonstrate collapse of the workings a pair of bores (Bores 10 and 11) was drilled in Area B. These bores were drilled using a combination of rotary coring and rotary percussion drilling.

7. FIELD WORK

7.1 Methods

Field work was undertaken in the period 30 July 2006 to 19 September 1996 and comprised the following:

- Drilling of 23 bores to depths ranging from 15 m to 63 m;
- The bores were generally progressed by auger drilling with standard penetration testing (SPT) in soils and HQ3 coring in the underlying rock;
- A number of bores were progressed using percussion drilling with air flush techniques. These bores were generally for confirming the presence of voids;
- On site logging by a geotechnical engineer, including core photography;
- Down hole camera assessment of bores;
- Ultrasound assessment of voids intercepted by the bores.

7.2 Results

Detailed test bore report sheets are attached and should be read in conjunction with the Notes Relating to This Report which explain the descriptive terms and classification methods referred to on the report.

The bore locations are shown on Drawing 1, attached, overlain on the record trace (RT295) for the Wallarah Seam workings.

It is noted that at several bores the locations where bords or pillars were encountered did not coincide with the locations of bords and pillars shown on the record trace. The location of the record trace is an average fit across the site and there are localised distortions in the mapping. The distortion generally appears to be of the order of about 5 m and is not consistent.

Bores which intersected voids are shown as green. Bores that intersected coal pillars are shown in maroon. Historical Bores from the Wallarah Coal Company are shown as pink. The depth to coal at each bore is shown on the plan.

7.2.1 Definition of the Edge of Workings

Bores 5 to 5C

Bore 5 targeted to the end of a roadway encountered coal from 9 m to 12.5 m overlain by very stiff to hard clay. An additional two bores were drilled to find a mine void and a void was encountered in Bore 5B between 11 m and 12.9 m depth (1.9 m vertical height). The floor of the void was cored and indicated medium strength siltstone.

Ultrasound assessment of the mine void was undertaken and indicated the following:

- Roadway/bord running in a north east- south west direction;
- Reasonably planar walls with up to about 0.5 m undulations;
- 6 m road width measured;
- No ends of the roadway were detected within the 6.3 m range of the ultrasonic sensor.

Reference to the record trace indicated that Bore 5B had probably intersected the roadway to the west of the one targeted by Bore 5.

In order to prove the end of the roadway an additional bore (Bore 5C) was drilled on the alignment of the workings (bearing 40°) at a distance of 17 m from Bore 5B. The bore indicated solid coal from 6.5 m to 11.1 m confirming the end of the roadway as indicated on the record trace. The workings in this location appear to be slightly to the east of that suggested by the record trace.

Bore 6

Bore 6 encountered very stiff to hard clay underlain by coal from 10.7 m to 12.8 m depth and then a mine void to 14.7 m depth (1.9 m vertical height). The floor of the void was cored and indicated generally high strength siltstone.

Ultrasound assessment of the mine void was undertaken and indicated the following:

- Roadway running in a north east- south west direction;
- Square end to roadway about 3 m to north east of bore, as expected from record trace;
- 6 m road width measured.

Due to the high quality of the ultrasound mapping, indicating a square ended roadway, no additional bore was drilled past the roadway.

Inclined Shaft

A round surface depression was noted in close proximity to the mapped location of a shaft at the edge of the workings between Bores 5 and 6. It is considered very likely that the depression represents the backfilled shaft. Survey of the shaft location indicates that it maps within about 5 m of the location of the shaft shown on the record trace.

Bore 7

Bore 7 encountered filling and stiff clay, however from about 4 m depth the drilling resistance was highly variable with some apparent bands of very low drilling resistance suggesting very loose soil or possible zones of void. A hard base was encountered at 17.1 m and coring from this depth indicated coal from 17.1 m to 17.2 m depth underlain by high strength siltstone.

Tilt up camera and ultrasonic assessment of the bore was not possible as the void was not of sufficient size, however the camera was used in axial mode and indicated the following:

- Top of coal at 12.3 m depth;
- Void from 13.55 m to 14.2 m;
- Rubble below 14.2 m.

It is considered that the bore was drilled into a roadway as intended, however the roof of the roadway had at least partially collapsed.

A second bore (7A) was drilled on the alignment of the workings (bearing 40°) at a distance of 8 m from Bore 7. The bore indicated much more uniform stiff to very stiff clay overlying solid coal from 13.7 m to 15.4 m confirming the end of the roadway as indicated on the record trace.

Bore 8

Bore 8 is summarised as follows:

DEPTH (m)	DESCRIPTION
Surface	
	FILLING and CLAY
1.0	
	Extremely low strength sandstone, conglomerate and claystone
6.9	
	CORE LOSS
12.3	
	Extremely low to very low strength claystone
18.43	
	VOID
18.93	
	CORE LOSS
19.28	
	Very low strength claystone and sandstone, possible rubble, with numerous zones of core loss
24.56	
	COAL
24.6	
	Medium strength siltstone
>26	

It is considered that the bore was drilled into a roadway as intended, however the roof of the roadway had at least partially collapsed.

Additional bores (Bores 8A, 8B and 8C) were drilled on the alignment of the workings (bearing 40°) at distances of 8 m, 13 m and 30 m from Bore 8. All three bores have indications of collapsed voids at depth suggesting that the roadway continued further to the north than shown on the record trace.

7.2.2 Definition of 20 m Cover Line

Bore 1

Bore 1 was drilled on the inferred 20 m cover line and indicated the following:

DEPTH (m)	DESCRIPTION
Surface	
	Filling and Silty Clay, very stiff to hard
1.0	
	CLAYSTONE, SANDSTONE and CONGLOMERATE, extremely low to medium strength with some core loss
19.9	
	SANDSTONE and SILTSTONE, low to medium strength
21.03	
	COAL
25.25	
	SILTSTONE, medium to high strength
>26.5	

Bore 2

Bore 2 was drilled on the inferred 20 m cover line and indicated the following:

DEPTH (m)	DESCRIPTION
Surface	
	Silty Clay, very stiff to hard
5.9	
	CLAYSTONE, SANDSTONE and CONGLOMERATE, extremely low to low strength with some core loss
13.25	
	SANDSTONE and LAMINITE, low to medium strength
19.7	
	COAL
23.28	
	SILTSTONE, medium to high strength
23.7	

Bore 3

Bore 3 was drilled on the inferred 20 m cover line and indicated the following:

DEPTH (m)	DESCRIPTION
Surface	
	Silty Clay, very stiff to hard
2.3	
	CLAYSTONE, SANDSTONE and CONGLOMERATE, extremely low to low strength with some core loss
17.6	
	SANDSTONE and CLAYSTONE, low to medium strength
22.84	
	COAL
27.3	
	SILTSTONE, medium to high strength
>28.5	

Bore 8

Bore 8 was drilled to define the edge of the workings (as described above) as well as to confirm the depth of cover. The bore indicated the base of the seam was at 24.6 m and with a typical seam thickness of less than 4 m indicates a depth of cover of at least 20 m.

Bore 9

Bore 9 encountered the following:

DEPTH (m)	DESCRIPTION
Surface	
	Sandy silty clay, very stiff to hard
2.0	
	CLAYSTONE, SANDSTONE and CONGLOMERATE, extremely low to low strength with some core loss
19.7	
	SANDSTONE, CONGLOMERATE and SILTSTONE, low to medium strength
30.7	
	COAL
31.5	
	VOID
34.85	
	SILTSTONE, high strength
>35.8	

Bore 12

DEPTH (m)	DESCRIPTION
Surface	
	Silty SAND
0.9	
	CLAY, hard
5.5	
	Saturated Clayey SAND, Clayey GRAVEL/Gravelly CLAY and Sandy GRAVEL
15.0	
	CLAY
19.5	
	SILTSTONE/SANDSTONE, low and medium strength
23.6	
	COAL
25.71	
	VOID
28.2	
	COAL
28.78	
	SILTSTONE, medium to high strength
>29.2	

7.2.3 Areas of Pillar Extraction

Bores 10 and 11

Bores 10 and 11 were drilled in an area at the south west corner of Area B, which is marked on the record trace as pillar extraction in the Wallarah Seam. The bores were undertaken to assess whether the extracted areas had fully collapsed.

Bore 10 was cored to 18.3 m depth and indicated several possible mining induced fractures. The coring was discontinued at 18.3 m due to very difficult drilling conditions and a second bore, Bore 10A, was drilled beside it using percussion methods. Bore 10A indicated an intact coal seam from 32.85 m to 36.85 m depth.

Bore 11 was drilled using percussion methods and indicated a small void from 45.5 m to 45.7 m underlain by goafed (collapsed and broken) rock to 51.75m, and then a thin remnant of the coal seam from 51.75 m to 52 m.

Bore 13

Bore was located well to the south of the site to provide information on the regional dip of the seam. Bore 13 was drilled using percussion methods and indicated a void from 58.5 m to 59.5 m with a remnant of the coal seam from 61.5 m to 62 m depth.

7.3 Summary

The depth of coal seams and void encountered in the bores is summarised in Table 1 below.

Table 1 – Summary of Depths of Coal Seam and Voids

Bore Number	Easting	Northing	Surface Level (AHD)	Depth to Top of Coal (m)	Depth to Base of Coal (m)	Thickness of Coal (m)	Level Top Coal AHD	Depth to Top of Void (m)	Depth to Base of Void (m)	Thickness of Void (m)
1	371204.5	6332084	21.4	21.05	25.35	4.3	0.35	NE	NE	NE
1A	371211.5	6332078	22	22	NE	-	0	23.8	25.4	1.6
2	371290.5	6332044	20.2	19.3	23.28	3.98	0.9	NE	NE	NE
2A	371291	6332047	20.0	19.5	23	3.5	0.544	NE	NE	NE
3	371482.5	6331969	24.1	22.84	27.3	4.46	1.26	NE	NE	NE
5	371199	6332168	11.9	9	12.5	3.5	2.9	NE	NE	NE
5a	371189	6332165	12.5	9	12	3	3.5	NE	NE	NE
5b	371180.8	6332162	13	9	9	0	4	11	12.9	1.9
6	371296.5	6332098	14.2	10.7	14.72	4.02	3.5	12.8	14.7	1.9
7	371419.5	6332051	15.8	-	17.1	NA	NA	NE	17.1	NE
7A	371419.5	6332051	15	13	15.41	2.41	2	NE	NE	NE
8	371622	6331953	19.4	NE	24.6	NA	NA	NE	NE	NE
8A	371628	6331957	19.1	20	22.8	-	-0.9	NE	NE	NE
8B	371632	6331961	19.0	19	NE	-	0	NE	NE	NE
8C	371642	6331975	19.1	16	NE	-	3.1	NE	NE	NE
9	371861	6331625	19.9	30.7	35.4	4.7	-10.783	31.5	33.85	2.35
10	371203	6332020	29.2	32.85	36.85	4	-3.65	NE	NE	NE
11	371251	6331879	37.3		52	-	-10.7	NE	NE	NE
12	371761	6331743	12.7	23.6	28.78	5.48	-10.9	25.96	28.2	2.24
13	371995	6331022	45.6	57	62	5	-11.388	58.5	59.5	1

Notes to Table 1:

NE – Not Encountered

Groundwater

The workings were generally dry, with the exception of Bores 9 and 12 to the south of the site, where groundwater was encountered from 15 m and 6.5 m depth respectively, in the range 4.5 to 5.5 m AHD. It is noted that groundwater levels are transient and can vary with climatic conditions.

8. COMMENTS

8.1 Edge of Workings

West of Pit E Entry

The results of Bores 5 to 5B, 6 and 7/7A as well as the probable shaft locations indicate that for the part of Area B between Bore 5B and Pit E tunnel entries, the mapped extent of workings shown on the record trace is accurate.

Supporting the results of the investigation it would be unlikely that the workings would extend further to the north for the following reasons:

- The mine surface infrastructure was located to the north and the mining would have been unlikely to underlie the surface infrastructure;
- The depth of cover is of the order of about 10 m and is overlain by stiff to hard clay. The stability of the working with only a clay cover would have been poor with less than 10 m cover.

Development is also proposed to the west of Bore 5B, however no subsurface investigation was undertaken in this area. Based on the above information, and the existing surface topography, it is likely that the mapped edge of the workings is accurate in this area, however this would require confirmation drilling.

East of Pit E Entry

The extent of the workings to the east of the Pit E tunnel entries is less certain. Bore 8 was drilled in a location shown on the record trace to be 3 m from the end of a mine roadway. The bore indicated a collapsed roof over a former void. Bores 8A to 8C were drilled along the alignment of the workings and indicated similar conditions suggesting the roadway continued at least 27 m past the mapped location. The roadway in question as shown on the record trace as shorter (not extending as far north east) than adjacent roadways, however Bore 8C was drilled about 3 m outside the typical extent of the nearby roadways.

The depth of cover to the workings is greater in this location than to the west of the Pit E entry and it is possible that the workings were extended further to the north east than shown on the record trace because of the available cover. Therefore a zone has been mapped on Drawing 1 in orange which indicates possible unmapped workings with less than 20 m cover. The zone has been extended to the approximate 10 m cover line as this is the typical limit of workings on the western part of the site. Additional drilling would be required to confirm the extent of the workings in this area.

There is a mapped area of shallow workings about 25 m to the east of Area A as shown on Drawing 1. No drilling has been undertaken to confirm the exact location of these workings.

8.2 Geometry of Bords

The geometry of the bords was confirmed at Bores 1A, 5B, 6, 9 and 12, where un-collapsed bords were intersected.

The working section (height of void) ranged from 1.6 m to 2.35 m. The width of the bords was measured at Bores 1A, 5B and 6 using ultrasonic methods. The north east-south west oriented bords (roadways) ranged from 5.0 m to 6.5 m wide, generally consistent with the record trace which indicated about 6 m wide roadways. A perpendicular bord (cut through) was measured at an intersection and was estimated to be approximately 4 m wide, however the width may reduce away from the intersection.

Plots of the ultrasound measurements are presented on Figures 2 to 5 in Appendix D.

8.3 Risk of Pothole Subsidence

History of Potholes

One well developed pothole has been observed on site, over an intersection of the workings, to the west of Bore 5B, where the depth of cover is about 10 m. A second possible pothole was observed about 15 m south west of Bore 7, where a shallow (less than 0.5 m deep) depression was noted, in an area where the depth of cover is probably about 15 m.

It is also understood that a pothole had formed on the western side of the cottages along Flowers Drive to the south of Area B. The pothole is reported to have affected a cottage which was demolished and the pothole in-filled. The exact location of the pothole has not been established, however review of historical aerial photographs indicates that the cottages were located in two cleared areas to the south of the site in the period 1954 to 1996, however are now all gone. No other cottages were noted to have been removed in this time in the general area.

Therefore it is considered likely that the pothole was located in the vicinity of Bore 12 (south of the site), where saturated alluvial/colluvial soils were encountered to 15 m depth, with a total depth of cover of about 20 m to 25 m.

The location of identified historic potholes at the site is shown on Drawing 1 attached, in Red.

Boreholes

Collapse of the roof of the workings was observed at Bore 7, where collapse and bulking of the roof of the roadway has occurred below a depth of about 4 m to the floor of the workings at 17.1 m.

Collapse of the roof of the workings was also observed at Bores 8 to 8C, with collapse and possible bulking of the roof below depths ranging from 7 m to 21 m with the base of the seam at depths of 19.8 m, greater than 21.5 m and 22.8 m.

Pothole Risk

An established rule of thumb for pothole subsidence is that potholes can progress above the roof of the workings through weather rock and residual clay a distance of up to five times the working section (height of void). Based on a typical working section of 2.0 m this would suggest a critical depth of cover of 10 m.

If such strata were overlain by saturated granular soils then there would be a risk of the saturated granular strata becoming liquefied and running into the workings, creating a sink hole above. Such strata was encountered at Bore 12, however such conditions are not expected on the development site.

Based on the site history of potholes, which generally seem to have formed in areas with about 10 m to 15 m cover, the results of bores which indicate that collapse of the roof has occurred up to 10 m to 15 m above the workings and experience with other sites, it is considered that there is a risk of pothole subsidence up to a depth of cover of about 15 m in areas of residual soil and weathered rock profiles.

Therefore it is recommended that for development in areas with less than 20 m cover of residual soil and rock, development be restricted as follows:

- For residential development full grouting of workings would be required;
- Roads in such areas may require grouting. Alternatively the consequences of a pothole in such an area could be mitigated by using Geo-grid (plastic mesh) reinforcement of the pavement to span a pothole may be a possible option. In this case the road and pothole would still need to be repaired, however the risk of harm to pedestrians and vehicle occupants would be significantly reduced;
- Buried services should ideally be located along existing roads or road which have been treated by grouting, otherwise they will need to be designed to span across potholes;
- Undeveloped areas will need to be managed appropriately to reduce the risk to public safety. This may include fencing and/or signage.

8.4 20 m Depth of Cover Line

Site B

Bores 1, 2, 3 and 8 were all drilled along the inferred 20 m depth of cover line and indicated the depth to workings or coal (in the absence of workings) was in the range 19.3 m to 21 m. The cover line was adjusted slightly to account for results of the bores, with the biggest change from the Phase 1 mapping at the eastern end near Bore 8, where a slight north easterly trending topographic spur results in an increased depth of cover.

No investigation was undertaken to the west of Bore 1. The depth of cover has been mapped in this location based on interpreted contours to the base of seam based on the results of drilling and the information on record traces. The approximate 20 m cover line in this area is shown as dashed red on Drawing 1, however would require confirmation by drilling.

8.5 Development in Areas with Greater than 20 m Cover

The south western parts of the Area B have between 20 m and 50 m depth of cover as mapped yellow on Drawing 1.

Development is likely to be generally restricted to single storey brick veneer (or similar). It may be possible to revise the development restrictions to something less onerous in some areas, subject to detailed risk assessment and subsidence predictions.

A standing pillar was encountered in Bore 10, where the record traces indicated that full pillar extraction had occurred and therefore reduction of the development restriction in this vicinity is very unlikely. In this area, localised grouting may be required to allow two storey development and possibly for one storey development. Bore 11, drilled to the south, however indicated that full collapse of the workings had occurred and in such areas the development restriction could probably be revised to allow two storey construction. Due to the inconsistency between the record trace and the results of Bore 10, significant drilling would be required to confirm the extent of fully collapsed workings and final development restrictions.

8.6 Grouting of Workings

Typical Procedure

Grouting of high risk pothole areas of workings would typically comprise the following:

- Drilling and placement of low slump grout to block off roadways near the edge of the target area, most likely near the 20 m cover contour;
- Mass infilling the closed off area using high slump grout;
- Grout mixes would depend on the availability of suitable materials, however, may include blends of fly ash, bottom ash, slag, lime or cement;
- In areas where partial collapse of workings has already occurred, special attention would be required to ensure that the voids are filled. This may require additional drilling of bores to fill localised voids and careful attention to verification of the grouting;
- Verification of the grouting would be achieved by a combination of review of grouting records, such as grout takes, as well as by verification drilling.

Estimated Volumes

The estimated volume of workings in high risk pothole areas, potentially requiring infill grouting has been estimated for various parts of the site. The estimates are based on an average width of 6 m for roadways and 4 m for cut-throughs and a typical working section of 2.0 m.

It is noted that the subsurface investigations were targeted on the central and eastern parts of Area B, east of Bores 1 and 5, and therefore the data supporting the volume estimates is stronger than that used to estimate volumes in areas where less investigation has been undertaken to date, such as west of Bores 1 and 5. The level of certainty in the volume calculations will therefore vary based on the strength of the input data. In areas with limited data, addition investigation is recommended to refine the volume calculations.

Table 2 below provides estimated volumes of the workings, together with a summary of the strength of the data supporting the estimation.

Table 2 - Estimated Volume of Workings in High Risk Pothole Area

Zone	Estimated Volume of Workings in High Risk Pothole Area (m3)	Basis of Estimate
Area B, zone marked in bold red on Drawing 1	36,000	Directly based on the results of bores in the subject area
Area B, zone to the west of Bores 1 and 5, shown as dashed red		Based on the record trace records and the interpreted 20 m depth of cover as described in Section 8.4. No drilling has been undertaken in this area.
Area B, possible unmapped workings	6000	Based on estimated zone of unmapped workings shown as dashed orange on Drawing 1 and extension of the roadways to the south to the limit of the zone. No drilling has been undertaken in this Zone

8.7 Shafts, Tunnels and Existing Potholes

There are several shafts and tunnel entries in Area B. Development over such features would be possible subject to grouting of the associated shallow workings together with partial excavation and re-compaction of the filling.

Existing pothole features would also require partial excavation and re-compaction.

8.8 Future Mining

Reference to the NSW Department of Primary industries web site indicates that the site is not underlain by any existing coal or minerals titles. The proposed development would not preclude future mining. Any future mining, however would need to be undertaken in a manner which limits surface subsidence and this may require bord and pillar mining. Restrictions on development due to future mining are normally provided by the DARZL Committee and a formal application to the MSB is required for consideration by DARZL.

The general area is subject to petroleum exploration licence 461 held by Macquarie Energy Pty Ltd which expires in September 2012. Petroleum extraction, if proposed in the future, can generally be designed to be compatible with existing development.

8.9 Additional Investigation

The investigations to date have been concentrated on the central and eastern parts of Area B and generally provided confirmation of conditions within this area. An area of possible unmapped workings in Area B, mapped as orange on Drawing 1, and additional investigation is recommended in this area to confirm the extent of workings. The presence of existing houses and dense vegetation currently limits access and such investigation would ideally be undertaken subsequent to demolition/ clearing.

The proposed development in Area B extends further to the west of the area subjected to concentrated investigation. The nature of the workings in this area has been inferred from the record traces and results of investigation immediately to the east and the presence of an actual pothole, however, additional drilling in this area would add confidence to the inferred conditions. The area contains dense vegetation, which would require prior clearing.

Drilling along the eastern boundary of Area 2 is suggested to confirm the absence of workings in this location.

It is also expected that the following will be required to refine the grouting design requirements:

- Some additional percussion drilling in anticipated grout bore locations to reduce the risk of unexpected conditions being encountered after the contractor has mobilised to site. These bores could later be used for grouting of the workings;
- Monitoring of mine water levels in terms of depth and quality to assess whether the mine water can be used for grout mixing and whether there is a risk that displaced water will require disposal/treatment;
- Batch testing of proposed grout mixes;
- Consultations with the MSB to get conditional approval of the proposed grouting methodology;

- Additional methane monitoring.

9. SUMMARY

9.1 Area A

Mine records indicate no mine workings in Area A. Therefore no restrictions with respect to mine subsidence are expected in this area.

9.2 Area B

Area B is underlain by workings in the Wallarah Seam at depths of cover ranging from about 10 m to about 40 m, as well as underlying workings in the Great Northern Seam in the south west corner of the site. The area has been divided into zones, with respect to expected mine subsidence related development restrictions, as follows:

- ***No mapped workings***. This zone is on the northern, lower lying parts of the area, mapped in green on Drawing 1. No mine subsidence related restrictions to development are expected in this zone;
- ***Mapped workings with less than 20 m cover***. This zone is mapped as red on Drawing 1 and has a high risk of pothole subsidence. Grouting of the workings would be required to allow development in this area;
- ***Possible unmapped workings with less than 20 m cover***. This zone is mapped as orange on Drawing 1 and indicates the possible presence of workings with less than 20 m cover. Additional assessment would be required to confirm the presence of such workings and if present would represent a high risk of pothole subsidence, as above;
- ***Greater than 20 m cover***. This zone is along the western parts of the southern boundary of the area, mapped in yellow on Drawing 1. Development is likely to be restricted to single storey brick veneer or similar. Localised grouting of the workings may be required, in particular for two storey development.

Area B includes a number of backfilled shafts and tunnel entries which will require remedial works as outlined in Section 8.7.

7. LIMITATIONS

Douglas Partners (DP) has prepared this report for this project at Catherine Hill Bay in accordance with DP's proposals dated 22 June 2007 and 20 January 2010. The work was carried out under Rio Tinto Short Form General Conditions for Consultancy Services, August 2004 as amended by DP letter of 6 September 2007. This report is provided for the exclusive use of the Coal & Allied Industries Ltd and Catylis for the specific project and purpose as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party.

The results provided in the report are considered to be indicative of the sub-surface conditions on the site only to the depths investigated at the specific sampling and/or testing locations, and only at the time the work was carried out. DP's advice may be based on observations, measurements, tests or derived interpretations. The accuracy of the advice provided by DP in this report is limited by unobserved features and variations in ground conditions across the site in areas between test locations and beyond the site boundaries or by variations with time. The advice may be limited by restrictions in the sampling and testing which was able to be carried out, as well as by the amount of data that could be collected given the project and site constraints. Actual ground conditions and materials behaviour observed or inferred at the test locations may differ from those which may be encountered elsewhere on the site. Should variations in subsurface conditions be encountered, then additional advice should be sought from DP and, if required, amendments made.

It is noted that the site is within a proclaimed mine subsidence district. This report outlines the potential risks associated with mine subsidence and presents guidelines for managing the risk and obtaining Mine Subsidence Board consideration for the proposed development. It is noted that the guidelines presented are not intended to fully prevent damage to property or person, rather reduce the risks and Douglas Partners accept no liability with respect to such damage. The Mine Subsidence Board should be consulted with respect to the proposed development to obtain their consent of the proposal.

This report must be read in conjunction with the attached "Notes Relating to This Report" and any other attached explanatory notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions from review by others of this report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this report. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

DOUGLAS PARTNERS PTY LTD

Reviewed by:

Will Wright
Principal

John Harvey
Principal

REFERENCE:

1. Douglas Partners Pty Ltd, Phase 1 – Constraints Paper, Geotechnical and Geo-environmental Assessment, Southern Area – Catherine Hill Bay, Prepared for Coal and Allied Operations Pty Limited, Project 39662, May 2007.

Douglas Partners
Geotechnics · Environment · Groundwater

NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

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

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

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

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

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

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

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

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

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

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water

table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

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

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

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

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

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

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

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

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

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

q_c = (12 to 18) c_u

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

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

Hand Penetrometers

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

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

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

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

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

Ground Water

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

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

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

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

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

Site Anomalies

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

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section

is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

AN ENGINEERING CLASSIFICATION OF SEDIMENTARY ROCKS IN THE SYDNEY AREA

This classification system provides a standardized terminology for the engineering description of the sandstone and shales in the Sydney area, but the terms and definitions may be used elsewhere when applicable.

Under this system rocks are classified by Rock Type, Degree of Weathering, Strength, Stratification Spacing, and Degree of Fracturing. These terms do not cover the full range of engineering properties. Descriptions of rock may also need to refer to other properties (e.g. durability, abrasiveness, etc.) where these are relevant.

ROCK TYPE DEFINITIONS

Rock Type	Definition
Conglomerate:	More than 50% of the rock consists of gravel sized (greater than 2mm) fragments
Sandstone:	More than 50% of the rock consists of sand sized (.06 to 2mm) fragments
Siltstone:	More than 50% of the rock consists of silt-sized (less than 0.06mm) granular particles and the rock is not laminated
Claystone:	More than 50% of the rock consists of clay or sericitic material and the rock is not laminated
Shale:	More than 50% of the rock consists of silt or clay sized particles and the rock is laminated

Rocks possessing characteristics of two groups are described by their predominant particle size with reference also to the minor constituents, e.g. clayey sandstone, sandy shale.

DEGREE OF WEATHERING

Term	Symbol	Definition
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original fresh rock substance is no longer recognisable.
Moderately Weathered	MW	Rock substance affected by weathering to the extent that staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is no longer recognisable.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh	Fs	Rock substance unaffected by weathering, limonite staining along joints.
Fresh	Fr	Rock substance unaffected by weathering.

STRATIFICATION SPACING

Term	Separation of Stratification Planes
Thinly laminated	<6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	>2 m

ROCK STRENGTH

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

Strength Term	Is(50) MPa	Field Guide	Approx. qu MPa*
Extremely Low:	0.03	Easily remoulded by hand to a material with soil properties	0.7
Very Low:	0.1	May be crumbled in the hand. Sandstone is “sugary” and friable.	2.4
Low:	0.3	A piece of core 150 mm long x 50 mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	7
Medium:	1	A piece of core 150 mm long x 50 mm dia. can be broken by hand with considerable difficulty. Readily scored with knife.	24
High:	3	A piece of core 150 mm long x 50 mm dia. cannot be broken by unaided hands, can be slightly scratched or scored with knife.	70
Very High:	10	A piece of core 150 mm long x 50 mm dia. may be broken readily with hand held hammer. Cannot be scratched with pen knife.	240
Extremely High:		A piece of core 150 mm long x 50 mm dia. is difficult to break with hand held hammer. Rings when struck with a hammer.	

* The approximate unconfined compressive strength (qu) shownin the table is based on an assumed ratio to the point load index of 24:1. This ratio may vary widely.

DEGREE OF FRACTURING

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

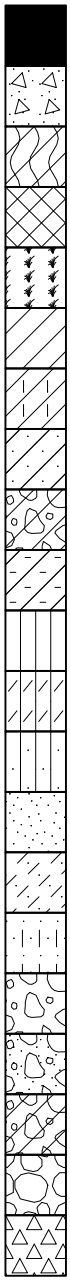
Term	Description
Fragmented:	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than the core diameter.
Highly Fractured:	Core lengths are generally less than 20 mm - 40 mm with occasional fragments.
Fractured:	Core lengths are mainly 30 mm - 100 mm with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

REFERENCE

International Society of Rock Mechanics, 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. 1 Final Draft October 1972

GRAPHIC SYMBOLS FOR SOIL & ROCK

SOIL



BITUMINOUS CONCRETE

CONCRETE

TOPSOIL

FILLING

PEAT

CLAY

SILTY CLAY

SANDY CLAY

GRAVELLY CLAY

SHALY CLAY

SILT

CLAYEY SILT

SANDY SILT

SAND

CLAYEY SAND

SILTY SAND

GRAVEL

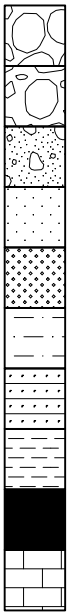
SANDY GRAVEL

CLAYEY GRAVEL

COBBLES/BOULDERS

TALUS

SEDIMENTARY ROCK



BOULDER CONGLOMERATE

CONGLOMERATE

CONGLOMERATIC SANDSTONE

SANDSTONE FINE GRAINED

SANDSTONE COARSE GRAINED

SILTSTONE

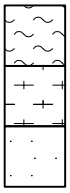
LAMINITE

MUDSTONE, CLAYSTONE, SHALE

COAL

LIMESTONE

METAMORPHIC ROCK

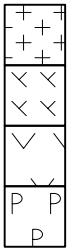


SLATE, PHYLITTE, SCHIST

GNEISS

QUARTZITE

IGNEOUS ROCK



GRANITE

DOLERITE, BASALT

TUFF

PORPHYRY

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ABBREVIATIONS USED IN DISCONTINUITIES COLUMN OF TEST BORE LOGS

Abbreviation	Meaning
DB	Drill Break
P	Parting
J	Joint
Fr	Fracture
F	Fault
un	Undulating
ro	Rough
H	Healed
pl	Planar
fg	Fragmented
cs lam	Carbonaceous lamination
sm	Smooth
ti	Tight
di	Probably drilling induced
st	Stepped
sl	Slickensided
Fe	Ironstained
hor	Horizontal
V	Vertical
sh	Subhorizontal
sv	Subvertical
cy	clay
ca	calcite

Examples:

1. At 62.04 m, P, 30°, un, st, ro, cs lam
   At 62.04 m Parting, 30°, undulating, stepped, rough, on carbonaceous siltstone lamination

2. At 65.08 m, Fr, 70°, pl, ro, st, fr
   At 65.08 m, fracture, planar, rough, stepped, fragmented.

BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 39662D
DATE: 07 Aug 07
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.3	FILLING: Dark grey-brown clayey coal filling, M<Wp							A			
	0.7	SILTY CLAY: (Stiff to very stiff) light brown silty clay, M>Wp										
1	1.0	SANDY SILTY CLAY: Very stiff light grey and brown mottled red sandy silty clay (extremely weathered conglomerate), with trace fine sized subangular gravel, M>Wp							A			
		CONGLOMERATE: Extremely low to low strength, extremely weathered brown conglomerate, slow auger progress							A			
2		From 1.9m, extremely low strength light grey-brown sandstone										
		From 2.1m to 2.3m, extremely low strength, extremely weathered (water inflow)										
	2.8	From 2.3m, low strength						2.8m: CORE LOSS: 400mm				
3	3.2	CORE LOSS:										
		SANDSTONE: Low to medium strength, highly weathered light grey-brown sandstone						3.25m: P, sh, pl, sm From 3.34m to 3.37m, Fg 3.43m: P, sh, pl, sm 3.46m: P, sh, pl, sm				
4								4.02m: P, sh, pl, ro				
	4.36	CONGLOMERATE: Medium strength, highly weathered brown conglomerate						4.3m: P, sh, pl, ro 4.45m: P, sh, pl, ro	C	86	78	
5								4.98m: P, sh, pl, ro 5.18m: P, sh, pl, ro 5.35m: P, sh, pl, ro				
								5.8m: P, sh, ro				
6								6.12m: J, 45°, pl, ro	C	72	30	
	6.65	CORE LOSS:						From 6.56m to 6.65m, friable 6.65m: CORE LOSS: 350mm				
7	7.0	CORE LOSS:						7m: CORE LOSS: 200mm				
	7.2	CLAYSTONE: Extremely low to very low strength, extremely to highly weathered grey claystone						7.29m: P, sh, pl, sm, clay seam 7.33m: P, sh, pl, sm, clay seam	C	50	0	
	7.65	CORE LOSS:										
8	7.9	CLAYSTONE/SILTSTONE: Very low strength, extremely to moderately weathered light grey-brown claystone/siltstone						7.46m: P, sh, pl, un, ro-sm From 7.46m to 7.65m, J, 60°, pl, ro, FeO 7.65m: CORE LOSS: 250mm 8.7m: J, 45°, un, ro, FeO	C	84	32	
9								8.95m: J, 45°, h 9.16m: J, 40°, un, sm, clay smear, FeO	C	100	77	

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 2.8m

TYPE OF BORING: Solid flight auger (tc-bit) to 2.8m, then HQ wireline to 26.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: 2.8m PVC 100mm diameter casing installed

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 39662D
DATE: 07 Aug 07
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.0	CLAYSTONE/SILTSTONE: continued						10.51m: P, sh, pl, sm				
	11								C	100	77	
	11.31	SANDSTONE: Very low to low strength, moderately weathered grey fine grained sandstone, with interbedded siltstone						11.8m: Fr, sv, pl, sm, clay smear, FeO 11.83m: P, sh, h, clay lined 2mm thick 11.94m: P, sh, un, ro, FeO 11.97m: P, sh, un, ro, FeO				
	12											
	12.3	CONGLOMERATE: Low to medium strength, highly weathered brown conglomerate, with interbedded sandstone										
	13							13.4m: J, 60°, un, ro, FeO	C	100	93	
	14							From 14.48m to 14.51m, friable				
	15							15m: P, sh, pl, sm				
	15.37	CORE LOSS:						15.37m: CORE LOSS: 400mm				
	15.77	CLAYSTONE/SILTSTONE: Extremely low to low strength, extremely weathered grey claystone/siltstone							C	85	56	
	16											
	17							From 17.35m to 17.42m, friable From 17.42m to 17.72m, Fr, sv, un, sm, clay lined				
	18							18.25m: J, 60°, un, sm				
	19								C	100	75	
	19.9							19.7m: J, 45°, un, sm From 19.75m to 19.9m,				

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 2.8m

TYPE OF BORING: Solid flight auger (tc-bit) to 2.8m, then HQ wireline to 26.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: 2.8m PVC 100mm diameter casing installed

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 39662D
DATE: 07 Aug 07
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	20.0	SILTSTONE: Low strength, moderately weathered grey siltstone						friable				
		SILTSTONE: continued						20.24m: P, sh, pl, ro-sm	C	100	75	
	20.84							20.72m: P, sh, un, ro				
21	21.03	SANDSTONE/SILTSTONE: Medium strength, slightly weathered grey fine grained sandstone/siltstone						20.75m: P, sh, un, ro				
	21.05							21.17m: P, sh				
	21.32	CARBONACEOUS MUDSTONE: Medium strength, slightly weathered brown carbonaceous mudstone						From 21.23m to 21.32m, Fg				
	21.47							21.32m: CORE LOSS: 150mm				
22		COAL: Medium strength, slightly weathered black coal						21.5m: P, sh				
		CORE LOSS:						21.56m: P, sh				
		COAL: Medium strength, fresh black coal						21.61m: P, sh	C	95	15	
								21.68m: P, sh				
								21.78m: P, sh				
								21.81m: P, sh				
								21.9m: P, sh				
23								From 22.05m to 23.65m, Fr, sv				
	23.65											
	23.8	CORE LOSS:						23.65m: CORE LOSS: 150mm				
24		COAL: Medium strength, fresh black coal						From 23.8m to 23.88m, Fg				
								24.05m: P, sh				
								24.21m: P, sh				
								24.23m: P, sh				
								24.35m: P, sh				
25								24.97m: P, sh	C	91	42	
	25.25	META SILTSTONE: Medium to high strength, fresh grey-brown meta siltstone, with interbedded fine grained sandstone						From 24.97m to 25.25m, Fg at 0.01 to 0.05m intervals				
								25.25m: P, sh, pl, sm				
								25.47m: P, sh, pl, sm				
26								25.6m: P, sh, pl, sm				
								25.65m: P, sh, pl, sm				
								25.7m: P, sh, pl, sm				
								25.75m: P, sh, pl, sm				
								25.95m: P, sh, pl, sm				
	26.5	Bore discontinued at 26.5m, limit of investigation						26.07m: P, sh, pl, sm				
								26.08m: P, sh, pl, sm				
27								26.13m: P, sh, pl, sm				
								26.15m: P, sh, pl, sm				
								26.21m: P, sh, pl, sm				
								26.4m: J, 60°, pl, st, sm				
28												
29												

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 2.8m

TYPE OF BORING: Solid flight auger (tc-bit) to 2.8m, then HQ wireline to 26.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: 2.8m PVC 100mm diameter casing installed

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED	
Initials:	
Date:	

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1A
PROJECT No: 39662D
DATE: 10 Aug 07
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0	SILTY CLAY: Silty clay grading to extremely weathered conglomerate							
	2.0	CONGLOMERATE:							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** PVC

TYPE OF BORING: Solid flight auger to 4m, then blade-bit (air) to 25.4m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore 1A located 9.2m at 120° from north of Bore 1 (pegged location)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1A
PROJECT No: 39662D
DATE: 10 Aug 07
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.0	SILTSTONE: (Extremely low to low strength)							
	11								
	12								
	13								
	14								
	15								
	16								
	17								
	18								
	19								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** PVC

TYPE OF BORING: Solid flight auger to 4m, then blade-bit (air) to 25.4m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore 1A located 9.2m at 120° from north of Bore 1 (pegged location)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1A
PROJECT No: 39662D
DATE: 10 Aug 07
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	21	SILTSTONE: (Extremely low to low strength) *(continued)*							
	22 22.0	SILTSTONE AND COAL: (Medium to high strength)							
	23								
	23.8	VOID:							
	24								
	25								
	25.4	Bore discontinued at 25.4m, due to limit of investigation							
	26								
	27								
	28								
	29								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** PVC

TYPE OF BORING: Solid flight auger to 4m, then blade-bit (air) to 25.4m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore 1A located 9.2m at 120° from north of Bore 1 (pegged location)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: 20.2
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 39662D
DATE: 06 Aug 07
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
20	0.2	FILLING: Dark grey and brown silty clay filling										
		SILTY CLAY: Very stiff to hard light brown silty clay, with some fine grained sand and fine sized subangular gravel, M>Wp							S			5,10,12 N = 22
19	1								pp			300 kPa
18	2											
	2.85	SANDY SILTY CLAY: Hard light brown mottled orange sandy silty clay, with trace to some fine sized subangular gravel (extremely weathered sandstone), M>Wp (moist)							S			6,9,13 N = 22
17	3											
16	4											
15	5											
	5.85	CORE LOSS:						5.85m: CORE LOSS: 50mm				
	5.9	CLAYSTONE: Extremely low to low strength, extremely to highly weathered grey and brown claystone						From 6.2m to 6.45m, friable/Fg				
14	6											
13	7							7.1m: P, sh, h	C	98	90	
								7.4m: J, 45°, pl, un, ro-sm				
								7.6m: J, 45°, st, h				
								7.7m: J, 50°, clay lined 2mm thickness, h				
12	8							7.9m: J, 60°, h				
								8.1m: J, sv, h				
								8.53m: P, sh, clay lined 3mm thickness				
11	9							From 9.13m to 9.16m, Fg	C	100	82	
	9.5	PEBBLY SANDSTONE: Extremely low to low strength, extremely to highly weathered brown pebbly										

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 5.85m

TYPE OF BORING: Solid flight auger (tc-bit) to 5.85m, then HQ3 wireline to 23.7m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: 6m 100mm PVC permanent casing installed

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: 20.2
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 39662D
DATE: 06 Aug 07
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
10	10.0	sandstone										
		PEBBLY SANDSTONE: Extremely low to low strength, extremely to highly weathered brown pebbly sandstone						10.7m: J, 45°, pl, ro, clay lined From 11.0m to 11.45m, friable/Fg	C	100	82	
9	11											
	11.7	CORE LOSS:						11.7m: CORE LOSS: 700mm	C	47	0	
8	12											
	12.4	CONGLOMERATE: Extremely low to medium strength, extremely to highly weathered brown conglomerate						From 12.4m to 12.75m, friable/Fg	C	64	0	
	12.6											
	12.75							12.75m: CORE LOSS: 500mm				
7	13	SANDSTONE/SILTSTONE: Extremely low to medium strength, extremely to highly weathered brown sandstone/siltstone										
	13.25	CORE LOSS:						13.32m: P, sh, un, ro 13.4m: P, sh, un, ro 13.5m: P, sh, un, ro 13.55m: J, (MFr?), sv, un, ro, FeO	C	60	0	
6	13.95	SANDSTONE: Extremely low to very low strength, extremely to highly weathered grey-brown sandstone						From 13.6m to 13.95m, friable 14.21m: P, sh, clay lined, h				
	14	LAMINITE: Low to medium strength, slightly weathered grey siltstone (sandstone laminite)										
5	15							14.95m: J, 45°, pl, ro				
	15.5	CORE LOSS:						15.45m: P, sh, pl, ro 15.5m: P, sh, pl, ro CORE LOSS: 50mm	C	98	86	
	15.55	LAMINITE: Low to medium strength, slightly weathered grey siltstone (sandstone laminite)										
4	16											
3	17							>>	C	100	100	
2	18											
1	19							From 19.0m to 19.03m, clay seam 30mm thickness From 19.07m to 19.11m, Fg 19.4m: P, sh 19.45m: P, sh	C	93	60	
	19.3	CARBONACEOUS SILTSTONE: Medium strength, fresh black carbonaceous siltstone										
	19.4											
	19.52											
	19.67	COAL: Medium strength, fresh										

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 5.85m

TYPE OF BORING: Solid flight auger (tc-bit) to 5.85m, then HQ3 wireline to 23.7m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: 6m 100mm PVC permanent casing installed

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: 20.2
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 39662D
DATE: 06 Aug 07
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
0	20.0	black coal										
		CORE LOSS:						19.52m: CORE LOSS: 150mm				
		COAL: Medium strength, fresh black coal						From 19.67m to 19.74m, Fg	C	93	60	
								19.82m: P, sh				
								20.7m: Fr, 45° to sv, st				
-1	21							20.76m: P, sh				
		COAL: Medium strength, fresh black coal						20.79m: P, sh				
		From 20.76m to 20.79m, carbonaceous mudstone						21.17m: P, sh				
								21.23m: P, sh				
								21.36m: P, sh				
								21.45m: P, sh				
								21.5m: P, sh				
								21.65m: P, sh				
								21.75m: P, sh				
-2	22							21.78m: P, sh				
								21.9m: P, sh				
								22.1m: P, sh	C	83	35	
								22.21m: P, sh				
								22.3m: P, sh				
								22.37m: P, sh				
								22.4m: P, sh				
								22.49m: P, sh				
	22.6	CORE LOSS:						22.6m: CORE LOSS: 350mm				
-3	22.95	COAL: Medium strength, fresh black coal						From 23.03m to 23.28m, Fg				
	23.28	SANDSTONE/SILTSTONE: Medium to high strength, fresh grey fine grained sandstone/siltstone						23.4m: Fr, sv, pl, ro-sm, pyrite				
	23.6							23.6m: CORE LOSS: 100mm				
	23.7	CORE LOSS:										
-4	24	Bore discontinued at 23.7m, limit of investigation										
-5	25											
-6	26											
-7	27											
-8	28											
-9	29											

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 5.85m

TYPE OF BORING: Solid flight auger (tc-bit) to 5.85m, then HQ3 wireline to 23.7m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: 6m 100mm PVC permanent casing installed

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2A
PROJECT No: 39662D
DATE: 10 Aug 07
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0	CLAY:							
	1								
	2								
	3	From 3.0m, extremely weathered conglomerate							
	4								
	5								
	6	6.0 CONGLOMERATE:							
	7								
	8								
	9								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 1m PVC permanent casing

TYPE OF BORING: Solid flight auger to 1.0m, then blade bit (hammer drill) to 26.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located _ _ _ _ _ _ _

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2A
PROJECT No: 39662D
DATE: 10 Aug 07
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.0	CONGLOMERATE: continued							
	11								
	12								
	13	13.0 SILTSTONE:							
	14								
	15								
	16								
	17								
	18								
	19								
	19.5	COAL:							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 1m PVC permanent casing

TYPE OF BORING: Solid flight auger to 1.0m, then blade bit (hammer drill) to 26.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located _ _ _ _ _ _ _

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2A
PROJECT No: 39662D
DATE: 10 Aug 07
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	20.0	COAL: continued							
	21								
	22								
	23 23.0	SILTSTONE:							
	24 24.0	CONGLOMERATE:							
	25								
	26 26.0	Bore discontinued at 26.0m, limit of investigation							
	27								
	28								
	29								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 1m PVC permanent casing

TYPE OF BORING: Solid flight auger to 1.0m, then blade bit (hammer drill) to 26.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located _ _ _ _ _ _ _

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 39662D
DATE: 08 Aug 07
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.3	CLAYEY SILT: Dark brown clayey silt, with abundant organics, M<Wp										
		SILTY CLAY: (Very stiff) light grey-brown mottled red silty clay, M>Wp										
	1.4	CLAYSTONE: Extremely low to low strength, extremely weathered light grey claystone							S pp			12,20/80mm,->450 kPa
	2.35	SANDSTONE/CONGLOMERATE: Extremely low to low strength, extremely weathered brown-red conglomerate										
	2.85	CORE LOSS:						2.85m: CORE LOSS: 2050mm	C	98	13	
	4.9	PEBBLY SANDSTONE: Very low to low strength, highly weathered brown pebbly sandstone						From 5.0m to 5.15m, Fg 5.26m: P, sh, pl, sm, clay lined				
	5.85	CORE LOSS:						From 5.72m to 5.85m, friable 5.85m: CORE LOSS: 350mm	C	67	19	
	6.2	CONGLOMERATE: Extremely low to low strength, highly weathered brown FeO stained conglomerate						From 6.2m to 6.55m, Fg				
	6.9	LAMINITE: Low strength, highly weathered light grey-brown and red sandstone and siltstone laminite						7.1m: J, 45°, st, pl, sm, FeO 7.2m: J, sv, h 7.4m: J, 50°, pl, sm, FeO 7.7m: J, sv, h 7.8m: J, 60°, h 8m: J, 60°, h 8.2m: J, 60°, h 8.25m: J, 60°, h	C	100	92	
								8.8m: P, 5°, h, FeO 8.89m: P, sh, un, ro 8.94m: P, sh, un, ro 8.97m: P, sh, un, ro 9.04m: P, sh, un, ro From 9.13m to 9.15m, Fg From 9.4m to 9.9m, J, sv, h, FeO	C	91	33	
	9.84	SILTSTONE/CLAYSTONE: Low										

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 5.85m

TYPE OF BORING: Solid flight auger (tc-bit) to 2.8m, then HQ3 wireline to 28.5m

WATER OBSERVATIONS: Groundwater obscured due to drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 39662D
DATE: 08 Aug 07
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.0	strength, highly weathered grey siltstone/claystone						From 9.5m to 9.52m, clay seam				
		SILTSTONE/CLAYSTONE: Low strength, highly weathered grey siltstone/claystone						10.24m: J, (MFR?), 60°, st, pl, sm				
	10.72	CORE LOSS:						10.46m: P, 3°, pl, sm 10.5m: P, 3°, pl, sm 10.72m: CORE LOSS: 250mm	C	91	33	
11	10.97	CONGLOMERATE: Low to medium strength, highly weathered brown conglomerate						From 11.1m to 11.6m, J, 70°, pl, ro, FeO				
								From 11.6m to 11.65m, friable	C	95	86	
12												
	12.7	CORE LOSS:						12.6m: P, sh, un, ro 12.7m: CORE LOSS: 1950mm				
13									C	11	0	
14												
	14.65	PEBBLY SANDSTONE: Very low to low strength, highly weathered brown pebbly sandstone						From 14.65m to 14.9m, Fg				
	14.9							14.9m: CORE LOSS: 200mm				
15	15.1	CORE LOSS:						From 15.1m to 15.3m, Fg				
		PEBBLY SANDSTONE: Very low to low strength, highly weathered light grey pebbly sandstone						From 15.46m to 15.5m, friable 15.71m: P, sh, un, ro, FeO	C	83	61	
16								From 16.03m to 16.08m, friable				
	16.75	CORE LOSS:						16.75m: CORE LOSS: 150mm	C	87	38	
	16.9	SANDSTONE: Low strength, highly weathered brown sandstone						17.1m: P, sh, pl, ro				
17												
	17.6	CLAYSTONE/SILTSTONE: Medium strength, slightly weathered grey claystone/siltstone						17.9m: P, sh, pl, sm				
18								18.44m: J, 45°, h	C	98	92	
19												
	19.24	CORE LOSS:						19.15m: P, sh, pl, ro 19.24m: CORE LOSS: 50mm				
	19.29	CLAYSTONE/SILTSTONE: Medium strength, slightly weathered grey claystone/siltstone						19.5m: J, 70°, h 19.7m: J, 45°, h 19.8m: J, 45°, h				

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 5.85m

TYPE OF BORING: Solid flight auger (tc-bit) to 2.8m, then HQ3 wireline to 28.5m

WATER OBSERVATIONS: Groundwater obscured due to drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 39662D
DATE: 08 Aug 07
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	20.0	CLAYSTONE/SILTSTONE: continued						20.26m: J, 15°, h 20.38m: J, 15°, pl, sm 20.46m: J, 60°, pl, sm, clay lined 2mm thick 20.6m: J, 80°, h				
	21							21.4m: J, 80°, h	C	100	67	
	22							22.1m: J, 45°, st, pl, ro From 22.53m to 22.57m, Fg				
	22.84							22.64m: P, sh, pl, sm				
	23 22.95	STONY COAL: Medium strength, slightly weathered black stony coal						22.95m: CORE LOSS: 250mm	C	45	0	
	23.2	CORE LOSS:										
		COAL: Medium strength, slightly weathered black coal						From 23.3m to 23.5m, Fg at 0.02m intervals From 23.5m to 23.85m, Fg at 0.04m to 0.05m intervals				
	24							24.1m: Fr, sv				
	25							From 24.66m to 24.71m, Fg at 0.01m intervals	C	100	54	
	26							25.47m: P, sh 25.62m: P, sh 26.1m: Fr, h				
	27							26.63m: P, sh 26.66m: P, sh 26.76m: P, sh 26.78m: P, sh 26.9m: P, sh 27m: P, sh 27.04m: P, sh 27.14m: P, sh 27.47m: P, sh, pl, ro, sm 27.59m: P, sh, pl, ro, sm From 27.9m to 28.5m, Fr, sv, h	C	100	33	
	27.3	META SILTSTONE: Medium strength, fresh grey-brown meta siltstone										
	28											
	28.5	Bore discontinued at 28.5m, limit of investigation										
	29											

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 5.85m

TYPE OF BORING: Solid flight auger (tc-bit) to 2.8m, then HQ3 wireline to 28.5m

WATER OBSERVATIONS: Groundwater obscured due to drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 39662D
DATE: 31 Jul 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING: Black coal filling, with some silty clay, humid							
1	0.9	SILTY CLAY: (Possible fill) brown silty clay, with trace gravel, M>>Wp							
	1.6	SILTY CLAY/CLAYEY SILT: (Soft to firm) grey silty clay/clayey silt, with some fine to medium grained sand, M>Wp							
2	2.0	SILTY CLAY: (Stiff) light grey mottled orange silty clay, M>Wp		A	2.5				
3									
4		From 4.0m, very stiff, M>Wp		A	4.0				
				A	4.5				
5		From 5.0m, hard light grey-white, M<Wp							
				A	5.5				
6									
7									
8									
9	9.0	COAL: Low strength black coal			9.0			▼	
				A					

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** Nil

TYPE OF BORING: Solid flight auger (tc-bit) to 12.5m (refusal)

WATER OBSERVATIONS: Free groundwater observed at 9.3m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 39662D
DATE: 31 Jul 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.0	COAL: continued From 10.0m, moist			10.0				
	11								
	12	From 12.0m, slow progress							
	12.5	Bore discontinued at 12.5m, refusal							
	13								
	14								
	15								
	16								
	17								
	18								
	19								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** Nil

TYPE OF BORING: Solid flight auger (tc-bit) to 12.5m (refusal)

WATER OBSERVATIONS: Free groundwater observed at 9.3m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧭ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5A
PROJECT No: 39662D
DATE: 31 Jul 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0	FILLING: Black coal filling							
	1.4	SILTY CLAY: (Possible fill) brown silty clay, with trace gravel, M>>Wp							
	1.6	SILTY CLAY: (Stiff) light grey mottled orange silty clay, M>Wp		A	2.0				
	4			A	4.0				
	5	From 5.0m, (very stiff) light brown, with trace to some fine grained sand and fine sized gravel, M<Wp		A	5.0				
	7	From 7.0m, light grey-white		A	7.0				
	8.2	SILTSTONE: (Extremely low to low strength) extremely weathered grey siltstone		A	8.3				
	9.0	COAL: Low strength black coal		A	9.0				

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** Nil

TYPE OF BORING: Solid flight auger (tc-bit) to 12.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located approximately 11m south-west of Bore 5

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5A
PROJECT No: 39662D
DATE: 31 Jul 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.0	COAL: continued			10.0				
	12.0	SILTSTONE: (Low to medium strength) slightly weathered grey siltstone							
	12.5	Bore discontinued at 12.5m, limit of investigation							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** Nil

TYPE OF BORING: Solid flight auger (tc-bit) to 12.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located approximately 11m south-west of Bore 5

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧭ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5B
PROJECT No: 39662D
DATE: 31 Jul - 01 Aug 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.15	FILLING: Black coal filling										
		FILLING: Dark grey clayey sand filling, humid										
	0.5	FILLING: Light grey silty clay filling, with trace to soem fine to medium sized gravel, M>Wp										
	1											
	1.8	SILTY CLAY: (Stiff) light brown silty clay, M>Wp										
	2								A			
	3											
	4											
	5	From 5.0m, light grey-brown										
									A			
	6											
	7	From 7.0m, (very stiff) M<Wp										
	8											
	8.7	SILTSTONE: (Low strength) slightly weathered grey siltstone							A			
	9											
	9.0	COAL: Low strength black coal										

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** HQ 12.85

TYPE OF BORING: Solid flight auger (tc-bit)

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located approximately 8.9m south-west of Bore 5A. 6m of permanent PVC casing installed

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5B
PROJECT No: 39662D
DATE: 31 Jul - 01 Aug 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.0	COAL: continued										
11	11.0	VOID: Push auger										
12												
	12.9	COAL: Black coal rubble							S			40,-,-
13	12.95	SILTSTONE: Rubble										
	13.1	SILTSTONE/SANDSTONE: Medium strength, slightly weathered fine grained dark grey siltstone/sandstone						From 13.14m to 13.17m, Fg 13.4m: J, 70° to sv, pl, ro, sm 13.58m: P, sh, pl, ro-sm 13.83m: P, sh, pl, ro-sm 14m: J, sv, h 14.05m: P, sh, pl, ro-sm 14.35m: P, sh, pl, ro-sm 14.38m: P, sh, pl, ro-sm 14.42m: P, sh, pl, ro-sm	C	100	42	
14												
	14.5	Bore discontinued at 14.5m, limit of investigation										
15												
16												
17												
18												
19												

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** HQ 12.85

TYPE OF BORING: Solid flight auger (tc-bit)

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located approximately 8.9m south-west of Bore 5A. 6m of permanent PVC casing installed

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5C
PROJECT No: 39662D
DATE: 17 Aug 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING: Black coal filling, with some silty clay, humid							
	0.4	SILTY CLAY: (Stiff to very stiff) light grey-brown silty clay, M>Wp							
	1								
	2								
	3	From 3.0m, gravelly clay							
	4								
		From 4.5m, (very stiff) red-brown, FeO staining							
	5								
	6	From 6.0m, light grey (extremely weathered siltstone)						▼	
	6.5	CLAYEY COAL: Black clayey coal							
	7	7.0 COAL: (Extremely low to low strength, slightly weathered) black coal		S	7.4 7.47		20/70mm, -,-		
	8								
		From 8.4m, slow auger progress (low to medium strength)		A	8.5 8.95				
	9								

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:**

TYPE OF BORING: Solid flight auger (tc-bit) to 11.55m

WATER OBSERVATIONS: Free groundwater observed at 6.4m during drilling

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5C
PROJECT No: 39662D
DATE: 17 Aug 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.0	COAL: continued							
	11								11
	11.1	SILTSTONE: Low to medium strength, slightly weathered brown-grey siltstone (near auger refusal)							
	11.55	Bore discontinued at 11.55m, limit of investigation							
	12								12
	13								13
	14								14
	15								15
	16								16
	17								17
	18								18
	19								19

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:**

TYPE OF BORING: Solid flight auger (tc-bit) to 11.55m

WATER OBSERVATIONS: Free groundwater observed at 6.4m during drilling

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧭ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 39662D
DATE: 01 Aug 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.2	FILLING: Black coal filling										
		SILTY CLAY: (Stiff to very stiff) brown-red silty clay, M>Wp							A			
	1											
	2								A			
	3											
	4								A			
	5	From 5.0m, light grey-white (very stiff), M>Wp							A			
	6											
	7											
	8	From 8.0m, red-brown, M≥ Wp							A			
	9											

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** HQ 14.75m

TYPE OF BORING: Solid flight auger (tc-bit) to 14.75m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: 9m permanent PVC casing installed

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 39662D
DATE: 01 Aug 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.0	SILTY CLAY: continued							A			
	10.2	From 10.0m, (very stiff to hard) brown (extremely weathered claystone), M<Wp										
	10.7	SILTSTONE: (Low to medium strength) highly weathered grey siltstone										
	11	COAL: (Low strength) black coal							A			
	12											
	12.8	VOID: Push auger (1.85m thickness)										
	13											
	14											
	14.65	CORE LOSS:						14.65m: CORE LOSS: 50mm	C	98	60	
	14.7											
	14.72	STONY COAL: Fragmented black stony coal (possible rubble)						14.82m: J, 45°, un, ro, calcite				
	15	SILTSTONE: Extremely low to high strength, fresh grey siltstone, with interbedded fine grained sandstone						14.9m: P, sh, pl, sm 14.96m: P, sh, pl, sm 15.07m: P, sh, pl, sm				
	16							15.82m: P, sh, pl, sm				
	16.32	CONGLOMERATE: Medium to high strength, fresh conglomerate						16.2m: P, sh, pl, sm 16.31m: P, sh, pl, sm 16.34m: P, sh, pl, sm From 16.45m to 16.48m, friable From 16.56m to 16.68m, friable From 16.63m to 16.65m, friable 16.68m: J, 45°, st, pl, ro 16.82m: P				
	17											
	17.4	Bore discontinued at 17.4m, limit of investigation										
	18											
	19											

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** HQ 14.75m

TYPE OF BORING: Solid flight auger (tc-bit) to 14.75m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: 9m permanent PVC casing installed

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 39662D
DATE: 30 Jul 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		FILLING: Dark brown silty clay filling, with trace to some fine to medium sized sub gravel filling										
	1.0	CLAY: (Stiff) brown-red clay, M<Wp										
	4.0	COLLAPSED SOIL: No drilling resistance, very little cuttings, light grey clay soil										
	7.0	VOID:							A			
		At 9.0m, push auger										

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** HW 10.5m

TYPE OF BORING: Solid flight auger (tc-bit) to 11.0m, then rotary to 17.1m, then HQ coring to 18.95m

WATER OBSERVATIONS: Groundwater obscured due to drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 39662D
DATE: 30 Jul 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.0	VOID: continued										
	10.3	CLAY: Very stiff to hard grey-brown clay (extremely weathered claystone)							S pp			1,3,8 N = 11 350-400 kPa
	11								S			1,6,9 N = 15
	12	COLLAPSED SOIL: (Possible void) pushing rock roller (washed out - no drilling resistance)										
	13											
	13.55	VOID										
	14											
	14.2	COLLAPSED SOIL: (Possible void) pushing rock roller (washed out - no drilling resistance)										
	15	From 15.0m to 15.2m, drilling										
	16											
	17											
	17.1	From 17.1m, drilling										
	17.3	COAL: Rubble, black coal, with trace calcite and pyrite						17.31m: P, sh, pl, ro-sm 17.34m: P, sh, pl, ro-sm 17.37m: P, sh, pl, ro-sm 17.43m: P, sh, pl, ro-sm 17.48m: P, sh, pl, ro-sm 17.51m: P, sh, pl, ro-sm 17.9m: P, sh, pl, ro-sm 18.06m: P, sh, pl, ro-sm 18.27m: J, 15°, pl, sm 18.39m: P, sh, pl, ro-sm 18.41m: P, sh, pl, ro-sm 18.55m: P, sh, pl, ro-sm 18.6m: P, sh, pl, ro-sm 18.65m: P, sh, pl, ro-sm 18.66m: P, sh, pl, ro-sm 18.82m: P, sh, pl, ro-sm	C	100	48	
	18	SILTSTONE: High strength, fresh grey siltstone										
	18.95	Bore discontinued at 18.95m, limit of investigation										
	19											

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** HW 10.5m

TYPE OF BORING: Solid flight auger (tc-bit) to 11.0m, then rotary to 17.1m, then HQ coring to 18.95m

WATER OBSERVATIONS: Groundwater obscured due to drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 7A
PROJECT No: 39662D
DATE: 03 Aug 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.05	FILLING: Dark grey silt topsoil filling, with abundant organics										
		FILLING: Brown silty clay filling, with trace to some fine to medium sized subangular gravel, M>Wp										
1	1.0	SILTY CLAY: Very stiff light brown silty clay, with trace to some fine to medium sized subrounded gravel, M>Wp							S			1,2,10/100mm
									pp			300 kPa
2		From 2.0m, light grey mottled red-brown very stiff to hard							S			8,8,10 N = 18
3									pp			350-450 kPa
4		From 4.0m, hard, M<Wp							S			9,12,18 N = 30
									pp			450 kPa
5		From 5.5m, FeO staining							S			12,14,15 N = 29
6												
7									S			6,13,14 N = 27
									pp			400 kPa
8									S			9,13,20 N = 33
9												

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** HW 14.0m

TYPE OF BORING: Solid flight auger (tc-bit)

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located 8m north-north-east (30º from north) of Bore 7

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 7A
PROJECT No: 39662D
DATE: 03 Aug 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.0	SILTY CLAY: continued							S			6,12,16 N = 28
	10.5	CLAY: Hard light grey-white mottled red clay (extremely weathered claystone), M<Wp							pp			>450 kPa
	11											
									S			5,10,14 N = 24
	12								pp			>450 kPa
	13											
	13.0	CLAY: (Extremely weathered coal) stiff black clay							A			
	13.7	CLAYEY COAL: (Extremely low strength) extremely weathered black clayey coal (with soil like properties)							S			9,13,15 N = 28
	14 14.04	COAL: Medium strength, fresh black coal						From 13.85m to 14.07m, friable 14.14m: P, sh 14.34m: P, sh 14.36m: P, sh	C	100	55	
	15 15.05	STONY COAL: Medium strength, fresh black stony coal						14.92m: P, sh 14.95m: P, sh 15.1m: P, sh				
	15.41	META SILTSTONE: Medium strength, fresh light grey meta siltstone, with interbedded fine grained sandstone						15.35m: P, sh, pl, sm 15.37m: P, sh, pl, sm 15.4m: P, sh, pl, sm 15.5m: P, sh, pl, sm 15.8m: P, sh, pl, sm 15.95m: P, sh 16.44m: P, sh, pl, sm 16.63m: P, sh, pl, sm 16.74m: P, sh, pl, sm, coal lined	C	100	89	
	16											
	17											
	17.5	Bore discontinued at 17.5m, limit of investigation						17.35m: P, sh, pl, sm, coal lined				
	18											
	19											

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** HW 14.0m

TYPE OF BORING: Solid flight auger (tc-bit)

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located 8m north-north-east (30º from north) of Bore 7

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 39662D
DATE: 01 Aug 07
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.2	FILLING: Dark brown silty filling, with abundant organics to 0.05m, then brown clayey silt/silty clay filling, with trace to some gravel										
		SILTY CLAY: (Stiff) brown silty clay, M>Wp										
1	1.0	CLAYEY CONGLOMERATE: (Extremely low strength) extremely weathered brown clayey conglomerate (with soil like properties)							S			7,8,11 N = 19
	1.8	SANDSTONE: (Extremely low to very low strength) extremely weathered light brown sandstone, with trace to some clay										
2									S			32,-,-
3									S			15 bouncing,-,-
4	4.1	CLAYSTONE: Extremely low to very low strength, extremely weathered grey/orange claystone						4.04m: DB 4.25m: DB				
	4.6	From 4.45m to 4.6m, medium strength, moderately weathered						4.51m: DB From 4.6m to 4.73m, friable				
5		TUFFACEOUS CLAYSTONE: Extremely low to very low strength, highly weathered light grey tuffaceous claystone, some extremely low to very low, highly weathered sandstone in parts From 4.9m, very low to low strength						5.19m: J, 45°, pl, sm 5.61m: DB	C	100	88	
6												
	6.68	SANDSTONE: Very low to low strength, highly weathered orange-brown sandstone										
7	6.9	CORE LOSS:						From 6.8m to 6.9m, Fg 6.9m: CORE LOSS: 3100mm	C	27	23	
8												
9									C	0	0	

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris/Low **CASING:** HW

TYPE OF BORING: Solid flight auger (tc-bit) to 4.0m, then HQ3 coring to 26.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 39662D
DATE: 01 Aug 07
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.0	CORE LOSS: continued						10m: CORE LOSS: 2100mm	C	0	0	
	11											
	12											
	12.1	CORE LOSS:						12.1m: CORE LOSS: 200mm	C	91	0	
	12.3	PEBBLY SANDSTONE: Extremely to medium strength, highly weathered brown pebbly sandstone						From 12.3m to 12.4m, Fg From 12.4m to 13.3m, MFR?, 70° to sv, calcite FeO				
	13											
	13.42	CLAYSTONE: (Extremely low strength) extremely weathered grey claystone						13.42m: P, sh, pl, ro 13.7m: J, 45°, h	C	100	0	
	14							14.43m: J, sv, FeO 14.6m: J, 45°, pl, sm				
	15							14.97m: P, sh, pl, sm 15.13m: P, sh, pl, ro 15.17m: P, sh, pl, ro	C	100	50	
	16							15.75m: P, sh, pl, ro				
	17							From 17.04m to 17.06m, friable				
	18							18.1m: P, sh, pl, sm, clay lined	C	100	86	
	18.43	VOID: (Drop rods to 18.93m, no resistance)						From 18.7m to 17.73m, MFR?, sv, h, FeO				
	18.93	CORE LOSS:						18.93m: CORE LOSS: 350mm	C	65	26	
	19							From 19.28m to 19.36m, Fg 19.5m: DB 19.55m: J, 45°, he From 19.63m to 19.9m,				
	19.28	CLAYSTONE RUBBLE: Very low strength, highly weathered grey claystone (goaf) From 19.63m, extremely low strength, extremely weathered										
	19.9											

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris/Low **CASING:** HW

TYPE OF BORING: Solid flight auger (tc-bit) to 4.0m, then HQ3 coring to 26.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 39662D
DATE: 01 Aug 07
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	20.0	SANDSTONE RUBBLE: Low strength, highly weathered grey sandstone (goaf)						friable	C	75	40	
	20.02							20.02m: CORE LOSS: 170mm				
	20.19	SANDSTONE RUBBLE: Low strength, highly weathered grey sandstone (goaf)						From 20.19m to 20.26m, friable	C	75	40	
		CORE LOSS:						From 20.43m, Fg				
21								20.6m: CORE LOSS: 640mm				
	21.24	CLAYSTONE RUBBLE: Extremely low strength, highly weathered grey/brown claystone (goaf) From 20.3m to 20.43m, very low strength						From 21.24m to 21.51m, Fg	C	50	0	
								From 21.64m, Fg				
	21.9	CORE LOSS:						21.9m: CORE LOSS: 1750mm				
22		SILTSTONE RUBBLE: Low strength, highly weathered grey/green siltstone rubble (goaf)										
		CORE LOSS:										
23									C	17	0	
	23.65	SILTSTONE AND COAL RUBBLE: (Low strength) slightly weathered black siltstone and coal rubble (goaf)						From 23.65m to 24.1m, Fg				
24	24.1	CORE LOSS:						24.1m: CORE LOSS: 200mm				
	24.3	COAL RUBBLE: Medium strength, fresh black coal rubble (goaf)						From 24.3m to 24.5m, Fg				
	24.5											
	24.56	COAL: (Medium strength) fresh black coal						24.56m: P, sh				
	24.6											
25		STONY COAL: Medium strength, fresh black stony coal						25.12m: P, sh, un, ro-sm	C	89	68	
		META SANDSTONE: Medium strength, fresh grey meta sandstone						25.27m: P, sh, un, ro-sm				
26	26.0	Bore discontinued at 26.0m, limit of investigation						25.93m: P, sh, un, ro-sm				
27												
28												
29												

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris/Low **CASING:** HW

TYPE OF BORING: Solid flight auger (tc-bit) to 4.0m, then HQ3 coring to 26.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8A
PROJECT No: 39662D
DATE: 09 Aug 07
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0	CLAY:							
	3.0	CONGLOMERATE:							
	9.0	SANDSTONE: (Extremely low strength), extremely weathered, friable sandstone, moist to wet							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 3m PVC

TYPE OF BORING: Solid flight auger to 3m, then hammer to 24m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located 8m at 30° from north of Bore 8

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8A
PROJECT No: 39662D
DATE: 09 Aug 07
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.0	SANDSTONE: continued							
	12.5	SILTSTONE: (Extremely low strength), extremely weathered From 13.5m, extremely low to medium strength siltstone							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 3m PVC

TYPE OF BORING: Solid flight auger to 3m, then hammer to 24m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located 8m at 30° from north of Bore 8

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8A
PROJECT No: 39662D
DATE: 09 Aug 07
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	20.0	COAL: Medium strength, fresh, black coal							
	21	From 21m, nil air return (extremely low strength), possible goaf							
	22								
	22.8	SILTSTONE: (Medium strength), possible goaf							
	23								
	24 24.0	Bore discontinued at 24.0m, due to collapsing conditions							
	25								
	26								
	27								
	28								
	29								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 3m PVC

TYPE OF BORING: Solid flight auger to 3m, then hammer to 24m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located 8m at 30° from north of Bore 8

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8B
PROJECT No: 39662D
DATE: 09 Aug 07
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SILTY CLAY: Grading to extremely weathered rock							
	2.0	CLAYSTONE: (Low strength), highly weathered, grey-brown claystone							
	5.0	CONGLOMERATE: (Extremely low strength), extremely weathered conglomerate							
		From 8.0m, possible 300mm void at 8m, nil returns (soft hammering)							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 2m PVC

TYPE OF BORING: Solid flight auger to 2m, then hammer to 21.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located 14m at 30° from north of Bore 8

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8B
PROJECT No: 39662D
DATE: 09 Aug 07
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.0	CONGLOMERATE: continued							
	12.0	SILTSTONE: (Medium strength), moderately weathered, grey siltstone, minimal returns							
	14.0	GOAF: Nil returns, medium to high strength with some extremely low strength bands 100-200mm thickness							
	19.0	COAL: Returns from 19m to 20m, possible goaf							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 2m PVC

TYPE OF BORING: Solid flight auger to 2m, then hammer to 21.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located 14m at 30° from north of Bore 8

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8B
PROJECT No: 39662D
DATE: 09 Aug 07
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	20.0	From 20m, nil returns, possible void and/or goaf COAL: continued							
	21.5	Bore discontinued at 21.5m, due to collapsing conditions							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 2m PVC

TYPE OF BORING: Solid flight auger to 2m, then hammer to 21.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located 14m at 30° from north of Bore 8

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8C
PROJECT No: 39662D
DATE: 15 Aug 07
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.25	TOPSOIL: Dark brown silty clay, with abundant organics to 0.05m, M<Wp										
	1	SANDSTONE/SILTSTONE: (Extremely low strength) extremely weathered light grey-brown and red sandstone/siltstone From 1.25m, extremely low to low strength From 1.7m, extremely weathered conglomerate							S			20/90mm,-,-
	2											
	3								S			20/80mm,-,-
	4											
	5								S			20/100mm,-,-
	6								S			20/70mm,-,-
	7 7.0	SANDSTONE: High strength, highly weathered grey-brown and red sandstone						7.34m: P, sh, pl, ro 7.37m: P, sh, pl, ro 7.45m: J, 45°, h 7.55m: CORE LOSS: 150mm From 7.7m to 7.77m, Fg	C	87	46	
	7.55 7.7	CORE LOSS:										
	8	SANDSTONE: Extremely low to medium strength, highly weathered brown-red sandstone						7.84m: P, sh, pl, ro 7.95m: P, sh, pl, ro From 8.15m to 8.25m, Fg 8.42m: J, 45°, pl, sm 8.48m: CORE LOSS: 500mm From 8.98m to 9.1m, Fg From 9.1m to 9.19m, clay seam	C	100	19	
	8.48	CORE LOSS:										
	9 8.98	SILTSTONE/CLAYSTONE: Very low strength, highly weathered grey siltstone/claystone							C	90	29	
	9.82	SANDSTONE: Extremely low to						From 9.82m to 10.32m,				

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 15.2m

TYPE OF BORING: Solid flight auger (tc-bit) to 5.85m, then rotary to 7.0m, then HQ3 wireline coring to 20.75m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8C
PROJECT No: 39662D
DATE: 15 Aug 07
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.0	very low strength, highly weathered grey-brown sandstone, with interbedded clay seams						Fr, sv, Fg				
	10.32	SANDSTONE: continued						10.32m: CORE LOSS: 200mm	C	90	29	
	10.52	CORE LOSS:						From 10.52m to 10.56m, friable, clay seam				
		SILTSTONE: Extremely low to low strength, extremely to highly weathered grey siltstone, with interbedded sandstone layers						10.67m: J, 30°, h From 10.7m to 11.0m, Fr, sv, Fg				
11	11.6	CORE LOSS:						11.6m: CORE LOSS: 600mm	C	50	37	
12	12.2	CORE LOSS:						12.2m: CORE LOSS: 250mm				
	12.45	SILTSTONE: Extremely low to very low strength, extremely to highly weathered grey siltstone, with interbedded sandstone and clay seams						From 12.4m to 12.52m, Fg From 12.52m to 12.59m, friable, clay seam	C	81	27	
13	13.05	VOID:						From 13.3m to 13.35m, friable				
	13.3	SILTSTONE/CLAYSTONE: Extremely low strength, extremely weathered grey siltstone/claystone						From 13.45m to 13.8m, friable with clay seams	C	100	0	
14	13.9	CORE LOSS:						From 13.8m to 13.9m, Fs 13.9m: CORE LOSS: 250mm				
	14.15	SILTSTONE: Extremely low strength, extremely weathered grey siltstone						From 14.15m to 15.05m, Fg/ friable	C	100	0	
15												
	15.4	From 15.2m to 15.25m, dark grey-black carbonaceous siltstone						15.19m: P, sh, pl, sm, core grind	C	100	100	
		SANDSTONE: Medium strength, slightly weathered grey sandstone						15.35m: P, sh, h 15.4m: P, sh, h 15.55m: J, 60°, pl 15.85m: P, sh, clay lined 5m thickness 15.9m: P, sh, pl, sm 16m: J, 70°, pl, sm				
16	16.23	COAL: Extremely low strength, extremely weathered black fragmented coal						From 16.23m to 16.5m, Fg				
	16.5	CORE LOSS: Collapsing roof during drilling						16.5m: CORE LOSS: 250mm	C	30	15	
17	16.75	VOID:										
18												
	18.2	CORE LOSS:						18.2m: CORE LOSS: 250mm				
	18.45	VOID:							C	63	40	
19												
	19.45	CORE LOSS:						19.45m: CORE LOSS: 200mm				
	19.65	COAL: Black fragmented black coal						From 19.65m to 19.76m, Fg				
	19.76	META SILTSTONE: High strength,										

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 15.2m

TYPE OF BORING: Solid flight auger (tc-bit) to 5.85m, then rotary to 7.0m, then HQ3 wireline coring to 20.75m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8C
PROJECT No: 39662D
DATE: 15 Aug 07
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	20.0	fresh grey-brown meta siltstone META SILTSTONE: continued						19.76m: P, sh 19.9m: P, sh, pl, ro-sm	C	63	40	
	20.75	Bore discontinued at 20.75m, limit of investigation										
	21											
	22											
	23											
	24											
	25											
	26											
	27											
	28											
	29											

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 15.2m

TYPE OF BORING: Solid flight auger (tc-bit) to 5.85m, then rotary to 7.0m, then HQ3 wireline coring to 20.75m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 39662D
DATE: 10 Aug - 14 Aug 07
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.2	FILLING: Brown silty clay filling, M<Wp										
		SANDY SILTY CLAY: Very stiff to hard light brown sandy silty clay										
	1											
		From 1.4m, claystone, light grey							S			10,12,15 N = 27
	2.0	SANDSTONE/CONGLOMERATE: (Extremely low strength) extremely weathered light brown grey sandstone/conglomerate, with some clay (soil like properties)										
	3								S			10,15,19 N = 34
	4											
									S			8,8,9 N = 17
	5											
	6	From 5.95m, claystone/sandstone, red-brown							S			12,17,23 N = 40
	7											
									S			12,22/80mm,-
	7.83	CORE LOSS:						7.83m: CORE LOSS: 2170mm				
	8											
	9								C	0	0	

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 31.0m

TYPE OF BORING: Solid flight auger (tc-bit) to 7.83m, then HQ3 wireline to 35.8m

WATER OBSERVATIONS: Free groundwater observed at 14m (17.8.07)

REMARKS: 50% water loss from 26.25m. 100% water loss from 30.0m during drilling

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 39662D
DATE: 10 Aug - 14 Aug 07
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.0	CORE LOSS: continued						10m: CORE LOSS: 1900mm	C	0	0	
	11.9	CORE LOSS:						11.9m: CORE LOSS: 1950mm	C	34	19	
	13.85	CLAYSTONE: Extremely low strength, extremely weathered grey claystone										
	14.5	SANDSTONE: Extremely low to low strength, extremely weathered brown sandstone						From 14.5m to 14.75m, friable				
	14.85	CONGLOMERATE: Low to medium strength, highly weathered brown conglomerate						15m: J, 45°, un, ro, FeO 15.1m: J, 45°, un, ro, FeO From 15.25m to 15.6m, friable	C	94	44	
	15.6	CORE LOSS:						15.6m: CORE LOSS: 50mm				
	15.65	CORE LOSS:						15.65m: CORE LOSS: 550mm				
	16.2	PEBBLY SANDSTONE: Extremely low to medium strength, extremely to highly weathered light grey-brown pebbly sandstone						From 16.25m to 16.35m, Fg 16.7m: P, sh, un, ro 17.05m: P, sh, un, ro 17.22m: P, sh, un, ro	C	70	54	
	17.5	CORE LOSS:						17.5m: CORE LOSS: 550mm				
	18.05	SANDSTONE: Low to medium strength, extremely weathered grey sandstone						From 18.05m to 18.65m, Fg at 0.02m to 0.05m intervals	C	52	0	
	18.45	CLAYSTONE: Extremely low strength, extremely weathered grey claystone From 18.9m to 18.94m, friable						From 18.9m to 18.94m, clay seam 40mm thickness	C	100	75	
	19.55	CORE LOSS:						From 19.45m to 19.55m, Fg, di				
	19.7	SILTSTONE: Low strength,						19.55m: CORE LOSS: 150mm	C	89	14	

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 31.0m

TYPE OF BORING: Solid flight auger (tc-bit) to 7.83m, then HQ3 wireline to 35.8m

WATER OBSERVATIONS: Free groundwater observed at 14m (17.8.07)

REMARKS: 50% water loss from 26.25m. 100% water loss from 30.0m during drilling

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

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BORE No: 9
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SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	20.0	moderately weathered grey siltstone										
	20.09	SILTSTONE: continued										
		SANDSTONE: Low to medium strength, moderately weathered grey-brown sandstone, with interbedded clay lined						19.85m: P, sh, pl, sm 19.92m: P, sh, pl, sm 19.93m: P, sh, pl, sm 20m: P, sh, pl, sm 20.07m: P, sh, pl, sm 20.11m: P, sh, pl, sm, clay lined 6mm thick	C	89	14	
	20.9											
21								20.24m: P, sh, pl, ro 20.35m: P, sh, pl, ro 20.41m: P, sh, pl, ro, clay lined 5mm thick 20.54m: P, sh, pl, ro, clay lined 5mm thick From 20.62m to 20.87m, Fg at 0.02m intervals 20.95m: P, sh, pl, ro, FeO 21.13m: P, sh, un, ro 21.17m: CORE LOSS: 800mm	C	53	0	
	21.17	SANDSTONE: Medium strength, highly weathered brown sandstone										
		CORE LOSS:										
22	21.97	PEBBLY SANDSTONE: Medium strength, highly weathered brown pebbly sandstone						From 21.17m to 22.1m, Fg From 22.1m to 22.65m, J, (MFr?), sv to 70°, pl, ro, FeO From 22.65m to 23.6m, FeO	C	76	70	
23												
	23.6	CORE LOSS:						23.6m: CORE LOSS: 300mm				
	23.9	CORE LOSS:						23.9m: CORE LOSS: 150mm				
24	24.05	CONGLOMERATE: Low to medium strength, Fg, grey conglomerate						From 24.05m to 24.15m, Fg	C	66	30	
	24.25											
	24.35	SILTSTONE: Low strength, moderately weathered grey siltstone						24.31m: P, sh, pl. sm 24.35m: CORE LOSS: 1250mm				
		CORE LOSS:										
25									C	34	21	
	25.6	SILTSTONE: Low to medium strength, slightly weathered grey siltstone						25.71m: P, sh, pl, s				
26								26m: J, 70°, st, pl, sm, calcite				
	26.25	CORE LOSS:						26.1m: J, 45°, pl, un, sm From 26.15m to 26.25m, Fg 26.25m: CORE LOSS: 100mm				
	26.35	SILTSTONE: Low to medium strength, moderately weathered grey siltstone, with interbedded fine grained sandstone						From 26.45m to 27.4m, J (MFr?), sv, h, calcite				
27								27.46m: P, sh, pl, sm				
								From 27.7m to 28.4m, J (MFr?), sv, h, calcite				
28									C	86	14	
								28.26m: J (MFr?), 45°, pl, sm				
								28.67m: P, sh, pl, sm, FeO				
29		From 29.0m to 29.2m, with interbedded mudstone										

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 31.0m

TYPE OF BORING: Solid flight auger (tc-bit) to 7.83m, then HQ3 wireline to 35.8m

WATER OBSERVATIONS: Free groundwater observed at 14m (17.8.07)

REMARKS: 50% water loss from 26.25m. 100% water loss from 30.0m during drilling

SAMPLING & IN SITU TESTING LEGEND

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D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

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EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 39662D
DATE: 10 Aug - 14 Aug 07
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	30.0	SILTSTONE: continued						29.9m: J (MFr?), 45° to sv, un, ro, FeO	C	71	20	
	30.25	From 30.2m, carbonaceous siltstone						30.25m: CORE LOSS: 450mm				
		CORE LOSS:										
	30.7	COAL: Medium strength, slightly weathered black coal						From 30.7m to 31.5m, Fg at 0.01m to 0.05m intervals	C	71	20	
	31											
	31.5	VOID:										
	32								C	0	0	
	33											
	33.75	CORE LOSS:						33.75m: CORE LOSS: 1050mm				
	34											
	34.8	COAL: Black fragmented coal (rubble)							C	49	0	
	35											
	35.42	SILTSTONE: High strength, fresh grey-brown siltstone						35.47m: J, 60°, pl, sm, calcite				
	35.8	Bore discontinued at 35.8m, limit of investigation						35.52m: P, sh, pl, ro 35.6m: P, sh, pl, ro 35.65m: P, sh, pl, ro 35.7m: P, sh, pl, ro				
	36											
	37											
	38											
	39											

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 31.0m

TYPE OF BORING: Solid flight auger (tc-bit) to 7.83m, then HQ3 wireline to 35.8m

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D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

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LOCATION: Flowers Drive, Catherine Hill Bay

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BORE No: 10
PROJECT No: 39662D
DATE: 30 Jul 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.2	TOPSOIL: Dark brown silty topsoil, with abundant organics										
		SILTY CLAY: (Stiff) light brown silty clay										
	1	From 0.9m, hard, extremely weathered claystone										
	1.3	CONGLOMERATE: Extremely weathered brown conglomerate										
		From 1.65m, sandstone										
	2											
	2.65	CORE LOSS:						2.65m: CORE LOSS: 200mm				
	2.85	SANDSTONE: Extremely low to low strength, highly weathered brown sandstone						3.11m: J, 45°, un, ro, clay lined 20mm thickness	C	85	100	
	3							3.2m: P, sh, un, ro, di?				
								3.48m: J, 45°, un, ro				
								3.52m: P, sh, pl, sm				
	3.9	CORE LOSS:						3.72m: P, sh, pl, ro				
	4							3.75m: P, sh, pl, ro				
								3.81m: P, sh, pl, ro				
								3.86m: P, sh, pl, ro				
								3.9m: CORE LOSS: 1300mm	C	35	0	
	5											
	5.2	SANDSTONE/CONGLOMERATE: Extremely low to low strength, extremely to highly weathered brown sandstone/conglomerate						From 5.2m to 5.8m, firable				
	6							5.9m: P, sh, ro				
	6.1	CORE LOSS:						6.1m: CORE LOSS: 100mm				
	6.2	SANDSTONE/CONGLOMERATE: Extremely low to low strength, extremely to highly weathered brown sandstone/conglomerate							C	94	53	
	7							6.8m: P, sh, pl, ro				
								7m: P, sh, pl, ro				
								7.11m: P, sh, pl, ro				
	8							8.06m: P, sh, pl, ro-sm	C	78	36	
								8.2m: J, 45°, h				
								8.27m: P, sh, ro				
	8.5	CORE LOSS:						8.4m: J, 60°, un, ro				
	8.8	SILTSTONE: Extremely low to low strength, slight weathered grey siltstone						From 8.41m to 8.50m, friable				
	9							8.5m: CORE LOSS: 300mm				
								From 9.2m to 9.26m, friable	C	100	82	
								9.3m: J, (MFr?), 45°, pl, ro-sm				
	10								C	87	51	

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 20.0m

TYPE OF BORING: Solid flight auger (tc-bit) to 2.65m, then HQ coring to 20.0m

WATER OBSERVATIONS: Groundwater obscured due to drilling fluids

REMARKS: Bore located 0.5m south of pegged location

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

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BORE No: 10
PROJECT No: 39662D
DATE: 30 Jul 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.05	SILTSTONE: continued						10.18m: P, sh, pl, ro-sm 10.37m: P, sh, pl, ro-sm				
	10.5	CORE LOSS:						From 10.45m to 10.50m, friable				
	10.7	SILTSTONE/SANDSTONE: Low to medium strength, highly weathered brown siltstone/sandstone						10.5m: CORE LOSS: 200mm 10.77m: J (MFr?), 60°, pl, ro, FeO 10.89m: J (MFr?), 60°, pl, ro, FeO 10.95m: P, sh, pl, ro, FeO	C	87	51	
	11.8	CORE LOSS:						10.97m: J, (MFr?), 45°, pl, ro, FeO 11.25m: J, 15°, pl, sm 11.45m: J, (MFr?), 60°, un, ro, FeO 11.6m: J, (MFr?), 60°, un, ro, FeO 11.7m: Friable 11.8m: CORE LOSS: 800mm	C	64	55	
	12.6	CONGLOMERATE: Extremely low to high strength, highly weathered brown conglomerate										
	14.0	SILTSTONE: Extremely low to low strength, slightly weathered grey siltstone						From 14.2m to 14.3m, Fg	C	100	66	
	14.5	SANDSTONE: Medium strength, fresh grey sandstone						14.35m: P, sh, pl, ro-sm 14.42m: P, sh, pl, ro-sm 14.45m: P, sh, pl, ro-sm 14.9m: P, sh, pl, ro-sm 15.1m: P, sh, pl, ro-sm 15.45m: J (MFr?), 45°, h, FeO 15.77m: P, sh, pl, ro 16m: P, sh, pl, ro	C	98	71	
	16	From 16.0m, conglomerate/sandstone										
	18.3	CORE LOSS:						18.3m: CORE LOSS: 1700mm	C	0	0	
	20.0	Bore discontinued at 20.0m, difficult drilling/collapsing conditions										

RIG: Edson 3000 **DRILLER:** APS (Simon) **LOGGED:** Harris **CASING:** HW 20.0m

TYPE OF BORING: Solid flight auger (tc-bit) to 2.65m, then HQ coring to 20.0m

WATER OBSERVATIONS: Groundwater obscured due to drilling fluids

REMARKS: Bore located 0.5m south of pegged location

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

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DIP/AZIMUTH: 90°/--

BORE No: 10A
PROJECT No: 39662D
DATE: 07 Aug 07
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0	CLAY:							
	2.65	CONGLOMERATE/SANDSTONE:							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 6m PVC permanent casing

TYPE OF BORING: Solid flight auger (tc-bit) to 3.0m, then 100mm diameter hammer to 42.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located at pegged location. Air* = air cutting sample

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

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Initials:
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LOCATION: Flowers Drive, Catherine Hill Bay

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BORE No: 10A
PROJECT No: 39662D
DATE: 07 Aug 07
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.0	CONGLOMERATE/SANDSTONE: continued							
	11								
	12								
	13								
	14								
	15								
	16								
	17								
	18								
	19								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 6m PVC permanent casing

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SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
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BORE No: 10A
PROJECT No: 39662D
DATE: 07 Aug 07
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	20.0	CONGLOMERATE/SANDSTONE: continued							
	21								
	22								
	23								
	24								
	25								
	26								
	27								
	28								
	29								

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SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	30.0	CONGLOMERATE/SANDSTONE: continued							
	31								
	32 32.0	SILTSTONE:							
	32.85								
	33	COAL: Fresh black coal			33.0		Air*		
	34				34.0				
	35								
	36								
	36.85								
	37	SILTSTONE:			37.0		Air*		
	38				38.0				
	39								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 6m PVC permanent casing

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SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
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BORE No: 10A
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SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	40.0	SILTSTONE: continued							
	41								
	42 42.0	Bore discontinued at 42.0m, limit of investigation							
	43								
	44								
	45								
	46								
	47								
	48								
	49								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 6m PVC permanent casing

TYPE OF BORING: Solid flight auger (tc-bit) to 3.0m, then 100mm diameter hammer to 42.0m

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REMARKS: Bore located at pegged location. Air* = air cutting sample

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
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SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 39662D
DATE: 06 Aug 07
SHEET 1 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0	FILLING: Black coal and crushed rock filling, humid							
	0.3	SILTY CLAY: (Stiff to very stiff) brown silty clay, M>Wp							
	2.8	SANDSTONE: (Extremely low to low strength) highly weathered brown sandstone							
	4.0	SANDSTONE/CONGLOMERATE:							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 4m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 4.0m, then 100mm diameter hammer to 54.0m depth

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Nil air returns from 45.5m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 39662D
DATE: 06 Aug 07
SHEET 2 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.0	SANDSTONE/CONGLOMERATE: continued							
	11								
	12								
	13								
	14								
	15								
	16								
	17								
	18								
	19								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 4m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 4.0m, then 100mm diameter hammer to 54.0m depth

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Nil air returns from 45.5m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 39662D
DATE: 06 Aug 07
SHEET 3 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	20.0	SANDSTONE/CONGLOMERATE: continued							
	21								
	22								
	23								
	24								
	25								
	26								
	27								
	28								
	29								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 4m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 4.0m, then 100mm diameter hammer to 54.0m depth

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Nil air returns from 45.5m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 39662D
DATE: 06 Aug 07
SHEET 4 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	30.0	SANDSTONE/CONGLOMERATE: continued							
	31								
	32								
	33								
	34								
	35								
	36								
	37								
	38								
	39								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 4m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 4.0m, then 100mm diameter hammer to 54.0m depth

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Nil air returns from 45.5m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 39662D
DATE: 06 Aug 07
SHEET 5 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	40.0	SANDSTONE/CONGLOMERATE: continued							
	41								
	42								
	43								
	44								
	45								
	45.5	VOID:							
	45.7	GOAF: Fracture spacing generally at 0.2m to 0.4m intervals							
	46								
	47								
	48								
	48.5	GOAF: (Loose) highly fractured goaf							
	49								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 4m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 4.0m, then 100mm diameter hammer to 54.0m depth

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Nil air returns from 45.5m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 39662D
DATE: 06 Aug 07
SHEET 6 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	50.0	GOAF: continued							
	51								
	51.75	COAL:							
	52.0	SANDSTONE/CONGLOMERATE:							
	53								
	54.0	Bore discontinued at 54.0m, limit of investigation							
	55								
	56								
	57								
	58								
	59								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 4m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 4.0m, then 100mm diameter hammer to 54.0m depth

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Nil air returns from 45.5m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 39662D
DATE: 17 Sep 07
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.25	TOPSOIL - Dark grey silt with trace to some fine to medium grained sand with abundant rootlets to 0.1m, moist										
	0.9	SILTY SAND - (Loose), light grey-brown fine to medium grained silty sand, moist from 0.4m, with trace to some clay, wet							S,pp			2,4,6 N = 10 >450 kPa
		CLAY - Hard, light grey-white mottled red clay, M<Wp							S,pp			3,10,10 N = 20 >450 kPa
	5.5	CLAYEY SAND - (Medium dense), grey clayey sand, moist to wet				▼			S			8, 22
	7.0	CLAYEY GRAVEL / GRAVELLY CLAY - Siff, grey-brown mottled red fine to medium sized subrounded clayey gravel / gravelly clay							S,pp			3,8,15 N = 23 100 kPa
		from 8.5m, dark brown							S			20,15/75mm
		from 9.3m to 10m, push auger, (weak zone)							S			4,10,10 N = 20

RIG: 4WD Drillcat **DRILLER:** Foody **LOGGED:** Harris **CASING:** 19.5

TYPE OF BORING: Solid flight auger (v-bit) to 19.5m, then NMLC rock coring to 29.7m

WATER OBSERVATIONS: Free groundwater observed at 6.5m during drilling

REMARKS: Bore grouted from 15.7m to ground level with grout pump

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 39662D
DATE: 17 Sep 07
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.0	SANDY GRAVEL - (Medium dense to dense), slightly clayey, grey fine to coarse grained sandy fine to medium sized subrounded gravel, saturated							S			5,20
	11											
		from 11.5m, sandy gravel / gravelly sand							S			4,10,10 N = 20
	12											
	13								S			5,10,18 N = 28
	14											
									S			8,21,21 N = 42
	15											
	15.0	CLAY - Very stiff, light grey-white mottled brown clay										
									S			7,13,10/50mm
	16											
	17								S			30/50mm, no sample
	18											
	19	from 18.8m, possible extremely low strength bedrock										
	19.5	SILTSTONE - Low strength, highly weathered, grey siltstone						19.54m: P,sh,pl,sm, FeO 19.76m to 20.15m,	C	100	25	

RIG: 4WD Drillcat **DRILLER:** Foody **LOGGED:** Harris **CASING:** 19.5

TYPE OF BORING: Solid flight auger (v-bit) to 19.5m, then NMLC rock coring to 29.7m

WATER OBSERVATIONS: Free groundwater observed at 6.5m during drilling

REMARKS: Bore grouted from 15.7m to ground level with grout pump

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 39662D
DATE: 17 Sep 07
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SILTSTONE - Low strength, highly weathered, grey siltstone *(continued)*						J,80°,un,sm, FeO	C	100	25	
	21							from 20.6m to 20.74m, friable from 21.18m to 21.28m, Fr,sv,pl,sm	C	100	54	
	22							21.85m: P,sh,pl,sm 21.9m: P,sh,pl,sm 22.03m: P,sh,pl,sm 22.43m: Fr, sh to sv, ir, ro-sm	C	100	100	
	22.8	CORE LOSS - 0.06m						from 22.6m to 22.8m, Fg, DI 22.8m: CORE LOSS: 60mm				
	22.86	SILTSTONE / SANDSTONE - Medium strength, slightly weathered, grey siltstone / sandstone						23.31m: P,sh,pl 23.53m: P,sh,pl				
	23.6	COAL - Medium strength, slightly weathered, black coal						from 23.65m to 23.9m, Fg at 0.05m intervals 24.1m: P,sh 24.3m: P,sh	C	96	66	
	24							from 24.46m to 24.54m, Fg 24.63m: P,sh 24.7m: P,sh, from 24.9m to 25.6m, Fr,sv	C	83	20	
	25.71	CORE LOSS - 0.25m						25.71m: CORE LOSS: 250mm				
	25.96	VOID - 2.24m							C	0	0	
	27											
	28											
	28.2	COAL - Extremely low strength, slightly weathered, black coal, fragmented to 28.46m (possible goaf to 28.46m)						from 28.2m to 28.48m, Fg 28.6m: P,sh from 28.7m to 28.78m, Fg 28.98m: P,sh,pl,sm	C	100	40	
	28.78	from 28.46m, medium strength, fresh, coal										
	29											
	29.2	SILTSTONE - Medium to high strength, fresh, grey siltstone CORE LOSS - 0.5m down borehole						29.2m: CORE LOSS: 500mm	C	0	0	
	29.7	Bore discontinued at 29.7m										

RIG: 4WD Drillcat **DRILLER:** Foody **LOGGED:** Harris **CASING:** 19.5

TYPE OF BORING: Solid flight auger (v-bit) to 19.5m, then NMLC rock coring to 29.7m

WATER OBSERVATIONS: Free groundwater observed at 6.5m during drilling

REMARKS: Bore grouted from 15.7m to ground level with grout pump

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 39662D
DATE: 08 Aug 07
SHEET 1 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0	CLAY:							
	1.35	SANDSTONE/CONGLOMERATE:							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 2.5m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 2.5m, then 100mm diameter hammer

WATER OBSERVATIONS: No free groundwater observed

REMARKS: From 57.0m, air loss

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 39662D
DATE: 08 Aug 07
SHEET 2 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.0	SANDSTONE/CONGLOMERATE: continued							
	11								
	12								
	13								
	14								
	15								
	16								
	17								
	18								
	19								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 2.5m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 2.5m, then 100mm diameter hammer

WATER OBSERVATIONS: No free groundwater observed

REMARKS: From 57.0m, air loss

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 39662D
DATE: 08 Aug 07
SHEET 3 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	20.0	SANDSTONE/CONGLOMERATE: continued							
	21								
	22								
	23								
	24								
	25								
	26								
	27								
	28								
	29								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 2.5m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 2.5m, then 100mm diameter hammer

WATER OBSERVATIONS: No free groundwater observed

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SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 39662D
DATE: 08 Aug 07
SHEET 4 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	30.0	SANDSTONE/CONGLOMERATE: continued							
	31								
	32								
	33								
	34								
	35								
	36								
	37								
	38								
	39								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 2.5m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 2.5m, then 100mm diameter hammer

WATER OBSERVATIONS: No free groundwater observed

REMARKS: From 57.0m, air loss

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 39662D
DATE: 08 Aug 07
SHEET 5 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	40.0	SANDSTONE/CONGLOMERATE: continued							
	41								
	42								
	43								
	44								
	45								
	46								
	47								
	48								
	49								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 2.5m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 2.5m, then 100mm diameter hammer

WATER OBSERVATIONS: No free groundwater observed

REMARKS: From 57.0m, air loss

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 39662D
DATE: 08 Aug 07
SHEET 6 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	50.0	SANDSTONE/CONGLOMERATE: continued							
	51								
	52								
	53								
	54								
	55								
	56	56.0 SILTSTONE:							
	57	57.0 From 57.0m, air loss GOAF: Nil returns							
	58								
		58.5 VOID: 1m thickness							
	59								
		59.5 GOAF: Nil returns							

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 2.5m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 2.5m, then 100mm diameter hammer

WATER OBSERVATIONS: No free groundwater observed

REMARKS: From 57.0m, air loss

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Coal and Allied Operations Pty Limited
PROJECT: Southern Area - Mine Subsidence Drilling
LOCATION: Flowers Drive, Catherine Hill Bay

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 39662D
DATE: 08 Aug 07
SHEET 7 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	60.0	GOAF: continued							
	61								
	61.5	COAL: (Soft hammering), extremely low strength coal or possibly coal rubble							
	62 62.0								
	63 63.0	Bore discontinued at 63.0m, limit of investigation							
	64								
	65								
	66								
	67								
	68								
	69								

RIG: Scout **DRILLER:** Total Drilling (Kiernan) **LOGGED:** Harris **CASING:** 2.5m PVC

TYPE OF BORING: Solid flight auger (tc-bit) to 2.5m, then 100mm diameter hammer

WATER OBSERVATIONS: No free groundwater observed

REMARKS: From 57.0m, air loss

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
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