



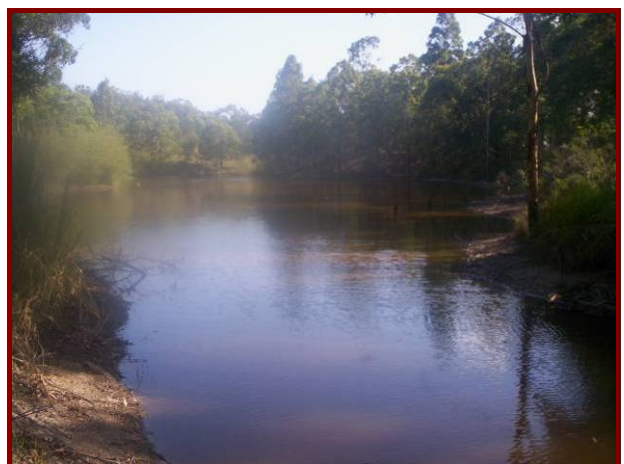
**Photos 45 and 46 – Fly Tipping**



**Photo 47 – Fly Tipping**



**Photo 48 – Overburden fill from Brown Colliery Open Cut**



**Photo 49 and 50 - Surface water in former Browns Colliery Open Cut**

## 5.9 Minmi South

Minmi South is the site of the former Browns Underground Colliery and Back Creek Open Cut as well as two smaller open cuts into the Young Wallsend Seam. The northern areas of the site are heavily disturbed. The southern parts are mostly bushland with scattered tracks and clearings, mostly associated with shafts to the Browns Colliery workings. There is scattered residential development, mostly on the north western parts.

The topography is moderately to steeply undulating. Surface levels range from about 10 m at the northern end to 70 m AHD at the southern end. Back Creek initiates in the southern parts of the site and passes north through the former Back Creek Open cut, before passing below Minmi Road and continuing into the Minmi North Area, as described above. There are numerous upslope gullies which feed into Back Creek, however they were dry at the time of the assessment.

Specific site features include the following:

- North western parts of the site are grassed with scattered residential development and disturbed surfaces (Photos 51, 52 and 58) including shallow slumping of some steeper slopes (Photos 53 and 54);
- Areas of filling and cutting on the north western parts, probably associated with the former Browns Colliery (Back Creek) (Photos 55 and 56);
- Narrow cuts into the hillside, possibly former mine entries for Browns Colliery (Photo 57);
- Open cut pit into the Young Wallsend seam, containing surface water (Photos 59 and 60);
- Filled ground to south of Reservoir Road;
- Extensive areas of filling associated with the former open cuts in the Young Wallsend seam (shown in Blue on Drawing 3) (Photos 73 and 76);
- Several concrete capped shafts, one at the northern end of the bushland and one at the southern end, near the Link Road (Photos 62 and 69). The capped shafts are shown on Drawings 2 and 3;
- Masonry walled dam, concrete footings and shallow rock with scattered surface chitter and fibro near the southern capped shaft. (Photos 67, 70, 71, 72);

- Several cleared areas within the bushland with disturbed surfaces, one containing a stone lined shaft or well.(Photo 66);
- Eroded gully between two cleared areas with remnant timber bridge structure (Photos 64 and 65);
- Former Back Creek Open Cut has been backfilled and includes a timber stairway leading up to a walking track. Parts of the former open cut are relatively low lying and contain surface water and reeds. The western batters of the former open cut are steep and heavily vegetated.



**Photo 51 – Undulating area north of Neal Close**



**Photo 52 – Gully falling towards Back Creek**



**Photo 53 and 54 – Disturbed and slumping slopes near former Browns Colliery**



**Photo 55 – Caravan on fill mound**



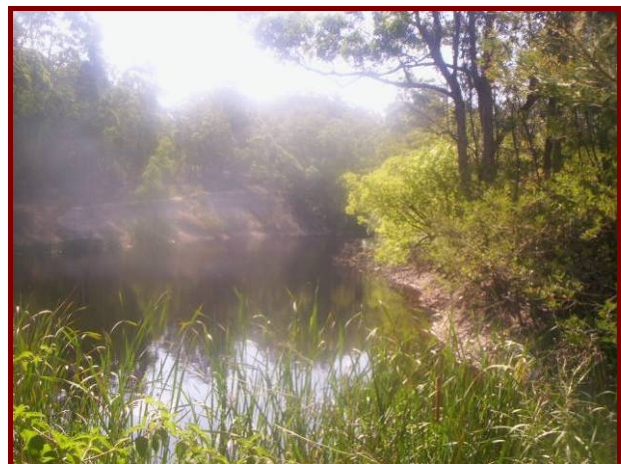
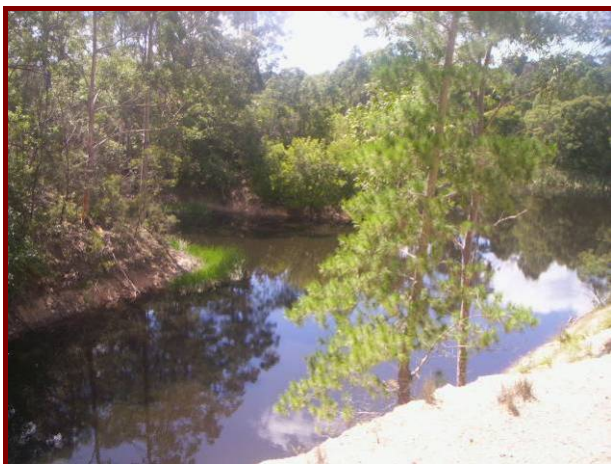
**Photo 56 – Cut bench into hillside, probably associated with Browns Colliery**



**Photo 57 - Narrow Bench cut into hillside, possible entry for Browns Colliery**



**Photo 58 – Undulating grassed hillside**



**Photo 59 and 60 – Young Wallsend Open Cut with surface water**



**Photo 61 – Filled ground near Reservoir Road**



**Photo 62 – Capped Shaft**



**Photo 64 – Erosion on gully banks**



**Photo 65 – Remnant Timber Bridge**



**Photo 66 – Stone lined well/shaft**



**Photo 67 – Masonry Walled Dam**



**Photo 69 – Capped Shaft**



**Photo 70 – Concrete Footing next to capped shaft**



**Photo 71 – Shallow rock with chitter at surface**



**Photo 72 – Fibro fragments on side of track**



**Photo 73 – Filled area on central site over former Young Wallsend Open Cut**



**Photo 74 – Dam cut in to rock**



**Photo 75 – Fill associated with former Young Wallsend Open Cut**



**Photo 76 – Grassed Fill Mound in Former Back Creek Open Cut**



**Photo 77 – Low lying reeded area in Former Back Creek Open Cut**

## **5.10 Link Road North and South**

The Link Road sites are primarily bushland with moderately to steeply undulating terrain. Surface levels range from about 20 m AHD at the northern and southern boundaries to about 90 m AHD at the Link Road. Slopes are typically in the order of 10° to 20° and locally up to around 30° (Photo 79), mostly on gully slopes, which typically contained loose surface boulders, suggesting potential shallow instability.

There are scattered access tracks and transmission line easements running diagonally through each allotment. Shafts No. 12 and 14 were located on the Link Road North. Inspection of the shaft sites indicated that both shafts have been capped and that there are remnants of previous structures including a number of old slabs and footings. The site were both heavily overgrown and were inaccessible except by foot. There appears to be a fill embankment running along the site boundary from near the Link Road / Minmi Road roundabout towards Shaft No 14 to the north. The filling generally appears to be rock and chitter filling with numerous conglomerate boulders at the northern end. The toe of the embankment appears to extend onto the site in places. This was probably a former access track to the shaft however is now inaccessible to vehicles due to the presence of extensive vegetation growing on it (Photos 80 and 81).



**Photo 78 – Track across Link Road South**



**Photo 79 – Steep Slopes in Link Road South Area**



**Photos 80 and 81 – Filling on Boundary near Shaft No. 14s**

## 6. SURFACE FEATURE MAPPING

Various site surface features described in the preceding sections above have been mapped on Drawings 1 to 4. The general categories of surface condition are described below.

### ***Disturbed Ground***

As outlined above, much of the site includes mining infrastructure and as a consequence the associated land has been heavily disturbed. The original ground surface in many areas is expected to have been reworked and in many places filled. The estimated extent of disturbed ground is shown on Drawings 1 to 4.

### ***Mounded Filling***

Significant areas of filling were observed on the site as shown in purple on Drawings 1 to 4. The filling can be divided into the following categories:

- Mine spoil from open cut pits;
- Railway/ road embankments;
- Localised mounds of filling;
- Surface fly tipping.

### ***Mine Spoil From Open Cut Pits***

The areas of open cut mining are generally surrounded by spoil from the excavations. In most instances the open cut pits have only been partly backfilled, with depths of filling ranging up to about 12 m.

### ***Embankments***

Several rail embankments were identified on the site. There are two in Minmi West, one running in an approximate north south direction through the eastern part of the site, servicing the C and B Pits and the open cut mine. There is another rail line embankment which runs off the one described above to the western boundary and formerly serviced the Duckenfield Colliery to the west of the site. The embankments are generally grassed and elevated between 1 m and 4 m above surrounding ground with batters in the order of 1.5H:1V to 2H:1V. Chitter was observed at the surface in some places. The main rail alignment passes through an area of steep cut in places, shown in red on Drawing 2 and discussed below.

An embankment on the western side of Minmi North serviced the Browns Colliery in Back Creek (Minmi South). This embankment is similar to the one described above with heights ranging up to about 5 m in places and batter slopes in the order of 1.5H:1V to 2H:1V. In places, the embankment has been formed from cut to fill, however significant amounts of chitter was observed at the surface. This alignment also passes through an area of steep cut shown in red on Drawing 2. The two embankments meet at the northern end of the site where they adjoin a small low lying triangular area.

### ***Mounded Filling and Surface Fly Tipping***

Numerous relatively small mounds of filling were observed across the site. These piles often contained building rubble and in places fibro sheeting which is likely to contain asbestos. Numerous instances of fly tipping were observed across the site. The tipped material included paint tins, fuel cans, and fibro sheeting.

### ***Potential Slope Instability***

No signs of gross deep seated slope instability were observed on the site, however a number of localised slumping slopes were observed, often associated with erosion from concentrated surface water flows. These areas are shown in red on Drawings 1 to 4, and included the following:

- Steep gully sides;
- Mine fill batters;
- Deforested slopes;
- Cuts for rail lines.

### ***Wells / Shafts***

A number of brick lined cisterns were identified and it is likely that there are others on the site, mostly in areas mapped as disturbed ground. The cisterns which have been identified are shown on Drawings 1 to 4 in white. They have generally been backfilled with building rubble and other waste.

The site contains numerous former mine shafts and entries, the details of which are provided in the mine subsidence risk assessment (Ref 3).

### ***Dams***

A number of dams were identified on site as follows:

- Masonry walled dam on the southern part of the site (Minmi South) near the Link Road. This is at the head of a steep gully and appears to retain up to about 4 m depth of water. The dam had a notch cut into the crest for low flow spilling and it appeared that spilling over the main crest of the dam would occur during high flows;
- A cut to fill dam was observed to the east of the southernmost area of open cut. This dam appears to have been cut into natural ground with wall heights ranging up to about 3 m to 4 m. The dam had no significant catchments and no spillway was observed;
- Several minor farm dams were also located across the site.

## 7. FIELD WORK

### 7.1 Sampling Rationale

A systematic and judgemental sampling procedure was conducted for the current assessment to address the potential sources of contamination identified in the desktop and walkover assessments.

It is noted that parts of the site were excluded from the subsurface investigations as these areas were heavily constrained by mine subsidence and were not proposed for development. These include the following:

- Minmi Far East;
- Railway St to Purple Hill Mine.

A total of 158 pits and six boreholes were sampled and analysed as part of the current assessment.

Samples were selected for analysis on the basis of the likely presence of contamination, based on material type, visual or olfactory evidence of possible contamination (i.e. odour or staining), proximity to a potential source of contamination, and whether generally representative of soil/fill conditions.

### 7.2 Methods

The field work was undertaken between the 31 July 2007 and 18 September 2007 and comprised the following:

- Excavation of 158 test pits to depths of up to 3.7 m using a backhoe as follows:
  - Minmi West: Pits 1 to 19, 50 to 86, 61A, 77A and 77B;
  - Minmi South: Pits 20 to 49, 23A and 23B;
  - Minmi East: Pit 87 to 96, 131 to 133, 135 to 137;
  - Minmi North: Pits 99 to 130, 134, 138;

- Link Road North: Pits 153 to 158;
- Link Road South: Pits 147 to 157;
- Note: Pits 122 and 139 were not excavated due to access restrictions.
- Drilling of six boreholes (Bores 23B, 57, 91, 94, 97 and 98) to depths of up to 8.6 m, in areas of former open cut mines where relatively deep filling was expected.

The test locations were set out by an environmental engineer from DP who also logged the subsurface profile in the pits and boreholes and collected samples for identification and testing purposes. The test pits were pegged on completion and then surveyed by Monteath & Powys Pty Ltd. The locations of the pits and boreholes are shown on Drawings 1 to 4, Appendix D and co-ordinates are listed in Table 3, Section 8.5.

Samples for environmental purposes were generally collected from the near surface, and at regular depth intervals or changes in strata within each pit and borehole. Soil samples were collected directly from the side walls of the test pits or bores or from the excavator bucket or auger using disposable gloves. Care was taken to remove any extraneous material deposited on the sample.

All sampling data was recorded on DP chain of custody sheets, and the general sampling procedure comprised:

- Decontamination of all sampling equipment using a 3% solution of phosphate free detergent (Decon 90) and tap water prior to collecting each sample;
- The use of disposable gloves for each sampling event;
- Transfer of samples into laboratory-prepared glass jars, and capping immediately;
- Collection of 10% replicate samples for QA/QC purposes;
- Collection of replicate soil samples in zip-lock plastic bags at each depth for PID screening;
- Labelling of sample containers with individual and unique identification, including project number, sample location and sample depth;
- Placement of the sample jars and replicate sample bags into a cooled, insulated and sealed container for transport to the laboratory;

- Use of chain of custody (C-O-C) documentation ensuring that sample tracking and custody could be cross-checked at any point in the transfer of samples from the field to the laboratory.

The process of obtaining samples and their transportation, storage and delivery to laboratories for analysis was documented on a DP standard chain-of-custody form. Copies of completed forms are contained in Appendix C.

Replicate samples for each sample were screened for the presence of volatile organic compounds (VOCs), using a Photovac 2020 photo-ionisation detector (PID) with a 10.6 eV lamp, calibrated to 100 ppm Isobutylene. The PID is capable of detecting over 300 VOCs.

Samples collected for the assessment of acid sulphate soil conditions were wrapped in plastic wrap and plastic bags to exclude air, and stored and transported on ice. Samples were then refrigerated in the DP laboratory.

The work was undertaken in accordance with the DP quality system and procedures for contamination assessments as presented in the company's field procedures manual. A list of the procedures used and other information on quality assurance and quality control, including analysis of replicate samples, is found in Appendix C.

### **7.3 Data Quality Objectives (DQOs)**

Table 2 summarises data quality objectives (DQOs) and the procedures designed to enable achievement of the DQOs.

**Table 2 – Data Quality Objectives**

DQO	Achievement Evaluation Procedure
Documentation completeness	Completion of field and laboratory chain of custody documentation, completion of borehole logs.
Data completeness	Analysis of appropriate determinants based on site history and on-site observation.
Data comparability	Use of NATA certified laboratory, use of consistent sampling technique.
Precision and accuracy for sampling and analysis	Achievement of 50% RPD for replicate analysis, acceptable levels for laboratory QC criteria.

## 7.4 Results

The subsurface conditions are presented in detail in the test pit and borehole logs, Appendix A. These should be read in conjunction with the general notes preceding them, which explain definitions of the classification methods and descriptive terms.

## 7.5 Minmi West

### ***South of Railway Street (Pits 1 to 19)***

The areas of Minmi West, south of Railway Street generally comprise scattered houses and grazed paddocks with an undulating surface due to previous development comprising a workshop as well as numerous houses on the slopes to the south.

Subsurface conditions on the slopes generally comprised silty filling ranging in thickness from 0.2 m to 1.9 m overlying very stiff to hard clay and siltstone/claystone at depths in the range 0.5 m to 2.5 m.

A number of former buried cisterns/pits were located on the site, as marked in white on Drawing 2. These were found to be localised pits, often brick lined, containing building rubble, sheet iron and other waste material such as plastic and glass. They were generally full of water.

In the area of the former workshops (Pits 8 to 15), the filling typically comprised sand and silt soils, including chitter and ash in places, as well as other deleterious materials such as metal and bricks. The filling in this area generally directly overlaid weathered claystone at depths in the range 0.25 m to 1.9 m.

### ***Railway Street to Purple Hill Open Cut Mine (Pits 50 to 53)***

Only limited investigation was undertaken in the area between Railway Street and the former Purple Hill Open Cut mine, comprising Pits 50 to 53 excavated near the approximate location of the former coke ovens. These pits encountered filling, comprising gravely clayey silt with coal chitter to depths in the range 0.35 m to 2.0 m underlain by clay and clayey sand with refusal occurring on conglomerate at depths in the range 1.9 m to 3.6 m. Groundwater seepage was observed in Pit 51 at 2.1 m depth.

### ***Purple Hill Open Cut Mine and Slopes to the North (Pits 54 to 59, 61 to 64, 66 to 69, 72, 73, and Bores 57 and 97)***

Variable filling including coal chitter was encountered in these pits to depths in the range 0.4 m to greater than 3.1 m. Bores 57 and 97 encountered filling to 6.6 m and 6.7 m respectively. Pit 67 encountered metal and fibro sheeting between 0.3 and 0.5 m depth. No filling was encountered at Pit 68.

Where the base of the filling was encountered, the filling was underlain by clays, silts and sands with refusal generally occurring on sandstone, siltstone and conglomerate between 0.7 and 8.5 m depth. Pit 54 encountered clayey gravely sand beneath the filling to termination at 3.4 m depth.

Groundwater was encountered in Pit 58 at 2.3 m depth, and in Bore 97 at 6.6 m depth.

### ***Former Rail Embankments and Screens (Pits 60, 65, 67, 70, 71, 74 to 80, 82, 85, 86)***

These test pits were excavated along former rail lines, many of which comprise an embankment elevated above the creek line as well as areas of cut to fill, such as where the sidings were near the former screens.

The pits encountered variable filling including coal chitter to depths between 0.2 m and at least 3.2 m, underlain by clays, silts and sands, with refusal generally on sandstone between 0.25 m to greater than 3.7 m depth.

Groundwater was observed in Pit 60 at 3.3 m, and Pit 85 at 2.85m. Seepage was observed in Pits 81 and 83 at 1.9 and 1.7 m depths respectively.

### ***Low Lying Northern Parts (Pits 81, 83 and 84)***

These pits encountered topsoil underlain by silts, clays, and sands to termination at 3.0 m in Pits 83 and 84, and possible refusal on rock in Pit 81 at 3.1 m depth.

Groundwater seepage was observed in Pits 81 and 83 at 1.9 m and 1.7 m depth respectively.

## **7.6 Minmi North**

### ***Former Rail Line (Pits 103, 108, 112, 113, 121, 130)***

These test pits were excavated along a former rail lines, much of which comprises embankment elevated above the creek line as well as areas of cut to fill.

Filling, including coal reject, clay, silt and concrete, was encountered to depths of 0 m to 0.9 m, underlain by clays and silts. Claystone or siltstone was observed from 0.6 m to 2.4 m in all pits except Pit 130. Groundwater observed in Pit 58 from 2.3 m in Bore 97 from 6.6 m.

***Gully Line and Low Lying Northern Areas (Pits 109, 110, 117, 119, 123, 129)***

Pits 109 and 110 encountered filling to 0.45 m and 1.05 m respectively, underlain by clayey silt and silty clay to termination at 2.2 m depth.

The remaining pits comprised clay, silty clay and clayey silt, underlain in Pits 123 and 129 by silty sands, and siltstone from 2.2 m depth in Pit 129.

Groundwater was observed in Pits 123 and 129 at 2.45 m and 1.6 m respectively. Seepage was observed in Pit 117 at 0.7 m and Pit 129 at 0.4 m depth.

***Southern Cleared Area (Pits 99, 100 to 102, 104, 105 to 107)***

This area formerly contained numerous mining cottages and the current surface is moderately undulating.

These pits generally comprised variable filling including clay, ash, coal, brick and metal, from 0 m to greater than 2.0 m depth. In Pits 99, 100 to 102, 104 and 106, the filling was underlain by clays and siltstone or claystone to refusal between 1.2 and 2.7 m depth.

Perched groundwater was observed in Pit 107 at 0.5 m.

***Northern Elevated Area (Pits 111, 114, 115, 118, 120, 124 to 128, 138)***

This area is elevated above the adjacent low lying land. Much of the area is forested and only lightly disturbed, however clearing and cut and filling has been undertaken on the northern portions.

Pits 124, 128 and 138 encountered filling to 0.4 m to 1.35 m depth. Residual soil generally comprised clays and silts to termination in Pits 124 to 126 and 128, and underlain by claystone or siltstone in the remaining pits from 0.5 m to 2.0 m depth to termination.

## 7.7 Minmi East

### ***Former Browns Open Cut Mine (Pits / Bores 87 to 96)***

This is the former site of an open cut mine in the Borehole Seam.

The majority of pits encountered filling, including clay, sand, coal, coal chitter, sandstone and siltstone to termination. Pit 88 encountered filling to 0.3 m underlain by sandy clay and refused on sandstone at 0.9 m depth. Pits 87 and 96 refused on sandstone at 1.9 m and 2.3 m respectively.

Bores 91 and 94 encountered filling to 5.1 m and 8.2 m depth respectively, underlain by siltstone and laminite.

Seepage was observed in Bores 94 and 98 at 8.0 m and 3.2 m respectively. Groundwater was observed from 6.6 m depth in Bore 97.

### ***Mid Eastern Parts (Pits 131 to 137)***

This area is generally forested with the exception of a clearing and some access tracks where the test pits were undertaken. Significant opportunistic tipping has been undertaken in this area.

These pits encountered variable filling to between 0.1 m and 0.55 m depth, underlain by clayey sand, silty clay and refusing on sandstone between 0.45 m and 0.8 m depth. No filling was observed in Pits 135 and 136.

### ***Far Eastern Area***

No investigation was undertaken in the far eastern area.

## 7.8 Minmi South

### ***Northern Cleared Areas (Pits 20 to 31)***

These areas are generally used for pasture, however previously contained miners cottages and the surface is highly undulating.

The pits generally encountered variable filling to between 0.45 m and 2.5 m depth, generally underlain by clay and claystone / siltstone / coal. Pit 23A was located within a cesspit / well and encountered filling including clay, coal, ash, brick, glass, and timber to greater than 2.0 m depth. No filling was observed in Pits 25, 26 or 29.

Perched groundwater was observed in Pits 23A and 23B at 1.0m and 2.0m respectively.

### ***Former Open Cut Pit and Entry to Wallsend Borehole Colliery (Pits 38 to 47 and Bore 98)***

The Browns Underground Colliery once extended onto the very eastern parts of this site. This area was then used as an open cut mine to the Young Wallsend Seam, which was later used as an entry point for the Wallsend Borehole Colliery underground operations.

These pits generally encountered variable filling including coal, ash and coke to termination. Pit 40 encountered firm to stiff gravelly clay from 2.6m. Pit 42 encountered claystone from 1.9m and a timber column coated with coal tar was observed adjacent to the edge of the pit. Pits 43 and 44 and 47 encountered clay, coal and / or claystone from 0.8 m depth.

Bore 98 encountered variable filling to 3.2m depth underlain by soft to firm silty clay to 5.3 m depth, and stiff to very stiff silty clay to termination at 5.95 m depth. Seepage was observed at 3.2 m depth.

### **Southern Areas (Pits 32 to 37, 48, 49, 140 to 146)**

These pits generally encountered silts underlain by stiff to hard clays to termination. Pits 32, 33, 37, 48, 140 to 143 and 145 encountered variable filling to between 0.25 m and 1.5 m depth.

Pits 32 to 34, 37, 48, 49, and 140 to 146 were terminated in siltstone, sandstone, claystone or conglomerate from 0.8 to 3.1 m depth.

### **7.9 Link Road North (Pits 153 to 158)**

These pits generally comprised silts, clays and gravels underlain by sandstone, siltstone, claystone, coal and conglomerate, with refusal occurring between 0.75 m and 3.1 m depth. Pit 153 encountered gravel filling (possibly natural) to 0.4 m depth.

### **7.10 Link Road South (Pits 147 to 152)**

These pits generally comprised silts, clays and gravel underlain by sandstone, siltstone and conglomerate, with refusal occurring between 0.8 m and 3.0 m depth. Deleterious filling was observed in Pit 149 to 0.2 m depth. In Pit 150 seepage was observed at 0.45 m and groundwater observed from 1.9 m depth.

### **7.11 Summary**

A summary of the depth of filling, depth to rock and depth of groundwater is presented in Table 3, below.

**Table 3 – Summary of Depth of Filling, Rock and Groundwater**

Location	Area	Easting	Northing	Surface Level (AHD)	Depth of Fill (m)	Depth to Rock (m)	Depth of Backhoe/Auger Refusal (m)	Depth of Groundwater (m)
Pit 1	Minmi West	370105	6360262	61.1	0.35	0.8	1.6	NE
Pit 2	Minmi West	370039	6360488	44.0	0.9	2.4	>3.0	NE
Pit 3	Minmi West	369783	6360645	35.2	0.5	1.4	2.3	NE
Pit 4	Minmi West	370010	6360567	36.1	1.8	1.8	2.7	NE
Pit 4A	Minmi West	369985	6360657	25.6	>2.7	>2.7	>2.7	NE
Pit 5	Minmi West	370172	6360539	34.4	0.7	1.7	1.7	NE
Pit 6	Minmi West	370299	6360576	42.6	1.0	1.3	1.8	NE
Pit 6A	Minmi West	370238	6360569	33.6	0	0.9	2.5	NE
Pit 7	Minmi West	370088	6360727	25.4	0.5	0.5	2.1	NE
Pit 8	Minmi West	370072	6360692	28.2	0	0.3	2.1	NE
Pit 9	Minmi West	370800	6360372	19.6	1.3	1.3	>2.1	NE
Pit 10	Minmi West	370113	6360705	26.0	0.8	0.8	1.9	NE
Pit 11	Minmi West	370015	6360704	25.3	0.6	1.0	1.9	NE
Pit 12	Minmi West	370062	6360727	25.4	1.9	1.9	>3.0	NE
Pit 13	Minmi West	370103	6360740	24.6	0.5	1.0	2.2	NE
Pit 14	Minmi West	370014	6360734	22.2	0.2	1.4	>3.0	NE
Pit 15	Minmi West	370043	6360753	22.9	1.0	1.0	1.7	NE
Pit 16	Minmi West	370092	6360768	23.0	0	1.3	2.6	NE
Pit 17	Minmi West	370259	6360676	31.9	0.7	2.5	>3.0	NE
Pit 18	Minmi West	370259	6360676	31.9	0	1.6	>3.0	NE
Pit 19	Minmi West	370201	6360769	23.9	0.7	1.4	2.7	NE
Pit 20	Minmi Sth	370254	6360796	24.4	1.2	1.2	>1.8	NE
Pit 21	Minmi Sth	370310	6360834	23.1	1.0	2.0	2.5	NE
Pit 22	Minmi Sth	370451	6360794	26.2	0.7	1.4	>3.4	NE
Pit 23	Minmi Sth	370424	6360784	27.3	1.4	>3.0	>3.0	NE
Pit 23A	Minmi Sth	370645	6360881	34.2	>2.0	>2.0	>2.0	Perched 1.0
Pit 23B	Minmi Sth	370671	6360737	27.4	2.6	2.6	4.2	Perched 2.0
Pit 24	Minmi Sth	370669	6360751	28.2	0.9	0.9	>3.0	NE
Pit 25	Minmi Sth	370671	6360753	28.3	0	1.4	2.6	NE
Pit 26	Minmi Sth	370798	6359511		0	0.5	>3.0	NE
Pit 27	Minmi Sth	370605	6360692	39.2	2.1	2.6	>3.0	NE
Pit 28	Minmi Sth	370747	6360611	32.4	1.9	2.3	2.6	NE
Pit 29	Minmi Sth	370500	6360475	34.9	0	1.6	>2.5	NE
Pit 30	Minmi Sth	370709	6360499	29.8	1.3	1.25	1.5	NE

**Table 3 – Summary of Depth of Filling, Rock, and Groundwater (continued)**

Location	Area	Easting	Northing	Surface Level (AHD)	Depth of Fill (m)	Depth to Rock (m)	Depth of Backhoe/Auger Refusal (m)	Depth of Groundwater (m)
Pit 31	Minmi Sth	370619	6360449	30.8	0.5	1.1	>2.7	NE
Pit 32	Minmi Sth	370646	6360388		0.6	1.7	>2.3	NE
Pit 33	Minmi Sth	370302	6360288	53.8	0.4	0.7	1.0	NE
Pit 34	Minmi Sth	370473	6360062		0	1.4	>2.5	NE
Pit 35	Minmi Sth	370525	6360525		0	>2.5	>2.5	NE
Pit 36	Minmi Sth	370534	6359944		0	>2.2	>2.2	NE
Pit 37	Minmi Sth	370513	6360016		1.5	2.9	>3.1	NE
Pit 38	Minmi Sth	370762	6360357	16.7	≥2.4	2.4?	2.4	NE
Pit 39	Minmi Sth	370823	6360398	18.9	>3.1	>3.1	>3.1	NE
Pit 40	Minmi Sth	370890	6360423	22.5	2.6	>3.0	>3.0	NE
Pit 41	Minmi Sth	370793	6360285	19.7	>3.3	>3.3	>3.3	NE
Pit 42	Minmi Sth	370862	6360313	24.6	1.9-2.5	1.9	2.8	NE
Pit 43	Minmi Sth	370912	6360333	26.3	1.0	1.0	2.5	NE
Pit 44	Minmi Sth	370954	6360388	26.6	1.1	2.1	>3.0	NE
Pit 45	Minmi Sth	370809	6360251	21.0	>3.1	>3.1	>3.1	NE
Pit 46	Minmi Sth	370856	6360262	25.5	>3.5	>3.5	>3.5	NE
Pit 47	Minmi Sth	370750	6360294	16.5	0.8	0.8	>3.0	NE
Pit 48	Minmi Sth	371043	6360238	40.0	0.8	0.8	>3.0	NE
Pit 49	Minmi Sth	371016	6360144	46.3	0	0.6	2.2	NE
Pit 50	Minmi West	370348	6360939	17.4	0.4	1.9	1.9	NE
Pit 51	Minmi West	370317	6360890	17.2	1.9	3.6	3.6	Seepage at 2.1 m
Pit 52	Minmi West	370312	6360935	16.2	0.7	>3.0	>3.0	NE
Pit 53	Minmi West	370352	6360911		2.0	2.4	2.4	NE
Pit 54	Minmi West	370356	6360994	14.4	2.0	>3.4	>3.4	NE
Pit 55	Minmi West	370397	6360976	17.8	1.4	≥2.7	≥2.7	NE
Pit 56	Minmi West	370413	6361032	16.8	0.5	1.3	1.5	NE
Bore 57	Minmi West	370274	6361090	16.3	6.6	6.6	6.7	>6.7
Pit 58	Minmi West	370199	6361127	16.8	3.1	3.1	3.1	2.3
Pit 59	Minmi West	370392	6361110	12.6	0.4	1.7	1.8	NE
Pit 60	Minmi West	370451	6361130	17.5	2.4	>3.7	>3.7	3.3
Pit 61	Minmi West	370110	6361163	21.6	>1.4	>1.4	>1.4	NE
Pit 61A	Minmi West	370123	6361162	21.6	>2.1	>2.1	>2.1	NE
Pit 62	Minmi West	370319	6361188	18.3	0.5	2.4	2.4	NE
Pit 63	Minmi West	370161	6361249	29.6	2.1	3.1	3.1	NE

**Table 3 – Summary of Depth of Filling, Rock, and Groundwater (continued)**

Location	Area	Easting	Northing	Surface Level (AHD)	Depth of Fill (m)	Depth to Rock (m)	Depth of Backhoe/Auger Refusal (m)	Depth of Groundwater (m)
Pit 64	Minmi West	370253	6361319	22.4	1.9	2.7	2.7	NE
Pit 65	Minmi West	370440	6361271	16.4	2.6	>3.7	>3.7	NE
Pit 66	Minmi West	370363	6361322	12.8	0.6	1.1	1.1	NE
Pit 67	Minmi West	370273	6361482		0.7	0.7	0.7	NE
Pit 68	Minmi West	370299	6361386	14.7	0	≥1.35	1.4	NE
Pit 69	Minmi West	370364	6361411	8.9	0.7	2.9	2.9	NE
Pit 70	Minmi West	370218	6361432	18.7	1.9	1.9	1.9	NE
Pit 71	Minmi West	370437	6361423	17.0	0.7	0.7	0.8	NE
Pit 72	Minmi West	370358	6361488	12.2	>2.9	>2.9	>2.9	NE
Pit 73	Minmi West	370346	6361524	13.7	>3.0	>3.0	>3.0	NE
Pit 74	Minmi West	370485	6361525	17.9	1.0	1.0	1.5	NE
Pit 75	Minmi West	370493	6361599	16.7	1.8	>2.7	>2.7	NE
Pit 76	Minmi West	370439	6361599	12.4	3.2	>3.2	>3.2	NE
Pit 77	Minmi West	370552	6361579	23.7	1.5	1.5	1.8	NE
Pit 77A	Minmi West	370543	6361560	24.3	>0.3	>0.3	>0.3	NE
Pit 77B	Minmi West	370544	6361561		0.4	0.4	0.6	ME
Pit 78	Minmi West	370501	6361575	16.7	0.2	0.2	0.3	NE
Pit 79	Minmi West	370577	6361649	15.4	0.3	1.6	1.6	NE
Pit 80	Minmi West	370619	6361685	15.8	0.7	>2.8	>2.8	NE
Pit 81	Minmi West	370521	6361727	8.7	0	3.1	3.1	Seepage from 1.9m
Pit 82	Minmi West	370656	6361723	14.7	0.65	1.2?	1.2?	NE
Pit 83	Minmi West	370483	6361803	5.8	0	>3.0	>3.0	Seepage at 1.7m
Pit 84	Minmi West	370588	6361804	9.5	0	>3.0	>3.0	NE
Pit 85	Minmi West	370659	6361784	12.6	>3.2	>3.2	>3.2	2.9
Pit 86	Minmi West	370725	6360847	23.9	0.5	>2.7	>2.7	NE
Pit 87	Minmi East	371112	6361052	25.4	1.8	1.8	1.9	NE
Pit 88	Minmi East	371255	6361044	48.8	0.3	0.8	0.9	NE
Pit 89	Minmi East	371366	6361039	37.3	>3.2	>3.2	>3.2	NE
Pit 90	Minmi East	371149	6361126	30.2	>3.6	>3.6	>3.6	NE
Bore 91	Minmi East	371275	6361093	42.8	5.1	5.1	>7.2	>7.15
Pit 92	Minmi East	371314	6361143	39.8	0.7?? >3.2	>3.2	>3.2	NE
Pit 93	Minmi East	371153	6361185	35.7	≥3.7	≥3.7	3.7	NE
Bore 94	Minmi East	371245	6361196	37.2	8.2	8.2	8.6	Seepage at 8.0m

**Table 3 – Summary of Depth of Filling, Rock, and Groundwater (continued)**

Location	Area	Easting	Northing	Surface Level (AHD)	Depth of Fill (m)	Depth to Rock (m)	Depth of Backhoe/Auger Refusal (m)	Depth of Groundwater (m)
Pit 95	Minmi East	371254	6361257	35.6	>3.7	>3.7	>3.7	NE
Pit 96	Minmi East	371217	6361321	31.3	2.1	2.2	2.3	NE
Bore 97	Minmi West	370220	6361203	23.4	8.5	8.5	8.5	6.6
Bore 98	Minmi Sth	370800	6360372	19.6	3.2	6.0	6.0	Seepage at 3.2m
Pit 99	Minmi Nth	370824	6361003	11.4	1.2	1.9	2.2	NE
Pit 100	Minmi Nth	370889	6360985	10.5	0.9	1.6	1.8	NE
Pit 101	Minmi Nth	370790	6361062	14.5	0.3	1.3	1.4	NE
Pit 102	Minmi Nth	370940	6361090	13.0	0	1.6	2.0	NE
Pit 103	Minmi Nth	370818	6361184		0.3	0.6	0.8	NE
Pit 104	Minmi Nth	370888	6361172	10.2	0.4	0.8	1.2	NE
Pit 105	Minmi Nth	370951	6361148	16.4	>2.0	>2.0	>2.0	Perched at 0.4m, possible shaft
Pit 106	Minmi Nth	371030	6361176	23.6	0.3	2.2	2.7	NE
Pit 107	Minmi Nth	370933	6361244	14.1	0	>1.8	>1.8	Perched at 0.5m, possible pothole or well
Pit 108	Minmi Nth	370826	6361119	10.4	0.6	1.1	1.3	NE
Pit 109	Minmi Nth	370910	6361335	5.2	0.5	>2.2	>2.2	NE
Pit 110	Minmi Nth	370958	6361511	4.8	1.1	>2.2	>2.2	NE
Pit 111	Minmi Nth	371204	6361716	10.9	0	0.7	>2.0	NE
Pit 112	Minmi Nth	370995	6361422	8.7	0.2	1.0	3.0	NE
Pit 113	Minmi Nth	370887	6361552	7.8	0.95	2.4	2.6	NE
Pit 114	Minmi Nth	370993	6361626	3.3	0	2.0	2.2	Seepage at 2m
Pit 115	Minmi Nth	371248	6361581	25.6	0	0.5	1.8	NE
Pit 117	Minmi Nth	371326	6361654	17.4	0	>3.0	>3.0	Seepage at 0.7m
Pit 118	Minmi Nth	371111	6361754	2.3	0	1.8	>2.5	NE
Pit 119	Minmi Nth	371410	6361780	7.2	0	>3.0	>3.0	NE
Pit 120	Minmi Nth	370950	6361854		0	0.5	1.5	NE
Pit 121	Minmi Nth	371085	6361870	2.4	0	0.8	1.2	NE
Pit 123	Minmi Nth	371314	6361143	39.8	0	>3.0	>3.0	2.5
Pit 124	Minmi Nth	371367	6361851	2.3	1.1	>3.0	>3.0	NE
Pit 125	Minmi Nth	371447	6361841	8.6	0	>3.0	>3.0	NE
Pit 126	Minmi Nth	371438	6361920	0.9	0	>3.0	>3.0	NE
Pit 127	Minmi Nth	371358	6361704	13.2	0	1.2	1.5	NE
Pit 128	Minmi Nth	371517	6361917	1.2	0.4	>2.5	>2.5	1.7

**Table 3 – Summary of Depth of Filling, Rock, and Groundwater (continued)**

Location	Area	Easting	Northing	Surface Level (AHD)	Depth of Fill (m)	Depth to Rock (m)	Depth of Backhoe/Auger Refusal (m)	Depth of Groundwater (m)
Pit 129	Minmi Nth	370930	6361924	2.7	0	2.2	>3.0	1.6 (seepage at 0.4)
Pit 130	Minmi Nth	371034	6362048	3.1	0.9	>2.5	>2.5	0.6
Pit 131	Minmi East	371273	6361374	29.8	0.1	0.3	0.5	NE
Pit 132	Minmi East	371329	6361369	24.4	0.2	0.3	0.6	NE
Pit 133	Minmi East	371301	6361420		0.5	0.7	0.7	NE
Pit 134	Minmi Nth	370928	6361024	14.6	0.3	0.3	0.7	NE
Pit 135	Minmi East	371528	6361201		0	0.3	0.5	NE
Pit 136	Minmi East	371563	6361392	31.8	0	0.5	0.6	NE
Pit 137	Minmi East	371582	6361513	24.6	0.6	0.6	0.8	NE
Pit 138	Minmi Nth	371593	6361844	3.7	1.4	2.2	>2.6	NE
Pit 140	LR North	370505	6359691		0.3	0.9	1.5	NE
Pit 141	LR North	370578	6359711		0.3	0.8	1.5	NE
Pit 142	LR North	370578	6359620		0.5	1.4	>3.0	NE
Pit 143	LR North	370029	6359456		1.5	2.0	2.4	NE
Pit 144	LR North	370220	6359383		0	0.9	1.4	NE
Pit 145	LR North	370956	6359114		0.3	0.5	0.8	NE
Pit 146	LR North	370794	6359506		0	0.7	1.0	NE
Pit 147	LR South	371817	6357519		0	2.9	3.0	NE
Pit 148	LR South	371820	6357510		0	0.9	1.0	NE
Pit 149	LR South	372079	6357488		0.2	0.6	1.0	NE
Pit 150	LR South	371243	6357903		0	2.0	2.1	1.9 (seepage at 0.45)
Pit 151	LR South	371555	6357967		0	0.5	>2.0	NE
Pit 152	LR South	371849	6358134		0	0.7	0.8	NE
Pit 153	LR North	372125	6358461		0.4	0.6	0.75	NE
Pit 154	LR North	372284	6358527		0	2.5	2.6	NE
Pit 155	LR North	371277	6359497		0	1.4	2.3	NE
Pit 156	LR North	371585	6358846		0	0.9	>1.2	NE
Pit 157	LR North	372030	6358980		0	0.5	1.6	NE
Pit 158	LR North	372370	6359220		0	1.3	3.1	NE

**Notes to Table 3:**

NE – Not Encountered

Note: Entries with no surface level shown are approximate coordinates from hand held GPS.

Very soft to firm possible alluvial soil was encountered in Bore 97 from 6.7 to 8.45m depth

Groundwater seepage was also observed emanating from a localised point in the upper reached of a gully in the northern part of Link Road South.

The presence of potentially combustible material (coal and chitter) was noted on the borehole and test pit logs, and is summarised in Table 4 below.

**Table 4 – Potentially Combustible Material within Test Bores and Pits**

Test Pit / Bore	Depth (m)	Approx % <sup>(1)</sup>	Test Pit/ Bore	Depth (m)	Approx % <sup>(1)</sup>
Pit 9	0.7-1.0	5	Pit 72	0-0.2, 0.4-2.4	5
Pit 15	0.1-0.95	50	Pit 73	0.6-3.0	70
Pit 17	0.4-0.7	15	Pit 74	0-0.3	10
Bore 23B	0-2.5	5-10	Pit 74	0.65-1.0	5
Pit 32	0-0.55	5	Pit 76	0-0.25	10
Pit 39	0.65-1.45	30	Pit 78	0-0.2	50
Pit 44	0-0.05	10	Pit 79	0-0.3	30
Pit 44	0.35-1.1	15	Pit 85	0-0.55	10
Pit 46	1.5-2.0	20	Pit 86	0-0.5	10
Pit 47	0-0.25	60	Pit 87	0-1.8	5-10
Pit 47	0.35-0.65	90	Pit 90	0.05-1.6	10-15
Pit 48	2.0		Pit 90	1.6-1.7	40-50
Pit 51	0.7-1.9	50	Pit 90	1.7-2.7	15
Pit 53	0.2-0.6	80	Pit 90	2.7-2.8	40-50
Pit 55	0-0.4	50	Pit 90	2.8-3.6	5-10
Pit 55	0.4-1.4	5-10	Bore 91	0-3.7	5-10
Bore 57	0-6.6	5-10	Bore 94	0-7.6	10
Pit 58	2.3-3.1	80	Bore 94	7.6-8.2	20-50
Pit 59	0-0.4	70	Bore 97	0-5.3	10
Pit 60	0-1.3	20	Bore 98	0.7-3.2	
Pit 60	1.3-1.9	90	Pit 99	0.4-0.85	85
Pit 61	0.6-1.3	10	Pit 104	0-0.15	20-40
Pit 63	0-0.7	5	Pit 108	0-0.3	65
Pit 65	0-0.25	40	Pit 113	0.4-0.6	30
Pit 65	0.25-1.2	40	Pit 130	0.35-0.9	60
Pit 66	0-0.6	50-60	Pit 142	0-0.2	50
Pit 70	1.4-1.6	20	Pit 142	0.2-0.45	50
Pit 71	0.2-0.65	90	Pit 143	0.25-0.7	50

**Notes to Table 4:**

(1) Approximate percentage only, based on visual assessment

## 7.12 Contaminant Observations

Based on the results of the site walkover survey and subsurface assessment, potential sources of contamination from the former site uses include the following:

- Fill materials (source unknown), may contain a range of contaminants including asbestos, hydrocarbons, heavy metals etc. Filling is present in areas marked as mounded filling and disturbed ground (Drawings 1 to 4) as well as minor filling within other cleared or developed areas;
- Oil and grease from the coal mining operations including disturbed and cleared areas;
- Ash associated with boilers and coke ovens with potential contaminants including PAHs, coal tars and heavy metals;
- Asbestos lining from buildings and fences. This may be present in filling, disturbed ground or cleared areas and from opportunistic tipping on access tracks;
- A sewage pump station was observed at the northern end of the site. There is some potential for offsite migration of contamination onto the adjacent lower lying parts of the site. Potential contamination would include nutrients, metals and biological hazards. No contaminant migration would be expected if the pump station has been kept in good order;
- Parts of the site are used for agricultural purposes, in particular for grazing. Potential contamination associated with such site uses includes herbicides, pesticides and high nutrient run-off.

Observations of potential contamination within the test bores and pits are summarised in Table 5 below.

**Table 5 – Contaminant Observations within Test Pits and Bores**

Potential Contaminant Observation	Location/Depth (m)
Fibro fragments	Pit 67 / 0.3-0.7
	Pit 149 / 0-0.2
	Pit 152 / surface
Deleterious Material (concrete, timber, metal, bricks, glass, plastic, PVC, bone, porcelain, asphalt, sleepers, rails)	Pit 1 / 0-0.35
	Pit 4A / 0.2-1.3
	Pit 7 / 0-0.3
	Pit 9 / 0-0.7
	Pit 13 / 0-0.5
	Pit 15 / 0-0.95
	Pit 19 / 0-0.7
	Pit 22 / 0-0.7
	Pit 23 / 0-0.4
	Pit 23A / 0 - >2
	Pit 33 / 0-0.35
	Pit 39 / 0.6 – 1.0
	Pit 42 / 0.9-1.5
	Pit 48 / 0 - 0.1
	Pit 67 / 0.3-0.5
	Pit 72 / 0.4-1.7
	Pit 77A, 77B / 0-0.35
	Pit 82 / 0-0.15
	Pit 95 / 2.6-2.7
	Pit 103 / 0-0.3
	Pit 105 / 0.4 - >2.0
	Pit 106 / 0-0.25
	Pit 107 / 0 - >1.8
	Pit 109 / 0-0.45
	Pit 112 / 0-0.15
	Pit 141 / 0 – 0.3
	Pit 143 / 0.7-0.9
	Pit 149 / 0-0.2
	Pit 152 / surface
	Pit 154 / surface
Pit 157 / surface	
Asphalt and possible coal tar on timber pile	Pit 42 / 0.9-1.5
Slight hydrocarbon / PAH odour / colouration	Pit 23A / 1.0 - >2.0
	Pit 42 / 0.9-1.5
	Pit 47 / 0.35-0.65

The results of PID screening on soil samples are shown on the test pit logs in Appendix A, and generally suggest the absence of gross volatile hydrocarbon impact.

There was no visual or olfactory evidence (i.e. staining or odours) to suggest the presence of gross contamination within the soils investigated.

Seepage water was observed in some of the pits. There was no visual or olfactory evidence (i.e. staining or odours) to suggest the presence of gross contamination within seepage water.

It is noted, however, that groundwater was not sampled or analysed to confirm groundwater constituents.

## **8. LABORATORY TESTING**

### **8.1 Contamination**

#### **8.1.1 General**

Laboratory testing was undertaken by SGS Environmental, a National Association of Testing Authorities, Australia (NATA) registered laboratory. Analytical Methods used are shown on the laboratory sheets in Appendix C.

A total of 135 soil samples from the pits and boreholes were selected to provide an assessment of soil/fill conditions. The samples were selected to target the identified potential sources of contamination (Ref 1) and to assess general site conditions.

The selected samples were analysed for the following potential contaminants:

- Total Recoverable Hydrocarbons (TRH);
- Polycyclic Aromatic Hydrocarbons (PAH);
- Organochlorine Pesticides (OCP);
- Organophosphorus Pesticides (OPP);

- Polychlorinated Biphenyls (PCB);
- Benzene, Toluene, Ethyl Benzene, Xylene (BTEX);
- Metals: Arsenic (As); Cadmium (Cd); Chromium (Cr); Copper (Cu); Lead (Pb); Mercury (Hg); Nickel (Ni); Zinc (Zn).

Quality Control/Quality Assurance (QA/QC) testing comprised 15 soil replicate samples.

In addition, seven fibro samples and 15 soil samples from test pits were analysed for asbestos.

TCLP leachability testing for selected metals was conducted on sixteen samples that exceeded sensitive land use criteria for TRH (where offsite disposal is likely) to further assess the waste classification.

Four soil samples were analysed for full chromium suite as part of the acid sulphate soil assessment. The results of acid sulphate soil investigation are presented in Section 10.

A total of 21 soil samples were analysed for aggressiveness (sulphate, chloride and pH), and combustibility testing was undertaken on 17 samples. The results of this testing is presented in Section 11.

### **8.1.2 Analytical Results**

The results of chemical analysis of soil samples are presented in the laboratory report sheets (Appendix C), and are summarised in Tables 6 to 10, below.

**Table 6 – Laboratory Results for Metals in Soil**

Test Location	Depth(m)	Metal							
		As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
Pit 1	0.1	<PQL	<PQL	<PQL	0.8	5	0.18	<PQL	6.9
R4		14	0.7	7.7	27	<b>160</b>	0.18	8.5	210
Pit 2	1.6	<PQL	<PQL	0.96	3.4	9.8	<PQL	5.1	15
Pit 3	0.2	9	0.3	6.7	18	21	0.05	6.8	64
Pit 4	0.5	10	0.8	15	38	<b>210</b>	0.35	13	250
Pit 4A	1.1	6	0.8	5.9	16	26	0.05	4.7	400
Pit 5	0.8	6	0.3	6.2	6.3	7	<PQL	1.4	15
Pit 6	0.25	13	0.5	14	29	<b>290</b>	0.09	15	120
R5		10	0.4	13	26	<b>460</b>	0.07	15	120
Pit 6	0.8	6	0.2	5.1	6.4	78	0.05	2.5	18
Pit 7	0.1	21	1.9	12	880	<b>410</b>	0.14	20	860
R1		20	1.8	14	4400	<b>540</b>	0.11	22	880
Pit 7	0.6	<PQL	0.1	2.8	1.8	13	<PQL	<PQL	7.1
Pit 8	0.1	12	0.96	6.7	520	<b>150</b>	0.1	6	280
Pit 9	0.1	19	2.4	14	460	<b>510</b>	0.1	24	520
Pit 11	0.1	4	0.3	3.3	130	53	<PQL	7.5	110
R2		5	0.4	4.8	260	81	0.05	8.3	130
Pit 13	0.1	9	2.3	4.6	110	<b>120</b>	0.21	12	1500
Pit 15	0.2	6	0.8	3.1	110	<b>100</b>	0.11	7.6	570
Pit 17	0.1	15	0.8	7.9	52	<b>230</b>	0.21	8.2	150
Pit 19	0.3	15	0.8	9.9	31	<b>140</b>	0.22	10	170
R8		16	0.9	9.1	33	<b>160</b>	0.25	9.4	200
Pit 19	0.3	9	0.3	10	47	<b>470</b>	0.26	6.4	170
Pit 21	0.3	7	0.2	4.1	2.6	12	0.41	1	12
Pit 22	0.15	5	1.3	8.9	27	<b>160</b>	0.21	7.8	290
Pit 22	0.5	<PQL	<PQL	4.7	3.9	20	<PQL	1.1	27
Pit 23	0.1	6	0.6	5.7	19	91	0.15	4.8	140
Pit 23A	1.5	5	0.7	3.1	8.7	55	0.06	5.7	750
Pit 24	0.1	7	0.4	5.5	9.8	18	<PQL	2.7	45
Pit 25	0.3	<PQL	0.2	8.7	16	9	<PQL	4.6	38
Pit 27	0.5	<PQL	0.1	1.7	3.6	19	<PQL	1.2	22
Pit 28	1.6	3	<PQL	3.2	6.9	9	<PQL	1.1	12

**Table 6 – Laboratory Results for Metals in Soil (continued)**

Test Location	Depth(m)	Metal							
		As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
Pit 29	0.1	6	0.4	4.1	7	18	<PQL	4.1	39
Pit 30	0.9	4	0.2	3.5	6.8	11	<PQL	1.4	16
Pit 31	0.2	8	1	8.5	18	59	0.12	9.4	260
Pit 32	0.6	9	0.3	8.1	7.9	9.7	<PQL	1.2	13
Pit 33	0.2	6	0.4	3.5	22	<b>100</b>	<PQL	1.8	250
Pit 35	0.1	17	1.9	8.4	18	<b>100</b>	0.08	11	620
Pit 35	0.7	10	0.4	10	5.7	11	<PQL	2	28
R3		15	0.7	16	6.4	17	<PQL	1.5	24
Pit 37	0.1	6	0.3	5.1	5.1	21	<PQL	2.1	23
Pit 38	1.9	4	0.2	1.1	3.4	7	0.05	5.9	20
Pit 39	1.6	6	0.3	6.1	11	4	<PQL	6.2	39
Pit 40	0.2	6	0.3	5.9	9.8	19	<PQL	4.9	63
Pit 41	2.0	6	0.3	3.5	4.9	14	<PQL	4.2	22
Pit 42	1.2	<PQL	0.1	1	5.9	19	<PQL	2.5	30
Pit 43	1.1	<PQL	<PQL	0.8	1	3	<PQL	<PQL	4
Pit 44	0.5	6	0.2	1.9	9.7	9	0.11	6.9	67
Pit 45	0.2	4	0.2	1.8	6.3	28	0.06	3.2	38
Pit 46	1.6	7	0.2	1.8	6.7	11	0.17	5.1	32
Pit 47	0.4	6	0.3	6.8	13	5	<PQL	8.5	47
Pit 47	2.3	6	0.9	5.2	61	20	0.08	11	760
Pit 48	0-0.5	<PQL	<PQL	6.4	1.3	1	<PQL	<PQL	35
Pit 49	0.1	9	0.6	7.1	8.9	11	<PQL	3	19
Pit 50	0.2-0.3	9	2.5	41	34	<b>120</b>	<PQL	9	200
Pit 51	0.8-1.0	5	0.2	16	12	22	0.13	7.1	22
Pit 53	0.8-1.0	<PQL	<PQL	3.1	7.5	3	<PQL	16	27
Pit 54	0.8-1.0	7	0.2	8.4	19	21	0.06	11	58
Pit 55	0-0.2	5	0.2	5.7	7.3	20	<PQL	4.9	33
Pit 56	0-0.15	15	0.6	8.7	26	70	0.06	11	120
Pit 58	0.1-0.3	4	0.3	12	4.7	18	<PQL	7.1	30
D111		4	0.3	12	5.9	15	<PQL	6.2	33
Pit 59	0-0.15	10	3.9	9.4	27	<b>410</b>	0.08	9.4	1900
D109		8	0.3	6.6	14	56	0.11	4	210

Table 6 – Laboratory Results for Metals in Soil (continued)

Test Location	Depth(m)	Metal							
		As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
Pit 60	0.3-0.5	18	0.4	2.9	18	25	0.27	9.6	88
D106		85	0.3	2.7	14	20	0.57	7	36
Pit 61	0.8-1.0	5	0.3	8.6	18	11	0.05	24	85
Pit 61A	1.9-2.1	6	0.1	7	13	7	<PQL	21	78
Pit 62	0.3-0.5	4	0.1	5.4	7	7	<PQL	2.7	19
Pit 63	0.3-0.5	11	0.1	6.4	19	11	0.07	7.1	23
D112		8	0.1	9.4	26	13	0.05	9	31
Pit 64	1.3-1.5	7	0.2	8.3	8.7	25	<PQL	4.8	30
Pit 65	0-0.15	8	0.4	3.3	40	22	0.05	6.5	46
Pit 66	0.3-0.5	11	0.5	10	27	<b>110</b>	0.21	10	190
Pit 67	0.3-0.5	6	0.4	19	9.4	31	<PQL	9.8	79
Pit 69	0.0-0.15	5	0.4	9.7	17	24	0.06	8.8	100
Pit 70	1.7-1.8	10	0.3	4.3	19	24	0.09	7.4	45
Pit 71	0-0.15	8	0.5	5.1	27	25	0.06	9.4	160
Pit 72	1.3-1.5	6	1	7.2	180	<b>180</b>	0.17	19	450
Pit 73	0.2-0.3	13	0.1	2.4	6.1	5	<PQL	5.4	11
Pit 74	0.8-1.0	11	0.6	3.5	35	29	0.09	11	67
Pit 75	1.1-1.3	<b>130</b>	0.3	4.9	20	21	0.48	10	72
Pit 76	0.3-0.5	3	<PQL	6.2	17	8	<PQL	12	34
Pit 77	0.3-0.5	<b>120</b>	<PQL	3.9	6.5	38	<PQL	4.8	42
Pit 77B	0.2-0.3	12	<PQL	2.6	5.8	14	<PQL	3.7	13
Pit 79	0-0.15	4	0.4	3.5	14	8	<PQL	18	120
Pit 80	0-0.15	<PQL	<PQL	5.9	7.6	6	<PQL	2.4	25
Pit 82	0-0.15	6	0.7	16	27	63	0.07	10	190
Pit 85	0.3-0.5	26	0.4	5.7	22	16	0.13	6.3	25
Pit 87	0.8-1.0	5	0.3	11	27	15	0.06	23	92
Pit 88	0.0-0.05	20	0.4	8	15	26	<PQL	5.2	60
D129		7	0.3	4.5	8.2	17	<PQL	4.4	41
Pit 89	2.1-2.3	5	<PQL	5.1	7.9	9	<PQL	2.8	22
Pit 90	0.8-1.0	4	0.1	5.1	12	7	<PQL	6	34
Pit 90	2.8-3.0	4	0.2	6.7	25	13	0.06	15	65

Table 6 – Laboratory Results for Metals in Soil (continued)

Test Location	Depth(m)	Metal							
		As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
Pit 92	0.3-0.5	<PQL	0.2	8.9	27	15	0.06	16	75
D123		4	0.2	8	26	18	0.05	20	77
Pit 93	1.3-1.5	6	0.3	6.3	26	16	0.06	27	100
Pit 95	2.5-2.7	4	<PQL	7.3	22	12	<PQL	8.1	52
Pit 96	0.8-1.0	21	<PQL	11	63	11	<PQL	2	18
Pit 99	0.2	4	<PQL	7.8	4.9	12	<PQL	3.9	33
Pit 100	0.1	8	0.6	10	51	<b>520</b>	0.05	19	160
Pit 100	0.4	9	0.3	11	23	43	0.16	13	84
Pit 101	0.1	6	0.4	5.5	9.3	91	0.09	3.6	58
Pit 103	0.1	5	1.1	7.8	13	42	<PQL	4.7	100
Pit 104	0.3	6	0.4	5.5	9.3	91	0.09	3.6	58
R7		5	<PQL	10	14	15	<PQL	14	21
Pit 105	0.6	4	<PQL	8	11	37	0.19	2.3	75
Pit 106	0.1	14	0.8	19	130	<b>160</b>	0.26	12	320
Pit 107	0.2	4	1.3	7.4	7.5	43	0.05	4.6	630
Pit 108	0.7	<PQL	<PQL	4.6	2.4	4	<PQL	2.7	12
Pit 109	0.1	10	0.5	6.5	13	71	0.16	9.5	89
Pit 110	0.3	5	<PQL	3.6	5.8	15	<PQL	4.2	21
Pit 110	1.0	6	<PQL	4.3	4.9	9.8	<PQL	4.5	16
Pit 112	0.1	13	1.5	8	43	<b>270</b>	0.11	3.7	<PQL
Pit 113	0.7	9	0.5	8.3	9	29	<PQL	4.4	59
Pit 115	0.2	5	<PQL	6.2	3.3	4	<PQL	2.4	17
R6		3	<PQL	6	2.7	4	<PQL	2.3	16
Pit 124	0.6	4	<PQL	4.4	4.9	6	<PQL	2.5	18
Pit 125	0.1	4	<PQL	2.7	2.1	12	<PQL	1.4	14
Pit 127	0.1	5	0.3	9.4	7.4	11	<PQL	3.8	31
Pit 128	0.1	5	0.6	11	12	24	0.05	15	84
Pit 130	0.1	13	<PQL	3.7	9	14	0.06	2.9	41
Pit 131	0.0-0.05	6	0.8	12	67	<b>130</b>	<PQL	5.3	270
Pit 133	0.2-0.3	10	0.3	12	3.4	17	<PQL	2.9	47
Pit 134	0.2	4	<PQL	3.9	2.9	14	<PQL	1.1	23
Pit 135	0.0-0.05	3	0.5	4.4	5.5	29	<PQL	1.9	41

**Table 6 – Laboratory Results for Metals in Soil (continued)**

Test Location	Depth(m)	Metal							
		As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
Pit 137	0.2-0.3	7	0.5	9.8	7	19	0.07	19	61
Pit 138	0.1	<PQL	0.4	5.5	8.2	17	<PQL	8.2	60
Pit 140	0.1	12	0.9	9.4	27	<b>110</b>	0.15	8.7	150
Pit 141	0.1	11	0.7	7.3	28	<b>110</b>	0.14	4.3	160
Pit 142	0.1	8	0.4	2	8.3	20	0.06	2.4	41
Pit 143	0.1	7	<PQL	2.9	12	19	<PQL	2.6	60
Pit 143	0.8	<b>150</b>	0.8	5.5	42	<b>530</b>	0.07	13	260
Pit 144	0.05	6	0.6	5.1	14	98	<PQL	2.7	220
Pit 146	0.1	11	0.8	5.8	9	37	<PQL	6.4	87
Pit 147A	0-0.05	11	<PQL	5.5	7.1	17	<PQL	1.9	21
Pit 149	0.05	5	4.4	6	13	<b>130</b>	0.06	3	770
Pit 152	0.1	9	0.9	3.7	15	71	0.05	1.8	78
Pit 153	0.1	<PQL	<PQL	1	0.6	6	<PQL	<PQL	2.8
Pit 157	0.1	4	<PQL	3.5	2.5	7	<PQL	3	30
Bore 23B	2.5	6	0.4	6.3	14	<b>120</b>	0.07	3.7	370
Bore 57	0.5	32	0.3	12	33	15	0.06	34	130
Bore 57	5.5	3	0.1	10	26	11	<PQL	18	120
Bore 91	3.5	5	0.1	7.4	12	30	0.05	10	75
Bore 94	2.0	5	0.3	12	35	16	0.07	28	130
Bore 97	2.0	4	0.3	10	29	12	0.05	31	150
BD4		4	0.4	10	31	13	0.06	<b>40</b>	180
Bore 97	5.5	5	0.1	7.4	16	7	<PQL	14	84
Bore 98	1.0	6	0.2	7.3	12	8	0.05	15	49
Laboratory PQL		3	0.1	0.3	0.5	1	0.05	0.5	0.3
NEHF A <sup>1</sup> (Ref 6)		100	20	100	1000	300	15	600	7000
General Solid Waste (Ref 8)		100	20	100	NC	100	4	40	NC
Restricted Solid Waste (Ref 8)		400	80	400	NC	400	16	160	NC

**Notes to Table 6:**

All results in mg/kg on a dry weight basis

PQL – Practical Quantitation Limits

NC – No Criteria

1 – Health Based Criteria for NEHF A - Residential Land Use,

3 – Chromium (VI) (Conservative)

Shaded results exceed NEHF A Health Based Criteria

Bold results exceed 'General Solid Waste' criteria (Ref 8)

Table 7 – Laboratory Results for TRH and BTEX in Soil

Test Location	Depth (m)	PID (ppm)	Analyte							
			TRH				BTEX			
			C <sub>6</sub> - C <sub>9</sub>	C <sub>10</sub> - C <sub>14</sub>	C <sub>15</sub> - C <sub>28</sub>	C <sub>29</sub> - C <sub>36</sub>	Benzene	Toluene	Ethyl Benzene	Xylene
Pit 1	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R4		<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 2	1.6	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 3	0.2	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 4	0.5	<1	<PQL	<PQL	90	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 4A	1.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 5	0.8	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 6	0.25	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R5		<1	<PQL	34	330	420	<PQL	<PQL	<PQL	<PQL
Pit 6	0.8	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 7	0.1	<1	<PQL	<PQL	77	330	<PQL	<PQL	<PQL	<PQL
R1		<1	<PQL	<PQL	92	250	<PQL	<PQL	<PQL	<PQL
Pit 7	0.6	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 8	0.1	<1	<PQL	<PQL	56	190	<PQL	<PQL	<PQL	<PQL
Pit 9	0.1	2.0	<PQL	<PQL	54	130	<PQL	<PQL	<PQL	<PQL
Pit 11	0.1	<1	<PQL	<PQL	53	240	<PQL	<PQL	<PQL	<PQL
R2		<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 13	0.1	<1	<PQL	<PQL	100	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 15	0.2	1.8	<PQL	<PQL	420	430	<PQL	<PQL	<PQL	<PQL
Pit 17	0.1	<1	<PQL	49	270	56	<PQL	<PQL	<PQL	<PQL
Pit 19	0.1	<1	<PQL	35	300	99	<PQL	<PQL	<PQL	<PQL
R8		<1	<PQL	41	310	93	<PQL	<PQL	<PQL	<PQL
Pit 19	0.3	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 21	0.3	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 22	0.15	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 22	0.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 23	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 23A	1.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 24	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 25	0.3	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 27	0.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 28	1.6	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 29	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 30	0.9	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 31	0.2	<1	<PQL	<PQL	190	<PQL	<PQL	<PQL	<PQL	<PQL

**Table 7 – Laboratory Results for TRH and BTEX in Soil (continued)**

Test Location	Depth (m)	PID (ppm)	Analyte							
			TRH				BTEX			
			C <sub>6</sub> - C <sub>9</sub>	C <sub>10</sub> - C <sub>14</sub>	C <sub>15</sub> - C <sub>28</sub>	C <sub>29</sub> - C <sub>36</sub>	Benzene	Toluene	Ethyl Benzene	Xylene
Pit 32	0.6	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 33	0.2	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 35	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 35	0.7	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R3		<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 37	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 38	1.9	3.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 39	1.6	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 40	0.2	<1	<PQL	<PQL	73	260	<PQL	<PQL	<PQL	<PQL
Pit 41	2.0	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 42	1.2	4.6	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 43	1.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 44	0.5	5.4	<PQL	<PQL	58	140	<PQL	<PQL	<PQL	<PQL
Pit 45	0.2	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 46	1.6	6.1	<PQL	<PQL	120	220	<PQL	<PQL	<PQL	<PQL
Pit 47	0.4	6.6	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 47	2.3	4.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 48	0-0.05	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 49	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 50	0.2-0.3	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 51	0.8-1.0	<1	<PQL	<PQL	110	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 53	0.8-1.0	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 54	0.8-1.0	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 55	0-0.2	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 56	0-0.15	<1	<PQL	<PQL	65	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 58	0.1-0.3	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
D111		<1	<PQL	<PQL	<PQL	77	<PQL	<PQL	<PQL	<PQL
Pit 59	0-0.15	<1	<PQL	<PQL	170	57	<PQL	<PQL	<PQL	<PQL
D109		<1	<PQL	<PQL	180	97	<PQL	<PQL	<PQL	<PQL
Pit 60	0.3-0.5	<1	<PQL	42	320	120	<PQL	<PQL	<PQL	<PQL
D106		<1	<PQL	54	380	150	<PQL	<PQL	<PQL	<PQL
Pit 61	0.8-1.0	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 61A	1.9-2.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 62	0.3-0.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

**Table 7 – Laboratory Results for TRH and BTEX in Soil (continued)**

Test Location	Depth (m)	PID (ppm)	Analyte							
			TRH				BTEX			
			C <sub>6</sub> - C <sub>9</sub>	C <sub>10</sub> - C <sub>14</sub>	C <sub>15</sub> - C <sub>28</sub>	C <sub>29</sub> - C <sub>36</sub>	Benzene	Toluene	Ethyl Benzene	Xylene
Pit 63	0.3-0.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
D112		<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 64	1.3-1.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 65	0-0.15	<1	<PQL	<PQL	280	170	<PQL	<PQL	<PQL	<PQL
Pit 66	0.3-0.5	<1	<PQL	<PQL	120	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 67	0.3-0.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 69	0.0-0.15	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 70	1.7-1.8	<1	<PQL	91	530	100	<PQL	<PQL	<PQL	<PQL
Pit 71	0-0.15	<1	<PQL	40	290	58	<PQL	<PQL	<PQL	<PQL
Pit 72	1.3-1.5	<1	<PQL	<PQL	190	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 73	0.2-0.3	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 74	0.8-1.0	<1	<PQL	35	270	100	<PQL	<PQL	<PQL	<PQL
Pit 75	1.1-1.3	<1	<PQL	110	640	270	<PQL	<PQL	<PQL	<PQL
Pit 76	0.3-0.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 77	0.3-0.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 77B	0.2-0.3	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 79	0-0.15	<1	<PQL	<PQL	110	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 80	0-0.15	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 82	0-0.15	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 85	0.3-0.5	<1	<PQL	<PQL	130	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 87	0.8-1.0	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 88	0.0-0.05	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
D129		<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 89	2.1-2.3	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 90	0.8-1.0	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 90	2.8-3.0	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 92	0.3-0.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
D123		<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 93	1.3-1.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 95	2.5-2.7	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 96	0.8-1.0	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 99	0.2	<1	<PQL	<PQL	<PQL	66	<PQL	<PQL	<PQL	<PQL
Pit 100	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

**Table 7 – Laboratory Results for TRH and BTEX in Soil (continued)**

Test Location	Depth (m)	PID (ppm)	Analyte							
			TRH				BTEX			
			C <sub>6</sub> - C <sub>9</sub>	C <sub>10</sub> - C <sub>14</sub>	C <sub>15</sub> - C <sub>28</sub>	C <sub>29</sub> - C <sub>36</sub>	Benzene	Toluene	Ethyl Benzene	Xylene
Pit 100	0.4	<1	<PQL	<PQL	88	98	<PQL	<PQL	<PQL	<PQL
Pit 101	0.1	<1	<PQL	<PQL	54	150	<PQL	<PQL	<PQL	<PQL
Pit 103	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 104	0.3	<1	<PQL	<PQL	89	120	<PQL	<PQL	<PQL	<PQL
R7		1.8	<PQL	<PQL	130	160	<PQL	<PQL	<PQL	<PQL
Pit 105	0.6	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 106	0.1	<1	<PQL	<PQL	<PQL	60	<PQL	<PQL	<PQL	<PQL
Pit 107	0.2	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 108	0.7	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 109	0.1	<1	<PQL	<PQL	110	81	<PQL	<PQL	<PQL	<PQL
Pit 110	0.3	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 110	1.0	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 112	0.1	<1	<PQL	<PQL	110	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 113	0.7	<1	<PQL	<PQL	80	96	<PQL	<PQL	<PQL	<PQL
Pit 115	0.2	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R6		<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 124	0.6	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 125	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 127	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 128	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 130	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 131	0.0-0.05	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 133	0.2-0.3	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 134	0.2	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 135	0.0-0.05	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 137	0.2-0.3	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 138	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 140	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 141	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 142	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 143	0.1	<1	<PQL	<PQL	77	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 143	0.8	<1	<PQL	<PQL	130	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 144	0.05	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

**Table 7 – Laboratory Results for TRH and BTEX in Soil (continued)**

Test Location	Depth (m)	PID (ppm)	Analyte								
			TRH				BTEX				
			C <sub>6</sub> - C <sub>9</sub>	C <sub>10</sub> - C <sub>14</sub>	C <sub>15</sub> - C <sub>28</sub>	C <sub>29</sub> - C <sub>36</sub>	Benzene	Toluene	Ethyl Benzene	Xylene	
Pit 146	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 147A	0-0.05	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 149	0.05	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 152	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 153	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 157	0.1	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 23B	2.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 57	0.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 57	5.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 91	3.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 94	2.0	1.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 97	2.0	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
BD4		<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 97	5.5	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 98	1.0	<1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Laboratory PQL			20	20	50	50	0.5	0.5	0.5	1.5	
NEHF A <sup>1</sup> (Ref 6)			NC	NC			NC	NC	NC	NC	NC
Service Station Sites <sup>2</sup> (Ref 7)			65	1000 total			1	1.4/130 <sup>1</sup>	3.1/50 <sup>1</sup>	14/25 <sup>1</sup>	
General Solid Waste (Ref 8)			650	10000 total			10	288	600	1000	
Restricted Solid Waste (Ref 8)			2600	40000 total			40	1152	2400	4000	

**Notes to Table 7:**

All results in mg/kg on a dry weight basis

PQL – Practical Quantitation Limits

NC – No Criteria

PID – Photoionisation Detector

1 – Health Based Criteria for NEHF A - Residential Land Use

2 – Threshold Concentration for Sensitive Land Use

Shaded results exceed Service Station Criteria

**Table 8 – Laboratory Results for OCP, OPP, PCB and PAH in Soil**

Test Location	Depth (m)	Total PAH <sup>3</sup>	Benzo(a) Pyrene	PCB	Total OPP	Total OCP	Aldrin + Dieldrin	Chlordane	DDT	Heptachlor
Pit 1	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R4		<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 2	1.6	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 3	0.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 4	0.5	5.59	0.59	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 4A	1.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 5	0.8	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 6	0.25	1.81	0.21	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R5		0.78	0.08	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 6	0.8	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 7	0.1	1.98	0.18	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R1		1.31	0.11	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 7	0.6	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 8	0.1	2.2	0.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 9	0.1	1.92	0.22	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 11	0.1	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R2		0.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 13	0.1	1.94	0.14	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 15	0.2	63.5	5.7	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 17	0.1	4.45	0.25	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 19	0.3	9.17	0.77	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R8		15.5	1.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 19	0.3	0.4	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 21	0.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 22	0.15	0.06	0.06	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 22	0.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 23	0.1	0.78	0.08	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 23A	1.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 24	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 25	0.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 27	0.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 28	1.6	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 29	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 30	0.9	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 31	0.2	2.43	0.13	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 32	0.6	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 33	0.2	1.71	0.21	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 35	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

**Table 8 – Laboratory Results for OCP, OPP, PCB and PAH in Soil (continued)**

Test Location	Depth (m)	Total PAH <sup>3</sup>	Benzo(a) Pyrene	PCB	Total OPP	Total OCP	Aldrin + Dieldrin	Chlordane	DDT	Heptachlor
Pit 35	0.7	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R3		<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 37	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 38	1.9	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 39	1.6	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 40	0.2	0.77	0.07	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 41	2.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 42	1.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 43	1.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 44	0.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 45	0.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 46	1.6	0.7	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 47	0.4	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 47	2.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 48	0-0.5	0.06	0.06	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 49	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 50	0.2-0.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 51	0.8-1.0	3.5	0.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 53	0.8-1.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 54	0.8-1.0	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 55	0-0.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 56	0-0.15	4.1	0.4	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 58	0.1-0.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
D111		<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 59	0-0.15	3.05	0.15	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
D109		17.7	<b>1.7</b>	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 60	0.3-0.5	3.93	0.13	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
D106		2.66	0.06	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 61	0.8-1.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 61A	1.9-2.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 62	0.3-0.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 63	0.3-0.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
D112		<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 64	1.3-1.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 65	0-0.15	1.87	0.07	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 66	0.3-0.5	3.43	0.33	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 67	0.3-0.5	0.47	0.07	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 69	0.0-0.15	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Table 8 – Laboratory Results for OCP, OPP, PCB and PAH in Soil (continued)

Test Location	Depth (m)	Total PAH <sup>3</sup>	Benzo(a) Pyrene	PCB	Total OPP	Total OCP	Aldrin + Dieldrin	Chlordane	DDT	Heptachlor
Pit 70	1.7-1.8	3.7	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 71	0-0.15	2.41	0.11	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 72	1.3-1.5	3.55	0.25	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 73	0.2-0.3	0.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 74	0.8-1.0	3.32	0.12	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 75	1.1-1.3	7.48	0.08	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 76	0.3-0.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 77	0.3-0.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 77B	0.2-0.3	0.56	0.06	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 79	0-0.15	0.6	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 80	0-0.15	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 82	0-0.15	0.59	0.09	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 85	0.3-0.5	1.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 87	0.8-1.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 88	0.0-0.05	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
D129		<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 89	2.1-2.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 90	0.8-1.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 90	2.8-3.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 92	0.3-0.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
D123		<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 93	1.3-1.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 95	2.5-2.7	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 96	0.8-1.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 99	0.2	0.4	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 100	0.1	0.59	0.09	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 100	0.4	1.63	0.13	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 101	0.1	17.1	<b>1.4</b>	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 103	0.1	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 104	0.3	0.68	0.08	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R7		2.49	0.19	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 105	0.6	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 106	0.1	1.89	0.19	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 107	0.2	2.19	0.19	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 108	0.7	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 109	0.1	3.88	0.38	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 110	0.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 110	1.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Table 8 – Laboratory Results for OCP, OPP, PCB and PAH in Soil (continued)

Test Location	Depth (m)	Total PAH <sup>3</sup>	Benzo(a) Pyrene	PCB	Total OPP	Total OCP	Aldrin + Dieldrin	Chlordane	DDT	Heptachlor
Pit 112	0.1	1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 113	0.7	3.15	0.15	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 115	0.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
R6		<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 124	0.6	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 125	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 127	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 128	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 130	0.1	0.4	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 131	0.0-0.05	0.36	0.06	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 133	0.2-0.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 134	0.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 135	0.0-0.05	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 137	0.2-0.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 138	0.1	0.58	0.08	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 140	0.1	0.27	0.07	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 141	0.1	0.89	0.09	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 142	0.1	0.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 143	0.1	0.89	0.09	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 143	0.8	7.75	0.75	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 144	0.05	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 146	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 147A	0-0.05	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 149	0.05	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 152	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 153	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Pit 157	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 23B	2.5	3.29	0.19	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 57	0.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 57	5.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 91	3.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 94	2.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 97	2.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
BD4		<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 97	5.5	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Bore 98	1.0	0.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

**Table 8 – Laboratory Results for OCP, OPP, PCB and PAH in Soil (continued)**

Test Location	Depth (m)	Total PAH	Benzo(a) Pyrene	PCB	Total OPP	Total OCP	Aldrin + Dieldrin	Chlordane	DDT	Heptachlor
Laboratory PQL		1.55	0.05	0.9	0.4	2.5	0.2	0.2	0.2	0.1
NEHF A <sup>1</sup> (Ref 6)	20	20	1	10	NC	NC	10	50	200	10
Service Station Sites <sup>2</sup> (Ref 7)	20	20	1	NC	NC	NC	NC	NC	NC	NC
General Solid Waste (Ref 8)	200	200	0.8	50	NC	NC	NC	NC	NC	NC
Restricted Solid Waste (Ref 8)	800	800	3.2	50	NC	NC	NC	NC	NC	NC

**Notes to Table 8:**

All results in mg/kg on a dry weight basis

PQL – Practical Quantitation Limits

NC – No Criteria

1 – Health Based Criteria for NEHF A - Residential Land Use

2 – Threshold Concentration for Sensitive Land Use

3 – Sum of total positive PAH results

Shaded results exceed NEHF A Health based Criteria

**Bold** results exceed NSW DECCW 'General Solid Waste' Guidelines

**Table 9 – Laboratory Results for Asbestos in Soil and Fibro Fragments**

Sample Identification	Sample Type	Asbestos Detected
Pit 1/0.1 m	Soil	No Asbestos Detected
Pit 13/0.1 m	Soil	No Asbestos Detected
Pit 21/0.3 m	Soil	No Asbestos Detected
Pit 23/0.1 m	Soil	No Asbestos Detected
Pit 33/0.2 m	Soil	No Asbestos Detected
Pit 42/1.2 m	Soil	No Asbestos Detected
Pit 52/0-0.15 m	Soil	No asbestos detected
Pit 67/0.3-0.5 m	Cement sheet fragment	Chrysotile asbestos detected
Pit 67/0.5-0.6 m	Soil	Chrysotile asbestos detected
Pit 77/0-0.01 m	Cement sheet fragment	Crocidolite, amosite and chrysotile asbestos detected
Pit 80/0-0.01 m	Cement sheet fragment	Crocidolite and chrysotile asbestos detected
Pit 80/0-0.15 m	Soil	No asbestos detected
Pit 82/0-0.15 m	Soil	No asbestos detected
Pit 95/2.5-2.7 m	Soil	No asbestos detected
Pit 144/0 m	Fibreboard fragment	Chrysotile asbestos detected
Pit 144/0.05 m	Soil	No asbestos detected
Pit 149/Fibro	Cement sheet fragment	Chrysotile asbestos detected
Pit 149/0.05	Soil	Chrysotile asbestos detected
Pit 152/Fibro	Cement sheet fragment	Chrysotile asbestos detected
Pit 152/0.1	Soil	Chrysotile asbestos detected
Pit 153/Fibro	Fibre board fragment	No asbestos detected
Pit 153/0.1	Soil	No asbestos detected, however Synthetic Mineral Fibres detected

**Table 10 – TCLP Leachability Testing**

Sample	Depth (m)	Benzo(a)pyrene		Arsenic (As)		Cadmium (Cd)		Chromium (Cr) <sup>(2)</sup>		Nickel (Ni)		Lead (Pb)		Mercury (Hg)	
		Total (mg/kg)	TCLP (mg/L)	Total (mg/kg)	TCLP (mg/L)	Total (mg/kg)	TCLP (mg/L)	Total (mg/kg)	TCLP (mg/L)	Total (mg/kg)	TCLP (mg/L)	Total (mg/kg)	TCLP (mg/L)	Total (mg/kg)	TCLP (mg/L)
R5		NT	NT	10	<PQL	NT	NT	13	<PQL	15	<PQL	460	<PQL	NT	NT
R1		0.11	<PQL	20	<PQL	NT	NT	14	<PQL	22	<PQL	540	<PQL	NT	NT
Pit 9	0.1	0.22	<PQL	19	<PQL	2.4	<PQL	14	<PQL	24	0.01	510	<PQL	NT	NT
Pit 15	0.2	5.7	<PQL	NT	NT	NT	NT	NT	NT	7.6	<PQL	100	<PQL	NT	NT
Pit 19	0.3	NT	NT	NT	NT	NT	NT	10	<PQL	6.4	<PQL	470	0.04	NT	NT
Pit 23A	1.5	NT	NT	NT	NT	NT	NT	NT	NT	5.7	0.012	55	<PQL	NT	NT
Bore 23B	2.5	0.19	<PQL	NT	NT	NT	NT	NT	NT	NT	NT	120	<PQL	NT	NT
Pit 59	0-0.15	NT	NT	NT	NT	3.9	<PQL	NT	NT	9.4	<PQL	410	<PQL	NT	NT
D109		1.7	<PQL	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Pit 67	0.3-0.5	NT	NT	NT	NT	NT	NT	19	<PQL	9.8	<PQL	31	<PQL	NT	NT
Pit 75	1.1-1.3	NT	NT	130	<PQL	NT	NT	NT	NT	10	<PQL	21	<PQL	0.48	<PQL
Pit 77	0.3-0.5	NT	NT	120	<PQL	NT	NT	NT	NT	4.8	<PQL	38	<PQL	NT	NT
Pit 100	0.1	0.09	<PQL	NT	NT	NT	NT	NT	NT	NT	NT	520	<PQL	NT	NT
Pit 101	0.1	1.4	<PQL	NT	NT	NT	NT	NT	NT	NT	NT	91	0.02	NT	NT
R8		1.2	<PQL	16	<PQL	NT	NT	NT	NT	9.4	<PQL	160	<PQL	NT	NT
Pit 143	0.8	0.75	<PQL	150	0.31	NT	NT	NT	NT	13	<PQL	530	3.6	NT	NT
Laboratory PQL		0.05	0.0005	3	0.05	0.1	0.005	0.3	0.005	0.5	0.01	1	0.02	0.05	0.0005
General Solid Waste with TCLP (Ref 8)		10 <sup>1</sup>	0.04	500 <sup>1</sup>	5	100 <sup>1</sup>	1	1900 <sup>1</sup>	5	1050 <sup>1</sup>	2	1500 <sup>1</sup>	5	50 <sup>1</sup>	0.2

**Notes to Table 10:**

(1) – General Waste Classification guidelines for Total Concentrations when used with TCLP Results (Ref 8)

(2) – Chromium (VI) criteria used to assess Chromium concentrations

R1 – Duplicate of Pit 7/0.1 m

R5 – Duplicate of Pit 6/0.8 m

R8 – Duplicate of Pit 19/0.1 m

D109 – Duplicate of Pit 59/0-0.15 m

PQL – Practical Quantitation Limit

NT – Not Tested

TCLP – standard NSW EPA TCLP test

## 8.2 Acid Sulphate Soil

Laboratory testing comprised 50 acid sulphate screening tests. The results of the screening tests are presented in Table 11, below.

**Table 11 – Results of Acid Sulphate Soil Screening Tests**

Sample ID	Sample Depth <sup>a</sup> (m)	Sample Description	Screening Test Results			
			pH			Strength of Reaction <sup>b</sup>
			pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub> - pH <sub>FOX</sub>	
Pit 59	0.5-0.6	Clayey silt, some sand	6.14	4.1	2.0	1
	0.8-1.0	Sandy clay	5.7	4.6	1.1	1
	1.3-1.5	Sandy clay	5.1	4.7	0.4	1
	1.7-1.8	Conglomerate, sandy clay	5.8	5.0	0.8	1
Pit 63	0-0.15	Gravelly sandy clay, some coal	5.6	2.7	1.9	1
	0.3-0.5	Gravelly sandy clay, some coal	6.1	4.4	1.7	2
	0.8-1.0	Gravelly clayey sand	5.7	3.8	1.9	2
	1.3-1.5	Gravelly sandy silt, some clay	5.6	3.5	2.1	1
Pit 69	1.8-1.9	Clayey silt, some sand	6.1	4.3	1.8	2
	2.3-2.5	Clayey sand, some gravel	6.5	3.7	2.8	2
Pit 109	0.6	Clayey silt, some sand	6.8	5.6	1.2	2
	1.2	Silty clay, some sand	6.7	5.2	1.5	2
Pit 114	0.2	Clay, some silt	6.6	5.2	1.4	3
	0.4	Silty clay	6.9	5.0	1.9	3
	1.0	Silty clay, some gravel	5.4	3.4	2.0	2
Pit 117	0.4	Clayey silt, abundant organics	6.0	6.7	-0.7	4
	1.0	Clay, trace organics	6.3	6.5	-0.2	2
	1.5	Clay	6.3	6.8	-0.5	2
	2.5	Silty Clay	6.3	5.8	0.5	2
Pit 119	0.1	Silty clay/clayey silt, abundant organics	6.75	4.0	2.75	4
	0.6	Sandy clayey silt, some organics	6.45	3.9	2.55	1-2
	1.0	Sandy clayey silt, some organics	5.5	3.0	2.5	1-2
	1.5	Silty clay, some organics	6.0	3.1	2.9	2
	2.0	Clay, trace organics	5.4	3.6	1.8	2
	2.5	Clay, some silt, trace organics	6.6	3.9	2.7	4
Pit 123	0.2	Clay, some silt and organics	5.9	4.0	1.9	2
	0.4	Clayey silt	7.1	5.6	1.5	3
	0.9	Silty Clay	7.0	5.6	1.4	3
	1.5	Silty Clay	6.9	6.3	0.8	2
	2.0	Silty Clay	7.4	6.6	0.8	2

**Table 11 – Results of Acid Sulphate Soil Screening Tests (continued)**

Sample ID	Sample Depth <sup>a</sup> (m)	Sample Description	Screening Test Results			
			pH			Strength of Reaction <sup>b</sup>
			pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub> - pH <sub>FOX</sub>	
Pit 123	2.5	Silty Clay, trace gravel	7.5	5.0	2.5	2
Pit 124	1.7	Clay, some silt, trace organics	4.9	3.2	1.7	2
	2.3	Clay, trace silt, trace organics	6.5	5.95	0.55	2
Pit 126	0.5	Clay, trace silt, some organics	6.3	3.5	2.8	2
	1.2	Clay, trace silt, trace organics	5.9	3.4	2.5	2
	1.7	Clay	5.2	3.3	1.9	1
	2.4	Clay, trace shells	5.3	3.5	1.8	1
Pit 128	0.6	Clay, some silt and organics	7.05	6.8	0.25	1-2
	1.0	Clay, trace organics	7.2	7.3	-0.1	2
	2.1	Silty sand	7.3	7.3	0	4
Pit 129	0.1	Silty clay, some organics	5.7	3.4	2.3	3
	0.5	Silty clay, some organics	5.9	3.6	2.3	2
	1.0	Silty clay, trace organics	6.6	5.1	1.5	2
	1.5	Clay, some silt	7.0	6.4	0.6	2
	1.8	Clayey silt, some gravel	7.4	5.6	2.8	2
Pit 130	1.0	Sandy clay, trace organics	7.5	4.3	3.2	1
	2.0	Sandy clay, trace organics	6.5	3.9	2.6	1
Pit 138	1.5	Clay, trace organics	5.9	3.5	2.4	2
Pit 150	0.1	Sandy silt, some clay and organics	7.0	3.2	3.8	2
	0.4	Sandy silty clay, trace gravel	7.2	4.8	2.4	1
Guideline		Sands to loamy sands, sandy loams to light clays medium to heavy clays and silty clays	<4 <sup>d</sup>	<3.5 <sup>e</sup>	≥1e	

**Notes to Table 11:**

a Depth below ground surface

b Strength of Reaction

1 denotes no or slight reaction

2 denotes moderate reaction

3 denotes high reaction

4 denotes very vigorous reaction

F denotes bubbling/frothy reaction indicative of organics

H denotes heat generated

d For actual acid sulphate soils (ASS)

e Indicative value only for Potential Acid Sulphate Soils (PASS)

Shaded results indicate an exceedence of QASSMAC criteria (Ref 10)

The QASSIT guidelines suggest that a soil pH<4 in water is an indicator of actual acid sulphate soils. The results of screening tests therefore suggest the absence of actual acid sulphate soils at the locations and depths tested.

The QASSIT guidelines also suggest that indicators of potential acid sulphate soils (PASS) include the following:

- Soil pH <3.5 in H<sub>2</sub>O<sub>2</sub> (i.e. pH<sub>FOX</sub>);
- Drop of 1 pH unit or more between pH<sub>F</sub> and pH<sub>FOX</sub>.

Thirty seven samples exhibited a pH drop of greater than one unit, and four also indicated a soil pH of less than 3.5 in hydrogen peroxide, suggesting that potential acid sulphate soils may be present within sandy silt and clay soils at a range of depths across the site.

It is noted that the above test method is a qualitative method only and gives an indication of the intensity of total acidification (pH). The ASSMAC guidelines indicate that peroxide may also oxidise organic matter (in addition to pyrite) to produce acids which are unlikely to form under natural conditions, thus giving falsely high indication of acid sulphate potential.

Based on the results of the screening tests and the identified ASS areas on the risk maps, four soil samples were selected for detailed laboratory testing, comprising the Full Chromium Suite in accordance with QASSIT guidelines (Ref 9 and 10).

Detailed test results are contained in the attached laboratory report sheets, and are summarised in Table 12, below.

**Table 12 – Results of Detailed Acid Sulphate Soil Laboratory Testing**

Sample ID	Sample Depth <sup>a</sup> (m)	Sample Description	Laboratory Results			
			pH <sub>KCL</sub>	Scr %S	s-TAA %S	Net Acidity <sup>c</sup> %S
Pit 119	1.0	Sandy clayey silt, some organics	4.5	<0.02	0.06	0.06
Pit 119	1.5	Silty clay, some organics	4.7	<0.02	0.09	0.09
Pit 124	1.7	Clay, some silt, trace organics	4.2	<0.02	0.17	0.19
Pit 150	0.1	Sandy silt, some clay and organics	5.7	<0.02	<0.02	<0.02
Guideline	Sands to loamy sands		-	-	-	0.03
	Sandy loams to light clays					0.06 <sup>f</sup> /0.03 <sup>g</sup>
	Medium to heavy clays and silty clays					0.1 <sup>f</sup> /0.03 <sup>g</sup>

**Notes to Table 12:**

a Depth below ground surface

c Calculated from ABA equation in ASS Laboratory Methods Guidelines (Ref 9)

f QASSMAC Action Criteria for disturbance of 1-1000 tonnes of material

g QASSMAC Action Criteria for disturbance of more than 1000 tonnes of material

Shaded results indicate an exceedence of QASSMAC criteria (Ref 10)

Scr – Chromium reducible sulphur

TAA – Titratable actual acidity

### 8.3 Combustibility Testing

Combustibility testing was undertaken on 17 fill samples containing coal materials to determine the percentage of combustible material. The results of testing are shown in Table 13, below.

**Table 13 – Results of Combustibility Testing**

Test Location/Depth (m)	Total Combustibles (%)
Pit 9 / 0.8	16.0
Pit 17 / 0.5	11.3
Pit 32 / 0.1	8.5
Pit 39 / 1.3	10.2
Pit 48 / 2.0	27.3
Pit 58 / 2.5-2.7	7.9
Pit 60 / 1.3-1.5	48.3
Pit 65 / 0.3-0.5	58.8
Pit 72 / 0.5-0.6	14.0
Pit 73 / 0.8-1.0	23.9
Pit 71 / 0.3-0.5	59.9
Pit 87 / 1.3-1.5	16.6
Pit 104 / 0.1	23.1
Pit 108 / 0.2	51.8
Pit 113 / 0.4	22.0
Pit 142 / 0.3	22.6
Pit 143 / 0.4	24.0

**Notes to Table 13:**

Combustibility estimated from % ash created on a dry weight basis

Reference should be made to the attached laboratory report sheets for details.

#### 8.4 Aggressivity Testing

Aggressivity testing was undertaken on 21 selected soil samples across the site, and comprised pH, Chloride and Sulphate testing, summarised in Table 14, below.

**Table 14 – Results of Aggressivity Testing**

Test Location/Depth (m)	pH (pH Units)	Chloride*, Cl (mg/kg)	Sulphate*, SO <sub>4</sub> (mg/kg)
Pit 2/1.6	5.3	150	190
Pit 4A/1.1	5.4	62	35
Pit 11/0.7	5.1	11	50
Pit 28/1.6	5	140	81
Pit 29/0.1	5.8	1.5	4
Pit 32/0.6	4.5	89	150
Pit 35/0.7	5.3	9.4	63
Pit 38/1.9	6.1	32	140
Pit 41/2.0	5.1	180	420
Pit 47/2.3	6	86	66
Pit 61A/1.9-2.1	6.1	75	84
Pit 64/1.3-1.5	5.3	220	190
Pit 67/0.3-0.5	5.7	7.9	10
Pit 72/1.3-1.5	5.9	<PQL	44
Pit 74/0.8-1.0	5.9	4.3	9
Pit 87/0.8-1.0	5.9	94	55
Pit 93/1.3-1.5	4.9	480	630
Pit 93/1.3-1.5	5	470	630
Pit 97/2.0	5.4	150	360
Pit 133/0.2-0.3	5.7	5.1	<PQL
Pit 137/0.2-0.3	5.5	12	56
PQL	NA	0.5	2

**Notes to Table 14:**

\* 1:5 soil:water

NA Not Applicable

Reference should be made to the attached laboratory report sheets for details.

## 9. ASSESSMENT OF CONTAMINATION

### 9.1 Assessment Criteria

Results of the chemical analyses were compared to the following NSW EPA recommended guidelines:

- NSW EPA (1998). Contaminated Sites – Guidelines for the Site Auditor Scheme 2<sup>nd</sup> Edition, April 2006 (Ref 6);
- NSW EPA (1994). Contaminated Sites – Guidelines for Assessing Service Station Sites, December 1994, (Ref 7);
- NSW DECCW (2008), “Waste Classification Guidelines: Part 1 – Classifying Waste”, April 2008 (Ref 8).

The NSW EPA Guidelines for the NSW Site Auditor Scheme (Ref 6) contain National Environmental Health Forum (NEHF) levels for various beneficial use scenarios including: low density residential (A), high density residential (D), recreational (E) and commercial/industrial (F). These criteria are applicable where aesthetic and ecological concerns are not an issue. Health based criteria for standard residential uses with access to soil (NEHF A), are considered to be appropriate for the proposed residential development.

The NSW EPA Guidelines for Assessing Service Station Sites (Ref 7) were used to assess total TRH and BTEX contamination across the site. The criteria used are threshold concentrations for sensitive land use.

The NSW DECCW Waste Classification Guidelines (Ref 8) was used to assess soil conditions for possible off-site disposal to a licenced landfill.

### 9.2 Assessment of Contamination

Soil chemical analysis results were generally within the health based criteria for low density residential land use (i.e. NEHF A), and NSW EPA sensitive land use criteria for TRH and BTEX, with the following exceptions:

- Metals: R5 at Pit 6/0.25m (Pb), Pit 7/0.1m and R1 (Pb, Cu), Pit 9/0.1m (Pb), Pit 19/0.3m (Pb), Pit 59/0-0.15m (Pb), Pit 75/1.1-1.3m (As), Pit 77/0.3-0.5m (As), Pit 100/0.1m (Pb), Pit 143/0.8m (As, Pb);
- TRH: Pit 75/1.1-1.3m; and
- Benzo(a)pyrene and Total PAH: Pit 15/0.2m; Benzo(a)pyrene only: Pit 19/0.1m, R8 D109 at Pit 59/0-0.15m and Pit 101/0.1m.

The results of laboratory analysis indicated the presence of bonded asbestos in fibro sheet fragments found at or near the surface of Pit 77, Pit 80, Pit 144, and Pit 149. Bonded asbestos was present in fragments and in soil filling at Pit 67 / 0.3-0.5m, Pit 149 / 0-0.05m, and Pit 152 / 0-0.1m.

Test locations exceeding the acceptance criteria are marked in red on Drawings 1 to 4.

Laboratory results for total concentrations indicated the waste classifications ranged between 'General Solid Waste' to 'Hazardous Waste'. Additional TCLP testing indicates the samples can be reclassified as 'General Solid Waste'. This classification is relevant for off-site disposal if proposed.

### 9.3 Conclusions

#### ***Minmi North***

The results of the assessment in the Minmi North area indicate the land is primarily used for grazing. A former rail alignment was located along the western boundary with a triangular area at the north west boundary bounded by the former rail lines to Back Creek and Pit C.

The results of preliminary sampling and analyses indicates the presence of the following contaminants which exceed residential land use criteria:

- Lead was detected at Pit 100 / 0.1m at the southern extent of Minmi North;
- Benzo(a)pyrene was identified at Pit 101/0.1m, also at the southern extent of Minmi North.

Material identified as exceeding the land use criteria will require remediation, which may include immobilisation prior to off site disposal at a licenced landfill. Preliminary leachability testing on samples indicate the material could be disposed of at a licenced landfill as 'General Solid Waste'. It is recommended that additional investigation is undertaken to delineate the extent of the contamination.

### ***Minmi East***

Minmi East contains two former open cut mines, Browns Minmi Open Cut on the western part, and Wallsend Borehole Colliery Open Cut on the eastern part. The final backfilled landforms from both mines contain significant depths of filling. A water body is located within the backfill of the former Browns Colliery Open Cut.

Significant opportunistic tipping including car wrecks, batteries, fibro sheeting was observed along the central track orientated north-south and bisecting Minmi East. A mound of overburden with some smaller mounds of building rubble, including fibro sheeting was noted north of the former Browns Minmi Open Cut. Deleterious surface materials and possible associated surface impacts will require removal/remediation.

The results of preliminary sampling and analysis of the filling on the western portion of Minmi East indicates the absence of gross contamination. No subsurface investigation or laboratory testing was undertaken on the eastern portion of Minmi East, as no development was proposed for this area at the time of fieldwork. Detailed assessment of Minmi East is recommended if development is considered on this part of the site.

### ***Minmi West***

The assessment of Minmi West identified the following features:

- Former Purple Hill Open Cut, partially filled;

- The former B and C pits and associated infrastructure including rail siding, boilers, workshops, coke ovens and locomotive sheds. Little direct evidence of the former structures was observed;
- Mounded filling and fill embankments across the Minmi West site, associated with the former rail lines, access tracks, and former mine development. Filling included building rubble and fibro sheeting.

The results of preliminary sampling and analyses indicates the presence of the following contaminants which exceed residential land use criteria:

- Metals: R5 at Pit 6/0.25m (Pb), Pit 7/0.1m and R1 (Pb, Cu), Pit 9/0.1m (Pb), Pit 19/0.3m (Pb), Pit 59/0-0.15m (Pb), Pit 75/1.1-1.3m (As), Pit 77/0.3-0.5m (As);
- TRH: Pit 75/1.1-1.3m; and
- Benzo(a)pyrene and Total PAH: Pit 15/0.2m; Benzo(a)pyrene only: Pit 19/0.1m and R8 D109 at Pit 59/0-0.15m, Pit 101/0.1m.

These exceedances were mostly in the areas of the former Pit C workshops (Pits 9, 11 and 15, Photo 1) the former rail line and rail sidings and screens (Pits 19 and 75 and 77, Photo 5). An exceedance also occurred at Pit 6, which appears to have been an area of former residential development.

The results of laboratory analysis indicated the presence of bonded asbestos in fibro sheet fragments found at or near the surface of Pit 77 near the former screening building and Pit 80 near in an area of mounded filling. Bonded asbestos was present in fragments and in soil filling at Pit 67 / 0.3-0.5m on the former rail line to Duckenfield Colliery. It should be noted that the composition of filling across the site may be variable. The possible presence of further fibro fragments (possibly asbestos based) within fill across the site cannot therefore be discounted.

Limited investigation was undertaken on parts of the site between Railway Street and the former Purple Hill open cut pit, with the exception of Pits 50 to 53 near the former coke ovens, as this site was identified as having a high risk of pothole subsidence and was less likely to be subject to development. This area is expected to be heavily disturbed by former mining activities and similar conditions to those encountered near the workshops can be expected. Additional investigation in this area would be required to confirm conditions.

Material identified as exceeding the land use criteria will require remediation, which may include immobilisation prior to off site disposal at a licenced landfill. Preliminary leachability testing on samples indicate the material could be disposed of at a licenced landfill as 'General Solid Waste'. Detailed assessment of this part of the site is recommended prior to construction.

### **Minmi South**

Specific site features for Minmi South include:

- Former Browns Underground Colliery and Back Creek Open Cut as well as two smaller open cuts into the Young Wallsend Seam, one which contained an entry to the Wallsend Borehole Colliery, containing extensive areas of filling;
- The northern portion of the site has been heavily disturbed, containing filling probably associated with the former Browns Colliery and Back Creek Open Cut;
- Filled ground to south of Reservoir Road;
- Several concrete capped shafts, one at the northern end of the bushland and one at the southern end, near the Link Road;
- Masonry walled dam, concrete footings and shallow rock with scattered surface chitter and fibro near the southern capped shaft;
- An asphalt / coal tar coated timber pile was observed at Pit 42 / 0.9-1.5m . Hydrocarbon odour / staining was also observed at Pit 23A / 1 to >2m, and Pit 47 / 0.35-0.65m. Laboratory testing of samples from the above locations did not indicate any elevated TRH or PAH contamination (all results were below practical quantification limits).

The results of preliminary sampling and analyses indicates the presence of the following contaminants which exceed residential land use criteria:

- Arsenic and lead exceedances were noted at Pit 143 / 0.8m, the site of the capped former shaft;
- Asbestos fragments were identified on the surface at Pit 144.

It should be noted that the composition of filling across the site may be variable. The possible presence of further fibro fragments (possibly asbestos based) within fill across the site cannot therefore be discounted.

Material identified as exceeding the land use criteria will require remediation, which may include immobilisation prior to off site disposal at a licenced landfill. Preliminary leachability testing on samples indicate the material could be disposed of at a licenced landfill as "General Solid Waste".

### ***Link Road North and South***

The Link Road sites are primarily bushland with scattered access tracks and transmission line easements running diagonally through each allotment. The Browns Colliery Record Trace indicated two shafts on the Link Road North site. Sampling and testing was not undertaken at the shaft locations due to their inaccessible nature.

The results of preliminary sampling and analyses indicates the presence of asbestos fragments and fibres in the soil at Pit 149 and Pit 152, probably from opportunistic dumping of filling on the site.

It should be noted that the composition of filling across the site may be variable. The possible presence of further fibro fragments (possibly asbestos based) within fill across the site cannot therefore be discounted.

The results of preliminary sampling and analysis of the filling in the Link Road North and South areas indicates the absence of gross contamination. Detailed assessment of this part of the site is recommended prior to construction. This should include the two shaft locations and the overgrown access track leading to Shaft No 14.

### **Summary of Contamination Constraints**

The results of the preliminary assessment indicated that site remediation will be required in Minmi West, concentrated on the workshops, rail lines and sidings/screens, with more localised remedial works expected in Minmi North, East and South, including in localised cisterns or cesspits which can be expected in areas previously containing miners cottages. Additional investigation is recommended across the site prior to development to provide additional delineation of affected areas.

Remediation, where required, would include the preparation of a remediation action plan (RAP), appropriate excavation and removal/disposal/capping of contaminated soil, followed by validation sampling and analysis in accordance with SEPP 55 and NSW DECCW guidelines (Ref 2).

The site is considered to be suitable for the proposed residential development in accordance with SEPP 55 and NSW DECCW guidelines, providing the following conditions are met as part of the development:

- Detailed contamination assessment is undertaken across the site to better identify the presence of localised contamination 'hot spots', including assessment of groundwater quality in areas of identified soil contamination;
- appropriate remediation is conducted to remove identified contaminants, including bonded asbestos fragments and asbestos impacted fill materials, and areas of soil contamination by TRH, Benzo(a)pyrene and heavy metals;
- deleterious materials and possible associated surface impact are removed;
- validation testing and verification is undertaken, where required.

Additional waste classification testing should be undertaken to classify materials prior to disposal to a licenced facility.

It is noted that validation of asbestos contamination should be conducted by a qualified asbestos consultant.

## 10. GEOTECHNICAL CONSTRAINTS

### 10.1 Disturbed Ground and Mounded Filling

Potential constraints associated with disturbed ground and mounded filling include the following:

- Presence of contamination, as described in Section 9 above, in particular possible buried asbestos;
- Uncontrolled filling, which has implications for building footings, requiring that the filling either be reworked or footings be founded in suitable bearing strata below the filling using piles; Due to the relatively large volumes of mine spoil expected in many places, significant earthworks (including segregation of unsuitable materials) would be required to rework the existing filling as controlled filling;
- Uncontrolled filling also has implications for services such as roads, pavements, water and sewer;
- Potential for combustion of the coal, possibly requiring removal or capping of the coal.

### 10.2 Founding Conditions

#### ***Uncontrolled Filling***

As discussed above, uncontrolled filling is unsuitable for founding of footings. Uncontrolled filling can be expected across areas of disturbed ground, where it will probably be intermittent and of limited thickness. This includes much of Minmi West, the northern parts of Minmi South as well as parts of Minmi East. Limited filling is expected on the Link Road Sites.

Many of these appear to contain old cisterns or cesspits which have been backfilled with uncontrolled filling. Some of these pits have been located, however it is likely that there are additional backfilled pits which have not been identified and additional more detailed investigation would be required to locate all of these. Notwithstanding any heritage requirements, if construction is proposed over these cisterns/pits, the uncontrolled filling would require removal and replacement with controlled filling. This may require over-excavation of the pits to allow access for compaction equipment.

The greatest depths of filling are expected at and surrounding the former open cut pits. Expected depths of filling at the various former pits are as follows:

- Purple Hill (Minmi West, Pits 54, 58, 61, 63 and Bores 57 and 97): The depth of filling encountered in this area ranged from about 2 m to 8 m. The base level of this former pit is estimated to be in the order of 10 m to 15 m AHD;
- Browns Colliery (Minmi East, Pits/Bores 87 to 96): The depth of filling encountered at test locations in this area ranged from about 2 m to 8 m. The base level of this former pit is estimated to be in the range 24 m to 30 m AHD;
- Open Cuts to former Young Wallsend Seam in Minmi South (Pits 38 to 47 and Bore 98). Fill was encountered in the test locations from 1.0 m to greater than 3.0m. The floor level of the coal seam in this area is expected to be in the order of 13 m AHD to 16 m AHD, suggesting fill depths in the order of 8 m to 12 m. Overburden filling underlain by soft soil was encountered to depths of up to 5.2 m depth in the area to the north of the former pit (Bore 98);
- Wallsend Borehole Colliery Open Cut: No investigation was undertaken in this area, however mine plans indicate the base of the pit was at a level of between 58 m AHD and 64 m AHD, suggesting between 4 m and 12 m depth of filling.

As indicated above, the mine spoil is likely to have been placed without compaction and therefore there is potential for large settlements. This could be managed by removal of the filling, re-compaction of the filling, piling of building footings to below the base of the filling, or a combination of the above.

Piling is not recommended for former open cut pits in the Young Wallsend Seam as there is 20 m cover to the Borehole Seam from the base of the open cut workings, and although the risk of pothole subsidence is low for such a cover depth, repair of piled footings affected by pothole subsidence would be very difficult. These pits include two pits in Minmi South as well as the Pit at the eastern end of Minmi East.

The filling in the base of the open cuts is likely to be saturated, probably requiring dewatering of the excavations for any reworking to be undertaken. Differential settlements occur in the backfill close to the alignment of the mine high wall; significant structures should not be located over such areas. It is known that the open cut pits broke into the underground workings in places, in particular the former Wallsend Borehole Colliery No 2 Entry and the former Purple Hill Open Cut, and therefore there will also be a need to plug any such workings to prevent the filling washing / flowing into the workings leading to surface subsidence / potholing. If the filling is fully reworked then plugging can be undertaken directly, possibly using reinforced concrete, however, if the filling is left in place and a piled option adopted, it would be necessary to plug by drilling and grouting the entries.

### ***Bushland Areas***

Bushland areas which are typically relatively undisturbed and generally are underlain by Tomago and Newcastle Coal Measures where conglomerate, sandstone and siltstone are expected at shallow depth. These formations in general are expected to provide good founding conditions, probably allowing conventional shallow footings. Reactive soils may be present in these areas, which means that they shrink and swell with changing moisture conditions, leading to ground surface movements. Soil reactivity can be readily accommodated in design, and should be confirmed during future detailed investigations prior to development by classifying building sites in accordance with AS 2870-1996 (Ref 11).

### ***Lower Lying Alluvial Soils***

Alluvial soils are expected on the northern parts of Minmi North and the central parts of Minmi West marked yellow on Drawings 1 to 4. There is potential for soft and compressive soil conditions in these areas, although no significant soft soils were encountered. This should be confirmed by detailed investigation if development is proposed on these low lying areas. Such soils can be managed by using of piled footings or ground improvement.

Reactive soils may also be present in these areas. Reactive soils shrink and swell with changing moisture conditions, leading to ground surface movements. Soil reactivity can be readily accommodated in design, and should be confirmed during future detailed investigations prior to development by classifying building sites in accordance with AS 2870-1996 (Ref 11).

### 10.3 Acid Sulphate Soils

A preliminary acid sulphate soil assessment was undertaken with reference to the ASSMAC “Acid Sulphate Soils Manual” (Ref 9) and QASSIT “Soil Management Guidelines” (Ref 10), and comprised the following:

- Review of available acid sulphate risk maps (Refer section 4.1);
- 50 screening tests on selected soil samples for pH in water ( $\text{pH}_F$ ) and pH in hydrogen peroxide ( $\text{pH}_{\text{FOX}}$ );
- Four samples tested for the full chromium suite to assess acid sulphate potential.

The results of detailed laboratory testing indicate the presence of potential acid sulphate soils in the low lying areas across the northern portion of Minmi North, within sandy clayey silt and clay alluvial soils (shown as yellow on Drawings 1 and 2).

A general acid sulphate soil management procedure is presented below, however preparation of a detailed Acid Sulphate Soil Management Plan (ASSMP) should be prepared prior to construction, if disturbance of the alluvial areas is proposed.

#### **Soil**

- Any natural alluvial soils excavated should be stockpiled separately prior to lime treatment in a bunded area to collect any leachate that may form;
- Lime treatment would involve mixing Agricultural Grade Lime into the stockpiled soil to neutralise any acid generated by the acid sulphate soils. Based on the laboratory test results the rate of lime application is estimated to be approximately 10 kg/m<sup>3</sup> soil;

- Further on-site screening tests by DP would then be required to verify that adequate neutralisation has occurred, and if necessary adjust the liming rate;
- The base of any excavation in the affected soils should be limed at a rate of approximately 1 kg/m<sup>2</sup>.

### **Groundwater**

- Groundwater extracted during dewatering (if required during construction) should be tested for pH prior to discharge;
- Dewatering monitoring would involve regular visits by DP personnel to measure dewatering pH. The frequency would depend on the construction programme and monitoring results, however is likely to initially be daily, possibly reducing to weekly once excavations are complete and consistent results are being achieved;
- If the pH of discharge water is below natural levels, a lime slurry should be added to raise the pH to within natural groundwater levels.

In summary, the treatment of acid sulphate soils and groundwater should be undertaken in a controlled manner to minimise the potential for generation and migration of acidic leachate. Monitoring of soil neutralisation and discharge water, should be undertaken during any disturbance of acid sulphate soils.

### **10.4 Combustion**

Coal and chitter (low quality coal) was encountered within the filling, primarily in the following locations:

- Former rail lines in Minmi West and Minmi North;
- Purple Cut Open Cut Pit and surrounding filling (Minmi West);
- Browns Minmi Open Cut (Minmi East);
- Open cut near entry to Wallsend Borehole Colliery (Minmi South);
- Other localised mounds of filling.

Locations where combustible material was encountered are shown on Drawings 1 to 4 in Appendix D.

The results of laboratory testing on selected samples indicated percentages of combustible materials within the range 8.5% to 60% with six of the twenty samples having a percentage greater than 30%. The thickness of layers including combustible material ranged from 0.05 m to 7.6 m, but generally less than 1 m, with an average of 1 m and a median of 0.5 m. When the laboratory results were correlated with the visual estimates of percentage combustibles in Table 3, the laboratory results generally indicated slightly lower results.

In situ combustion of such material can occur if the material is ignited by an external source such as a surface fire, or lightening. Combustion is encouraged if there is a ready supply of oxygen as typically occurs in loose filling, especially on steep slopes.

DP is unaware of any local or state or national guidelines with respect to combustible material, however Wollongong Council has developed guidelines. According to Wollongong Council Guidelines for the use of chitter material in residential development (copy attached), chitter material must have an average combustibility not exceeding 30%, and a maximum combustibility (of an individual sample) not exceeding 40%.

It is considered that there would be some risk of combustion of coal and chitter filling occurring, however the risk of this can be reduced by applying appropriate engineering solutions. Various engineering solutions to manage the potential for combustion may include one or more of the following:

- Removal of combustible material;
- Blending of inert material with combustible material;
- Compaction of the material;
- Limiting batter slopes, generally to less than about 4H:1V;
- Capping with a layer of compacted inert material.

Removal of all combustible material would be difficult to achieve in practice, as the majority of the filling contains some intermixed combustible material and full segregation would be impractical. Identification of 'hot-spots' and removal or blending with less combustible material would be more achievable and could be undertaken as part of site regrading activities, and together with either partial or full depth compaction of the filling and limiting batter slopes, would be expected to reduce the risk of combustion significantly. It may be possible to reduce the requirements for removal/blending of combustible material if the site is capped with a compacted inert material.

It is recommended that additional investigation be undertaken in the areas identified above, prior to development to further characterise the distribution of combustible material to allow refinement of suitable options for management of the combustible material.

## **10.5 Slope Stability**

No signs of gross deep seated slope instability were observed on the site, however a number of localised slumping slopes were observed, often associated with erosion from concentrated surface water flows. These areas are shown in red on Drawings 1 to 4, and included the following:

- Steep gully sides and slopes, especially southerly trending slopes;
- Mine fill batters;
- Deforested slopes.

It is expected that such localised instabilities can be managed by appropriate hillside development and management of surface water. Additional investigation is recommended in these areas to confirm requirements. A number of steep slopes in the southern parts of the site were difficult to assess in detail due to the presence of very dense vegetation, however similar management strategies would be expected to be suitable.

Deep seated instability can often occur near the outcrop of coal seams, especially where the seam is subject to groundwater flows and pressures. Accurate delineation of the outcrops will be important in this regard and will require subsurface investigation. Subsurface investigation will need to identify the outcrop of the other coal seams that have not been mined because inappropriate development (especially deep cuts and fills) could cause slope instability on the coal and tuff layers. The highest risk of unfavourable dipping seams is on the northern parts of Link Road South, which slope to the south and where a localised groundwater seep was observed.

A number of steep cuts were observed, associated with former railway lines. These cuts generally revealed a weathered soil zone up to about 2 m deep overlying sandstone and siltstone bedrock. Some fretting of the face and parting of blocks was observed. It is expected that this can be managed by trimming of the batters and localised rock bolting and / or shot-creting. Detailed assessment of the cuts should be undertaken as part of further investigations.

The following general guidelines for construction on slopes are provided to assist with urban planning.

It is expected that individual cuts or fills of up to 2 m vertical height would generally be appropriate, however specific assessment is recommended in areas shown red on Drawing 1 to 4. Such cuts or fills should be either supported by a conventional engineered retaining wall or battered. Preliminary design or assessments should be based on stage long term batter slopes being limited to 2H:1V, however steeper batters may be possible in rock, subject to geotechnical assessment.

Deeper and/or steeper cuts and fills are likely to be possible subject to appropriate investigation and engineering design; however specialised support systems may be required. Such support systems could include the following:

- Rock cuts - rock bolting with shotcrete;
- Soil cuts – soil nailing (similar to above);
- Potentially unstable seams of coal/clay may require installation of drainage;
- Deep filling – reinforced earth walls with concrete block or gabion fascia.

Areas of deep seated instability, if identified, will require remedial engineering works. This may include one or a combination of installation of surface and subsurface drainage, remedial earthworks, and/or anchoring.

## **10.6 Erosion / Dispersion**

Areas of erosion were noted on site and based on the Soil Landscape Sheet for Newcastle the soils on the slopes typically have high erosion potential.

Water quality may be impacted due to sediment laden run-off from the topsoil material occurring during construction. Such potential erosion and sedimentation are readily amenable to mitigation measures such as silt fences, revegetation/reshaping batters, drainage structures (catch drains), sediment traps and sedimentation basins.

## **10.7 Excavatability**

Shallow rock is expected over much of the site, especially the southern elevated parts of the site. Such shallow rock may require large earthmoving equipment for excavation, such as excavators with rock teeth or bulldozers with rippers. There is some risk that heavy ripping or pneumatic/hydraulic hammering may be required if medium or high strength rock occurs within the depth of excavation, however subsurface investigation would be required to assess the presence of such material.

## **10.8 Soil Salinity / Aggressivity**

The generic soil landscapes encountered on site can include the presence of naturally acidic or saline soils, however reference to the NSW Government Natural Resources Atlas indicates no known occurrences or indicators of salinity on the site. No notable signs of salinity were identified during the site walk over assessment.

Saline or acidic soils may be aggressive to buried structures or services. The results of testing listed in Table 14 above indicated generally non-aggressive and mild exposure classifications when compared to the requirements for steel/concrete piles presented in AS 2159-1995 (Ref 12).

It is recommended, however, to provide sufficient concrete cover and appropriate strength to accommodate for the environment and any changes in conditions. Specific detailed assessment should be undertaken for construction in areas of potential acid sulphate soils.

### **10.9 Hazardous Coal Seam Gas**

Monitoring of borehole gas concentrations was undertaken to assess the potential for future extraction of coal seam methane as well as the presence of hazardous gases carbon monoxide (CO), hydrogen sulphide (H<sub>2</sub>S) and methane (CH<sub>4</sub>).

The results are presented in the Mine Subsidence Risk Assessment (Ref 3) and indicated low concentrations of methane in some of the bores immediately following drilling, however subsequent monitoring indicated no measurable concentrations suggesting any methane which was present was limited and quickly dissipated. Trace concentrations of H<sub>2</sub>S were measured at one location near the former entry to the Wallsend Borehole Colliery and no concentrations of CO were measured.

Therefore based on the information to date it is considered that there is a low risk of hazardous gases being present at the site. It is possible that trace concentrations of such gas may escape to the surface immediately following formation of mine subsidence potholes, if they occur, however such gas would be expected to quickly dissipate and as discussed in the Mine Subsidence Risk Assessment (Ref 3) development on parts of the site with a high risk of pothole subsidence will be restricted. If development in areas near shallow workings is proposed then consideration may need to be given to more detailed gas monitoring. Gas, if present can, generally be managed by installation of gas venting systems in proposed structures.

## 10.10 Summary of Geotechnical Constraints

A number of potential geotechnical constraints have been identified as outlined in the sections above, however the site is considered to be suitable for the proposed residential development, subject to application of appropriate engineering solutions including the following:

- Where filling is encountered below proposed development, the filling should be removed and recompacted. Alternatively, footings could be founded below the filling using piles although piles are not recommended in former open cut pits in the Young Wallsend Seam;
- Assessment of the presence of soft soils on the northern part of the site and the use of piled footings or ground improvement, if necessary;
- Assessment of site classifications with respect to reactive soils and design of footings in accordance with AS 2870-1996;
- Develop and work in accordance with acid sulphate soil management plans for any potential disturbance of acid sulphate soils which have been identified on the northern parts of the site;
- Additional assessment of potentially combustible material and development of a management plan which may include the following options:
  - Removal of combustible material;
  - Blending of inert material with combustible material;
  - Compaction of the material;
  - Limiting batter slopes, generally to less than about 4H:1V;
  - Capping with a layer of compacted inert material.
- Detailed investigation of slope stability in particular in identified higher risk areas, to allow confirmation of limits of cuts, fills and batter slopes as well as any specialised excavation support or slope stabilisation works. Such potentially unstable slopes, if present, can typically be managed by one or a combination of the installation of surface and subsurface drainage, remedial earthworks, retaining walls and/or anchoring;
- Provision of appropriate sedimentation and erosion controls during construction;
- Possible use of heavy ripping for excavations;
- Design of footings and buried services for appropriate exposure classifications with respect to aggressive soils. Specific additional investigation should be undertaken for in areas of potential acid sulphate soils.

## 11. GROUNDWATER FLOW

### 11.1 Concept Model

Based on the results of the desktop assessment, the subsurface investigation and the site topography a conceptual groundwater model has been developed for the site as follows:

- Groundwater recharge on the majority of the site is very limited due to the low permeability clay soil and weathered rock and the well drained slopes. The vast majority of rainfall is expected either run off or be lost by evapo-transpiration;
- Some recharge may occur in these areas due to infiltration through mine subsidence induced cracks in the rock. This would be expected to infiltrate near vertically to the mine workings;
- The mine workings fall to the south and any infiltration to the mine workings would be expected to drain to the workings to the south of the site; Subsurface investigation of the mine workings (Ref 3) indicated that the mine workings on the northern parts of the site were dry, and on the central and southern parts of the site the piezometric head was at significant depth;
- A groundwater spring / seep was noted in a southerly trending gully in the northern part of Link Road South following a period of sustained rainfall in October 2008. It is likely that this is due to infiltration of groundwater through mining induced cracks and lateral flow through an unworked coal seam. The seep was in a gully about 150 m downslope of a ridge line and therefore the catchment for infiltration of such groundwater would be limited;
- The alluvial soils on the northern parts of the site (shown in Yellow on Drawing 1) are expected to comprise unconfined aquifers perched above the less permeable underling residual soils and rock;
- These alluvial soils are in creek lines and low lying areas on the southern fringe of extensive areas of swamp to the north. The source of the recharge water is primarily from surface runoff from the upstream catchments, most of which are within the proposed development area. Some direct recharge will occur in these area and some recharge may be due to rising water levels in the swamp to the north. Groundwater recharge from the adjacent areas of residual soils will be very minor;

- Groundwater will flow within the alluvial areas, generally following the fall of the creek/gully as well as interact with the surface water flows in the creek. In times high rainfall and high creek levels the aquifer will be recharged and in times of low rainfall and low creek levels the groundwater may provide base-flow back to the creek and help maintain the water levels in lower lying ponded areas;
- The backfilled open cut pits are also expected to represent localised perched aquifers, comprising permeable backfill underlain by less permeable rock. Recharge would generally occur from direct infiltration as well as run-off from surrounding areas. These areas are generally heavily disturbed.

## 11.2 Effect Of Development On Groundwater Levels

It is understood that vegetation communities which can be dependant of groundwater have been identified within gully lines on the southern parts of the site as well as within the areas of alluvial soils identified on the northern parts of the site. Changes to groundwater levels in these areas may have an adverse effect on such vegetation communities.

It is considered that the alluvial soils on the northern part of the site are the only location where permanent shallow groundwater aquifers are expected (with the exception of former open cut pits) and the water table levels in these areas may be sensitive to the development.

Groundwater recharge to these aquifers is considered to be due to direct rainfall in the alluvial areas as well as runoff from the surrounding residual areas, however not due to groundwater recharge from the residual areas.

Provided that the existing surface water flow rates / levels and fluctuations thereof within the creek are maintained there will be minimal impact on the groundwater levels and therefore groundwater dependent vegetation communities. This can be achieved by appropriate water-sensitive urban design, which would include the provision of surface water storage devices such as ponds or swales to limit peak flows.

The soil in the base of gullies / intermittent creeks on the central and southern parts of the site, underlain by residual soils, can be expected to become saturated in times of rainfall, however these are unlikely to represent groundwater aquifers. The seep that was observed on the northern slopes of Link Road South, is likely to be from infiltration in a localised upslope area. The seep is likely to extend the period for which the downslope creek would otherwise flow, rather than provide a permanent source of flow. Development may reduce the amount of infiltration to the catchment area, reducing the flow from the seep and possibly reducing the amount of time that the seep is active.

Similarly to the alluvial areas, the intermittent saturation of these soils can be maintained using appropriate water sensitive urban design.

### **11.3 Effect Of Development On Groundwater Quality**

The potential for adverse impacts on groundwater quality from the proposed development would most likely come from surface runoff. As with groundwater/surface water levels, the surface water quality and therefore groundwater quality can be managed by appropriate water sensitive urban design. It is proposed that the development of the site will incorporate water sensitive urban design measures including a detailed surface water management plan which will be prepared prior to any construction on site.

## **12. MINE SUBSIDENCE CONSTRAINTS**

Potential constraints due to mine subsidence is the subject of a detailed mine subsidence risk assessment (Ref 3) which should be read in conjunction with this report.

### 13. ADDITIONAL INVESTIGATIONS

#### ***Contamination***

Based on the results of assessment to date it is considered that detailed contamination assessment is required.

Areas of additional investigation should include, but not necessarily limited to, the following:

- Further assessment of the presence of, and delineation of contaminated filling, and/or contamination from mining operations. A range of potential contaminants should be assessed, including heavy metals, PAH, TRH, BTEX, OCP/PPP pesticides, PCBs and asbestos;
- Assessment of groundwater quality in areas of identified contamination to assess the potential for groundwater contamination;
- Assessment of surface fibro to confirm the presence of asbestos in fibro fragments and possibly in near surface soils. Assessment of asbestos materials should be undertaken by a qualified asbestos consultant.

Remediation, if required, would include the preparation of a remediation action plan (RAP), appropriate excavation and removal/disposal/capping of contaminated soil, followed by validation sampling and analysis in accordance with NSW EPA (Ref 1) and SEPP 55 (Ref 2) guidelines.

#### ***Geotechnical***

Additional geotechnical investigation is expected to be required prior to development which may include the following:

- Additional assessment of combustible material and improvement measures;
- Specific slope stability investigation of steep slopes and proposed areas of cut or filling exceeding the guidelines presented in Section 11;
- Specific foundation investigation for proposed buildings, in particular areas containing filling such as former open cut mines;

- Site classifications to AS 2870;
- Earthworks procedures and specifications;
- Pavement thickness design for roads;
- Acid sulphate soil management plan (ASSMP).

#### **14. LIMITATIONS OF THIS REPORT**

Douglas Partners (DP) has prepared this report for this project at Minmi and Link Road in accordance with DP's proposal dated 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.

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

**Stephen Jones**

Principal

**REFERENCES**

1. NSW EPA Contaminated Sites “Guidelines for Consultants Reporting on Contaminated Sites”, November 1997.
2. NSW DUAP and EPA, “Managing Land Contamination, Planning Guidelines. SEPP55 – Remediation of Land” August 1998.
3. Douglas Partners Pty Ltd, Phase 2 – Mine Subsidence Risk Assessment, Proposed Residential Subdivision, Minmi”, Prepared for Coal and Allied Operations Pty Limited, Project 39663.07, March 2010.
4. Brian Robert Andrews, “Coal, Railways and Mines, The Story of the Railways and Collieries of J & A Brown”, Iron Horse Press, 2004.
5. Giffard H Eardley, “The Railways of J & A Brown by Giffard H Eardley”, Australian Railway Historical Society, 1972.
6. NSW EPA Contaminated Sites “Guidelines for Assessing Service Station Sites”, December 1994.
7. NSW EPA Contaminated Sites “Guidelines for NSW Site Auditor Scheme, 2<sup>nd</sup> Edition”, April 2006.
8. NSW DECCW, Waste Classification Guidelines – Part 1: Classifying Waste, April 2008.

9. ASSMAC (1998) "Acid Sulphate Soil Manual", New South Wales Acid Sulfate Soil Management Advisory Committee, August 1998.
10. Dear SE, Moore NG, Dobos SK, Watling KM and Ahern CR "Soil Management Guidelines" in "Queensland Acid Sulphate Soil Technical Manual", Department of Natural Resources and Mines, November 2002.
11. Australian Standard AS 2870-1996 "Residential Slabs and Footings – Construction", June 1996, Standards Australia.
12. Australian Standard AS 2159-1995 "Piling – Design and Installation", Standards Australia.

---

**APPENDIX A**

**NOTES RELATING TO THIS REPORT  
BOREHOLE LOGS – BORES 23B, 57, 91, 94, 97 AND 98  
TEST PIT LOGS – PITS 1 TO 158**

---



## 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:—

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

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

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

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.

*Copyright © 1998 Douglas Partners Pty Ltd*

## 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) shown in 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

# BOREHOLE LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**BORE No:** 23B  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
	0	FILLING - Generally comprising dark grey to brown clayey silt with some fine to coarse sized gravel (coal, ash, siltstone)	X							
	1									
	2							▼		
	2.5			A,PID	2.5		<1 ppm			
	2.55	FILLING - Generally comprising light brown silty clay with some sand (siltstone / claystone filling), M~Wp	X							
	2.7	SILTSTONE - Extremely low strength, extremely weathered, light brown siltstone	X	S,PID			3.5,6 N = 11 <1 ppm			
	3	COAL - Extremely low to very low strength, extremely weathered, dull black coal with some claystone and siltstone bands	█		2.95					
	3.6									
	4	SILTSTONE - Extremely low to very low strength, extremely to moderately weathered, light brown siltstone	X		4.0		15, refusal			
	4.15	Bore discontinued at 4.15m, refusal	X		4.15					

**RIG:** 4WD Utility Mounted Drilling Rig    **DRILLER:** Foody    **LOGGED:** Reid    **CASING:** Uncased  
**TYPE OF BORING:** 100mm diameter solid flight auger (v-bit refusal at 4.15m)  
**WATER OBSERVATIONS:** Free groundwater observed at 2m  
**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	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:



# BOREHOLE LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**BORE No:** 57  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
		FILLING - Generally comprising orange-brown sandy silt with trace fine grained gravel and coal / coal chitter fragments, humid	[Cross-hatched pattern]	A,PID	0.1		<1 ppm			
			[Cross-hatched pattern]	A,PID	0.5		<1 ppm			
	0.9	FILLING - Generally comprising dark grey brown and orange-brown claystone and siltstone filling with some coal chitter fragments, humid to damp	[Cross-hatched pattern]	A,PID	1.0		<1 ppm		1	
			[Cross-hatched pattern]	S,PID			2,4,4 N = 8 <1 ppm			
			[Cross-hatched pattern]		1.45					
	2		[Cross-hatched pattern]	A,PID	2.0		<1 ppm		2	
			[Cross-hatched pattern]	A,PID	2.5		<1 ppm			
			[Cross-hatched pattern]	S,PID			3,3,4 N = 7 <1 ppm			
	3		[Cross-hatched pattern]		2.95				3	
	4	from 4m, some sandstone fragments	[Cross-hatched pattern]						4	

**RIG:** 4WD Utility Mounted Drilling Rig    **DRILLER:** Foody    **LOGGED:** Reid    **CASING:** Uncased  
**TYPE OF BORING:** 100mm diameter solid flight auger (v-bit refusal at 6.65m then tc-bit refusal at 6.7m)  
**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	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:



# BOREHOLE LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**BORE No:** 57  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
		FILLING - Generally comprising dark grey brown and orange-brown claystone and siltstone filling with some coal chitter fragments, humid to damp ( <i>continued</i> )	[Cross-hatched pattern]	A,PID	5.0		<1 ppm			
				A,PID	5.5		<1 ppm			
				S,PID			3,4,4 N = 8 <1 ppm			
	6				5.95				6	
	6.6	SILTSTONE/SANDSTONE - Medium to high strength, fresh, light grey siltstone / sandstone Bore discontinued at 6.7m, refusal	[Dotted pattern]	A,PID	6.5		<1 ppm			
	6.7									
	7									
	8									
	9									

**RIG:** 4WD Utility Mounted Drilling Rig    **DRILLER:** Foody    **LOGGED:** Reid    **CASING:** Uncased  
**TYPE OF BORING:** 100mm diameter solid flight auger (v-bit refusal at 6.65m then tc-bit refusal at 6.7m)  
**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	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 & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**BORE No:** 91  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing			Water	Well Construction Details	
				Type	Depth	Sample			
	0.3	FILLING - Generally comprising brown and red-brown silty clay with some sand and gravel and trace coal chitter, M~Wp	[Cross-hatched]	A,PID	0.1		<1 ppm		
	0.6	FILLING - Generally comprising dark brown-black and light brown coal chitter and siltstone / claystone filling, dry	[Cross-hatched]	A,PID	0.5		<1 ppm		
	1.0	FILLING - Generally comprising light brown siltstone and claystone filling with some sand and gravel with trace coal chitter	[Cross-hatched]		1.0				
			[Cross-hatched]	A,S,PID			3,6,10 N = 16 <1 ppm		
			[Cross-hatched]		1.45				
	2.0		[Cross-hatched]	A,PID	2.0		<1 ppm		
			[Cross-hatched]	A,PID	2.5		<1 ppm		
			[Cross-hatched]	S,PID			<1 ppm, 3,6,10/60mm		
	3.0	at 2.85m, refusal on low to medium strength cobbles, boulders	[Cross-hatched]		2.86				
			[Cross-hatched]	A,PID	3.5		<1 ppm		
	3.7	FILLING - Generally comprising light brown and light orange-brown sandstone / siltstone / claystone filling, dry	[Cross-hatched]						
	4.0		[Cross-hatched]		4.0				
			[Cross-hatched]	A,S,PID			6,12,12 N = 24 <1 ppm		
			[Cross-hatched]		4.45				

**RIG:** 4WD Utility Mounted Drilling Rig    **DRILLER:** Foody    **LOGGED:** Reid    **CASING:** Uncased

**TYPE OF BORING:** 100mm diameter solid flight auger (v-bit refusal at 2.85m then tc-bit to refusal)

**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	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 & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**BORE No:** 91  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing			Water	Well Construction Details		
				Type	Depth	Sample				Results & Comments
	5.1	SILTSTONE - Extremely low to very low strength, extremely to highly weathered, grey-brown and orange-brown siltstone		A,PID	5.0		<1 ppm			
				A,S,PID	5.5		12,13,14 N = 27 <1 ppm			
	6				5.95				6	
				A,PID	6.5		<1 ppm			
	7				7.0		<1 ppm, 20, refusal		7	
	7.15	Bore discontinued at 7.15m, limit of investigation								
	8								8	
	9								9	

**RIG:** 4WD Utility Mounted Drilling Rig    **DRILLER:** Foody    **LOGGED:** Reid    **CASING:** Uncased  
**TYPE OF BORING:** 100mm diameter solid flight auger (v-bit refusal at 2.85m then tc-bit to refusal)  
**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	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 & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**BORE No:** 94  
**PROJECT No:** 39663C  
**DATE:** 01 Nov 07  
**SHEET** 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing			Water	Well Construction Details		
				Type	Depth	Sample				Results & Comments
		FILLING - Generally comprising light brown clayey silt with some sand and gravel, coal chitter (siltstone / claystone / sandstone / filling), dry to humid	[Cross-hatched pattern]	A,PID	0.1		<1 ppm			
				A,PID	0.5		<1 ppm			
1							1.0			1
				A,S,PID				1,2,2 N = 4 <1 ppm		
							1.45			
2				A,PID			2.0	1.1 ppm		2
				A,PID			2.5	1.6 ppm		
				S,PID				2,3,4 N = 7 1 ppm		
3					2.95			3		
		FILLING - Generally comprising grey-brown and orange-brown siltstone and sandstone filling with some coal chitter, sand, silt and gravel, dry to humid	[Cross-hatched pattern]	A,PID	3.5		<1 ppm			
3.7										
4				A,S,PID				3,4,5 N = 9 <1 ppm		4
					4.0					
					4.45					

**RIG:** 4WD Utility Mounted Drilling Rig    **DRILLER:** Foody    **LOGGED:** Reid    **CASING:** Uncased  
**TYPE OF BORING:** 100mm diameter solid flight auger (v-bit refusal at 8.3m then tc-bit refusal at 8.6m)  
**WATER OBSERVATIONS:** Seepage observed at 8m  
**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	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:



# BOREHOLE LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**BORE No:** 94  
**PROJECT No:** 39663C  
**DATE:** 01 Nov 07  
**SHEET 2 OF 2**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing			Water	Well Construction Details	
				Type	Depth	Sample			
		FILLING - Generally comprising grey-brown and orange-brown siltstone and sandstone filling with some coal chitter, sand, silt and gravel, dry to humid ( <i>continued</i> )	[Cross-hatched pattern]	A,PID	5.0		<1 ppm		
				A,S,PID	5.5		5,7,9 N = 16 <1 ppm		
	6			A,PID	6.5		<1 ppm		
	7				7.0				
				A,S,PID	7.45		6,6,12 N = 18 <1 ppm		
	7.6	FILLING - Generally comprising dull black coal chitter, clay	[Cross-hatched pattern]						
	8	from 8m, saturated	[Cross-hatched pattern]	A,PID	8.0		<1 ppm	▼	
	8.2	LAMINITE - Low to medium strength, fresh, light grey and grey laminite at 8.3m, v-bit refusal	[Dotted pattern]	A,S,PID	8.3 8.31		<1 ppm		
	8.6	Bore discontinued at 8.6m, refusal	[Dotted pattern]						
	9								

**RIG:** 4WD Utility Mounted Drilling Rig    **DRILLER:** Foody    **LOGGED:** Reid    **CASING:** Uncased  
**TYPE OF BORING:** 100mm diameter solid flight auger (v-bit refusal at 8.3m then tc-bit refusal at 8.6m)  
**WATER OBSERVATIONS:** Seepage observed at 8m  
**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 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:



# BOREHOLE LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**BORE No:** 97  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing			Water	Well Construction Details	
				Type	Depth	Sample			
		FILLING - Generally comprising brown clayey sandy silt with some gravel and coal chitter fragments, humid	X	A,PID	0.1		<1 ppm		
	0.6	from 0.5m, humid to damp	X	A,PID	0.5		<1 ppm		
		FILLING - Generally comprising (firm to stiff), grey-brown silty clay with some sand, gravel and coal chitter fragments, M>Wp	X	A,PID	1.0		<1 ppm		1
	1	from 1m, some siltstone and sandstone rock fragments, M<Wp	X	S,PID,pp			2,3,4 N = 7 <1 ppm, 80-120 kPa		
			X		1.45				
	2		X	A,PID	2.0		<1 ppm		2
	2.1	FILLING - Generally comprising grey and brown siltstone / claystone filling with some clay and gravel and coal chitter, humid	X	A,PID	2.5		<1 ppm		
			X	S,PID			3,2,3 N = 5 <1 ppm		
	3		X		2.95				3
			X	A,PID	3.5		<1 ppm		
	4		X	A,PID	4.0		<1 ppm		4
			X	S,pp			2,4,4 N = 8 <1 ppm		
			X		4.45				

**RIG:** 4WD Utility Mounted Drilling Rig    **DRILLER:** Foody    **LOGGED:** Reid    **CASING:** Uncased  
**TYPE OF BORING:** 100mm diameter solid flight auger (v-bit refusal at 8.5m)  
**WATER OBSERVATIONS:** Free groundwater observed at 6.6m  
**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	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:



# BOREHOLE LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**BORE No:** 97  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing			Water	Well Construction Details	
				Type	Depth	Sample			
	5.3	FILLING - Generally comprising grey and brown siltstone / claystone filling with some clay and gravel and coal chitter, humid ( <i>continued</i> )	[Cross-hatch pattern]	A,PID	5.0		<1 ppm		
	5.3	FILLING - Generally comprising orange-brown and red-brown clayey sand / sandy clay with some sandstone fragments, moist to wet, M>Wp	[Cross-hatch pattern]	A,PID	5.5		<1 ppm		
	6		[Cross-hatch pattern]	S,PID	5.95		2,2,2 N = 4 <1 ppm		
	6.7	SANDY CLAY - Soft, grey and orange-brown sandy clay with ironcemented bands, M>Wp	[Diagonal lines pattern]	A,PID	6.5		<1 ppm	▼	
	7		[Diagonal lines pattern]	A,PID	7.0		<1 ppm		
	8		[Diagonal lines pattern]	S,PID,pp	7.45		2,1,3 N = 4 <1 ppm, 40 kPa		
	8		[Diagonal lines pattern]	pp	8.0		40 kPa		
	8.45 8.5	SANDSTONE - Very low to low strength, orange-brown fine to medium grained sandstone Bore discontinued at 8.5m, refusal	[Dotted pattern]	S	8.5				
	9		[Dotted pattern]		8.95				

**RIG:** 4WD Utility Mounted Drilling Rig    **DRILLER:** Foody    **LOGGED:** Reid    **CASING:** Uncased  
**TYPE OF BORING:** 100mm diameter solid flight auger (v-bit refusal at 8.5m)  
**WATER OBSERVATIONS:** Free groundwater observed at 6.6m  
**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	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:



# BOREHOLE LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**BORE No:** 98  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
	0.25	FILLING - Generally comprising brown sandy silt with gravel and rock and coal chitter fragments, dry to humid	[Cross-hatch pattern]							
	0.7	FILLING - Generally comprising brown pebbly sandstone filling with some sand and gravel, dry at 0.3m, v-bit refusal	[Cross-hatch pattern]	A,PID	0.5		<1 ppm			
	1.0	FILLING - Generally comprising dark brown-black coal and coal chitter with sand, gravel and silt, some tuff and siltstone (2mm-150mm diameter), humid	[Cross-hatch pattern]	A,PID	1.0		<1 ppm			
			[Cross-hatch pattern]	S	1.45		3,4,5 N = 9			
	2.0	from 2.1m, (loose)	[Cross-hatch pattern]	A	2.0					
			[Cross-hatch pattern]	S	2.5		1,1,1 N = 2			
	3.2	SILTY CLAY - Soft to firm, grey-brown silty clay with trace sand, M>Wp	[Diagonal lines pattern]	A,PID,pp	3.5		<1 ppm, 80 kPa	▼		
	4.0	from 4m, very soft to soft	[Diagonal lines pattern]	A,PID,pp	4.0		<1 ppm, <25 kPa			
			[Diagonal lines pattern]	S	4.45		1,1,2 N = 3			

**RIG:** 4WD Utility Mounted Drilling Rig    **DRILLER:** Foody    **LOGGED:** Reid    **CASING:** Uncased

**TYPE OF BORING:** 100mm diameter solid flight auger (v-bit refusal at 0.3m then tc-bit refusal to 2m, then v-bit refusal)

**WATER OBSERVATIONS:** Seepage observed at 3.2m

**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	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:





# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 1  
**PROJECT No:** 39663C  
**DATE:** 29 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.1	FILLING - Grey-black gravelly sandy silt (including ash and concrete fragments), damp from 0.1m, concrete footing, porcelain plate and glass bottle		D,PID	0.1		<1 ppm							
	0.35	CLAYEY SILT - Grey clayey silt, humid		D,PID	0.4		<1 ppm							
	0.5	CLAY - Hard, light grey mottled orange clay, M<<Wp												
	0.8			D,PID,pp	0.7		<1 ppm, >400 kPa							
	1.0	SILTSTONE / CLAYSTONE - Extremely low strength, extremely weathered, grey / grey mottled orange siltstone and claystone from 0.95m, very low to low strength, fragmented												
	1.55	Pit discontinued at 1.55m, refusal												
	2.0													
	3.0													
	4.0													

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3
- Cone Penetrometer AS1289.6.3.2

**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	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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 2  
**PROJECT No:** 39663C  
**DATE:** 29 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
		FILLING - Grey-brown gravelly sandy silt (including ash and coal), moist from 0.1m, damp		D,PID	0.15		<1 ppm						
	0.55	FILLING - Intermixed grey-brown clay (M<Wp), and gravelly sandy silt, damp		D,PID	0.6		<1 ppm						
	0.9	CLAY - Grey-brown clay with some intermixed dark grey clay and trace fine to medium grained subangular gravel, M>Wp		D,PID,pp	1.0		<1 ppm, 210-240 kPa	1					
		from 1.5m, hard, increased gravel content, some organics, <Wp		D,PID,pp	1.6		<1 ppm, >400 kPa						
	2.35	CLAYSTONE - Extremely low strength, extremely weathered, light grey claystone with some dark brown silty claystone bands to 2.9m		D,PID	2.4		<1 ppm						
		from 2.9m, light grey mottled orange											
	3.0	Pit discontinued at 3.0m, limit of investigation											

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

Sand Penetrometer AS1289.6.3.3

Cone Penetrometer AS1289.6.3.2

**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	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

# TEST PIT LOG

**CLIENT:** Coal and Allied  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 3  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.5	FILL - Grey / brown clayey silt with some fine to coarse grained subangular gravel, damp from 0.1m, some clay clumps and cobbles to 200mm		D/PID	0.2		<1							
	1.0	CLAY - Very stiff to hard grey / brown clay with some silt, m>Wp  from 1.0m, very stiff grey mottled orange		D/PID pp	0.6		<1 310 - >400 kPa							
	1.4	CLAYSTONE - Extremely low strength, extremely weathered light grey claystone with some iron staining  from 1.9m, very low strength, fragmented		D/PID pp	1.1		<1 210 - 320 kPa							
	2.3	Pit discontinued at 2.3m, refusal												

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**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	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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 4  
**PROJECT No:** 39663C  
**DATE:** 29 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
		FILLING - Grey-brown sandy silt with some fine to medium grained subangular gravel (including coal and ash), moist	[Cross-hatched pattern]	D,PID	0.1		<1 ppm						
		from 0.45m, increased gravel content (coal and ash)		D,PID	0.5		<1 ppm						
	0.8	FILLING - Grey silty clay with some fine to medium grained sand, M>Wp, and fine to coarse grained subangular and subrounded gravel	[Cross-hatched pattern]	D,PID,pp	1.0		<1 ppm, 260-380 kPa	1					
	1.8			D,PID,pp	1.7		<1 ppm						
	2	CLAYSTONE - Extremely low strength, extremely weathered, light grey claystone with some orange sand pockets	[Horizontal line pattern]					2					
	2.7	Pit discontinued at 2.7m, refusal											
	3							3					
	4							4					

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**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	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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 4A  
**PROJECT No:** 39663C  
**DATE:** 29 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.2	FILLING - Grey-brown clayey silt with some fine to coarse grained subangular gravel, moist at 0.05m, plastic sheet		D,PID	0.1		<1 ppm							
		FILLING - Grey-brown clay with some silt and fine to coarse grained subangular gravel with plastic, glass bottle and bone inclusions in upper 1.0m, M>Wp		D,PID,pp	0.4		<1 ppm, 280-320 kPa							
	1			D,PID	1.1		<1 ppm							
		at 1.3m, metal sheet												
	2			D,PID,pp	2.0		<1 ppm, 180-370 kPa							
	2.7	Pit discontinued at 2.7m												
	3													
	4													

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

Sand Penetrometer AS1289.6.3.3

**REMARKS:** Pit within filled excavation

Cone Penetrometer AS1289.6.3.2

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	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

# TEST PIT LOG

**CLIENT:** Coal and Allied  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 5  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)										
				Type	Depth	Sample	Results & Comments		5	10	15	20							
		FILL - Orange / brown sandy fine to coarse grained subangular and subrounded gravel, moist																	
	0.5	FILL - Brown clayey silt with some gravel (including coal), moist		D/PID	0.6		<1												
	0.7	CLAY - Stiff to very stiff grey / brown clay, m>Wp		D/PID pp	0.8		<1 190 - 280 kPa												
	1	from 1.0m, grey mottled orange, trace to some sand																	
	1.7	Pit discontinued at 1.7m, refusal																	
	2																		
	3																		

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**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	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

# TEST PIT LOG

**CLIENT:** Coal and Allied  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 6  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
		FILL - Grey / brown gravelly sandy silt (including coal and ash), moist  from 0.2m to 0.4m increased gravel content (ash)		D/PID	0.25		<1						
	0.7	FILL - Grey / brown clayey silt with trace fine to coarse grained subangular gravel, moist  at 0.9m, glass bottle observed		D/PID	0.8		<1						
	1.0	CLAYEY SILTSTONE - Very low strength, highly weathered light grey mottled orange clayey siltstone						1					
	1.75	Pit discontinued at 1.75m, refusal											
	2							2					
	3							3					

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**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 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

# TEST PIT LOG

CLIENT: Coal and Allied  
 PROJECT: Preliminary Geo-Contamination Assessment  
 LOCATION: Minmi

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

PIT No: 6A  
 PROJECT No: 39663C  
 DATE: 30 Oct 07  
 SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.25	CLAYEY SILT - Grey clayey silt, moist		D/PID	0.1		<1						
	0.25	CLAY - Hard light grey mottled orange clay, m < Wp		D/PID pp	0.4		<1 >400 kPa						
	0.85	CLAYSTONE - Extremely low strength, extremely weathered light grey claystone											
	1												
	2	from 1.7m, some iron staining											
	2.5	Pit discontinued at 2.5m, refusal											
	3												

RIG: JCB 3CX Backhoe, 600mm bucket with teeth

LOGGED: Collins

WATER OBSERVATIONS: No free groundwater observed

- Sand Penetrometer AS1289.6.3.3
- Cone Penetrometer AS1289.6.3.2

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 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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 7  
**PROJECT No:** 39663C  
**DATE:** 25 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.3	FILLING - Grey gravel, generally comprising rock, concrete, brick and trace ash sandy silt with some subangular cobbles to 300mm and inclusions of brick and metal, humid		D,PID	0.1		<1 ppm						
	0.65	FILLING - Grey fine to coarse grained subangular gravel and cobbles to 300mm with some clay (ripped sandstone) at 0.6m, timber plank		D,PID	0.6		<1 ppm						
	1	CLAYSTONE - Very low strength, highly weathered grey mottled orange claystone, fractured from 0.9m, low strength claystone and siltstone with occasional extremely low strength clayey lenses											
	2.1	Pit discontinued at 2.1m, refusal											
	3												
	4												

**RIG:** JCB 3CX Backhoe with 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3
- Cone Penetrometer AS1289.6.3.2

**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 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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 8  
**PROJECT No:** 39663C  
**DATE:** 25 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.25	SILTY SAND - Brown silty fine to medium grained sand with some fine to medium grained subangular gravel and clay clumps (M<<Wp), damp	· · · · · · · · · · · · · · ·	D,PID	0.1		<1 ppm						
	0.8	CLAYSTONE - Extremely low strength, extremely weathered, grey mottled orange claystone, highly fragmented (possible fill to 1.4m)	▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬	D,PID	0.4		<1 ppm						
	1	from 0.8m, low strength											
	2	from 1.4m to 1.6m, extremely low strength											
	2.1	Pit discontinued at 2.1m, refusal											
	3												
	4												

**RIG:** JCB 3CX Backhoe with 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3
- Cone Penetrometer AS1289.6.3.2

**REMARKS:**

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

CHECKED
Initials:
Date:



**Douglas Partners**  
 Geotechnics • Environment • Groundwater

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 9  
**PROJECT No:** 39663C  
**DATE:** 25 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
		FILLING - Brown gravelly silty fine to medium grained sand with some cobbles to 250mm and inclusions of coke, metallic ash, brick and metal railway sleepers, damp		D,PID	0.1		2.0 ppm						
	0.7	at 0.6m, timber sleepers and metal bar											
	1.0	FILLING - Intermixed brown silty fine to medium grained sand, dark grey coal reject generally comprising 55% carbonaceous siltstone, 40% silty sand, 5% coal		D,PID	0.8		3.4 ppm						
	1.3	FILLING - Fine to coarse gravel, cobbles and boulders to 450mm, (ripped siltstone and claystone)											
	2.1	CLAYSTONE - Extremely low strength, extremely weathered, light grey claystone with some orange mottling, highly fragmented  from 1.6m, low strength											
	2.1	Pit discontinued at 2.1m, limit of investigation											
	3												
	4												

**RIG:** JCB 3CX Backhoe with 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**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	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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 10  
**PROJECT No:** 39663C  
**DATE:** 29 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.2	CLAYEY SILT - Grey-brown clayey silt with some fine to medium grained subangular gravel (possible fill)		D,PID	0.1		<1 ppm						
		FILLING - Grey clay, fine to coarse grained subangular gravel and cobbles to 250mm		D,PID	0.5		<1 ppm						
	0.8	CLAYSTONE - Low strength, moderately weathered, grey mottled orange claystone, fragmented						1					
	1.2	SANDY SILTSTONE - Very low strength, highly weathered, orange sandy siltstone											
	1.55	CLAYSTONE - Very low strength, highly weathered, light grey mottled orange claystone											
	1.9	Pit discontinued at 1.9m, refusal						2					
	2												
	3												
	4												

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

Sand Penetrometer AS1289.6.3.3

Cone Penetrometer AS1289.6.3.2

**REMARKS:**

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

CHECKED
Initials:
Date:



**Douglas Partners**  
 Geotechnics • Environment • Groundwater

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 11  
**PROJECT No:** 39663C  
**DATE:** 25 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
		FILLING - Grey gravelly silty sand including trace fine to medium grained gravel sized ash, humid		D,PID	0.1		<1 ppm						
	0.45	FILLING - Dark grey clayey sandy fine to medium grained gravel (ash), damp		D,PID	0.5		<1 ppm						
	0.55	CLAY - Very stiff, grey mottled orange clay, M > Wp from 0.7m, grading into claystone		D,PID,pp	0.7		<1 ppm, 220-250 kPa						
	1.0	CLAYSTONE - Extremely low strength, extremely weathered, grey mottled orange claystone, silty and orange sandy in parts, fragmented, strength increasing with depth						1					
		from 1.6m, light grey, low strength											
	1.9	Pit discontinued at 1.9m, refusal						2					
	2												
	3												
	4												

**RIG:** JCB 3CX Backhoe with 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

Sand Penetrometer AS1289.6.3.3

Cone Penetrometer AS1289.6.3.2

**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	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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 12  
**PROJECT No:** 39663C  
**DATE:** 25 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.15	FILLING - Brown silty fine to medium grained sand with some fine to medium subangular and subrounded gravel (ash), damp	[Cross-hatched pattern]	D,PID	0.2		<1 ppm						
	0.5	FILLING - Dark grey fine to medium grained subangular and subrounded gravel (ash) with some intermixed brown silty sand, humid from 0.35m, increased silty sand content											
	1	FILLING - Very stiff, grey mottled orange clay with trace fine grained subangular gravel, M>Wp from 1.1m, stiff to very stiff grey clay, M>Wp	[Cross-hatched pattern]	D,PID,pp	0.7		<1 ppm, 240-320 kPa						
	1.55	from 1.4m, slightly sandy grey mottled orange clay (ripped claystone)											
	1.65	FILLING - Stiff to very stiff, dark grey-brown organic silty clay, M>Wp	[Cross-hatched pattern]	D,PID,pp	1.6		<1 ppm, 150-220 kPa						
	1.9	FILLING - Very stiff intermixed light grey mottled orange gravelly clay and grey clay, M>Wp											
	2	CLAYSTONE - Extremely low strength, extremely weathered, light grey mottled orange claystone, highly fragmented from 2.8m, very low strength, highly weathered	[Horizontal line pattern]	D,PID,pp	1.8		<1 ppm, 200-350 kPa						
	3.0	Pit discontinued at 3.0m, limit of investigation											

**RIG:** JCB 3CX Backhoe with 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**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	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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 13  
**PROJECT No:** 39663C  
**DATE:** 29 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.5	FILLING - Dark grey-brown gravelly silt with some sand (including ash and coal) with brick, timber and metal inclusions, moist		D,PID	0.1		<1 ppm						
	1.0	CLAY - Very stiff to hard, grey mottled orange clay, M>Wp		D,PID,pp	0.6		<1 ppm, 340-400 kPa						
	2.2	CLAYSTONE - Extremely low strength, extremely weathered, light grey claystone, fragmented		D,PID	1.1		<1 ppm	1					
	2.2	Pit discontinued at 2.2m, refusal											
	3.0							3					
	4.0							4					

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**REMARKS:**

SAMPLING & IN SITU TESTING LEGEND	
A	Auger sample
D	Disturbed sample
B	Bulk sample
U	Tube sample (x mm dia.)
W	Water sample
C	Core drilling
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
S	Standard penetration test
PL	Point load strength Is(50) MPa
V	Shear Vane (kPa)
>	Water seep
≡	Water level

CHECKED
Initials:
Date:



**Douglas Partners**  
 Geotechnics • Environment • Groundwater

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 14  
**PROJECT No:** 39663C  
**DATE:** 25 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.2	FILLING - Brown gravelly silty fine to medium grained sand including trace coal, humid		D,PID	0.1		<1 ppm							
		CLAY - Very stiff, grey mottled orange clay, M> Wp		D,PID,pp	0.4		<1 ppm, 300-380 kPa							
	1			pp	1.0		220-320 kPa	1						
	1.35	CLAYSTONE - Very low strength, highly weathered, light grey mottled orange claystone, highly fragmented												
		from 1.6m to 2.7m, extremely low strength, light grey												
	2							2						
	3	Pit discontinued at 3.0m, limit of investigation						3						
	4							4						

**RIG:** JCB 3CX Backhoe with 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**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 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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 15  
**PROJECT No:** 39663C  
**DATE:** 25 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.05 0.1	FILLING - Grey-brown silty sand with some fine to medium grained subangular and subrounded gravel (including brick fragments), humid		D,PID	0.2		1.8 ppm						
		FILLING - Light grey sandy silt with some fine to medium grained gravel (ash), humid											
		FILLING - Dark grey-black fine to coarse grained sand and gravel sized coal reject, generally comprising 50% coal, 45% carbonaceous siltstone, 5% ash at 0.15m, timber sleeper		D	0.5								
	0.95	CLAYSTONE - Extremely low strength, extremely weathered, light grey mottled orange claystone, highly fragmented						1					
	1.7	from 1.55m, low strength Pit discontinued at 1.7m, refusal											
	2							2					
	3							3					
	4							4					

**RIG:** JCB 3CX Backhoe with 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**REMARKS:**

SAMPLING & IN SITU TESTING LEGEND	
A	Auger sample
D	Disturbed sample
B	Bulk sample
U	Tube sample (x mm dia.)
W	Water sample
C	Core drilling
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
S	Standard penetration test
PL	Point load strength Is(50) MPa
V	Shear Vane (kPa)
>	Water seep
≡	Water level

CHECKED
Initials:
Date:



**Douglas Partners**  
 Geotechnics • Environment • Groundwater

# TEST PIT LOG

**CLIENT:** Coal and Allied  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 16  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.1	CLAYEY SILT - Grey / brown clayey silt, moist												
		CLAY - Hard, grey / brown clay, m<Wp		D/PID pp	0.2		<1 >400 kpa							
		from 0.8m, very stiff light grey mottled orange, m<Wp		D/PID pp	0.9		<1 250 - 340 kpa							
	1.3	CLAYSTONE - Extremely low strength, extremely weathered light grey mottled orange claystone with some iron staining, fragmented												
		from 2.2m, very low strength												
	2.6	Pit discontinued at 2.6m, refusal												
	3													

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3
- Cone Penetrometer AS1289.6.3.2

**REMARKS:**

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

CHECKED
Initials:
Date:



**Douglas Partners**  
 Geotechnics • Environment • Groundwater

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 17  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.4	FILLING - Dark grey-brown slightly sandy silt with some clay and fine to medium grained gravel sized coal and ash, moist		D,PID	0.1		<1 ppm						
	0.7	FILLING - Grey-brown silty fine to medium grained sand with some clay and trace to some fine to medium grained gravel including coal and ash, moist		D,PID	0.5		<1 ppm						
	1.0	CLAY - Stiff to very stiff, grey mottled orange-red clay with trace fine to medium grained sand and trace fine grained subangular gravel, M>Wp  from 2m, M<Wp		D,PID,pp	0.9		<1 ppm, 190-270 kPa	1					
	2.5			D,PID,pp	1.4		<1 ppm, >400 kPa						
	2.5	CLAYSTONE - Extremely low to very low strength, highly weathered grey claystone		D	2.4								
	3.0	Pit discontinued at 3.0m, limit of investigation											

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**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	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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 18  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.1	TOPSOIL - Grey-brown clayey silt with some fine to medium grained sand, moist		D,PID	0.05		<1 ppm							
		CLAY - Stiff to very stiff, grey mottled orange-red clay with trace fine to medium grained subangular gravel, M>Wp		D,PID,pp	0.2		<1 ppm, 180-280 kPa							
		from 0.5m, light grey mottled orange, trace cobbles to 100mm		D,PID,pp	0.7		<1 ppm, 190-290 kPa							
		from 1.2m, hard		pp	1.2		>400 kPa							
		from 1.4m, increasing silt content, grading into siltstone, M <Wp												
	1.6	SILTSTONE - Extremely low strength, extremely weathered, light grey mottled orange siltstone		D	1.8									
	2.1	CLAYSTONE - Extremely low strength, extremely weathered, light grey mottled orange-red claystone												
		from 2.7m, extremely low to very low strength, some ironstaining/cementing												
	3.0	Pit discontinued at 3.0m, limit of investigation												

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**REMARKS:**

SAMPLING & IN SITU TESTING LEGEND	
A	Auger sample
D	Disturbed sample
B	Bulk sample
U	Tube sample (x mm dia.)
W	Water sample
C	Core drilling
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
S	Standard penetration test
PL	Point load strength Is(50) MPa
V	Shear Vane (kPa)
>	Water seep
≡	Water level

CHECKED
Initials:
Date:



**Douglas Partners**  
 Geotechnics • Environment • Groundwater

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 19  
**PROJECT No:** 39663C  
**DATE:** 30 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.15	FILLING - Dark grey-brown clayey silt with some sand, trace fine to coarse gravel including coal and ash, and minor metal and porcelain fragment inclusions, moist		D,PID	0.1		<1 ppm							
		FILLING - Stiff, grey, dark grey and orange-brown clay with some silt and sand, trace to some fine to coarse gravel including ash and minor metal, porcelain and glass inclusions, moist at 0.3m, brick inclusions		D,PID,pp	0.3		<1 ppm, 110-140 kPa							
	0.7	CLAY - Very stiff, light grey mottled orange clay, M>Wp		D,PID,pp	0.8		<1 ppm, 270-320 kPa							
	1	from 1.2m, hard		pp	1.2		>400 kPa							
	1.4	SILTSTONE - Very low strength, highly weathered, grey mottled orange siltstone, sandy in parts												
	2.1	CLAYSTONE - Very low strength, highly weathered, grey claystone with some ironstaining / cementing												
		from 2.4m, low strength, moderately weathered												
	2.7	Pit discontinued at 2.7m, refusal												
	3													
	4													

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**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	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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 20  
**PROJECT No:** 39663C  
**DATE:** 31 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
		FILLING - grey mottled orange clay with some silt and trace fine to coarse grained subangular gravel (including trace coal) in upper 250mm, M>Vp  from 0.8m, some cobbles and boulders to 300mm		D,PID,pp	0.2		<1 ppm, 190-230 kPa						
	1.2	CLAYSTONE - Extremely low strength, extremely weathered, grey mottled orange claystone, fractured  from 1.5m, very low strength											
	1.8	Pit discontinued at 1.8m											
	2												
	3												
	4												

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

- Sand Penetrometer AS1289.6.3.3  
 Cone Penetrometer AS1289.6.3.2

**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	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

# TEST PIT LOG

**CLIENT:** Coal & Allied Pty Ltd  
**PROJECT:** Preliminary Geo-Contamination Assessment  
**LOCATION:** Minmi

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

**PIT No:** 21  
**PROJECT No:** 39663C  
**DATE:** 31 Oct 07  
**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
		FILLING - Grey-brown clayey silt with some fine to medium grained sand and fine to medium grained subangular and subrounded gravel, minor coal and metal inclusions, damp		D,PID	0.3		<1 ppm						
	0.7	FILLING - Grey sandy silt with some fine to medium grained sub angular gravel, humid (possible natural)		D,PID	0.8		<1 ppm						
	0.95	CLAY - Hard, grey mottled orange clay with some silt, M<Wp		D,PID,pp	1.1		<1 ppm, >400 kPa	1					
		from 1.3m, very stiff, reduced silt content, M>Wp		pp	1.4		300-370 kPa						
		from 1.7m, very stiff to hard, some sand and silt		pp	1.9		380->400 kPa						
	2.0	CLAYEY SILTSTONE - Extremely low strength, extremely weathered, grey mottled orange clayey siltstone with some ironstaining						2					
	2.5	Pit discontinued at 2.5m, refusal											
	3							3					
	4							4					

**RIG:** JCB 3CX Backhoe, 600mm bucket with teeth

**LOGGED:** Collins

**WATER OBSERVATIONS:** No free groundwater observed

Sand Penetrometer AS1289.6.3.3

Cone Penetrometer AS1289.6.3.2

**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	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