

Our Ref: S167E/032a
Date: 5 September 2013

Rob Hunt
Centennial Coal
Level 18, BT Tower
1 Market Street
Sydney NSW 2000

Dear Rob,

RE: GROUNDWATER MONITORING NETWORK – BORE COMPLETION REPORT

1. INTRODUCTION

RPS was engaged by Springvale Coal Pty to expand the existing groundwater monitoring network at the Centennial Springvale Coal Services operation (Coal Services). The operation is situated at Blackmans Flat, NSW.

This report provides a summary of activities carried out during the hydrogeological field programme undertaken at Coal Services from the 19 August 2013 to the 26 August 2013.

Hydrogeological data acquired during the field programme are presented to provide Coal Services with the required information to enable future data analysis and manipulation of monitoring data from the installed monitoring points.

1.1 Document Structure

The document is laid out as follows:

- **Section 2:** Provides the reasoning behind the hydrogeological field programme and why it was initiated by Coal Services. It describes the aims and objectives of the field programme and the tasks which were undertaken to achieve these objectives.
- **Section 3:** Details the work that has been carried out as a part of the field programme. Schedule of activities are presented, along with the hydrogeological data which was collected during the programme.
- **Section 4:** Presents the conclusions, key outcomes and recommendations which have been made following the completion of the field programme and provides recommendations for ongoing groundwater monitoring.

2. BACKGROUND

Centennial operates the Coal Services site located in the Blackmans Flat, Lidsdale and Wallerawang localities in NSW (Figure 1). The Project is an existing approved facility within the Springvale development consent and consists of a wash plant; reject emplacement facilities and a coal distribution network of conveyors. Centennial intend to upgrade the site to enable up to 7.0Mtpa of coal to be washed with up to 6.3Mtpa of export coal delivered to Lidsdale Siding via the existing overland conveyor system.

Groundwater and surface water have been identified as key environmental issues to be managed on site. The existing surface water monitoring program is outlined in the site surface water assessment and includes monitoring for water quality at a number of locations across the Project site comprising three monitoring stations on Wangcol Creek, one upstream of the Project and two downstream. In addition, visual inspections of all sediment dams are complete weekly.

The existing groundwater monitoring network onsite consists of three monitoring bores (BH1, BH2 and BH3) which monitor the Berry and Marangaroo Formations (Figure 1).

The objective of this programme was to develop and implement an efficient groundwater monitoring network that will satisfy regulators and stakeholders on impact identification and site environmental management.

3. FIELD PROGRAMME

In order to achieve the objectives outlined in section 2, the following tasks were undertaken:

- Identification of existing monitoring bores that can be utilised for further monitoring.
- The installation of an additional four groundwater monitoring bores.
- Hydraulic testing of BH07 and existing monitoring bores BH04 and BH05.
- Field water quality parameter sampling from installed monitoring bores (pH, EC and temperature).

3.1 Existing Monitoring Bores

A number of existing monitoring bores have been located on site that can be incorporated into the groundwater monitoring network. Bore details are provided on Table 1 and the locations are shown on Figure 1.

Table 1: Existing Monitoring Bore Details and Nomenclature

| Recommended SVCS Name | Previous Name | Easting | Northing | Depth (mbgl) |
|-----------------------|---------------|----------|-----------|--------------|
| BH01 | BH01 (D&P) | 225978.2 | 6305017.7 | 18.3 |
| BH02 | BH02 (SKM) | 225948 | 6303880 | 30.0 |
| BH03 | BH03 (D&P) | 226175.2 | 6304416.4 | 18.6 |
| BH04 | Unavailable | 225614 | 6304539 | 27.5 |
| BH05 | Unavailable | 225769 | 6304711 | 30.2 |
| BH06 | MPGM4-D2 | 226183 | 6304758 | 9.3 |
| BH11 | Unavailable | 225088 | 6304251 | 35.3 |
| BH12 | Unavailable | 225667 | 6304819 | 19.7 |
| BH13 | Unavailable | 225667 | 6304819 | 13.0 |
| BH14 | BH01 (SKM) | 224866 | 6304259 | 33.2 |
| BH15 | BH04 (SKM) | 225042 | 6304667 | 24.6 |

*Douglas and Partners (D&P)

*Sinclair Knight Merz (SKM)

3.2 Monitoring Bore Installation

Monitoring bore installations were designed to complement the existing monitoring network targeting the Lithgow coal seam (BH08, BH09 and BH10) and an up gradient site unaffected by operational activity (BH07). Groundwater licenses were obtained prior to the installation of each monitoring bore. Monitoring bore locations are shown on Figure 1.

All four standpipe monitoring bores were completed in accordance with specifications outlined in the *Minimum Construction Requirements for Water Bores in Australia* (NUDLC, 2012). Table 2 summarises the completion details with detailed construction logs provided in Appendix A.

Holes were drilled using a 100mm diameter conventional air hammer. A 130mm diameter solid stem auger was used to install 125mm PVC Conductor casing up to 3m. The conductor casing was held in place using A&B Foam.

All standpipe monitoring bores were constructed with a 50mm nominal diameter (ND), class 18 (CL18) PVC casing, and completed with lockable a steel surface monument set in a concrete plinth.

BH07: UPGRADIENT MONITORING SITE

Following installation of the casing, the borehole annulus was backfilled with a graded gravel pack (3.2 to 6.4mm grain size) to a level just above the slotted interval. A bentonite plug, approximately 2m thick, was placed above the gravel pack and the annulus was then sealed back to surface using a cement grout.

BH08, BH09 AND BH10: LITHGOW SEAM WORKINGS

Monitoring bores BH08, BH09 and BH10 were drilled and constructed in the cavity of the old underground workings in the Lithgow Seam. Following installation of the casing, the borehole annulus was plugged with a rubber C-Bridge in a competent section of rock above the void space of the mined out Lithgow Seam. A bentonite plug, approximately 2m thick, was placed above the C-Bridge and the annulus was then sealed back to surface using a cement grout.

Screened Interval

A slotted section of the casing (screened interval) providing the targeted monitoring was installed adjacent to the lithology to be monitored (Table 2). The slotted casing consisted of machine slotted (1mm aperture) 50mm ND, CL18 PVC.

The length of the screened interval in each monitoring bore was dictated by the assessed saturated thickness of the targeted groundwater zone or the estimated thicknesses of old mine workings. This was estimated from previous drilling investigations and confirmed during drilling.

Standpipe monitoring bore BH07 was screened in siltstone/sandstone to allow the collection of groundwater level and quality monitoring data from the regolith above the Lithgow Seam.

Monitoring bores BH08, BH09 and BH10 were screened in the old Lithgow Seam workings to provide data on the groundwater level and quality that may be stored in the old workings. The screened interval in these monitoring bores was isolated from the overlying consolidated sediments through the use of bentonite plugs and cement grouting of the bore annulus.

3.3 MONITORING BORE DEVELOPMENT

Following installation, BH07 was developed by airlift pumping and surging. Monitoring bores BH08, BH09 and BH10 were not developed as these bores are screened through the open mine void. Existing monitoring bores BH04 and BH05 were also airlifted to help assess if they are located in the mine void.

The development process removes the fines and drilling fluids from the casing, gravel pack and surrounding aquifer, and develops the monitoring bore interface with the aquifer, increasing the accuracy of monitoring measurements and samples.

When airlifting (surging and pumping), compressed air is introduced into the monitoring bore such that aerated slugs of water are lifted irregularly out of the top of the well casing. This can be cycled on an off to create surging action. Sufficient flow from the top of the monitoring bore will remove sediment and fine particles from the borehole.

BH04, BH05 and BH07 were developed until the water return was assessed (by the onsite hydrogeologist) to be sufficiently free of fine particles to permit collection of accurate and representative water quality samples, water levels and aquifer hydraulic properties.

3.4 WATER LEVEL AND WATER QUALITY FIELD MEASUREMENTS

Water level measurements were taken at each of the monitoring bores that were drilled and developed during the installation program. Water level measurements were taken using a water level dip metre reading the depth from monitoring bore collar. The reading was then subtracted from the surveyed collar elevation to obtain a water level in mAHD (Table 3).



BH10 is noted to be dry and the Lithgow seam and underground workings are shown to be unsaturated at this location.

Key water quality parameters of pH, electrical conductivity (EC) and temperature were measured during the drilling program and in particular during the monitoring bore development process using a hand held multi-parameter water quality meter (Table 3). To ensure the accuracy of measurements was maintained, the probe was calibrated at the start of the project.

Table 2: Installation Details

| Current Bore ID | Easting | Northing | Ground Level Elevation (mAHD) | Collar Elevation (mAHD) | Drilling Commenced | Drilling Completed | Drilled depth (mbgl) | Cased depth | Screened interval (mbgl) | Target Aquifer | Estimated Coal Seam Interval (mbgl) | C-Bridge (mbgl) | Bentonite seal (mbgl) |
|-----------------|----------|----------|-------------------------------|-------------------------|--------------------|--------------------|----------------------|-------------|--------------------------|----------------------------------|-------------------------------------|-----------------|-----------------------|
| BH07 | 225485.7 | 6303099 | 924.24 | 925.16 | 23/08/2013 | 23/08/2013 | 33 | 33 | 18-33 | Up-gradient saturated overburden | N/A | N/A | 15-17 |
| BH08 | 225978.6 | 6304608 | 927.38 | 928.27 | 20/08/2013 | 21/08/2013 | 24.4 | 24.4 | 21.4-24.4 | Lithgow Seam workings | 21.5-24.4 | 19 | 16.8-19 |
| BH09 | 225875.7 | 6304526 | 929.79 | 930.75 | 19/08/2013 | 20/08/2013 | 25.5 | 25 | 22.5-25 | Lithgow Seam workings | 23.1-25.5 | 20.7 | 18-20.7 |
| BH10 | 225652.9 | 6304342 | 936.45 | 937.4 | 21/08/2013 | 23/08/2013 | 25.2 | 25 | 22-25 | Lithgow Seam workings | 23.0-25.6 | 16.5 | 14-16.5 |

Table 3: Water Level and Water Quality Measurements

| Current Bore ID | Water Level (mTOC) | Water Level (mAHD) | EC (mS/cm) | pH | Temp (C°) |
|-----------------|--------------------|--------------------|------------|------|-----------|
| BH04 | 21.81 | 908.90 | 0.67 | 8.06 | 16.2 |
| BH05 | 21.47 | 908.12 | 0.94 | 8.26 | 14.9 |
| BH06 | 1.62 | 904.28 | - | - | - |
| BH07 | 20.42 | 904.92 | 1.14 | 8.7 | 13.8 |
| BH08 | 21.91 | 906.36 | 3.08 | 7.03 | 11.9 |
| BH09 | 23.80 | 906.95 | 3.7 | 6.8 | 15.7 |
| BH10 | Dry | Dry | Dry | Dry | Dry |

3.5 Hydraulic Testing

Hydraulic testing was undertaken on monitoring bores BH04, BH05 and BH07 to provide an understanding of the properties of the monitored aquifer. Testing was not undertaken on bores BH08, BH09 or BH10 as these are known to be cased through open void and testing would not return any useable data. The testing was undertaken in the form of a slug test. An automated data-logger (In-Situ Level Troll 500) was used to measure and log pressure readings at a high frequency during hydraulic testing.

Hydraulic testing provides estimates of the aquifer characteristics such as hydraulic conductivity, transmissivity and, where possible storativity. This information permits the calculation of groundwater flow gradients through the measured aquifer bed/s and confining formations. This information is also used in numerical groundwater models to assess impact to groundwater systems and associated environmental values.

The program focussed on providing indicative values of hydraulic conductivity (alternatively referred to as permeability). Results of the hydraulic testing are as follows:

- BH04 recovered too quickly once the slug was submerged and removed from the water level for the data logger to record any measurable change in the water level. This reveals that this monitoring bore is likely installed within the Lithgow Seam workings.
- BH05 did not recover once the slug was submerged and removed from the water table revealing it has a low hydraulic conductivity that is unable to be measured accurately using the slug test methodology. This would indicate that the bore is constructed in a pillar of the Lithgow Seam.
- BH07 has an estimated hydraulic conductivity (K) value of 7.86×10^{-6} m/s (0.68m/d) (Figure 2).

4. KEY OUTCOMES AND RECOMMENDATIONS

4.1 Key Outcomes

The primary purpose of expanding the existing monitoring network was to provide a greater density of monitoring holes to enable future assessment of potential groundwater related impacts. The new groundwater monitoring network and targeted aquifers are summarised in Table 4.

Table 4: Updated Monitoring Network and Target Aquifer

| Current Bore ID | Aquifer Monitored |
|-----------------|------------------------------------|
| BH01 | Lithgow Seam |
| BH02 | Marrangaroo formation |
| BH03 | Saturated overburden |
| BH04 | General |
| BH05 | Lithgow Seam |
| BH06 | Lithgow Seam |
| BH07 | Up-gradient overburden (saturated) |
| BH08 | Lithgow Seam |
| BH09 | Lithgow Seam |
| BH10 | Lithgow Seam |
| BH11 | General |
| BH12 | General (paired site) |
| BH13 | General (paired site) |
| BH14 | Lithgow Seam |
| BH15 | Up-gradient Overburden (dry) |



4.2 Recommendations

With the updated monitoring network in place it is important that the monitoring bores are monitored regularly to pick up any fluctuations in water levels and water chemistry.

It is recommended that data loggers are installed at selected locations during the next groundwater monitoring round to record high frequency (6 hourly) groundwater level information.

It is recommended that monitoring is undertaken at the following frequencies:

- Water levels on a monthly basis with data loggers downloaded minimum quarterly.
- Basic water chemistry (pH, EC and TDS) on a quarterly basis.
- Comprehensive water quality on a biannual basis with selected bores to be tested quarterly.

We trust this information is sufficient for your purposes; however should you require any further details or clarification, please do not hesitate to contact our office.

Yours sincerely
RPS Water

Jason

Jason Carr
Hydrogeologist

Greg

Greg Sheppard
Principal Hydrogeologist

cc:
enc:

FIGURES



LEGEND

Status

- Current groundwater monitoring network
- Existing bore to be re-commissioned
- Installed monitoring bore

- Creek
- Coal Services Project Boundary
- Town
- Elevation Contour
- Principal Road

Scale and Orientation

N

0 100 200 400 Metres

SCALE 1:10,000 @ A3

GDA 1994 MGA Zone 56

DATA SOURCES
RPS Aquaterra

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Note: The information shown on this map is a copyright of RPS Aquaterra Australia 2012



Figure 1

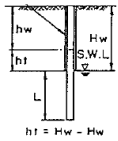
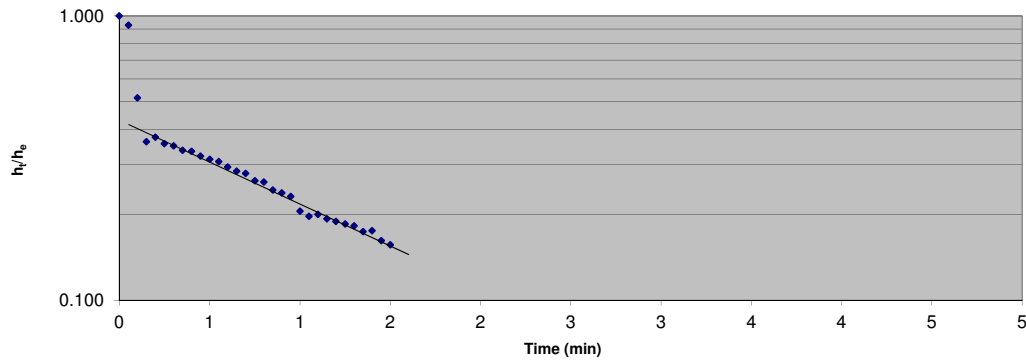
**Springvale Coal Services
Groundwater Monitoring Network**

| | | | |
|------------|------------|------------|-------|
| AUTHOR | JC | PROJECT NO | S167E |
| CHECKED BY | GS | REVISION | A |
| DATE | 05/09/2013 | DRAWING NO | DD01 |

FALLING HEAD TEST

| | | | | |
|--|-------------------|---|-----------------|---------------|
| Bore No: BH07 | Test No: #1 | Job No: S167E/E2 | Date: 26-Aug-13 | Logged by: JC |
| Borehole co-ordinates: Easting: 225492 | Northing: 6303102 | Collar elevation (m): 0.91 | | |
| Depth to top of test section (m): 19.34 | | Length of test section, L (m): 12.76 | | |
| Depth of static water level, H _w (m): 19.33 | | Radius of borehole, r (m): 0.05 | | |
| Excess head, h _e (m): 0.73 | | Radius of standpipe or casing, r _c (m): 0.05 | | |

Head - time graph (slope of graph is S)



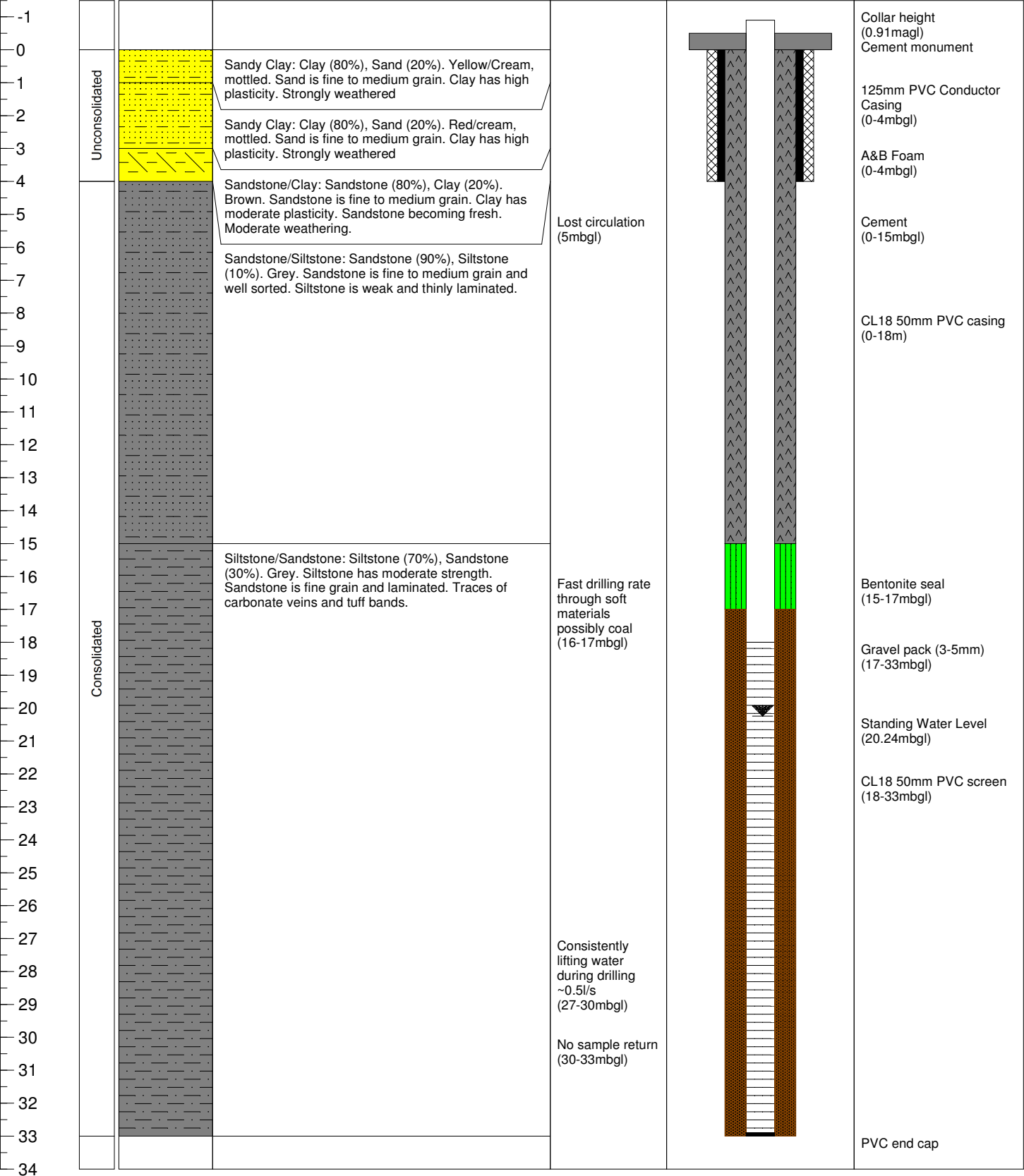
Calculations:

| | | | | |
|--|----------|--|--|---|
| h ₁ | 0.37 | | | |
| t ₁ | 0.2 | | | |
| h ₂ | 0.15 | | | |
| t ₂ | 1.5 | | | |
| S | 3.0E-01 | | | where S = (log (h ₁ /h ₂))/(t ₂ - t ₁), (ie slope of plot, t in mins) |
| Permeability, k = 0.133 x S x (rc ² /L) | | | | |
| k | 7.86E-06 | | | m/sec |
| k | 6.79E-01 | | | m/day |

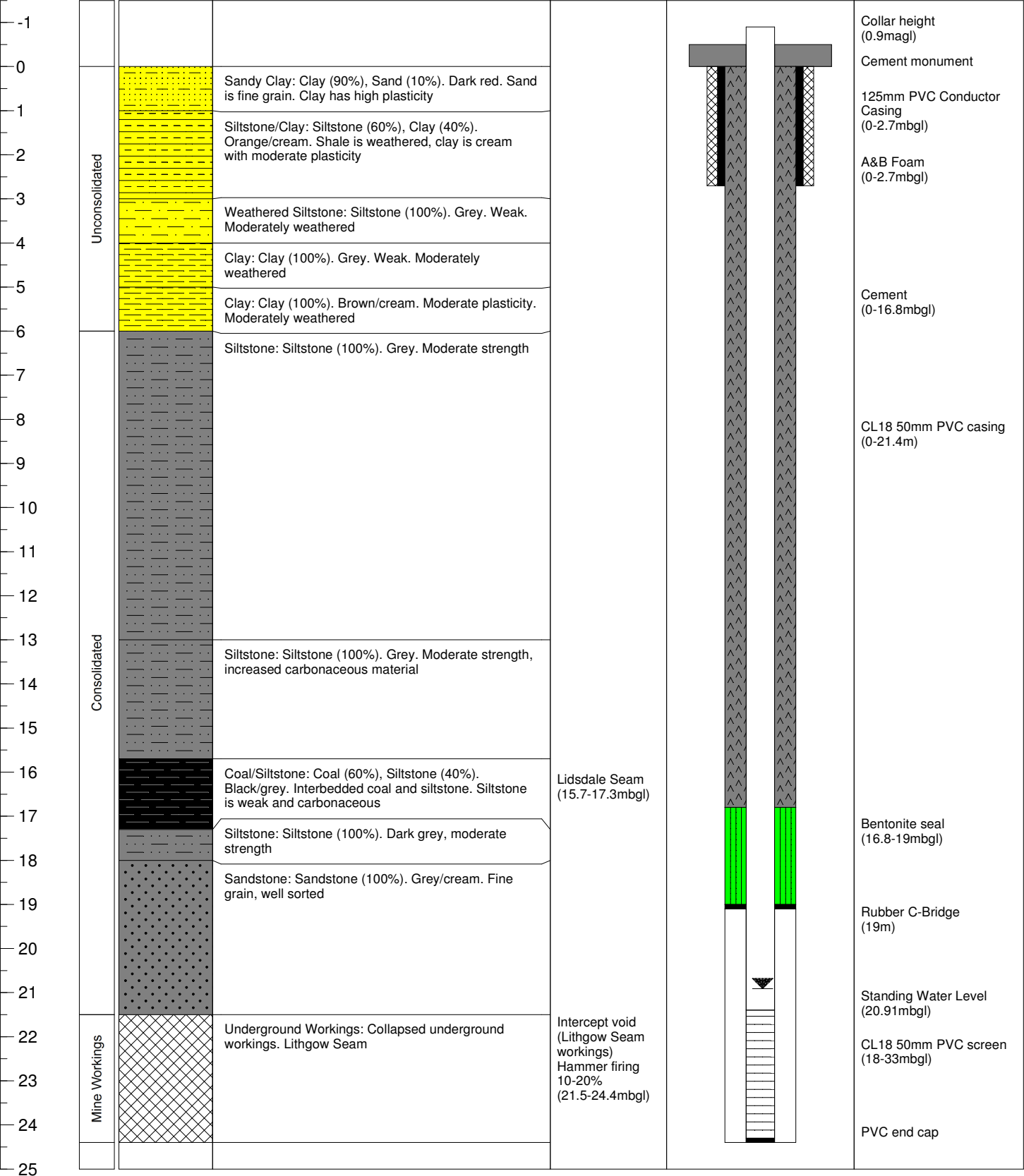
| Time | Depth to | Excess head, | h _t /h ₀ | Time | Depth to | Excess head, | h _t /h ₀ | Time | Depth to | Excess head, | h _t /h ₀ |
|-------|-----------------------|--|--------------------------------|-------|-----------------------|--|--------------------------------|-------|-----------------------|--|--------------------------------|
| (min) | water, h _w | h _t =H _w -h _w | | (min) | water, h _w | h _t =H _w -h _w | | (min) | water, h _w | h _t =H _w -h _w | |
| 0.000 | 20.064 | 0.734 | 1 | 2.600 | 19.386 | 0.056 | 0.076294 | 5.200 | 19.342 | 0.012 | 0.01635 |
| 0.050 | 20.012 | 0.682 | 0.9291553 | 2.650 | 19.38 | 0.05 | 0.06812 | 5.250 | 19.341 | 0.011 | 0.01499 |
| 0.100 | 19.708 | 0.378 | 0.5149864 | 2.700 | 19.383 | 0.053 | 0.072207 | 5.300 | 19.339 | 0.009 | 0.01226 |
| 0.150 | 19.595 | 0.265 | 0.3610354 | 2.750 | 19.375 | 0.045 | 0.061308 | 5.350 | 19.34 | 0.01 | 0.01362 |
| 0.200 | 19.605 | 0.275 | 0.3746594 | 2.800 | 19.375 | 0.045 | 0.061308 | 5.400 | 19.34 | 0.01 | 0.01362 |
| 0.250 | 19.591 | 0.261 | 0.3555858 | 2.850 | 19.38 | 0.05 | 0.06812 | 5.450 | 19.342 | 0.012 | 0.01635 |
| 0.300 | 19.586 | 0.256 | 0.3487738 | 2.900 | 19.377 | 0.047 | 0.064033 | 5.500 | 19.341 | 0.011 | 0.01499 |
| 0.350 | 19.577 | 0.247 | 0.3365123 | 2.950 | 19.372 | 0.042 | 0.057221 | 5.550 | 19.343 | 0.013 | 0.01771 |
| 0.400 | 19.575 | 0.245 | 0.3337875 | 3.000 | 19.37 | 0.04 | 0.054496 | 5.600 | 19.344 | 0.014 | 0.01907 |
| 0.450 | 19.566 | 0.236 | 0.3215259 | 3.050 | 19.369 | 0.039 | 0.053134 | 5.650 | 19.336 | 0.006 | 0.00817 |
| 0.500 | 19.56 | 0.23 | 0.3133515 | 3.100 | 19.371 | 0.041 | 0.055858 | 5.700 | 19.339 | 0.009 | 0.01226 |
| 0.550 | 19.556 | 0.226 | 0.3079019 | 3.150 | 19.374 | 0.044 | 0.059946 | 5.750 | 19.337 | 0.007 | 0.00954 |
| 0.600 | 19.546 | 0.216 | 0.2942779 | 3.200 | 19.367 | 0.037 | 0.050409 | 5.800 | 19.338 | 0.008 | 0.0109 |
| 0.650 | 19.539 | 0.209 | 0.2847411 | 3.250 | 19.362 | 0.032 | 0.043597 | 5.850 | 19.336 | 0.006 | 0.00817 |
| 0.700 | 19.535 | 0.205 | 0.2792916 | 3.300 | 19.364 | 0.034 | 0.046322 | 5.900 | 19.338 | 0.008 | 0.0109 |
| 0.750 | 19.523 | 0.193 | 0.2629428 | 3.350 | 19.361 | 0.031 | 0.042234 | 5.950 | 19.337 | 0.007 | 0.00954 |
| 0.800 | 19.521 | 0.191 | 0.260218 | 3.400 | 19.359 | 0.029 | 0.03951 | 6.000 | 19.34 | 0.01 | 0.01362 |
| 0.850 | 19.509 | 0.179 | 0.2438692 | 3.450 | 19.358 | 0.028 | 0.038147 | 6.050 | 19.341 | 0.011 | 0.01499 |
| 0.900 | 19.505 | 0.175 | 0.2384196 | 3.500 | 19.362 | 0.032 | 0.043597 | 6.100 | 19.337 | 0.007 | 0.00954 |
| 0.950 | 19.5 | 0.17 | 0.2316076 | 3.550 | 19.361 | 0.031 | 0.042234 | 6.150 | 19.338 | 0.008 | 0.0109 |
| 1.000 | 19.481 | 0.151 | 0.2057221 | 3.600 | 19.359 | 0.029 | 0.03951 | 6.200 | 19.338 | 0.008 | 0.0109 |
| 1.050 | 19.475 | 0.145 | 0.1975477 | 3.650 | 19.351 | 0.021 | 0.02861 | 6.250 | 19.336 | 0.006 | 0.00817 |
| 1.100 | 19.477 | 0.147 | 0.2002725 | 3.700 | 19.357 | 0.027 | 0.036785 | 6.300 | 19.337 | 0.007 | 0.00954 |
| 1.150 | 19.472 | 0.142 | 0.1934605 | 3.750 | 19.356 | 0.026 | 0.035422 | 6.350 | 19.34 | 0.01 | 0.01362 |
| 1.200 | 19.469 | 0.139 | 0.1893733 | 3.800 | 19.356 | 0.026 | 0.035422 | 6.400 | 19.337 | 0.007 | 0.00954 |
| 1.250 | 19.466 | 0.136 | 0.1852861 | 3.850 | 19.354 | 0.024 | 0.032698 | 6.450 | 19.337 | 0.007 | 0.00954 |
| 1.300 | 19.464 | 0.134 | 0.1825613 | 3.900 | 19.356 | 0.026 | 0.035422 | 6.500 | 19.335 | 0.005 | 0.00681 |
| 1.350 | 19.458 | 0.128 | 0.1743869 | 3.950 | 19.357 | 0.027 | 0.036785 | 6.550 | 19.335 | 0.005 | 0.00681 |
| 1.400 | 19.459 | 0.129 | 0.1757493 | 4.000 | 19.353 | 0.023 | 0.031335 | 6.600 | 19.337 | 0.007 | 0.00954 |
| 1.450 | 19.449 | 0.119 | 0.1621253 | 4.050 | 19.352 | 0.022 | 0.029973 | 6.650 | 19.335 | 0.005 | 0.00681 |
| 1.500 | 19.445 | 0.115 | 0.1566757 | 4.100 | 19.351 | 0.021 | 0.02861 | 6.700 | 19.337 | 0.007 | 0.00954 |
| 1.550 | 19.445 | 0.115 | 0.1566757 | 4.150 | 19.348 | 0.018 | 0.024523 | 6.750 | 19.338 | 0.008 | 0.0109 |
| 1.600 | 19.445 | 0.115 | 0.1566757 | 4.200 | 19.347 | 0.017 | 0.023161 | 6.800 | 19.34 | 0.01 | 0.01362 |
| 1.650 | 19.441 | 0.111 | 0.1512262 | 4.250 | 19.353 | 0.023 | 0.031335 | 6.850 | 19.349 | 0.019 | 0.02589 |
| 1.700 | 19.43 | 0.1 | 0.1362398 | 4.300 | 19.35 | 0.02 | 0.027248 | 6.900 | 19.338 | 0.008 | 0.0109 |
| 1.750 | 19.424 | 0.094 | 0.1280654 | 4.350 | 19.348 | 0.018 | 0.024523 | 6.950 | 19.335 | 0.005 | 0.00681 |
| 1.800 | 19.425 | 0.095 | 0.1294278 | 4.400 | 19.346 | 0.016 | 0.021798 | 7.000 | 19.336 | 0.006 | 0.00817 |
| 1.850 | 19.421 | 0.091 | 0.1239782 | 4.450 | 19.345 | 0.015 | 0.020436 | 7.050 | 19.338 | 0.008 | 0.0109 |
| 1.900 | 19.416 | 0.086 | 0.1171662 | 4.500 | 19.347 | 0.017 | 0.023161 | 7.100 | 19.337 | 0.007 | 0.00954 |
| 1.950 | 19.414 | 0.084 | 0.1144414 | 4.550 | 19.345 | 0.015 | 0.020436 | 7.150 | 19.335 | 0.005 | 0.00681 |
| 2.000 | 19.411 | 0.081 | 0.1103542 | 4.600 | 19.345 | 0.015 | 0.020436 | 7.200 | 19.339 | 0.009 | 0.01226 |
| 2.050 | 19.409 | 0.079 | 0.1076294 | 4.650 | 19.349 | 0.019 | 0.025886 | 7.250 | 19.338 | 0.008 | 0.0109 |
| 2.100 | 19.404 | 0.074 | 0.1008174 | 4.700 | 19.343 | 0.013 | 0.017711 | 7.300 | 19.336 | 0.006 | 0.00817 |
| 2.150 | 19.404 | 0.074 | 0.1008174 | 4.750 | 19.341 | 0.011 | 0.014986 | 7.350 | 19.334 | 0.004 | 0.00545 |
| 2.200 | 19.402 | 0.072 | 0.0980926 | 4.800 | 19.343 | 0.013 | 0.017711 | 7.400 | 19.331 | 0.001 | 0.00136 |
| 2.250 | 19.397 | 0.067 | 0.0912807 | 4.850 | 19.344 | 0.014 | 0.019074 | 7.450 | 19.331 | 0.001 | 0.00136 |
| 2.300 | 19.396 | 0.066 | 0.0899183 | 4.900 | 19.343 | 0.013 | 0.017711 | 7.500 | 19.338 | 0.008 | 0.0109 |
| 2.350 | 19.396 | 0.066 | 0.0899183 | 4.950 | 19.343 | 0.013 | 0.017711 | 7.550 | 19.338 | 0.008 | 0.0109 |
| 2.400 | 19.391 | 0.061 | 0.0831063 | 5.000 | 19.342 | 0.012 | 0.016349 | 7.600 | 19.331 | 0.001 | 0.00136 |
| 2.450 | 19.387 | 0.057 | 0.0776567 | 5.050 | 19.348 | 0.018 | 0.024523 | | | | |
| 2.500 | 19.379 | 0.049 | 0.0667575 | 5.100 | 19.34 | 0.01 | 0.013624 | | | | |
| 2.550 | 19.385 | 0.055 | 0.0749319 | 5.150 | 19.345 | 0.015 | 0.020436 | | | | |

APPENDIX A

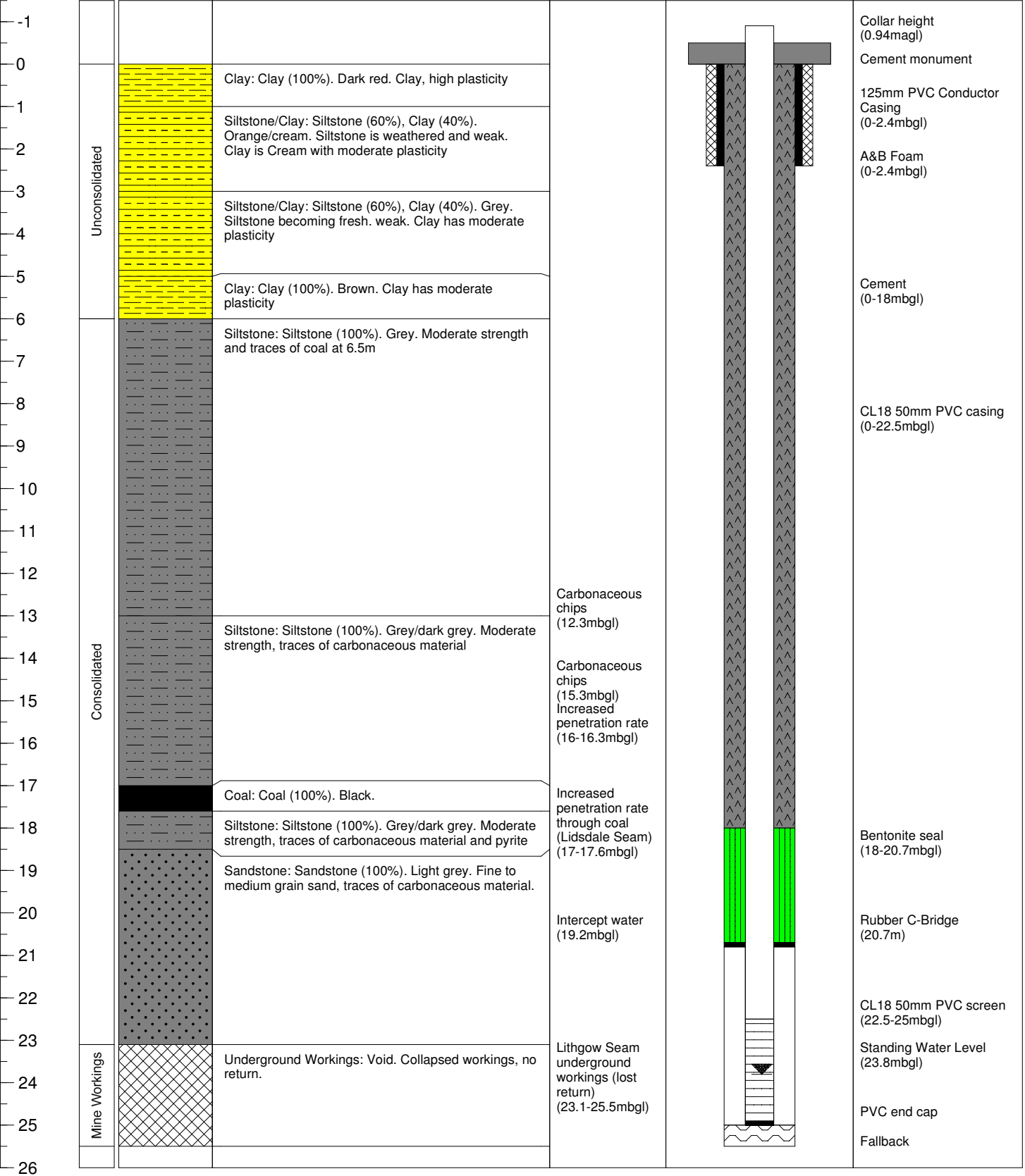
| | | | | | | | | |
|--|---------|----------------|-------------------------------|--|-------------------------|-----------------------------------|---------------------|--|
| <div><div>RPS</div><div>Level 9 17 York Street, Sydney NSW, 2000 Australia Tel: (+61) (02) 8270 8388 Fax: (+61) (02) 8270 8399</div></div> | | | COMPOSITE WELL LOG | | | Well No: BH07 | | |
| | | | Client: Centennial Coal | | | Project: Springvale Coal Services | | |
| | | | Commenced: 23/08/2013 | | Method: Air Hammer | | Area: Coal Services | |
| | | | Completed: 23/08/2013 | | Bit Record: 100mm | | Easting: 225492 | |
| | | | Drilled: Macquarie Drilling | | Bit Type: Hammer | | Northing: 6303102 | |
| | | | Logged By: Jason Carr | | Collar Height: 0.91magl | | Elevation: 943mAHD | |
| | | | Static Water Level: 20.24mbtc | | Date: 26/08/2013 | | Total Depth: 33mbgl | |
| Depth (mbgl) | Geology | Graphic Log | Lithological Description | | Field Notes | Well Completion | | |
| | | | | | | Diagram | Notes | |



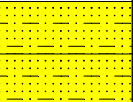

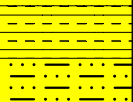
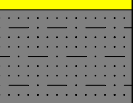
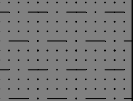
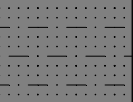
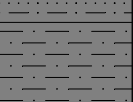
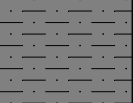
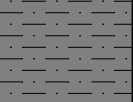
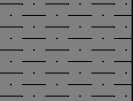
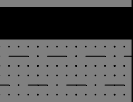
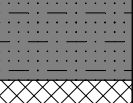
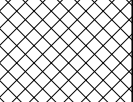
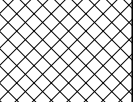
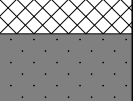

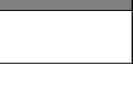

| | | | | | | | | |
|--|---------|----------------|-------------------------------|--|------------------------|-----------------------------------|-----------------------|--|
| <div>RPS</div> <div>Level 9 17 York Street, Sydney NSW, 2000 Australia Tel: (+61) (02) 8270 8388 Fax: (+61) (02) 8270 8399</div> | | | COMPOSITE WELL LOG | | | Well No: BH08 | | |
| | | | Client: Centennial Coal | | | Project: Springvale Coal Services | | |
| | | | Commenced: 20/08/2013 | | Method: Air Hammer | | Area: Coal Services | |
| | | | Completed: 21/08/2013 | | Bit Record: 100mm | | Easting: 225977 | |
| | | | Drilled: Macquarie Drilling | | Bit Type: Hammer | | Northing: 6304607 | |
| | | | Logged By: Jason Carr | | Collar Height: 0.9magl | | Elevation: 944mAHD | |
| | | | Static Water Level: 20.91mbtc | | Date: 22/08/2013 | | Total Depth: 24.4mbgl | |
| Depth (mbgl) | Geology | Graphic Log | Lithological Description | | Field Notes | Well Completion | | |
| | | | | | | Diagram | Notes | |



| | | | | | | | | |
|--|---------|-------------|-----------------------------|--|-------------------------|-----------------------------------|---------------------|--|
| <div><div>RPS</div><div>Level 9 17 York Street, Sydney NSW, 2000 Australia Tel: (+61) (02) 8270 8388 Fax: (+61) (02) 8270 8399</div></div> | | | COMPOSITE WELL LOG | | | Well No: BH09 | | |
| | | | Client: Centennial Coal | | | Project: Springvale Coal Services | | |
| | | | Commenced:19/08/2013 | | Method: Air Hammer | | Area: Coal Services | |
| | | | Completed: 20/08/2013 | | Bit Record: 100mm | | Easting: 225881 | |
| | | | Drilled: Macquarie Drilling | | Bit Type: Hammer | | Northing: 6304532 | |
| | | | Logged By: Jason Carr | | Collar Height: 0.94magl | | Elevation:953mAHD | |
| | | | Static Water Level:23.8mbtc | | Date: 26/08/2013 | | Total Depth: 25.5 | |
| Depth (mbgl) | Geology | Graphic Log | Lithological Description | | Field Notes | Well Completion | | |
| | | | | | | Diagram | Notes | |



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|--|---------|----------------|-----------------------------|--|-------------------------|-----------------------------------|---------------------|--|
| <div><div>RPS</div><div>Level 9 17 York Street, Sydney NSW, 2000 Australia Tel: (+61) (02) 8270 8388 Fax: (+61) (02) 8270 8399</div></div> | | | COMPOSITE WELL LOG | | | Well No: BH10 | | |
| | | | Client: Centennial Coal | | | Project: Springvale Coal Services | | |
| | | | Commenced: 21/08/2013 | | Method: Air Hammer | | Area: Coal Services | |
| | | | Completed: 23/08/2013 | | Bit Record: 100mm | | Easting: 225676 | |
| | | | Drilled: Macquarie Drilling | | Bit Type: Hammer | | Northing: 6304317 | |
| | | | Logged By: Jason Carr | | Collar Height: 0.91magl | | Elevation: 934mAHD | |
| | | | Static Water Level: Dry | | Date: 26/08/2013 | | Total Depth: 29mbgl | |
| Depth (mbgl) | Geology | Graphic Log | Lithological Description | | Field Notes | Well Completion | | |
| | | | | | | Diagram | Notes | |

| | | | | | | |
|----|-----------------------------------|---|--|---|---|--|
| -1 | | | | | | Collar height (0.91magl) |
| 0 | Unconsolidated |  | Sandy Clay: Clay (80%), Sand (20%).. Orange/cream. Clay has high plasticity. Sand is fine to medium grain and contain traces of weathered siltstone. Strongly weathered | |  | Cement monument |
| 1 | |  | Sandy Clay: Clay (60%), Sand (40%).. Cream/orange. Clay has high plasticity. Sand is fine to medium grain and contain traces of weathered siltstone. Strongly weathered | | | 125mm PVC Conductor Casing (0-2.8mbgl) |
| 2 | |  | | | | A&B Foam (0-2.8mbgl) |
| 3 | |  | | | | |
| 4 | Consolidated |  | Siltstone/Clay: Siltstone (80%), Clay (20%). Brown. Siltstone has moderate strength, moderately weathered. Clay has weak plasticity , traces of sand (possible contamination). | | | Cement (0-14mbgl) |
| 5 | |  | Clay/Sandstone: Clay (70%), Sandstone (30%). Orange/cream. Clay has moderate plasticity. Sandstone is fine grain and weathered. | | | |
| 6 | |  | Sandstone/Siltstone: Sandstone (80%), Siltstone (20%). Grey. Sandstone is fine grain and friable. Siltstone laminations, siltstone is weak. | | | CL18 50mm PVC casing (0-22mbgl) |
| 7 | |  | | | | |
| 8 | |  | | | | |
| 9 | |  | | | | |
| 10 | |  | Siltstone/Sandstone: Siltstone (80%), Sandstone (20). Grey. Siltstone is weak. Sandstone bands ,very fine to fine grain. Traces of Tuff and Coal | | | |
| 11 | |  | | | | |
| 12 | |  | | | | |
| 13 | |  | | | | |
| 14 | Subsidence zone and mine workings |  | | | | Bentonite seal (14-16.5mbgl) |
| 15 | |  | | | | |
| 16 | |  | | Carbonaceous chips (15.4mbgl) | | |
| 17 | | | | Tuff band (16.8mbgl) | | Rubber C-Bridge (16.5m) |
| 18 | | | Coal: Coal (100%). Black. Minor siltstone laminations. | Lidsdale Seam (17.4mbgl) | | |
| 19 | | | Sandstone/Siltstone: Sandstone (70%), Siltstone (30%). Grey. Sandstone is fine grain. Siltstone laminations. | Lost circulation (18.7mbgl) | | |
| 20 | | | | | | |
| 21 | | | | | | |
| 22 | | | Underground Workings: Lost Circulation | Lost circulation (20.7mbgl) | | CL18 50mm PVC screen (22-25mbgl) |
| 23 | | | | | | |
| 24 | | | | | | |
| 25 | | | | Hard Band (23.6mbgl) | | |
| 26 | | | | Void (24.6-25.6mbgl) | | PVC end cap |
| 27 | | | Marrangaroo Formation: Inferred Marrangaroo Formation - no sample return. | Consolidated Material (27-29mbgl) | | Fallback |
| 28 | | | | | | |
| 29 | | | | Lost blade bit and casing advancer down hole (Tagged top at 25.2mbgl) | | |
| 30 | | | | | | |