ACARP Project C26023

CoalLog Manual Version 3.1

Borehole Data Standard for the Australian Coal Industry

Brett J. Larkin (GeoCheck Pty Ltd) & David R. Green (PRIMED Global Pty Ltd)

September 2021

ACARP Project C26023

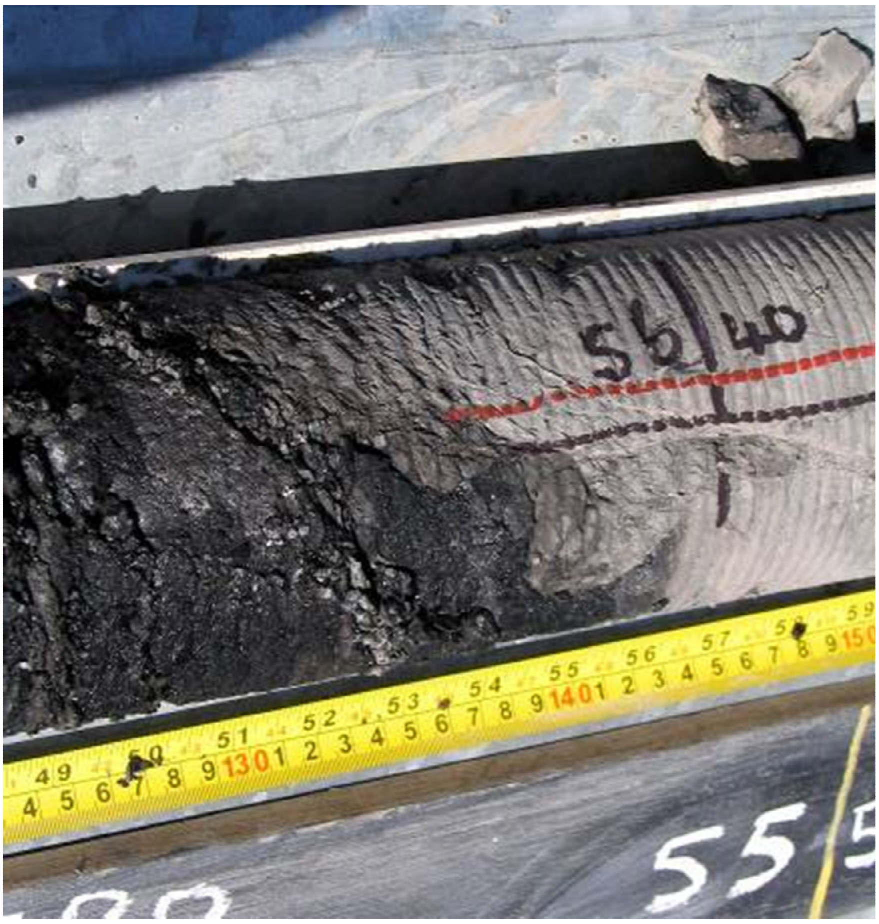
CoalLog v3.1 - Borehole Data Standard for the Australian Coal Industry

Table of Contents

1 Introduction

This Manual describes the CoalLog v3.1 - Borehole Data Standard for the Australian Coal Industry. This Standard enables the recording of consistent and standardised borehole data. It was developed cooperatively by representatives of coal exploration and mining companies, consultants, and software providers, in Queensland and New South Wales.

The manual, along with its associated downloadable files, includes the background and rationale for the development of this standard, the principles on which it was developed, and its key elements including code dictionaries, logging sheets and field definitions. The details of the data layout and use of the coding sheets is provided as well as descriptions of the codes. A full description of the field names, sizes, and other details are included to enable a standard database and transfer format protocol to be implemented.



2 The History of CoalLog

2.1 History of Coal Exploration Data Collection

Three mining software companies: Mincom, ECS (Minex software) and Maptek (Vulcan software) were established in Australia in the late 1970's. All three independently developed a system of coding sheets and dictionaries for the collection of coal exploration data. The three systems had a lot in common but also had significant differences. Many of these differences were quite arbitrary and purely the result of a lack of dialogue between the companies. From relatively early in their development, both ECS and Maptek enabled clients to define their own sheet formats and all three allowed clients to modify their dictionary. Even though many of ECS's and Maptek's clients had their own formats, the formats of all of the clients of each company were fairly similar. As Mincom probably had about 40% of all the clients including large players such as BHP and Rio Tinto, and all their clients were using the same data format their format, this format became the closest to a de facto standard within the industry.

There were numerous drawbacks with these formats:

1) The data collected today differs from that collected forty years ago when these systems were developed. For instance, portion and parish are generally not recorded now, nor are grain roundness, grain description or permeability and yet details such as environmental factors, depths of core runs and water flows are now routinely collected but are not adequately catered for in these systems.

2) Today data is often collected by contractors who regularly move between clients. Often, when moving, they face changes in logging sheet formats and dictionaries. Frequently the same code will even have different meanings in different companies' systems. For example, SO is soil in some dictionaries and sooty coal in others, KL is core loss in some and kaolinite in others, while silt and siltstone are SL and ST in some and the reverse in others. This is an unnecessary source of data errors.

3) Most of the previous formats and dictionaries were designed by one or two very experienced geologists, however, as no single geologist's experience covers every possible situation, all these formats and dictionaries have deficiencies. A system that has been properly peer reviewed is far less likely to contain such deficiencies.

4) When companies obtain a new property, previous data for the property often will not have the same format and dictionary as that used by the new owner. They, therefore, will generally undertake one of the following:
    - convert all of the previously collected data to their format. Generally, this is expensive and results in some loss of information. Due to changes in ownership and changes in data formats some of the data at some sites has been converted up to four times. With the widespread use of the CoalLog standard, data in such situations would only need to be converted once;
    - just strip out the tops and bottoms of seams, convert the lithologies and then discard the remaining data, or;
    - completely ignore previous data.

5) It is not uncommon for historical data to be obtained without an accompanying dictionary. In these circumstances, one commonly attempts to work out what software system was originally used to store the data, compares the codes to a dictionary from that system, and then make a reasonable guess for codes that do not concord with this dictionary. Another unnecessary source of errors.

6) When moving data from one software system to another, companies commonly face problems with different conventions for indicating multiple lithologies in a unit, multiple description lines for a lithology and comments.

7) Consultants spend vast amounts of time dealing with data being received in various formats and dictionaries from different clients or even from the same clients. The cost of this time is ultimately charged back to the clients.

2.2 Development of the Standard

Between 2007 and 2010, an initial prototype for the standard was developed by senior GeoCheck staff: Andries Pretorius, Gary Ballantine and Brett Larkin.

An initial meeting was held in June 2010 in Brisbane to present and discuss the prototype. Twenty-six people attended the meeting including representatives from:

- coal mining companies including Anglo American, Aquila, BMA, EndoCoal, New Hope and Rio Tinto
- geological data collection companies including Resolve and Moultrie
- geological software companies including acQuire, GeoCheck, Maptek, MicroMine, Mincom, Minex and Snowden
- consultants, including Paul Maconochie from GeoTek Solutions, John Simmons from Sherwood Geotechnical and Research Services, David Green from GEMS
- the Geological Survey of NSW

Useful feedback on the prototype was also received before the meeting by email from Centennial Coal and Palaris Mining.

At this meeting it was decided that:

1) the set of principles outlined in Chapter 3 should be adhered to in the development of this standard.

2) there needed to be a specification for the actual layout of the sheets and the dictionary as well as the transfer of data between software systems. In particular, how to handle several lithologies recoded in a single unit, how depths were handled (tops and bases or only bases and whether they were recorded just on the first line of a unit or all lines) and how comments were handled.

3) there should be a standard on what information is recorded in the “Parameter” block of LAS files and the format for this information.

4) to establish four subcommittees to develop the standard viz.:
   - geology sheet and dictionary subcommittee chaired by David Green
   - geotech sheet and dictionary subcommittee chaired by John Simmons
   - software data transfer subcommittee chaired by Brett Larkin
   - LAS header subcommittee.

Over the next eighteen months, the subcommittees met various times although the LAS subcommittee did not meet at all.

There was a final meeting of all the subcommittees together in January 2012 to ratify the initial version of the Manual and associated forms and dictionaries before publishing.

Following the release of Version 1.0, a review committee was established. It has met intermittently to review and ratify minor changes to the standard. Version 1.1 was released in September 2012, version 1.2 in November 2013, version 2.0 in March 2015, version 2.1 in October 2018 and this version 3.0 in May 2019. For Version 2.0 the main changes were the inclusion of a CoalLog Field Training Manual, expansion of the Drilling Sheet to include parameters for Depth calculations, recommended codes for Australian Coal Basins and their Seams and a standard set of Lithology patterns. For Version 3, the main changes were the inclusion of standards for: the transfer of Coal Quality data, information recorded in the ~Parameter section of Las files, colours for Lithology plotting colours and recommended codes for some of the more ephemeral items such as Drilling and Geophysical company. A full list of the changes for each version can be downloaded from the CoalLog webpage.

3 Design Principles

The Standard has been designed based on the following principles:

1. **It has been developed for the Australian coal industry.**

   Even though other commodities or countries may find it useful, their requirements have not been taken into account. It has been developed by representatives of the Australian coal industry for the Australian coal industry.

2. **Existing Standards have been incorporated.**

   All relevant existing standards for describing geological or geotechnical data have been incorporated wherever possible.

3. **It is for the capture of observations rather than interpretations.**

   Fields and codes have been developed only for the capture of observations. Interpretation of the data is not covered by this Standard.

4. **Minimize amount of data entry.**

   Fields and codes have been designed with the aim of minimizing the number of keystrokes required to enter data.

5. **The coding sheets and data table layouts are flexible and comprehensive.**

   The Standard defines the fields that can be included in a coding sheet or data table. The order can be modified and fields can be omitted except for a very limited number of compulsory fields.

6. **The fields and dictionary codes are extremely comprehensive.**

   All required drilling, geological, and geotechnical data from a borehole can be recorded in the Standard. All fields included in the Standard are of sufficient size and style to record logging data in common use. Fields which use codes from the dictionary have specified field lengths. Other fields, such as Hole Name, Depth, Seam Name etc., have specified maximum field lengths and for numerical fields a maximum number of places after the decimal point (see Appendix D). The dictionary includes all necessary codes to enable comprehensive logging of boreholes in Australian coalfields (see Appendix E). The Standard also includes descriptions for the dictionary codes (Chapter 5).

7. **Recommended coding sheets are provided.**

   A coding sheet containing all the fields at their maximum field lengths will not fit onto a single A4 sheet of paper. Coding sheets with recommended fields less than the maximum which fit onto a single A4 sheet of paper have been provided (see Appendix D).

8. **The fields, field names and specifications, and dictionary codes are fixed.**

   Unique names have been given to Dictionary Categories and Data Fields. Additional fields may be added but may be ignored by other systems. Any extract from a database which contains additional fields must give these fields a name starting with the characters *Custom_* or *NC_*. Dictionary items cannot be changed or added to the standard set for each Data Field.

9. Dictionary category names are unique across all data types.

Where the same dictionary category name is used in more than one data type, it refers to the same set of dictionary codes, For example, the category **Defect_Type** is used by both the Lithology and Geotechnical sheets and has a common set of codes for both sheets.

10. Codes for specific items are consistent across all fields wherever possible.

Where a description occurs in more than one coded field, it should have the same code in each field that it used. For example, "quartz" has the same code QZ in Lithologies, Minerals, Defect Infill Types, and for "quartzose" in Adjectives.

11. The most commonly used code is retained except where there is a conflict within the field.

As far as practically possible, the codes that were in most common use have been included in the Standard except where they are inconsistent (see previous principle) or are in use for another item.

12. There is only one way to record a particular feature.

Even though the standard is designed to be as comprehensive as possible, it also attempts to remove any redundancies between fields, and to minimise the amount of information stored in the **Adjective** or **Comments** fields. Information that can be stored in a specific field (eg secondary lithology, minerals, geotechnical features, etc) should not be recorded elsewhere. This has resulted in a substantial reduction in the number of valid codes available in **Adjectives** compared to most previous systems. This should also facilitate database searches and data compilation.

13. A reference dictionary is provided for some fields.

A number of fields contain information that may be specific to the locality or time of data collection and so are difficult to enforce a standard set of codes. These fields include:

- **Survey_Company**, **Geolog_Organiz**, and **Geophys_Company** on the Header sheet
- **Drill_Company** and **Rig_Type** on the Drilling sheet
- **Seam** and **Horizon** on the Lithology sheet
- **Lab_Name** on the Sample Dispatch, Quality – Results, Reflectance and Test Specifications sheets

Instead CoalLog includes a Reference Dictionary for these fields. This includes many but not all possible options for these fields. Users should use the Reference Dictionary when designing their own dictionaries for these fields. Where the user has items that are not currently in the Reference Dictionary, they can request a new code for their item by sending an email to coalLog@ausimm.com. Note when creating codes for these fields that the Standard specifies recommended and maximum sizes for these fields.

14. Fields should record information unique to that record.

Redundant information should not be included in fields such as Seam and Sample Number, whose contents are not defined by the Standard. For example:

- Seam Name should not include the Ply Name and vice versa
- Sample Number should not include the Hole Name

If required, it is always possible to later combine information recorded in two separate fields into a single item but it is often very difficult if not impossible to modify or extract separate items of data that have been stored together.

15. Dates are recorded in DD/MM/YYYY format.

Note that in this format the "/" is included in the date.

16. Only the "base" or "to" depth is recorded.

Base depths of lithological units and rock mass units are recorded on the CoalLog coding sheets as it is assumed that the "top" or "from" depth is the previous "base" depth. Where a "top" depth is not equal to the previous "base" depth, the user is required to add an additional record (eg Lithology = Not Logged (NL) or Not Recorded (NR)) explaining why no data exists for the interval. The base or middle depth of a defect can be recorded in the geotech sheet, but which of these conventions has been used must be clearly specified.

17. Secondary lithologies should be recorded where they comprise >10% of a unit.

To promote the collection of lithology data that can be searched, extracted, plotted, and used, the Standard encourages the recording of any distinct lithology which comprises >10% of a logged unit to be individually described. Most lithology codes have been removed from **Adjectives**. A **Litho_Perc** must be recorded for each Lithology and these must add up to a total of 100% for the unit.

18. Geotechnical fields on the Lithology sheet should only be used when the Geotechnical sheet is not used.

If detailed information is collected for individual geotechnical features (on the Geotechnical coding sheet) it is expected that a Lithology sheet will also be completed, but it is not necessary to fill in the Geotechnical fields of this sheet.

19. All dips are recorded relative to the perpendicular to the core axis.

That is, if the borehole is vertical then the dip of any feature is measured from the horizontal.

20. Provision has been made for some frequently used historical codes to be retained but they should not be used for current data collection.

Some dictionary items are included for historical data but should not be used for current data collection. For example, the term "Coal Inferior" is too vague as it is unclear what it is inferior to or how it is inferior. Is it because it is stony, weathered, heat affected, or something else? Consequently, it cannot be easily converted to one of the "standard" codes and thus needs to be retained. Dictionary items that are only for historical data are shown in the dictionary in a grey font rather than black.

21. Software using the standard must be able to support the full coding sheet formats and dictionaries.

The design specifications of CoalLog (Appendix D) must be supported by any compliant software directly or by provision of conversion scripts to enable direct transfer of data.

22. The data transfer format requires the records to be in the correct order.

The records in the data transfer format must be in order, that is their depths must increase down the file and for Lithology data, units with multiple lines must have the multiple lines in order. However, the Standard for the data transfer format provides compulsory fields which can be used to sort records into order before importing as long as these fields have been correctly completed.

4 Data Layout

The CoalLog standard provides data layouts (Appendix D) for hand written manual logging in situations where computerised field data capture techniques may not be available. The suggested templates are based on a standard A4 sheet size for the following data types:

- Header
- Geologists
- Casing
- Cementing
- Drilling Details
- Drilling Core Runs
- Lithology
- Sample Dispatch
- Water Observations
- Rock Mass Units and Defects
- Point Load Tests.

This chapter provides examples of data recorded on the recommended sheet formats to demonstrate these layouts. Fields that must exist and contain data are shown with a coloured background on the logging sheets. The layout of the sheets can be modified including changing the order of fields and for non-coded data the size of the fields, however, field sizes can be no greater than the maximum for the field as shown in the CoalLog Logging Sheet Specifications. Even though on most sheets **BoreHole_Name** and **From_Depth** are not included for each individual line on the logging sheet, they need to be included for each record in their corresponding CoalLog data transfer file format. For more information on the fields for each data format including field name, field type, recommended and maximum field size and which fields are required to exist and contain data see the CoalLog Logging Sheets Specifications downloadable spreadsheet.

For all data types, a comment can be recorded as a separate line (or lines) on the logging sheet immediately following the unit it references. In CoalLog, there is no limit on the size of individual comments and they may contain non-printable characters such as an <Enter> (generated by pressing the Enter key on the keyboard). Be aware though that some database systems that may be used to store the data may have a limit on the size of comments and/or may not be capable of including non-printable characters such as an <Enter>. These systems need to be able to process a data transfer file with comments larger in size than their maximum and/or non-printable characters.

4.1 Header, Geologists, Casing and Cementing Logs

Figure 4.1 shows a completed Hole Status Sheet which includes Header, Geologists, Casing and Cementing Logs. In previous systems, the name of the geologist who logged the hole, the casing data, and cementing data were often recorded as part of the header but this had the disadvantage that there was only space for a single value for the entire hole. If any of these items changed going down the hole, there was no facility for recording multiple values and their depths.

For the Header log, **Borehole_Name** is the only required data. If **Easting** or **Northing** is specified then **Geodetic_Datum** must also be specified. **Date Started** and **Date Completed** fields can be omitted from the Header data if this information is recorded in the Drilling Log. If **Easting** or **Northing** is specified then **Geodetic_Datum** must also be specified.

For the Geologists, Casing and Cementing logs, **From_Depth** and **To_Depth** are required on every line. However, for the Geologists and Casing logs the **To_Depths** should increase going down the log whereas for Cementing logs they should decrease. Also, for Geologists and Cementing logs there should not be any overlapping intervals whereas overlapping intervals are allowable in a Casing log where one length of casing has been inserted inside a wider length of casing.

4.2 Drilling Logs

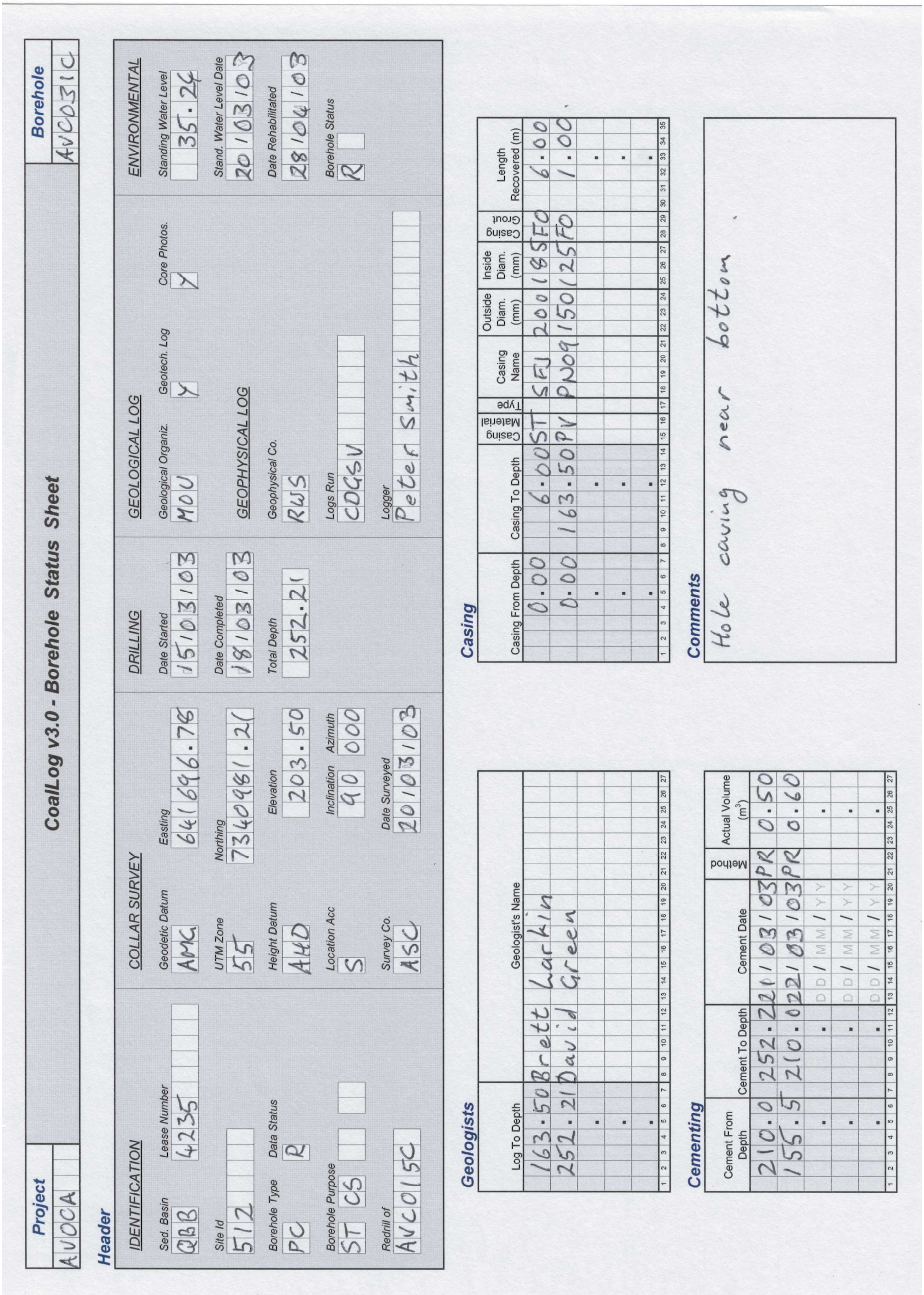
Figures 4.2 and 4.3 show completed Drilling Details and Drill Core Run sheets. Even though this information needs two paper sheets for recording, it should all be entered up into a single database table (Figure 4.4). Note that a new line needs to be entered into this log every time any of the fields change in value.

From_Depth, To_Depth (ie the Driller's To Depth), **Drill_Date** and **Bit_Type** are required on every line and a **Run_No**. is required on every line that has core run data, (i.e. **Geo_To_Depth**, **Recov_Length**, **Run_Photo**, **Drill_Run_Len**, **Run_Loss_Gain** and/or **Cum_Loss_Gain)**.

For non-historical data, where the **Bit_Type** is a coring bit, that is one of:

DW - diamond core (wireline)
PC – poly crystalline diamond core (conventional)
PW – ploy crystalline diamond core (wireline)
TC – tungsten carbide core (conventional)

either **Core_Size** or **Drill_Size_Name** must be specified



Project: AVOCA
Borehole: AVC031C

CoalLog v3.0 - Borehole Status Sheet

Header

IDENTIFICATION
- Sed. Basin: QBB
- Lease Number: 4235
- Site Id: 512
- Borehole Type: PC
- Data Status: R
- Borehole Purpose: ST CS
- Redrill of: AVC015C

COLLAR SURVEY
- Geodetic Datum: AMG
- Easting: 641696.76
- UTM Zone: 55
- Northing: 7340961.21
- Height Datum: AHD
- Elevation: 203.50
- Location Acc: S
- Inclination: 90
- Azimuth: 000
- Survey Co.: ASC
- Date Surveyed: 20/03/03

DRILLING
- Date Started: 15/03/03
- Date Completed: 18/03/03
- Total Depth: 252.21

GEOLOGICAL LOG
- Geological Organiz.: MOU
- Geotech. Log: Y
- Core Photos.: Y

GEOPHYSICAL LOG
- Geophysical Co.: RWS
- Logs Run: CDGSV
- Logger: Peter Smith

ENVIRONMENTAL
- Standing Water Level: 35.26
- Stand. Water Level Date: 20/03/03
- Date Rehabilitated: 28/04/03
- Borehole Status: R

Geologists

Log To Depth	Geologist's Name
163.50	Brett Larkin
252.21	David Green

Casing

Casing From Depth	Casing To Depth	Casing Material	Type	Casing Name	Outside Diam. (mm)	Inside Diam. (mm)	Casing Grout	Length Recovered (m)
0.00	6.00	ST		SFJ	200	185	FO	6.00
0.00	163.50	PV		PN09	150	125	FO	1.00

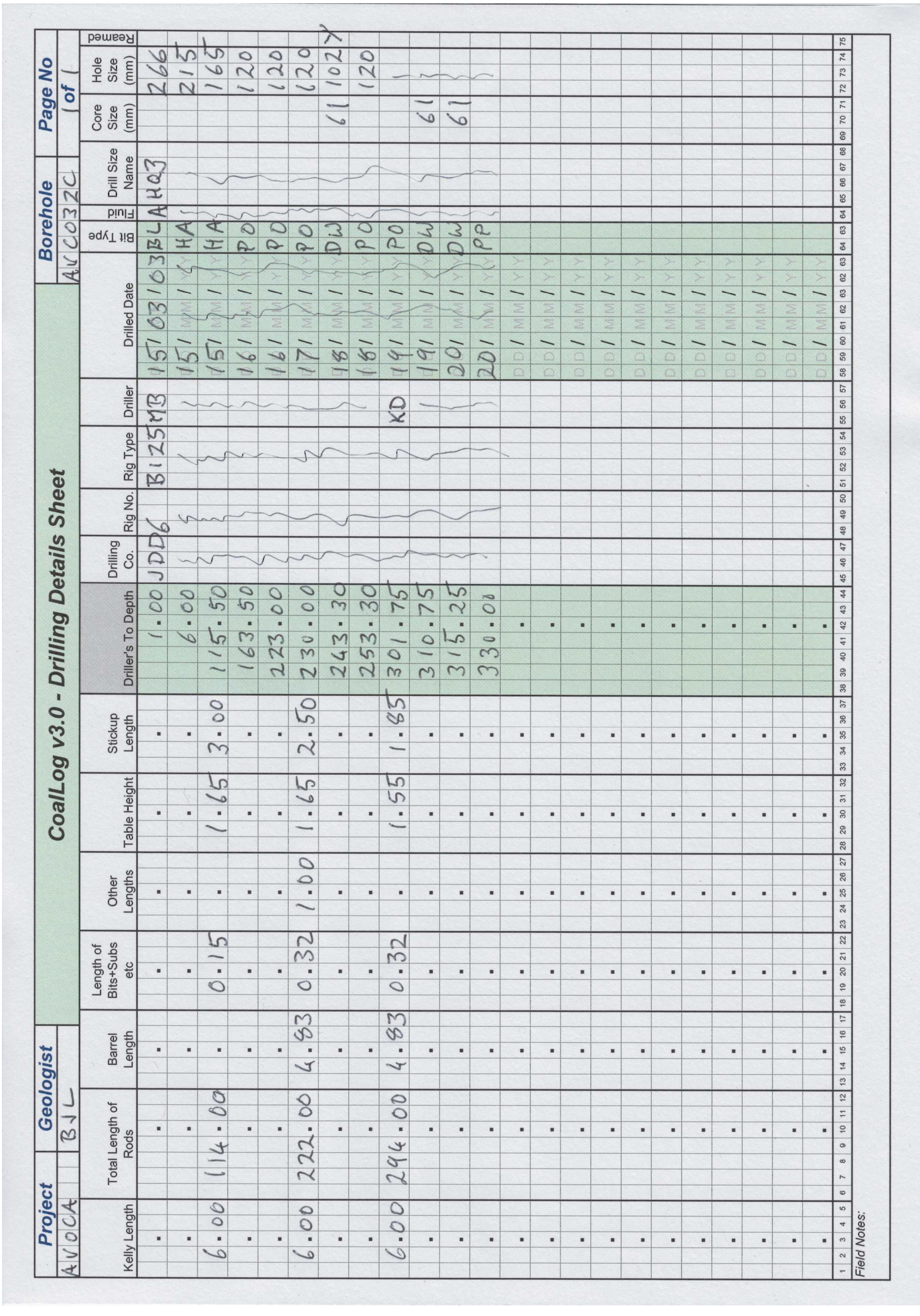
Cementing

Cement From Depth	Cement To Depth	Cement Date	Method	Actual Volume (m^3)
210.0	252.2	21/03/03	PR	0.50
155.5	210.0	22/03/03	PR	0.60

Comments

Hole caving near bottom.

Figure 4.1: Hole Status Sheet with example data



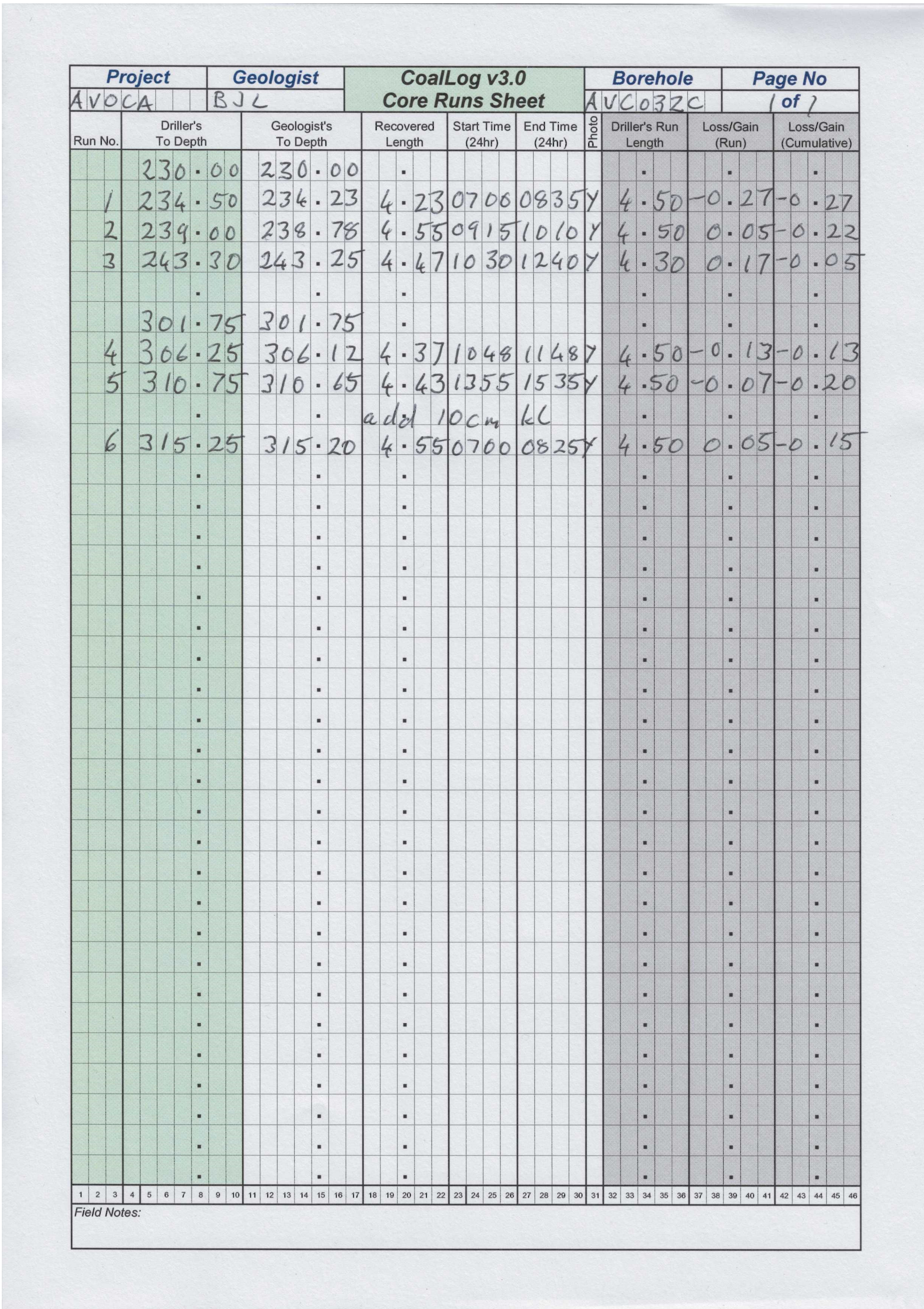
CoalLog v3.0 - Drilling Details Sheet

Project: AVOCA | Geologist: BJL | Borehole: AVC032C | Page No: 1 of 1

Kelly Length	Total Length of Rods	Barrel Length	Length of Bits+Subs etc	Other Lengths	Table Height	Stickup Length	Driller's To Depth	Drilling Co.	Rig No.	Rig Type	Driller	Drilled Date	Bit Type	Fluid	Drill Size Name	Core Size (mm)	Hole Size (mm)	Reamed
							1.00	JDD	6	B125	MB	15/03/03	BL	A	HQ3		266	
							6.00					15/ /	HA				215	
6.00	114.00		0.15		1.65	3.00	115.50					15/ /	HA				165	
							163.50					16/ /	PO				120	
							223.00					16/ /	PO				120	
6.00	222.00	4.83	0.32	1.00	1.65	2.50	230.00					17/ /	PO				120	
							243.30					18/ /	DW			61	102	Y
							253.30					18/ /	PO				120	
6.00	294.00	4.83	0.32		1.55	1.85	301.75				KD	19/ /	PO					
							310.75					19/ /	DW			61		
							315.25					20/ /	DW			61		
							330.00					20/ /	PP					

Field Notes:

Figure 4.2: Drilling Details Sheet with example data



Project	Geologist	CoalLog v3.0 Core Runs Sheet	Borehole	Page No
AVOCA	BJL		AVC032C	1 of 1

Run No.	Driller's To Depth	Geologist's To Depth	Recovered Length	Start Time (24hr)	End Time (24hr)	Photo	Driller's Run Length	Loss/Gain (Run)	Loss/Gain (Cumulative)
	230.00	230.00							
1	234.50	234.23	4.23	0700	0835	Y	4.50	-0.27	-0.27
2	239.00	238.78	4.55	0915	1010	Y	4.50	0.05	-0.22
3	243.30	243.25	4.47	1030	1240	Y	4.30	0.17	-0.05
	301.75	301.75							
4	306.25	306.12	4.37	1048	1148	Y	4.50	-0.13	-0.13
5	310.75	310.65	4.43	1355	1535	Y	4.50	-0.07	-0.20
			add 10cm	kc					
6	315.25	315.20	4.55	0700	0825	Y	4.50	0.05	-0.15

Field Notes:

Figure 4.3 Core Runs Sheet with example data

Kelly Length	Total Length of Rods	Barrel Length	Length of Bits+Subs etc	Other Lengths	Table Height	Stickup Length	Driller's From Depth	Driller's To Depth	Drilling Co.	Rig No.	Rig Type	Driller	Drilled Date	Start Time (24hr)	End Time (24hr)	Bit Type	Fluid	Drill Size Name	Core Size (mm)	Hole Size (mm)	Reamed	Run No.	Recovered Length	Geologist's Run From Depth	Geologist's Run To Depth	Photo	Driller's Run Length	Loss/Gain (Run)	Loss/Gain (Cumulative)	Comments
.	.	.	.	.	.	.	0.00	1.00	JDD	6	B125	Merv Besgrove	15/03/2003			BL	A	HQ3		266			.	.	.		.	.	.	
.	.	.	.	.	.	.	1.00	6.00	JDD	6	B125	Merv Besgrove	15/03/2003			HA	A	HQ3		215			.	.	.		.	.	.	
6.00	114.00	.	0.15	.	1.65	3.00	6.00	115.50	JDD	6	B125	Merv Besgrove	15/03/2003			HA	I	HQ3		165			.	.	.		.	.	.	
.	.	.	.	.	.	.	115.50	163.50	JDD	6	B125	Merv Besgrove	16/03/2003			HA	I	HQ3		165			.	.	.		.	.	.	
.	.	.	.	.	.	.	163.50	223.00	JDD	6	B125	Merv Besgrove	16/03/2003			PO	I	HQ3		120			.	.	.		.	.	.	
6.00	222.00	4.83	0.32	1.00	1.65	2.50	223.00	230.00	JDD	6	B125	Merv Besgrove	17/03/2003			PO	I	HQ3		120			.	.	.		.	.	.	
.	.	.	.	.	.	.	230.00	234.50	JDD	6	B125	Merv Besgrove	18/03/2003	0700	0835	DW	I	HQ3	61	102	Y	1	4.23	230.00	234.23	Y	4.50	-0.27	-0.27	
.	.	.	.	.	.	.	234.50	239.00	JDD	6	B125	Merv Besgrove	18/03/2003	0915	1010	DW	I	HQ3	61	102	Y	2	4.55	234.23	238.78	Y	4.50	0.05	-0.22	
.	.	.	.	.	.	.	239.00	243.30	JDD	6	B125	Merv Besgrove	18/03/2003	1030	1240	DW	I	HQ3	61	102	Y	3	4.47	238.78	243.25	Y	4.30	0.17	-0.05	
.	.	.	.	.	.	.	243.30	253.30	JDD	6	B125	Merv Besgrove	18/03/2003			PO	I	HQ3		120			.	.	.		.	.	.	
6.00	294.00	4.83	0.32	.	1.55	1.85	253.30	301.75	JDD	6	B125	Mark Hill-Weber	19/03/2003			PO	I	HQ3		120			.	.	.		.	.	.	
.	.	.	.	.	.	.	301.75	306.25	JDD	6	B125	Mark Hill-Weber	19/03/2003	1048	1148	DW	I	HQ3	61	120		4	4.37	301.75	306.12	Y	4.50	-0.13	-0.13	
.	.	.	.	.	.	.	306.25	310.75	JDD	6	B125	Mark Hill-Weber	19/03/2003	1355	1535	DW	I	HQ3	61	120		5	4.43	306.12	310.65	Y	4.50	-0.07	-0.20	add 10cm KL
.	.	.	.	.	.	.	310.75	315.25	JDD	6	B125	Mark Hill-Weber	20/03/2003	0700	0825	DW	I	HQ3	61	120		6	4.55	310.65	315.25	Y	4.50	0.05	-0.15	
.	.	.	.	.	.	.	315.25	330.00	JDD	6	B125	Mark Hill-Weber	20/03/2003			PP	I	HQ3		120			.	.	.		.	.	.	

Figure 4.4: Single Database Table with the data from Figures 4.2 and 4.3

4.3 Lithology Logs

Figure 4.5 shows a completed Lithology Log. No fields on the logging sheets are required to contain data on every line although as explained in the 'Continuation Lines' section below, values are required in certain fields on some lines.

Note that the requirements for a CoalLog Lithology data transfer file are slightly more complex than those for the logging sheet. The data transfer file requires **Borehole_Name**, **From_Depth**, **To_Depth** and a **Record_Seq_Flag** on every record and **Litho_Perc** on every record with a **Litho_Type** The logging sheet requirements are simpler than those for the data transfer file format in order to reduce the amount of data recording and entry for the geologist. It is expected that the additional required information in the data transfer file will be automatically generated by the computer when producing the file.

<u>Continuation Lines</u>

Most coal exploration data systems also have facilities for recording comments similar to the one at the bottom of Figure 4.5. The data systems will often require a specific continuation flag field for the handling of multiple lines and comments but these are not required for the CoalLog logging sheets. However, a **Record_Seq_Flag** is required in the CoalLog Lithology data transfer file (see Chapter 7, Data Transfer Format). Whilst a continuation flag field has not been included in the CoalLog Lithology logging sheets, some users may still need to add one to their logging sheets for use by their specific data systems.

For units with a single lithology, the **Litho_Perc** field may be left blank when recording on logging sheets but needs to be included and set to 100% when the data is exported in CoalLog data transfer format.

It is common practice in the Australian coal industry to record lithological units consisting of more than a single lithology (for example, the unit with a **To_Depth** of 78.23 in Figure 4.5), and to record more detail for a lithology than will fit onto a single line (for example, the unit with a **To_Depth** of 48.05 in Figure 4.5). For units with multiple lithologies, **Litho_Perc** is required on every line with a **Litho_Type**. For each secondary **Litho_Type** in a unit, a **Litho_Interrel** is required on one of the lines of the preceding **Litho_Type**. This requirement can be omitted for the encoding of historical data where the interrelationship was never recorded. Where the relationship is unclear such as chipped sections of a hole, IM for intermixed should be used. The sum of the **Litho_Perc**'s for the unit must add up to 100%.

Where the description for a unit does not fit onto a single line, it may be continued onto the next line. In both the case of multiple lithology lines and multiple description lines, the lines subsequent to the first line in a lithological unit may have their **To_Depth** as blank on the logging sheets but need to have **To_Depth** repeated on every line of the unit in a CoalLog data transfer file.

<u>Horizon Field on Lithology Sheet</u>

There is a separate field on the Lithology sheet for recording horizons. A horizon is a zero thickness item such as base of Tertiary, base of weathering, water level, or top of a particular formation. It is entered on the record whose **To_Depth** matches the depth of the horizon. To specify a horizon, it may be necessary to split a lithological unit in two if it occurs in the middle of a lithological unit. For example in Figure 4.5, as the water level (BHWL) occurs at a depth of 7.00m within the unit between 1.00m and 10.00m, the unit has been split at 7.00m so that the water level horizon can be entered.

Rather than having a separate formation name column, users who want to record formations should do so by entering either the “top of” and/or “base of” the formation in the **Horizon** field. These horizons should start with a “T” for “top of” or a “B” for “base of” followed by a mnemonic for the formation. The CoalLog Reference Dictionary lists formations commonly encountered in Australian coal fields but it may be necessary for users to add to this list in their own dictionaries.

To record horizons historically, data formats required the user to create a separate zero thickness unit on which the **Horizon** was recorded in the **Seam** field and the remainder of the record for the unit was left blank. Having a separate field for horizon information has the following advantages:

- It eliminates any need for zero thickness units enabling software to flag any zero thickness units as erroneous;
- As zero thickness units are now not valid, the same base depth repeated on subsequent lines of a logging sheet can be used as a flag to indicate the continuation of a unit;
- It separates **Horizon** information from seam/stratigraphic information. When examining data by eye or with computer software, it can be confusing when the two types of information are recorded in the same field, especially when there is a **Horizon** such as ’Water Level’ in the middle of a seam.

Lithology Sample Number

When taking core samples, the sample number assigned to the sample should be entered in the **Sample_No** field of the lithology sheet. This field is stored as a character string rather than a number therefore it should be noted that a **Sample_No** such as 000501 will not match a **Sample_No** of 501 in laboratory results. If a sample starts or ends in the middle of a lithology unit, the unit will need to be split at this point in the data so that the correct start or end depth can be recorded. For example, the carbonaceous mudstone between 78.23m and 80.04m in Figure 4.5 has been split at 79.54m so that the start of **Sample_No** 000501 can be recorded.

Lithological Qualifier

A **Litho_Qual** field is included in the Lithology Sheet to control how a lithology is displayed on a detailed graphic log. It is only used for coals, unconsolidated sediments, alluvia, conglomerates, sandstones, tuffs, tuffites, breccias and fault breccias:

- for coals, it includes brightness of the coal, or whether it is cindered, fusainous, sapropelic, etc.
- for unconsolidated sediments, it includes clayey, silty, sandy, gravelly (for example, a gravel or silt may be described as sandy), and size categories for gravels and sands,
- for conglomerates and alluvia, it contains clast sizes
- for sandstones, tuffs, tuffites, breccias and fault breccias, it contains grain sizes

This field enables software to produce a graphic log with the option of displaying lithologies just based on their lithology code, or on their lithology code and lithology qualifier combined. Similarly, it also enables reports or statistics to be generated on the lithology code alone, or the lithology code and qualifier combined.

Geotech Fields on Lithology Sheet

It is recommended that a full geotechnical log be completed on all cored sections of boreholes. However, where a full geotechnical log is not being recorded then the geotechnical characteristics of the rock can be recorded in the **Est_Strength**, **Bed_Spacing**, **Defect_Type**, **Defect_Intact**, **Defect_Spacing**, and **Defect_Dip** fields of the Lithology Sheet. When a full geotechnical log is being recorded these fields should be omitted from the Lithology log, although **Weathering** should still be recorded in the Lithology log as well as the Geotechnical Log.

Defects

Each Defect entry can consist of **Defect_Type**, **Defect_Intact**, **Defect_Spacing** and **Defect_Dip**. If the entry refers to a single defect then the **Defect_Spacing** must be left blank. For example, the fault within the siltstone at 31.41m in Figure 4.5. If the entry refers to a set of defects then a **Defect_Spacing** must be entered. For example, the joints within the basalts at 24.53m and 28.92m in Figure 4.5.

Defect Intact

If defects are intact then an "I" must be entered in the **Defect_Intact** field. For example, the intact fault within the siltstone at 31.41m in Figure 4.5. The **Defect_Intact** field should be left blank for defects that are not intact.

Defect and Bedding Dip

The general convention in the Australian coal industry is that all dip angles should be recorded relative to the perpendicular to the core axis that is relative to the horizontal for vertical holes. The user may though elect to either use this convention when measuring angles or measure them relative to the core axis itself. However, it must be clearly stated which convention has been used and there must be consistency across the user's entire data set.

Defect Dips

Where all the defects in a set of defects have the same dip, that dip is entered in the **Defect_Dip** field on the same line as its defect description. For example, in the basalt with a **To_Depth** of 24.53m in Figure 4.5, two sets of joints are shown. One with moderately narrow spacing (20-60mm) and a dip of 20° and the other widely spaced (200-600mm) with a dip of 60°. Where the dips of the defects in a set of defects range between two angles, then both the minimum and the maximum dips should be recorded. The minimum dip angle must be entered in the **Defect_Dip** field on the same line as its **Defect_Type**, and the maximum dip angle should be entered on the next line and the **Defect_Type** and **Defect_Spacing** fields on this line left blank. For example, the moderately wide spaced joints set of joints ranging in dip between 40° and 55° in the basalt with a **To_Depth** of 28.92m in Figure 4.5.

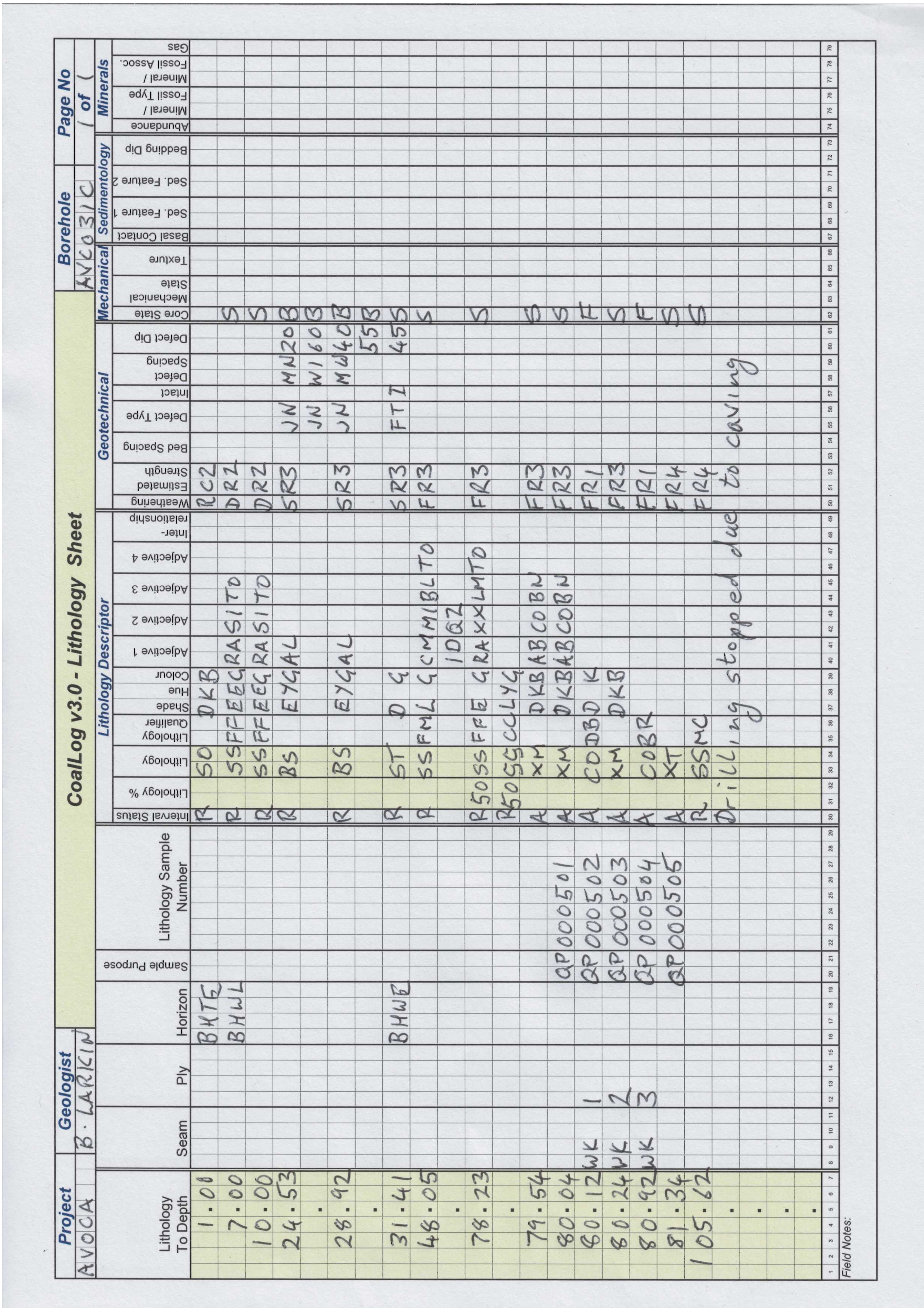
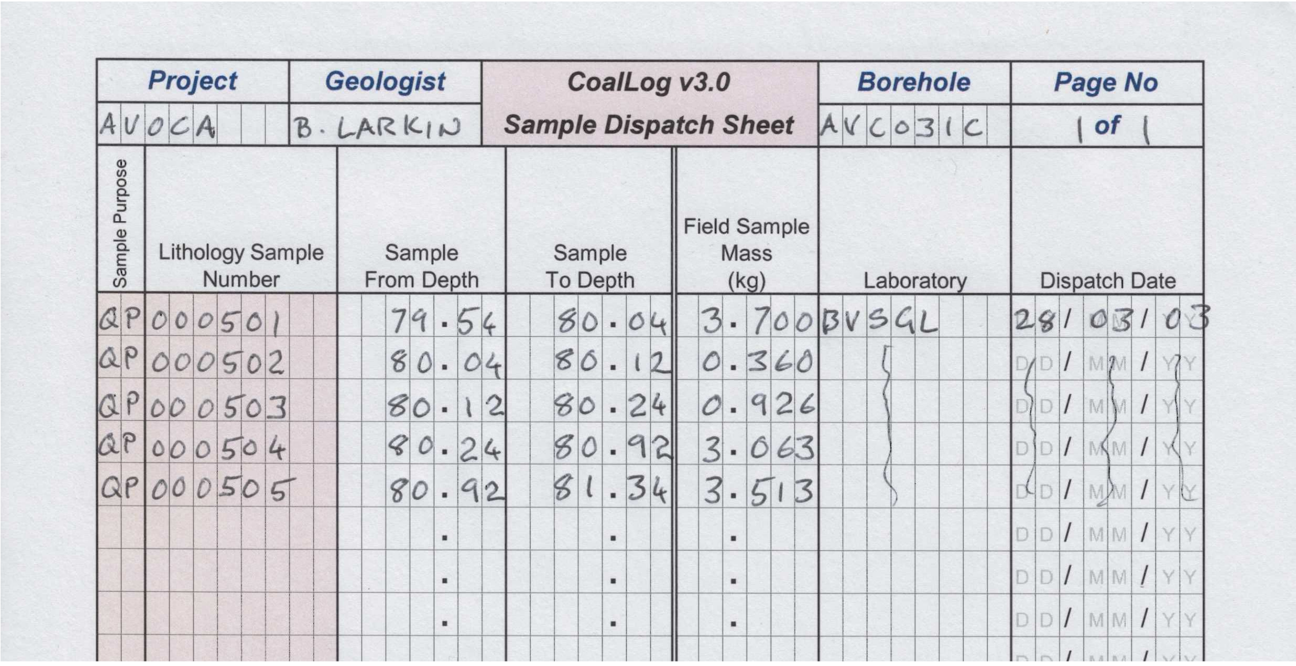


Figure 4.5: Lithology Sheet with example data

4.4 Sample Dispatch Sheet

Figure 4.6 shows a completed Sample Dispatch sheet. A new line needs to be entered into this log for each sample**. Sample_Purpose** and **Sample_No** are required on every line.



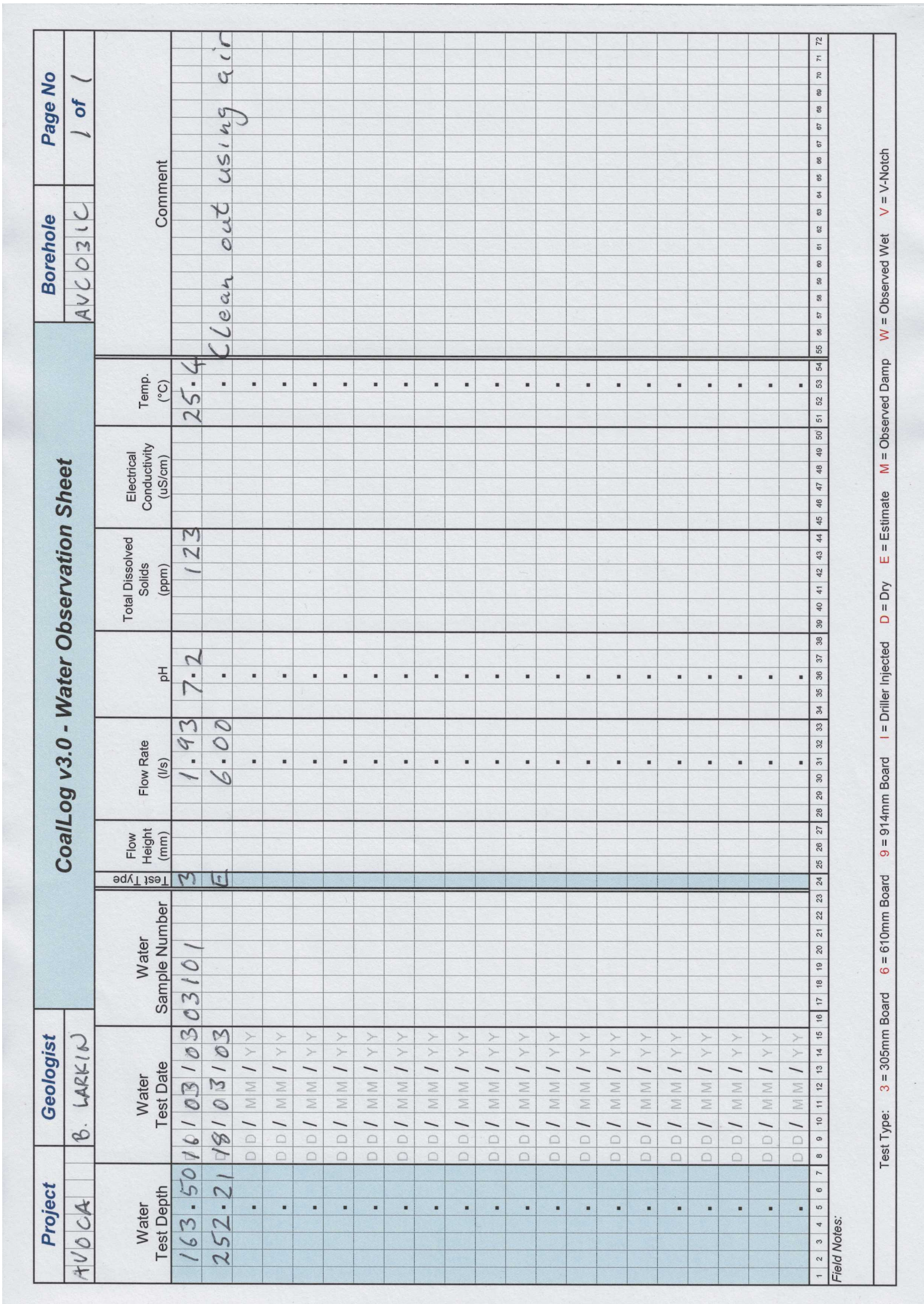
Project	Geologist	CoalLog v3.0 Sample Dispatch Sheet	Borehole	Page No
AVOCA	B. LARKIN		AVCO31C	1 of 1

Sample Purpose	Lithology Sample Number	Sample From Depth	Sample To Depth	Field Sample Mass (kg)	Laboratory	Dispatch Date
QP	000501	79.54	80.04	3.700	BVSGL	28/03/03
QP	000502	80.04	80.12	0.360		DD/MM/YY
QP	000503	80.12	80.24	0.926		DD/MM/YY
QP	000504	80.24	80.92	3.063		DD/MM/YY
QP	000505	80.92	81.34	3.513		DD/MM/YY
		.	.	.		DD/MM/YY
		.	.	.		DD/MM/YY
		.	.	.		DD/MM/YY

Figure 4.6: Sample Dispatch Sheet with example data

4.5 Water Observation Logs

Figure 4.7 shows a completed Water Observation Log. A new line needs to be entered into this log for every water sample. **Test_Depth** is required for every line and **Flow_Test_Type** is required for all samples where either **Flow_Height** or **Flow_Rate** is recorded.



CoalLog v3.0 - Water Observation Sheet

Project	Geologist	Borehole	Page No
AVOCA	B. LARKIN	AVC031C	1 of 1

Water Test Depth	Water Test Date	Water Sample Number	Test Type	Flow Height (mm)	Flow Rate (l/s)	pH	Total Dissolved Solids (ppm)	Electrical Conductivity (uS/cm)	Temp. (°C)	Comment
163.50	16/03/03	03101	3		1.93	7.2	123		25.4	
252.21	18/03/03		E		6.00					Clean out using air

Field Notes:

Test Type: 3 = 305mm Board 6 = 610mm Board 9 = 914mm Board I = Driller Injected D = Dry E = Estimate M = Observed Damp W = Observed Wet V = V-Notch

Figure 4.7: Water Observation Sheet with example data

4.6 Rock Mass Unit (RMU) and Defects Logs

Figure 4.8 shows a completed Rock Mass Unit and Defects Log. The left-hand side of the sheet contains data for each Rock Mass Unit in the hole and the right-hand side shows data for individual defects.

Rock Mass Unit

A Rock Mass Unit is not a lithological unit but a unit with uniform geotechnical characteristics, such as: weathering, strength, plasticity, or defect spacing, throughout the entire unit. It may well consist of a group of adjacent lithological units which all have the same geotechnical characteristics e.g. sandstone interbedded with siltstone and a siltstone interbedded with sandstone may be merged into a single RMU. If part of a single lithological unit has different geotechnical characteristics to the rest of the unit then it should be divided into a separate lithological unit for each rock mass unit, even though the lithology is the same throughout. For example, a massive sandstone may need to be split into fresh and slightly weathered RMU's.

RMU **To_Depth** and **RMU_Type** are required for every RMU. **Weathering** and **Est_Strength** are required for the RMU Types: broken zone (B), core with defects (D) and unbroken core (U).

Rock Mass Unit Type

RMU_Type indicates what data must be recorded for the RMU and how it should be treated for the calculation of parameters such as RQD (Rock Quality Designation) and Fracture Frequency. For example, broken zone (B), core loss (L), open (O) and unbroken core (U), will not have any individual defect data but yet will have very different values for RQD and Fracture Frequency.

Defects

Any rock mass defect is a surface or zone at or within which the geomechanical properties are significantly different from those of the surrounding rock material and therefore potentially or actually exerts an influence on the rock mass strength. The geotechnical purpose of logging defects is to provide information for assessing the influence of the defect on rock mass strength and behaviour as reliably as possible.

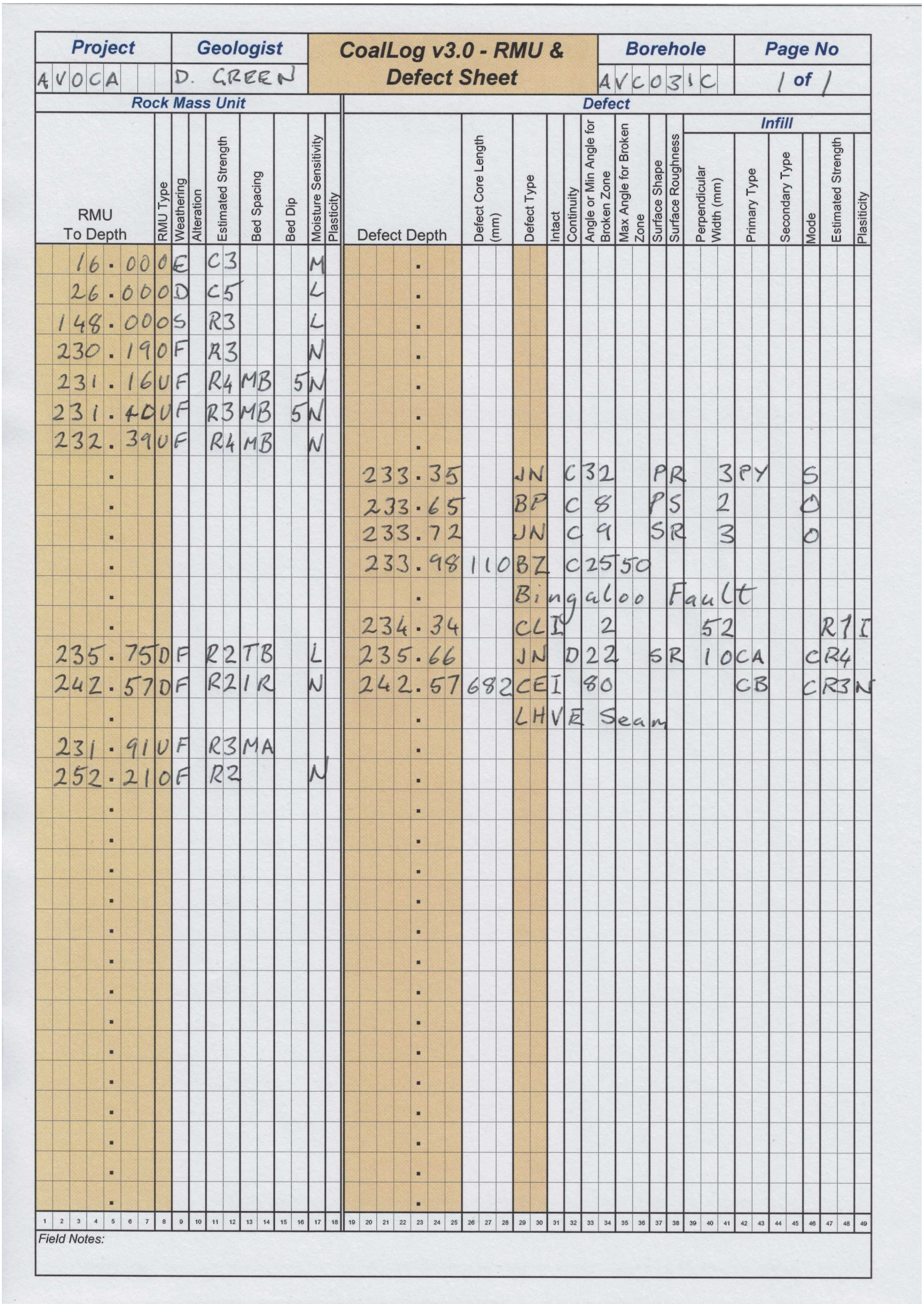
Defect_Depth, **Defect_Length** and **Defect_Type** are required for each defect. **Defect_Length** can be omitted for the encoding of historical data where the defect length was never recorded.

Where the RMU Type is 'core with defects' (D) then the individual defects within the RMU must be recorded. These must be recorded in the sheet after the previous RMU and before or on the line containing the RMU which they are within (e.g. the defects in the RMU between 232.39 and 235.75 in Figure 4.7).

The only other RMU Types that can have defect data are 'broken zones' (B). However, defect data for broken zones cannot have a **Defect_Depth** as the defect data applies to multiple defects throughout the zone.

Defect Depth

Defect_Depth is recorded at the middle of the defect (Figure 4.9).



Project	Geologist	CoalLog v3.0 - RMU & Defect Sheet	Borehole	Page No
AVOCA	D. GREEN		AVC031C	1 of 1

Rock Mass Unit: RMU To Depth	RMU Type	Weathering	Alteration	Estimated Strength	Bed Spacing	Bed Dip	Moisture Sensitivity	Plasticity	Defect: Defect Depth	Defect Core Length (mm)	Defect Type	Intact	Continuity	Angle or Min Angle for Broken Zone	Max Angle for Broken Zone	Surface Shape	Surface Roughness	Perpendicular Width (mm)	Infill: Primary Type	Secondary Type	Mode	Estimated Strength	Plasticity
16.00	O	E		C3			M		.														
26.00	O	D		C5			L		.														
148.00	O	S		R3			L		.														
230.19	O	F		R3			N		.														
231.16	U	F		R4	MB	5	N		.														
231.40	U	F		R3	MB	5	N		.														
232.39	U	F		R4	MB		N		.														
.									233.35		JN		C	32		P	R	3	PY		S		
.									233.65		BP		C	8		P	S	2			O		
.									233.72		JN		C	9		S	R	3			O		
.									233.98	110	BZ		C	25	50								
.									.		Bingaloo Fault												
.									234.34		CL	I		2				52				R1	I
235.75	D	F		R2	TB		L		235.66		JN		D	22		S	R	10	CA		C	R4	
242.57	D	F		R2	IR		N		242.57	682	CE	I		80					CB		C	R3	N
.									.		LHVE Seam												
231.91	U	F		R3	MA				.														
252.21	O	F		R2			N		.														

Field Notes:

Figure 4.8: RMU & Defect Sheet with example data

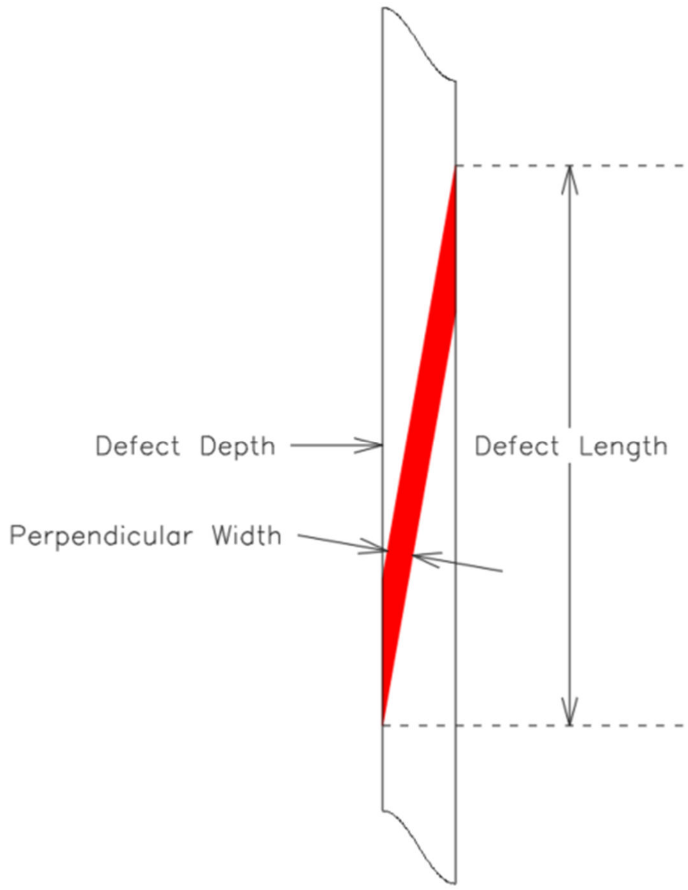


Figure 4.9: Measuring Defect Depth, Defect Length and Perpendicular Width

Defect Length

The **Defect_Length** is the length of core affected by the defect (Figure 4.9). For example, the broken zone with a defect depth of 233.98 in Figure 4.8 affects 110mm of the core.

Defect Intact

If the defect is intact then an “I” must be entered in the Defect Intact column (e.g. the intact clay band with a defect depth of 234.34 in Figure 4.8). If the defect or defects are not intact then the Defect Intact column must be left blank.

Bed Angle, Defect Dip Angle, Minimum and Maximum Defect Dip Angle for Broken Zone

The general convention in the Australian coal industry is that all dip angles should be recorded relative to the perpendicular to the core axis that is relative to the horizontal for vertical holes. The user may though elect to either use this convention when measuring angles or measure them relative to the core axis itself. However, it must be clearly stated which convention has been used and there must be consistency across the user’s entire data set.

Perpendicular Width

Perp_Width is the width of material within the defect as measured perpendicular to the defect (Figure 4.9).

4.7 Point Load Logs

Figure 4.10 shows a completed Point Load Log. Often when performing point load tests, a single stick of core will be broken numerous times. In the example, each of the three sticks of core was broken seven times to achieve results. Each stick was initially broken in two using a diametral test, that is, breaking it perpendicular to the long axis of the core. Each of the two resulting sticks were then submitted to a second diametral test resulting in four sticks of core, and then these were each subjected to an axial test, that is they were loaded along the long axis of the core.

For each new stick of core, a line is recorded with a **To_Depth**, **Sample_Length** and **Sample_State**. If the stick has been allotted a **Sample_No** this is also recorded on this line. **Test_Id**, **PL_Test_Type**, **Platen_Sep**, **Width**, **Failure_Load**, and **Failure_Mode** are required for the test on the original stick or resulting part-sticks.

Test Sample Id

Test_Id can be any sequence of numbers and/or characters. The only restriction is that each **Test_Id** for a single **Sample_No** must be unique.

Test Sample Midpoint Depth

Test_Mid_Depth is the depth of the midpoint of the Test Sample. This records the actual location of the test sample. This information may be omitted at the discretion of the user.

Platen Separation

Platen_Sep is the distance between the platens when the sample is mounted in the point load tester. For diametral tests, this is generally the core diameter and for axial tests it is the core length of the stick or part-stick.

Width

Width is the width of the sample perpendicular to the direction of the load. For diametral tests, this is generally the core length of the stick or part-stick and for axial tests it is the core diameter.

Project	Geologist	CoalLog v3.0 Point Loads	Borehole	Page No
AVOCA	D. GREEN		AVC031C	1 of 1

Point Load To Depth	Sample Length (m)	Sample State	Point Load Sample Number	Test Sample Id	Test Sample Midpoint Depth	PL Test Type	Platen Sep. (D) (mm)	Width (W) (mm)	Failure Load (kN)	Failure Mode
234.91	.16	W	00521	1	234.84	D	61	162	3.05	B
				2	234.88	D	61	70	2.73	B
				3	234.79	D	61	92	1.57	P
				4	234.90	A	30	61	3.26	P
				5	234.86	A	40	61	3.95	P
				6	234.82	A	35	61	2.50	P
				7	234.78	A	53	61	2.41	P
235.35	.15	W	00522	1	235.28	D	61	150	0.97	J
				2	235.31	D	61	82	1.10	B
				3	235.23	D	61	68	3.20	B
				4	235.33	A	39	61	1.91	P
				5	235.29	A	43	61	2.19	P
				6	235.25	A	36	61	3.76	P
				7	235.21	A	45	61	4.08	P
242.99	.17	W	00523	1	242.91	D	61	170	2.15	B
				2	242.95	D	61	90	2.66	P
				3	242.86	D	61	80	3.23	B
				4	242.97	A	40	61	3.10	J
				5	242.93	A	45	61	3.93	J
				6	242.88	A	42	61	3.75	P
				7	242.84	A	40	61	4.91	P

Field Notes:

Sample State: D = Dry, W = Wet

Test Type: D = Diametral, A = Axial, I = Irregular

Failure Mode: I = Invalid, P = penetrative, J = joint, B = bedding plane

Figure 4.10: Point Loads Sheet with example data

5 Dictionary Descriptions

This Chapter provides all the dictionary items, their codes, descriptions, and a source of the description (where available). They are arranged in order of Header (grey), Casing (grey), Cementing (grey), Drilling (light grey), Lithology (yellow), Water Observations (light blue) and Geotechnical (orange).

Items shown in grey text should not be used for current logging but have been included to enable historical data to be encoded into CoalLog.

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Header Items			
BOREHOLE TYPE			
Fully cored	**FC**	Borehole cored from surface to total depth.	
Open/chip	**OC**	Borehole drilled using open-hole methods from surface to total depth.	
Partly cored	**PC**	Borehole chipped to target depths prior to coring.	
Reverse Circulation	**RC**	Borehole chipped to total depth using reverse circulation to return samples through the drilling rods.	
BOREHOLE PURPOSE			
Blasthole	**BH**	Borehole drilled primarily for blasting overburden or interburden. Utilised as a geological data set.	
Coal Quality	**CQ**	Borehole drilled to obtain samples for laboratory testing and coal analysis.	
Large Diameter	**CL**	Large diameter tests for coal physical properties and washability	
Slim Core Testing	**CS**	Slim core testing for basic coal quality	
Spontaneous Combustion Testing	**CC**	Borehole Drilled to obtains samples for spontaneous combustion testing	
Environmental	**EN**	Borehole drilled to obtain samples of strata for laboratory analysis of parameters which may impact on the environment.	
Acid Leachate Testing	**EA**		
Stygofauna monitoring	**ES**		
Gas	**GS**	Borehole drilled for gas analysis. Typical applications include exploration, compliance and greenhouse gas emissions.	
Compliance Gas Testing	**GC**	Gas content testing in drainage areas to ensure remaining gas content is below the mining threshold.	
Controlled Pressure Well	**GL**		
End of Hole Well	**GE**		
Gas Drainage Undiff.	**GD**		
Goaf Drainage	**GG**		
Pumping Inert Gas into Workings	**GN**	Borehole drilled to pump inert gas(es) into workings during high gas or fire events	
Ranging Well	**GR**		
Surface to In-seam Well	**GI**	Collar position only (not a vertical hole)	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Underground in Seam Gas-Riser	**GU**		
Vertical Production Well	**GZ**		
Virgin Gas Testing	**GV**	Gas content testing in areas not subject to gas drainage.	
Geotech	**TG**	Borehole drilled to investigate the geotechnical properties of the strata and provide samples for mechanical testing.	
Pumping Pre-consolidation Grout	**TC**	Borehole drilled to pump grout into seam roof to pre-consolidate	
Extensometer	**TE**		
Geotechnical Properties	**TR**	Borehole drilled to obtain strata core for geotechnical rock property testing.	
Penetrometer	**TP**		
Primary Hydraulic Fracturing	**TF**		
Stress Test Cell/Stress overcore	**TX**		
Tiltmeter	**TL**		
Hydrological	**HY**	Borehole drilled to investigate water level or for piezometer installation.	
Multi-channel Vibrating Wire Piezometer	**HM**		
Nested Standpipe Piezometer	**HN**		
Production Water Bore	**HW**		
Standpipe Peisometer	**HS**		
Vibrating Wire Peisometer	**HV**		
Lox	**LX**	Borehole drilled to obtain samples to determine the amount of oxidation of any coal seam by either visual and tactile or coal analysis methods.	
Service	**SV**	Borehole drilled to provide a conduit or access to and from mine workings for equipment or materials.	
Ballast	**SB**	Ballast drop hole	
Cement	**SC**	Cement drop hole	
Electricity	**SE**	Power supply drop hole	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Nitrogen	**SN**	Nitrogen drop hole	
Refuge	**SR**	Refuge hole	
Plug	**SP**	Plug hole	
Stone Dust	**SD**	Stone dust drop hole	
Structure	**ST**	Borehole drilled to investigate the attitude of strata and the impact of any tectonic features.	
Fault Delineation	**SF**		
Intrusion Delineation	**SI**		
DATA STATUS			
Raw/Uncorrected	**R**	Not depth adjusted.	
Adjusted to geophysics	**A**	Data is adjusted to match geophysical logs.	
Seams adjusted to geophysics	**S**	Seams are adjusted to match geophysical logs.	
Corrected to verticality	**V**	Data adjusted to Verticality log.	
Final	**F**	All adjustments made to data.	
Unknown	**U**	Depth adjustment and completeness unknown.	
GEODETIC DATUM			
Australian Geodetic Datum	**AGD**	Australian Geodetic Datum	http://www.icsm.gov.au/
Australian Geodetic Datum 66	**AGD66**	Australian Geodetic Datum 66	http://www.icsm.gov.au/
Australian Geodetic Datum 84	**AGD84**	Australian Geodetic Datum 84	http://www.icsm.gov.au/
Australian Mapping Grid	**AMG**	Australian Mapping Grid - projection based on AGD84	http://www.icsm.gov.au/
Geocentric Datum Australia	**GDA**	Geocentric Datum Australia	http://www.icsm.gov.au/
Geocentric Datum Australia 94	**GDA94**	Geocentric Datum Australia 94	http://www.icsm.gov.au/
Geocentric Datum Australia 2020	**GDA2020**	Geocentric Datum Australia 2020	http://www.icsm.gov.au/
Local Datum	**LOC**	Local datum used	
Map Grid Australia	**MGA**	Map Grid of Australia 1994 - projection based on GDA94	http://www.icsm.gov.au/

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Universal Transverse Mercator	UTM	Universal Transverse Mercator Coordinate System	http://www.icsm.gov.au/
HEIGHT DATUM			
Australian Height Datum	**AHD**	Australian Height Datum as prescribed by the National Mapping Council of Australia	http://www.ga.gov.au/
Approximate Level	**APX**	Approximate level	
Local Datum	**LOC**	Local datum used	
LOCATION ACCURACY			
Approximate	**A**	Estimated height	
Barometric	**B**	Height determined using the barometric pressure	
Digitised	**D**	Digitally copied from plans	
GPS (hand held)	**G**	Height determined using a hand-held GPS device	
Surveyed	**S**	Height determined using survey instruments	
LOGS RUN			Firth, D., 1994, Log Analysis for Mining Applications: edited by Peter Elkington, Reeves Wireline Services.
Acoustic Scanner	**A**	Continuous borehole wall images produced from the amplitude and travel time of reflected sound energy.	
Caliper	**C**	Log of borehole diameter measured by a mechanical arm on the logging tool.	
Cement bond log	**B**	Cement bond log.	
Density	**D**	Log of material density, normally measured from a gamma ray source.	
Dipmeter	**I**	Log of formation dip angles produced from micro-resistivity and orientation measurements.	
Downhole Camera	**M**	Images captured by a televiewer along the length of the borehole.	
Full Waveform Sonic	**F**	Log of the time taken for sound energy to travel through the rock formation based on P-waves and S-waves.	
Gyroscopic Verticality	**Y**	Log of borehole inclination and azimuth derived from a gyroscope and accelerometers.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Magnetic Susceptability	**K**	Log of ratio of induced pole strength in rock to inducing magnetic field from the tool	
Natural Gamma	**G**	Log of naturally occurring gamma radiation.	
Neutron	**N**	Log of porosity derived from thermal neutron detection.	
Resistivity	**R**	Log of the resistance of the rock formation to an applied electrical current.	
Spontaneous Potential	**P**	Log of naturally occurring currents due to ionic activity between borehole fluid and rock formation.	
Sonic	**S**	Log of the time taken for sound energy to travel through the rock formation based on P-waves.	
Temperature	**T**	Log of borehole temperature.	
Verticality	**V**	Log of borehole inclination and azimuth derived from a magnetometer and accelerometers.	
X-Ray	**X**	Log of X-Ray.	
BOREHOLE STATUS			
Backfilled	**B**	Borehole has been backfilled from the surface.	
Casing removed	**X**	All casing has been removed from the borehole.	
Cemented	**N**	Borehole has been cemented.	
Completed	**C**	Borehole has been completed, with all necessary cementing and rehabilitation carried out.	
Equipment in borehole	**E**	Equipment has been left in the hole - the nature of the equipment and the depths should be recorded.	
Hazard in borehole	**H**	An object has been left in the borehole which may need to be avoided, mitigated or removed prior to mining.	
Infrastructure	**I**	Borehole is being used for mining infrastructure.	
In Progress	**P**	Drilling is in progress.	
Mined	**M**	Borehole has been mined out.	
Open	**O**	Borehole has been left open.	
Piezometer	**Z**	A piezometer has been installed in the borehole to monitor water levels.	
Plugged	**G**	Borehole has been plugged near the surface.	
Rehabilitated	**R**	Borehole site has been fully rehabilitated.	
Unknown	**U**	Borehole status is unknown	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Water bore	**W**	Borehole has been left open for use as a water bore.	
Casing Items			
CASING MATERIAL			
fibreglass	**FB**		
PVC	**PV**		
stainless steel	**SS**		
steel	**ST**		
CASING TYPE			
perforated	**P**		
slotted	**S**		
threaded	**T**		
CASING NAME			
HWT thread class	**HWT**		
Ozcon casing	**OZCO**		
PN06 class UPVC	**PN06**		
PN09 class UPVC	**PN09**		
PN12 class UPVC	**PN12**		
PN18 class UPVC	**PN18**		
SFJ thread class	**SFJ**		
CASING GROUT			
bentonite	**BE**		
concrete aggregate	**AG**		
cement slurry	**CS**		
cuttings	**CT**		
two pack foam	**FO**		
gypsum	**GY**		
pressure grouted slurry	**PG**		
soil	**SO**		

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
washed gravel	**GV**		
Cementing Items			
CEMENT METHOD			
from surface	**FS**		
not recorded	**NR**		
poly reel	**PR**		
sacrifice poly	**SP**		
through drill rods	**TR**		
uncased	**UC**		
Drilling Items			
BIT TYPE			
auger	**AG**	Auger Bit	
blades / drag blade	**BL**	Rotary Blade Bit	
diamond core (wireline)	**DW**	Wireline Coring Bit	
hammer	**HA**		
mill claw	**MC**		
poly crystalline diamond core (conventional)	**PC**		
poly crystalline diamond core (wireline)	**PW**		
poly crystalline diamond open	**PO**		
rock roller / tricone	**TR**	Rock Roller Bit (for borehole reaming)	
surface / wing	**SF**		
tungsten carbide core (conventional)	**TC**	Conventional Coring Bit	
unknown	**UN**		
DRILL FLUID			
air	**A**		

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
foam	**F**		
bentonic mud	**M**		
polymer	**P**		
soluble oil	**S**		
water	**W**		
water injection	**I**		
DRILL SIZE NAME			
Wireline Barrel			
NQ (48mm / 76mm)	**NQ**		
HQ (64mm / 96mm)	**HQ**		
PQ (85mm / 123mm)	**PQ**		
NQ triple tube (45mm / 76mm)	**NQ3**		
HQ triple tube (61mm / 96mm)	**HQ3**		
PQ triple tube (83mm / 123mm)	**PQ3**		
Conventional Barrel			
NMLC triple tube (52mm / 76mm)	**NMLC**		
HMLC triple tube (64mm / 99mm)	**HMLC**		
PMLC triple tube (/)	**PMLC**		
3" conventional (76mm / (76mm / 111mm)	**3C**		
4" conventional (102mm / 140mm)	**4C**		
6" conventional (/)	**6C**		
8" conventional (203mm / 260mm)	**8C**		

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
10" conventional (/)	**10C**		
12" conventional (305mm /)	**12C**		
Lithology Items			
SAMPLE PURPOSE			
Coal quality raw ply (coal, roof, floor or parting)	**QP**	Section of a coal seam (coal, roof, floor or parting) that has been sampled for coal analysis purposes.	
Coal quality bulk sample	**QB**	Sample of a coal seam or ply not usually from bore core that is generally in excess of 1000 kg.	
Coal quality channel sample (underground)	**QU**	Sample of a coal seam (or more usually a series of plies) which is cut from the rib in underground workings for the purpose of coal analysis testing.	
Coal quality raw coal composite	**QR**		
Coal quality washability composite (pre clean coal analysis)	**QW**		
Coal quality clean coal composite	**QC**		
Coal quality sizing composite	**QS**		
Subset quality raw ply (coal, roof, floor or parting)	**BP**		
Subset quality raw coal composite	**BR**		
Subset quality washability composite	**BW**		
Subset quality clean coal composite	**BC**		
Quality standard raw ply (coal, roof, floor or parting)	**ZP**		
Quality standard raw coal composite	**ZR**		

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Quality standard washability composite	ZW		
Quality standard clean coal composite	ZC		
Quality standard bulk sample	ZB		
Quality standard channel sample (underground)	ZU		
Quality duplicate raw ply (coal, roof, floor or parting) for repeat analysis	DP		
Quality duplicate raw coal composite for repeat analysis	DR		
Quality duplicate washability composite for repeat analysis	DW		
Quality duplicate clean coal composite for repeat analysis	DC		
Quality duplicate bulk sample for repeat analysis	DB		
Quality duplicate channel sample for repeat analysis	DU		
Loxline raw ply (coal, roof, floor or parting)	**LP**	Section of a coal seam (coal, roof, floor or parting) that has been sampled to determine the amount of oxidation of coal.	
Spontaneous combustion raw ply (coal, roof, floor or parting)	**SP**	Section of a coal seam (coal, roof, floor or parting) that has been sampled to determine the propensity of the coal to spontaneously combust.	
Spontaneous combustion bulk sample	**SB**	Sample of a coal seam or ply not usually from bore core that is generally in excess of 1000 kg and has been collected to determine the propensity of the coal to spontaneously combust.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Spontaneous combustion channel sample	**SU**	Sample of a coal seam (or more usually a series of plies) which is cut from the rib in underground workings for the purpose of testing to determine the coal's propensity to spontaneously combust.	
Geotechnical sample - laboratory tested	**GT**	Sample of strata (overburden, coal, interburden or floor) collected for the purpose of laboratory testing to determine a mechanical property.	
Geotechnical sample - field tested	**GF**	Sample of strata (overburden, coal, interburden or floor) tested in the field to determine a mechanical property.	
Water quality sample - laboratory tested	**WT**	Sample of water collected from a borehole for the purpose of laboratory testing to determine water quality.	
Water quality sample - field tested	**WF**	Sample of water collected from a borehole and tested in the field to determine water quality.	
Gas sample - exploration (virgin)	**ME**	Sample of strata (overburden, coal, interburden or floor) from an exploration borehole collected for the purpose of laboratory testing to determine seam gas content and type. Gas sample taken from undrained virgin ground.	
Gas sample - compliance (drained)	**MD**	Gas sample taken from coal that has been drained, commonly in an underground mine.	
Environmental sample - soil	**ES**	Sample of soil collected for laboratory testing to determine mineralogical properties for environmental purposes (e.g. rehabilitation potential).	
Environmental sample - overburden characterisation (compliance)	**EO**	Sample of strata (overburden, coal, interburden or floor) collected for the purpose of laboratory testing to determine mineralogical properties for environmental purposes (e.g. overburden characterisation).	
Environmental sample - reactive ground	**ER**	Sample of strata (overburden, coal, interburden or floor) collected for the purpose of laboratory testing to determine if reactive ground is present.	
Age dating	**AD**	Radiocarbon/Shrimp, etc.	
Palynology	**PN**		
Petrology	**PE**		

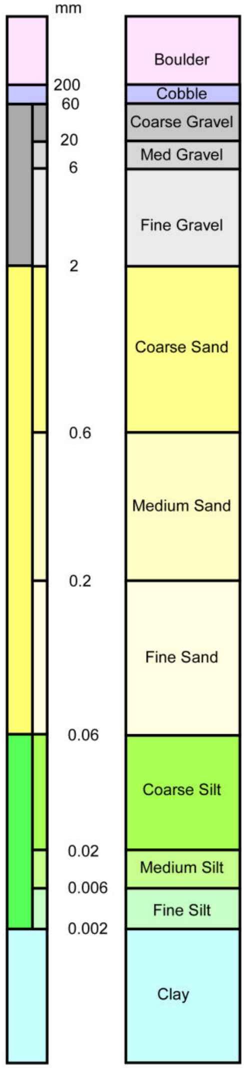
CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
INTERVAL STATUS			
Raw/Uncorrected	**R**	Not depth adjusted.	
Adjusted to geophysics	**A**	Data is adjusted to match geophysical logs.	
Interpreted from Geophysics	**I**	Litho_Type and depths interpreted from geophysical logs	
Unknown	**U**	Depth adjustment and completeness unknown.	
LITHOLOGY	-	-	-
Unconsolidated Sediments		see following Figure for comparison with Wentworth scale.	
Clay	**CL**	Majority of particles are less than 0.002 mm	AS1289
Mud	**MD**	A mixture of silt and clay primarily mixed with water, can contain particles of other dimensions such as sand.	www.webref.org/geology
Silt	**SI**	Majority of particles are between 0.002 and 0.06 mm	AS1289
Sand	**SA**	Majority of particles are between 0.06 and 2 mm	AS1289
Gravel	**GV**	Majority of particles are between 2 and 60 mm	AS1289
Cobbles	**OB**	Majority of particles are between 60 and 200 mm	AS1289
Boulders	**BO**	Majority of particles are greater than 200 mm	AS1289
Alluvium	**AL**	Alluvial deposit (product of river or stream action).	Oxford Dictionary of Earth Sciences
Colluvium	**CV**	Weathered rock debris that has moved downhill via creep or surface wash.	Oxford Dictionary of Earth Sciences
Diatomaceous Earth	**DE**	Deposit consisting of diatoms (unicellular algae that can be single, colonial, or filamentous).	Oxford Dictionary of Earth Sciences
Fill/Spoil	**FI**	Any unconsolidated material that has been deposited by equipment or other human activity.	
Fireclay	**FC**	(syn: underclay) A layer of fine-grained (usually clay) lying immediately below a coal seam, the soil in which the coal forming plants were rooted; often siliceous or aluminous; a clay that can withstand high heat without deforming or disintegrating, i.e. kaolin.	www.webref.org/geology
Loam	**LO**	Any soil that is a mix of sand, silt, and clay, without a majority of any grain size.	Oxford Dictionary of Earth Sciences
Soil	**SO**	Natural unconsolidated mineral and organic matter occurring above bedrock on the surface of the Earth; any loose, soft, deformable material.	Oxford Dictionary of Earth Sciences

3. PARTICLE SIZE TERMINOLOGY[1]

As published in Field Geologist's Manual (2001) with AS classification added

	U.S. Standard sieve mesh	Grain diameter (mm)		Phi (ϕ) units	Wentworth size class
	Use wire squares	4096		− 12	Boulder
		1024		− 10	
		256		− 8	
GRAVEL		64	64	− 6	Cobble
		16		− 4	Pebble
	5	4	4	− 2	
	6	3.36		− 1.75	Granule
	7	2.83		− 1.5	
	8	2.38		− 1.25	
	10	2.00	2	− 1.0	
	12	1.68		− 0.75	Very coarse sar
	14	1.41		− 0.5	
	16	1.19		− 0.25	
	18	1.00	1	0.0	
	20	0.84		0.25	Coarse sand
	25	0.71		0.5	
	30	0.59		0.75	
	35	0.50	½	1.0	
	40	0.42		1.25	Medium sand
SAND	45	0.35		1.5	
	50	0.30		1.75	
	60	0.25	¼	2.0	
	70	0.210		2.25	Fine sand
	80	0.177		2.5	
	100	0.149		2.75	
	120	0.125	⅛	3.0	
	140	0.105		3.25	Very fine sand
	170	0.088		3.5	
	200	0.074		3.75	
	230	0.0625	1/16	4.0	
	270	0.053		4.25	Coarse silt
	325	0.044		4.5	
SILT		0.037		4.75	
		0.031	1/32	5.0	
		0.0156	1/64	6.0	Medium silt
	Use	0.0078	1/128	7.0	Fine silt
	pipette	0.0039	1/256	8.0	Very fine silt
	or	0.0020		9.0	
	hydro-	0.00098		10.0	Clay
MUD	meter	0.00049		11.0	
		0.00024		12.0	
		0.00012		13.0	
		0.00006		14.0	

Australian Standard AS 1289



CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Carbonaceous Sediments			
Coal	**CO**	Carbon rich mineral deposit formed from the accumulation of organic matter and containing less than 50% ash yield on combustion; coal streaks brown (low rank) to black (high rank) when scratched with a metal tool.	Oxford Dictionary of Earth Sciences (mod)
Lignite	**LG**	(USA)~70% carbon, high moisture and volatile content, between peat and bituminous coal in rank; a type of brown coal; contains at least 20% water.	Sedimentary Geology by Prothero and Schwab
Brown Coal	**BC**	(Europe) A low-rank coal which is brown or brownish-black, but rarely black. It commonly retains the structures of the original wood. It is high in moisture, low in heat value, and cracks badly upon drying; contains between 10% and 20% water; range from lignite to subbituminous in rank.	www.webref.org/geology
Peat	**PE**	Unconsolidated but partially compacted accumulation of plant remains in varying states of decomposition, consisting of high moisture and volatile matter content, and ~60% carbon (dry ash free); the precursor to coal.	Sedimentary Geology by Prothero and Schwab (mod)
Burnt Wood / Charcoal	**BW**	a term used in old geological literature for carbon produced by the incomplete burning (pyrolysis) of trees and other vegetation in lava and pyroclastic flows (especially in Japan). Occasionally also used (especially in the USA) for carbonized vegetable matter in sedimentary rocks, where it may be associated with lignite or silicified wood.	www.mindat.org/min-40391.html
Weathered Coal	**CW**		
Oil Shale	**OS**	Any fine grained sedimentary rock that produces substantial quantities of oil when heated.	Sedimentary Geology by Prothero and Schwab
Tar Sand	**TS**	(syn: oil sand) Oil reservoir where the volatiles have escaped and the rock has become impregnated with hydrocarbon residue.	Oxford Dictionary of Earth Sciences
Coaly Claystone Coaly Mudstone Coaly Sandstone Coaly Shale Coaly Siltstone	**ZC** **ZM** **ZS** **ZH** **ZT**	Please refer to the clastic sedimentary rock descriptions - coaly is an adjective to describe any sedimentary rock that does not have a black streak (streak is usually dark grey to brown) when scratched with a metal tool, but is dark grey to black with coal inclusions; a rock that is between 50-75% ash.	
Carbonaceous Claystone Carbonaceous Mudstone Carbonaceous Sandstone	**XC** **XM** **XS**	Please refer to the clastic sedimentary rock descriptions - carbonaceous is an adjective to describe any sedimentary rock that does not have a black	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Carbonaceous Shale Carbonaceous Siltstone	**XH** **XT**	streak (streak can be any colour) when scratched with a metal tool, but has coal inclusions; a rock that is >75% ash.	
Clastic Sedimentary Rocks			
Sedimentary Rock, undifferentiated	**SU**	Any sedimentary rock.	
Claystone	**CS**	Sedimentary rock mostly composed of individual grains or clasts less than 0.002 mm.	
Pellet Claystone	**PC**	(syn: kaolinite clayrock, flint clay) A distinctive rock made up of light grey and/or light brown claystone clasts set in a darker, often carbonaceous matrix. Pellets and matrix consist primarily of well crystallised kaolinite.	A Guide to Cored Rocks in the Sydney Basin.
Mudstone	**MS**	Intermediary between claystone and siltstone; any sedimentary rock mostly composed of particles less than 0.02 mm.	Sedimentary Geology by Prothero and Schwab
Shale	**SH**	Any mudrock that shows fissility.	Sedimentary Geology by Prothero and Schwab
Siltstone	**ST**	Sedimentary rock mostly composed of individual grains or clasts between 0.002 and 0.02 mm.	
Sandstone	**SS**	Sedimentary rock mostly composed of individual grains or clasts between 0.06 and 2 mm.	
Conglomerate	**CG**	Sedimentary rock mostly composed of subrounded, subangular, and rounded clasts greater than 2 mm.	
Conglomerate (>65% matrix)	**M1**	A rock with clasts >2mm in a finer grained matrix which comprises >65%.	
Conglomerate (35-65% matrix)	**M2**	A rock with clasts >2mm in a finer grained matrix which comprises 35-65%.	
Conglomerate (<35% matrix)	**M3**	A rock with clasts >2mm in a finer grained matrix which comprises <35%.	
Breccia	**BR**	Sedimentary rock mostly composed of angular clasts greater than 2 mm.	
Fault Breccia	**FB**	The assemblage of angular fragments resulting from the crushing, shattering, or shearing of rocks during movement on a fault; a friction breccia. It is distinguished by its cross-cutting relations, by the presence of fault gouge, and by blocks with slickensides; angular to subangular fragments of crushed rock, up to several meters in size, filling a fault.	www.webref.org/geology

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Diamictite	**DI**	A type of lithified, matrix supported sedimentary rock that consists of a wide range of unsorted to poorly sorted sediment, such as sand or larger sized particles suspended in a mud matrix.	Wikipedia
Tillite	**TI**	A sedimentary rock formed from glacial debris.	Oxford Dictionary of Earth Sciences
Chemical Sedimentary Rocks			
Calcrete	**CC**	(syn: caliche) Carbonate horizon formed in a soil in a semi-arid region by the precipitation of $CaCO_3$ carried in solution, develops over several thousand years with initial stages being nodular, and mature stages massive to laminar.	Oxford Dictionary of Earth Sciences
Carbonate	**CB**	Sedimentary rocks composed of >95% calcite or dolomite.	Oxford Dictionary of Earth Sciences
Chalk	**CK**	Porous, fine grained sedimentary rock composed predominantly of the calcareous skeletons of micro organisms.	Oxford Dictionary of Earth Sciences
Chert	**CH**	Chalcedonic nodules or irregular masses that occur in a sedimentary environment, often in association with black shales and spillites.	Oxford Dictionary of Earth Sciences
Cone in Cone Carbonate	**KK**	A secondary structure occurring in marls, limestone, ironstones, coals, etc. It is a succession of small cones of approx. the same size one within another and sharing a common axis.	www.webref.org/geology
Dolomite	**DM**	(syn: dolostone) A sedimentary rock composed of >90% dolomite ($CaMg(CO_3)_2$, $(CaFe(CO_3)_2$, $(CaMn(CO_3)_2)$.	Oxford Dictionary of Earth Sciences
Ferricrete	**FK**	Deposit which can develop into a hardened mass of sesquioxides of iron, especially in subtropical zones.	Oxford Dictionary of Earth Sciences
Fossil Wood	**FW**	Silicified wood; wood that has turned into a rock through fossilization.	www.webref.org/geology
Ironstone	**IS**	Iron rich sedimentary rock.	Oxford Dictionary of Earth Sciences
Kaolinite	**KA**	(syn: dickite, nacrite, kaolin) A group of clay minerals belonging to the 1:1 group of phyllosilicates which represent the final product from the chemical weathering of feldspars including low temperature hydrothermal reactions; a rock predominately composed of kaolin minerals.	Oxford Dictionary of Earth Sciences
Laterite	**LA**	Weathering product of rock composed of hydrated iron and aluminium oxides and hydroxides, clay minerals, and some silica, formed in humid, tropical areas.	Oxford Dictionary of Earth Sciences
Limestone	**LS**	Sedimentary rocks composed of calcite or dolomite.	Oxford Dictionary of Earth Sciences

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Limonite	**LI**	Secondary weathering mineral from iron, may accumulate to give an iron rich deposit.	Oxford Dictionary of Earth Sciences
Silcrete	**SC**	Deposit which can develop into a hardened mass of silica, especially in subtropical zones.	Oxford Dictionary of Earth Sciences
Tonstein	**TN**	A compact kaolinite and or smectite rich mudstone which develops as a palaeosol and is frequently found as thin bands within or near coal seams; laterally extensive occurrences are believed to be a product of weathered volcanic ash.	Oxford Dictionary of Earth Sciences
Igneous			
Igneous Rock, undifferentiated	**IG**	Any igneous rock.	
Volcanic Rock, undifferentiated	**VR**	Any extrusive igneous rock, e.g. rhyolite, andesite, basalts.	An Introduction to Igneous and Metamorphic Petrology by Winter
Intrusive Rock, undifferentiated	**IN**	Any intrusive igneous rock, e.g. granitoids and gabbros.	
Acid/Felsic Volcanic	**AV**	Any extrusive igneous rock >66 wt.% silica	An Introduction to Igneous and Metamorphic Petrology by Winter
Intermediate Volcanic	**IV**	Any extrusive igneous rock 52-66 wt.% silica	
Basic/Mafic Volcanic	**BV**	Any extrusive igneous rock 45-52 wt.% silica	
Acid/Felsic Intrusive	**AI**	Any intrusive igneous rock >66 wt.% silica	
Intermediate Intrusive	**II**	Any intrusive igneous rock 52-66 wt.% silica	
Basic/Mafic Intrusive	**BI**	Any intrusive igneous rock 45-52 wt.% silica	
Andesite	**AN**	A basic extrusive igneous rock >65% plagioclase, <20% quartz.	An Introduction to Igneous and Metamorphic Petrology by Winter
Basalt	**BS**	An intermediate extrusive igneous rock >65% plagioclase, <20% quartz.	
Trachyte	**TR**	A silica-saturated, weakly porphyritic alkaline volcanic rock of intermediaye composition containing mainly sanidine or orthoclase phenocrysts, but also alkali feldspar, clinopyroxene, Fe-Ti oxides, amphibole and biotite in a groundmass often showing trachytic texture.	New Penguin Dictionary of Geology
Rhyolite	**RH**	An acidic extrusive igneous rock >20% quartz, <65% plagioclase.	
Dolerite	**DO**	Medium grained basalt/gabbro.	
Monzonite	**MZ**	A medium to coarse grained intrusive rock >50% plagioclase, <20% quartz, >10% alkali feldspar.	New Penguin Dictionary of Geology
Gabbro	**GB**	An intrusive igneous rock composed of plagioclase and pyroxenes.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Granite	**GR**	An intrusive igneous rock >20% quartz, <65% plagioclase, >10% alkali feldspar (normalized).	
Syenite	**SY**	An intrusive igneous rock with alkali feldspar exceeding 67% and quartz or nepheline which makes up 5-20% of the rock. Compositionally equivalent to trachyte.	New Penguin Dictionary of Geology
Granodiorite	**GD**	An intrusive igneous rock >20% quartz, 65-90% plagioclase (normalized).	
Tuff	**TF**	A sedimentary or igneous rock made of igneous fragments < 2 mm (ash) deposited by pyroclastic or water processes.	Oxford Dictionary of Earth Sciences
Tuffite	**TT**	A tuff containing 75% to 25% pyroclastic material	IUGS
Volcanic Breccia	**VB**	A rock made up of pyroclastic fragments that are at least 64 millimeters in diameter.	www.geology.com
Metamorphic			
Metamorphic Rock, undifferentiated	**MM**	Any metamorphic rock.	
Basement Undifferentiated	**BU**	Highly folded metamorphic or igneous rocks, overlain by relatively undeformed sedimentary rocks; non-prospective rocks below prospective strata.	Oxford Dictionary of Earth Sciences
Mylonite	**MY**	A metamorphic rock formed by ductile deformation resulting in a fine-grained, dense, hard rock.	
Quartzite	**QT**	A metamorphic rock composed predominately of quartz.	An Introduction to Igneous and Metamorphic Petrology by Winter
Slate	**SL**	A very fine grained metamorphic rock with well developed cleavage, cleavage surfaces are dull.	An Introduction to Igneous and Metamorphic Petrology by Winter
Phyllite	**PH**	A metamorphic rock displaying schistosity in which very fine phyllosilicates impart a silky sheen to the foliation surface.	An Introduction to Igneous and Metamorphic Petrology by Winter
Schist	**SZ**	A metamorphic rock displaying schistosity in which inequant minerals show a preferred orientation.	An Introduction to Igneous and Metamorphic Petrology by Winter
Gneiss	**GN**	A metamorphic rock displaying gneissose structure (layered/banded generally with dark minerals and felsics).	An Introduction to Igneous and Metamorphic Petrology by Winter

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Minerals			
Calcite	**CA**	Usually white but can also be colourless, grey, red, green, blue, yellow, brown, orange. White streak, vitreous lustre. Perfect rhombohedral cleavage. Low Mohs hardness (3). Dissolves in cold dilute HCl.	
Gypsum	**GY**	Colourless/White, Grey. Characterised by its softness (Mohs hardness 2) with three unequal cleavages. Occurs interstratified with limestones and shales. Also as lenticular bodies or scattered crystals in clays and shales.	
Pyrite	**PY**	Pale brass-yellow, tarnishes darker and iridescent. Crystals are usually cubic, faces may be striated, but also frequently octahedral and pyritohedron. Often inter-grown, massive, radiated, granular, globular and stalactitic. Very hard (6-6.5). Metallic lustre. Paramagnetic. Metallic glistening lustre.	
Quartz	**QZ**	Colourless/White. No cleavage. Very hard (7). Occurs as drusy, fine-grained to microcrystalline, massive crystals. Conchoidal fracturing. Transparent to nearly opaque. Vitreous lustre but can also be observed as waxy-dull when massive.	
Siderite	**SD**	A carbonate mineral of iron, sometimes of importance as an ore. Crystals typically found as brown to tan rhombohedrons in clusters, faces often curved or composites; more often found as medium to dark brown massive fine grained material or as massive crystalline material with exposed curved cleavage surfaces. Relatively hard (3.75-4.25). Vitreous or silky to pearly lustre. Translucent to subtranslucent. Most often found in bedded sedimentary deposits with a biological component, with shales, clays and coal beds.	
Talc	**TA**	Light to dark green, brown, white in colour. Almost always in foliated masses, rarely platey to pyramidal crystals. Very soft (1). Waxlike or pearly lustre. Translucent. White to very pearly green streak. Usually found in metamorphic rocks with abundant carbonate minerals associated.	
Other			
Core Loss	**KL**	No core recovered for a section	
Lost Coal (from geophysics)	**LC**	No core recovered but interpreted from downhole geophysics as coal	
Missing Record	**MR**	No lithology available from historical record	
Non Coal	**NC**	Not coal, including overburden and interburden	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
No Recovery	**NR**	No returns from drilling	
Not Logged	**NL**	Drilled but not logged	
Old Workings	**OW**	Void caused by mining	
Void	**VD**	Empty space other than old workings	
LITHOLOGY QUALIFIER			
Coal Brightness			
bright (>90%)	**BR**	>90 % bright coal	
bright with dull bands (60-90%)	**BB**	60-90 % bright coal	
interbanded dull and bright bands(40-60%)	**BD**	40-60 % bright coal	
mainly dull with frequent bright bands (10-40%)	**DB**	10-40 % bright coal	
dull with minor bright bands (1-10%)	**DM**	1-10 % bright coal	
dull (<1%)	**DD**	<1 % bright coal	
anthracite	**AN**	Coal that is >90 % carbon with little moisture or volatiles, highest ranked coal.	Sedimentary Geology by Prothero and Schwab
cindered	**CI**	Partially to mostly burned coal.	www.dictionary.com
coked	**KC**	Coal containing the solid carbonaceous residue derived from incomplete burning of coal.	Oxford Dictionary of Earth Sciences
cannel (torbanite, bog)	CT	A sapropelic coal formed from spores and algae.	Oxford Dictionary of Earth Sciences
dull conchoidal	**DC**	Fine grained uniform bituminous coal with a dull, greasy lustre and conchoidal fracture containing a high percentage of volatiles.	Oxford Dictionary of Earth Sciences
fusainous	**FU**	Containing fossilized charcoal produced by the burning of plant material in an anaerobic environment.	Oxford Dictionary of Earth Sciences
heat affected	**HA**	Changing characteristics assumed to be caused by heat.	general understanding
inferior	IF	Syn: stony coal	
sapropelic	**SP**	A hydrogen rich coal, including cannel coal or torbanite (formed from spores) and boghead coal (formed from algae).	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
stony	**SY**	Coal that is 40-60 % ash, will still streak black with a metal tool, but feels to heavy to be coal, very dull.	general understanding
undifferentiated	**CU**		
Unconsolidated Sediments			
clayey	**CL**	Having clay sized particles (<0.002 mm).	
silty	**SI**	Having silt sized particles (between 0.002 and 0.06 mm).	
sandy	**SA**	Having sand sized particles (between 0.06 and 2 mm).	
gravelly	**GV**	Having gravel sized particles (between 2 and 60 mm).	
Sandstone / Sand / Gravel		Also apply to carbonaceous sandstone (XS) and coaly sandstone (ZS) NB descriptions are different to those in common use (Wentworth scale).	
very fine grained	**VV**	Consists of individual grains of sediment, or lithified particles ranging from 0.0625 – 0.125mm in diameter.	Udden-Wentworth, 1922
very fine to fine grained	**VF**	Consists of individual grains of sediment, or lithified particles ranging from 0.0625 – 0.250mm in diameter.	Udden-Wentworth, 1922
very fine to medium grained	**VM**	Consists of individual grains of sediment, or lithified particles ranging from 0.0625 – 0.5mm in diameter.	Udden-Wentworth, 1922
very fine to coarse grained	**VC**	Consists of individual grains of sediment, or lithified particles ranging from 0.0625 – 1mm in diameter.	Udden-Wentworth, 1922
very fine to very coarse grained	**VX**	Consists of individual grains of sediment, or lithified particles ranging from 0.0625 – 2mm in diameter.	Udden-Wentworth, 1922
fine grained	**FF**	Consists of grains ranging from 0.06 to 0.20 mm in size for Sandstone or Sand, and from 2 to 6 mm for Gravel.	AS1289
fine to medium grained	**FM**	Consists of grains ranging from 0.06 to 0.60 mm in size for Sandstone or Sand, and from 2 to 20 mm for Gravel.	AS1289
fine to coarse grained	**FC**	Consists of grains ranging from 0.06 to 2.00 mm in size for Sandstone or Sand, and from 2 to 60 mm for Gravel.	AS1289
fine to very coarse grained	**FX**	Consists of individual grains of sediment, or lithified particles ranging from 0.125 – 2mm in diameter.	
medium grained	**MM**	Consists of grains ranging from 0.20 to 0.60 mm in size for Sandstone or Sand, and from 6 to 20 mm for Gravel.	AS1289

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
medium to coarse grained	**MC**	Consists of grains ranging from 0.20 to 2.00 mm in size for Sandstone or Sand, and from 6 to 60 mm for Gravel.	AS1289
medium to very coarse grained	**MX**	Consists of individual grains of sediment, or lithified particles ranging from 0.250 – 2mm in diameter.	Udden-Wentworth, 1922
coarse grained	**CC**	Consists of grains ranging from 0.60 to 2.00 mm in size for Sandstone or Sand, and from 20 to 60 mm for Gravel.	AS1289
coarse to very coarse grained	**CX**	Consists of individual grains of sediment, or lithified particles ranging from 0.50 – 2mm in diameter.	Udden-Wentworth, 1922
very coarse grained	**XX**	Consists of individual grains of sediment, or lithified particles ranging from 1 – 2mm in diameter.	Udden-Wentworth, 1922
Conglomerate/Alluvium		NB descriptions are different to those in common use (Wentworth scale).	
granular	**GG**	Containing grains 2 to 20 mm in size.	AS1289
granular to pebbly	**GP**	Containing grains 2 to 60 mm in size.	AS1289
granular to cobbly	**GO**	Containing grains 2 to 200 mm in size.	AS1289
granular to bouldery	**GU**	Containing grains 2 to >200 mm in size.	AS1289
pebbly	**PP**	Containing grains 20 to 60 mm in size.	AS1289
pebbly to cobbly	**PO**	Containing grains 20 to 200 mm in size.	AS1289
pebbly to bouldery	**PU**	Containing grains 20 to >200 mm in size.	AS1289
cobbly	**OO**	Containing grains 60 to 200 mm in size.	AS1289
cobbly to bouldery	**OU**	Containing grains 60 to >200 mm in size.	AS1289
bouldery	**UU**	Containing grains >200 mm in size.	AS1289
Tuff/Tuffite/Breccia/Fault Breccia			
clay sized	**CS**	Having clay sized particles (<0.002 mm).	
mud sized	**MS**	Having clay and silt sized particles (<0.06 mm).	
silt sized	**TS**	Having silt sized particles (between 0.002 and 0.06 mm).	
sand sized	**SS**	Having sand sized particles (between 0.06 and 2 mm).	
SHADE			
light	**L**	Pale or whitish	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
light to medium	**A**	Pale to intermediate	
light to dark	**C**	Pale to blackish	
medium	**E**	Intermediate	
medium to dark	**B**	Intermediate to blackish	
dark	**D**	Blackish	
banded	**N**	Alternating light and dark pattern	
mottled	**M**	A mixture of two or more colours with no discernible pattern, often with amorphous shapes	
speckled	**S**	Spotted	
variegated	**V**	Marked with patches or spots of different colours	
HUE / COLOUR			
blackish / black	**K**		
bluish / blue	**L**		
brownish / brown	**B**		
buff	**F**		
creamy / cream	**C**		
greenish / green	**E**		
greyish / grey	**G**		
multicoloured	**M**	for use with conglomerates	
off white	**X**		
orangey / orange	**O**		
pinkish / pink	**P**		
purplish / purple	**U**		
reddish / red	**R**		
whitish / white	**W**		
yellowish / yellow	**Y**		
LITHOLOGY ADJECTIVE			
Quantity			
abundant (30-60%)	**AB**	A component present in the range of 30 to 60 %.	
common (15-30%)	**CM**	A component present in the range of 15 to 30 %.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
decreasing in abundance	**DA**		
dominant (>60%)	**DO**	A component present in the range of 60 to 100 %.	
highly	**HI**		
in part	**IP**		
increasing in abundance	**IA**		
large	**LR**		
minor (1-15%)	**MN**	A component present in the range of 1 to 15%.	
partially	**PR**		
rare (<1%)	**RA**	A component present in the range of 0 to 1%.	
slightly	**TY**		
strongly	**TG**		
thick	**TK**		
thin	**TH**		
very	**VE**		
Appearance			
altered	**AL**	Mineral or rock properties and/or appearance has been changed by the effects of heat, weathering or metasomatic fluids.	
bright	**BR**	High lustre or shiny; when used to describe coal composition refers to vitrain band.	
clear	**LC**	Transparent	
coarser (<10% of unit)	**XC**	Grain size of material is greater than majority (>90%) of main rock type.	
conchoidal	**CC**	Form of fracturing which takes the form of a curved, concentric ribbed surface.	The Penguin "Dictionary of Geology"
dull	**DD**	Low lustre; when used to describe coal composition refers to the granular or attrital matrix to the vitrain bands.	
fault gouge	**FT**	Rock material that has been ground to a uniform clay or fine silt particle size in a fault zone.	The Penguin "Dictionary of Geology"
finer (<10% of unit)	**FF**	Grain size of material is less than majority (>90%) of main rock type.	
hard	**HR**		
heat affected	**HA**	Mineral or rock properties and/or appearance has been altered by the effects of heat from a metamorphic or igneous source.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
interbanded	**IB**	Alternating stratum or lamina conspicuous because they differ in colour and/or grainsize from adjacent layers.	
irregular	**IR**		
lustrous	**LU**	Reflecting light efficiently without glitter or sparkle	
opaque	**OP**	Does not reflect or transmit light.	Concise Oxford Dictionary
resinous	**RS**	Has appearance of resin, which is a plant secretion with a translucent sheen.	
soft	**SO**		
translucent	**TL**	Transmitting light but not transparent.	Concise Oxford Dictionary
Lithological			
acidic	**AC**	Igneous rock containing more than 66 wt.% silica (SiO2), most of the silica being in the form of silicate minerals, but with the excess of about 10% as free quartz. Typical acid rocks are granites, granodiorites, and rhyolites.	*Oxford Dictionary of Earth Science (mod)*
arenitic	**AR**	Containing or showing characteristics of Arenite: a sandstone type where less than 15 % of rock is mud matrix.	Oxford Dictionary of Earth Science
arkosic	**AK**	Containing quartz and 25 % or more of feldspar.	Oxford Dictionary of Earth Science
basaltic	**BS**	Containing or showing characteristics of Basalt: a dark-coloured, fine-grained, extrusive, igneous rock composed of plagioclase feldspar, pyroxene, and magnetite, with or without olivine, and containing not more than 52 wt. % silica (SiO2).	*Oxford Dictionary of Earth Science (mod)*
basic	**BC**	Rock with a relatively high concentration of iron, magnesium, and calcium, and with 45–52 wt. % of silica (SiO2). Examples include gabbro and basalt.	*Oxford Dictionary of Earth Science (mod)*
bentonitic	**BE**	Montmorillonite-rich clay formed by the breakdown and alteration of volcanic material.	Oxford Dictionary of Earth Science
calcareous	**CA**	Containing more than 30 % calcium carbonate.	Oxford Dictionary of Earth Science
carbonaceous	**XX**	Resembling or containing carbon. Pure carbon occurs naturally as diamond, graphite, fullerene, and as the amorphous carbon black. Charcoal, produced by the destructive distillation of organic matter, is also a pure form of carbon.	Oxford Dictionary of Earth Science
carbonate	**CB**	A sedimentary rock with 95 % or more of either calcite or dolomite, and is synonymous with limestone.	Oxford Dictionary of Earth Science

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
chloritic	**CR**	Containing or showing characteristics of Chlorite: a group of phyllosilicate (sheet silicate) minerals with the general composition (Mg,Fe,Al)6[(SiAl)4O10](OH)8 and related to the micas; sp. gr. 2.6–3.3; soft and green; platy or tabular *habit; occur in low grade metamorphic rocks of greenschist facies and as an alteration product of ferromagnesian minerals in igneous rocks.	Oxford Dictionary of Earth Science
clayey	**CL**	Containing or showing characteristics of Clay: In the Udden–Wentworth scale, particles less than 4 µm in size.	Oxford Dictionary of Earth Science
claystone	**CS**	see Lithology section. where <10% unit	
coal stringers	**CX**	Combined code as these may be common in the coal floor and may indicate recoverable coal in the floor.	
coaly	**CO**	Containing or comprising of Coal: a carbon-rich mineral deposit formed from the remains of fossil plants.	Oxford Dictionary of Earth Science
conglomeratic	**CG**	Containing or showing characteristics of Conglomerate: a coarse grained (rudaceous) rock with rounded clasts that are greater than 2mm in size.	Oxford Dictionary of Earth Science
detrital	**DE**	Minerals in sedimentary rocks, which were derived from pre-existing igneous, metamorphic or sedimentary rocks.	The Penguin "Dictionary of Geology"
dolomitic	**DM**	Containing or showing characteristics of Dolomite: a widely distributed rock-forming mineral, CaMg(CO3)2; sp. gr. 2.8–2.9; hardness 3.5–4.0; trigonal; usually white or colourless, but can be yellowish and brown; white streak; vitreous lustre; crystals are usually rhombohedral with curved.	Oxford Dictionary of Earth Science
feldspathic	**FS**	Containing 25 % or more of feldspar.	Oxford Dictionary of Earth Science
ferruginous	**FE**	Of, containing, or similar to iron.	Oxford Dictionary of Earth Science
fossiliferous	**FO**	Containing fossils: anything ancient or the remains of a once-living organism.	Oxford Dictionary of Earth Science
fusainous	**FU**	predominantly containing fusain. Normally in Lithological Qualifier but available in Lithological Adjectives for times where the Qualifier has been used for brightness	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
glauconitic	**GC**	Containing or showing characteristics of Glauconite: a member of the mica group, with the composition (K,Ca,Na)_2(Fe3_,Al,Mg,Fe2_)4[(Si,Al)4O10]2(OH)4; sp. r. –3.0; hardness 2; monoclinic; olive green, yellowish, or blackish green; dull lustre; granular; occurs in marine sediments as aggregates up to 1 mm in diameter.	Oxford Dictionary of Earth Science
graphitic	**GP**	Containing or showing characteristics of Graphite: sp. gr. 2.1; hardness 2; greyish-black; feels soft and greasy; good basal cleavage; scaly, columnar, granular, or earthy; occurs in veins and may be disseminated through rocks as a result of metamorphism of original carbon-rich sediments.	Oxford Dictionary of Earth Science
illitic	**IL**	Containing or showing characteristics of Illite (hydromuscovite): a clay mineral and member of the 2 : 1 group of phyllosilicates (sheet silicates) with the formula K1–1.5 Al4[Si7–6.5 Al1–1.5 O20](OH)4; sp. gr. 2.6–2.9; hardness 1–2; monoclinic; crystals form tiny flakes.	Oxford Dictionary of Earth Science
intermediate	**IM**	Igneous rock whose chemical composition lies between those of basic and acidic rocks. The limits are not fixed rigidly and a number of schemes exist that are based on modal mineralogy and the whole rock chemistry.	Oxford Dictionary of Earth Science
intrusive	**IN**	Applied to a body of rock, usually igneous, that is emplaced within pre-existing rocks. Intrusions are classified according to their size, their shape, and their geometrical relationship to the enclosing rocks.	Oxford Dictionary of Earth Science
iron stained	**ID**	Stained red-orange by the element Iron: Fe, sp. gr. 7.5; hardness 4.5; grey; massive or granular; malleable.	Oxford Dictionary of Earth Science
kaolinitic	**KA**	Containing or showing characteristics of Kaolinite (dickite, nacrite, China clay, kaolin): a group of clay minerals belonging to the 1 : 1 group of phyllosilicates (sheet silicates), and with the general formula Al4[Si4O10](OH)8; sp. gr. 2.6–2.7; hardness 2.0–2.5; monoclinic; white, greyish, or stained a variety of colours; dull earthy lustre; occurs as a secondary mineral produced by the alteration of aluminosilicates, especially alkali feldspars; is widely distributed in igneous rocks, gneisses, and pegmatites, and in sedimentary rocks.	Oxford Dictionary of Earth Science
lateritic	**LA**	Containing or showing characteristics of a Laterite: a weathering product of rock, composed mainly of hydrated iron a*nd aluminium oxides and hydroxides, and clay minerals, but also containing some silica.*	Oxford Dictionary of Earth Science

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
limonitic	**LI**	Containing or showing characteristics of Limonite: FeO(OH).nH2O; sp. gr.2.7–4.3; hardness 4.0–5.3; yellowish-brown to reddish-brown; normally earthy lustre; usually amorphous; occurs as a secondary mineral from the weathering of iron in rocks and mineral deposits.	Oxford Dictionary of Earth Science
lithic	**LT**	Comprising of more than 25% rock fragments.	Oxford Dictionary of Earth Science
loamy	**LO**	Containing or showing characteristics of Loam: a class of soil texture composed of sand, silt, and clay, which produces a physical property intermediate between the extremes of the three components.	Oxford Dictionary of Earth Science
manganiferous	**MG**	Containing or showing characteristics of the element Manganese: a gray-white or silvery brittle metallic element, occurring in several allotropic forms, found worldwide, especially in the ores pyrolusite and rhodochrosite and in nodules on the ocean floor.	The American Heritage® Dictionary of the English Language, Fourth Edition
marly	**MR**	Containing or showing characteristics of a Marl: a pelagic or hemipelagic sediment, typically found interbedded with purer oozes in beds up to 1.5m thick, with a composition intermediate between a non-biogenic sediment and a calcareous or siliceous ooze. It is 30 % clay and 70 % microfossils, at least 15 % of its volume being siliceous microfossils.	Oxford Dictionary of Earth Science
metamorphosed	**MM**	Having undergone metamorphism: the process of changing the characteristics of a rock in response to changes in temperature, pressure, or volatile content.	Oxford Dictionary of Earth Science
micaceous	**MI**	Containing Micas: a group of phyllosilicates (sheet silicates) with a 2 : 1 atomic structure; the group is characterized by the silicon oxygen tetrahedral layers of composition [Si4O10]n and a general composition may be written (K,Na)2Y6[Z4O10]2(OH,F)4, where Y _ Mg, Fe, Fe3_, or Al, and Z _ Si or Al; the micas include muscovite, biotite, phlogopite, glauconite, lepidolite, and zinnwaldite, the brittle micas, and also the related minerals talc, stilpnomelane, and pyrophyllite.	Oxford Dictionary of Earth Science
muddy	**MD**	Containing or showing characteristics of Mud, an argillaceous or clay-bearing deposit	Oxford Dictionary of Earth Science
mudstone	**MS**	see Lithology section. where <10% unit	
oxidised	**OX**	Having undergone oxidation, a reaction in which oxygen combines with, or hydrogen is removed from, a substance.	Oxford Dictionary of Earth Science

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
peaty	**PE**	Containing or showing characteristics of Peat: an organic soil or deposit; in Britain, a soil with an organic soil horizon at least 40 cm thick. Peat formation occurs when decomposition is slow owing to anaerobic conditions associated with waterlogging. Decomposition of cellulose and hemicellulose is particularly slow for Sphagnum plants, which are characteristic of such sites, and hence among the principal peat-forming plants.	Oxford Dictionary of Earth Science
phosphatic	**PP**	Containing or showing characteristics of phosphates, a rock or deposit made up largely of inorganic phosphate, commonly calcium phosphate.	Oxford Dictionary of Earth Science
pyritic	**PY**	Containing or showing characteristics of Pyrite (fool's gold): a sulphide mineral, FeS_2; sp. gr. 4.9–5.2; hardness 6.0–6.5; cubic; pale brass-yellow, does not tarnish; greenish-black streak; metallic lustre; crystals cubic, pyritohedra (pentagonal dodecahedra), octahedra, or combinations of the two; cleavage poor basal {001}; occurs with other sulphide ores genetically associated with basic and ultrabasic rocks, and together with pyrrhotine and chalcopyrite; very widely distributed in a great variety of environments, and found in igneous rocks as an accessory mineral, in sedimentary rocks (especially black shales), as nodules in metamorphic rocks, and common in hydrothermal veins.	Oxford Dictionary of Earth Science
quartzose	**QZ**	Comprising of Quartz (rock crystal): a widely distributed rock forming silicate mineral SiO_2 sp. gr. 2.65; hardness 7; trigonal; commonly colourless or white, but can occur in a variety of colours; vitreous lustre; crystals usually six-sided prisms terminated by six-faced pyramids, the prisms often striated, also occurs extensively in massive form; no cleavage; conchoidal fracture; found in many igneous and metamorphic rocks, extensively in clastic rocks, and a common gangue mineral in mineral veins.	Oxford Dictionary of Earth Science
sandstone	**SS**	see Lithology section. where <10% unit	
sandy	**SA**	Containing or showing characteristics of sand: in AS1289 scale, particles between 0.06 and 2 mm.	AS1289

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
shaly	**SH**	Showing characteristics of Shale: a fine-grained, fissile, sedimentary rock composed of clay-sized and silt-sized particles of unspecified mineral composition.	Oxford Dictionary of Earth Science
shelly	**HY**	Contains a large proportion of shell or shell fragments.	Oxford Dictionary of Earth Science
sideritic	**SD**	Containing or showing characteristics of Siderite (chalybite, spathose iron): $FeCO_3$; sp. gr. 3.8–4.0; hardness 3.5–4.5; trigonal; grey to grey-brown or yellowish-brown, translucent when pure; white streak; vitreous lustre; uneven fracture; crystals rhombohedral with curved faces, but also occurs massive, granular, fibrous, compact, botryoidal, and earthy in habit; cleavage perfect rhombohedral {1011}; widespread in sedimentary rocks, especially clays and shales where it is concretionary and makes clay into ironstone, also as a gangue mineral in hydrothermal veins together with other metallic ores and as a replacement mineral in limestone; dissolves slowly in cold, dilute hydrochloric acid, which effervesces when warmed.	Oxford Dictionary of Earth Science
siliceous	**SC**	Containing, resembling, relating to, or consisting of Silica: Silicon dioxide (SiO_2) which occurs naturally in three main forms: (a) crystalline silica includes the minerals quartz, tridymite, and cristobalite; (b) cryptocrystalline or very finely crystalline silica includes some chalcedony, chert, jasper, and flint; and (c) amorphous hydrated silica includes opal, diatomite, and some chalcedony. Coesite and stishovite are two high density polymorphs of quartz which rarely occur in nature.	The American Heritage® Dictionary of the English Language, Fourth Edition
silicified	**SF**	Has been converted into or impregnated with Silica: refer to siliceous for definition of Silica.	The American Heritage® Dictionary of the English Language, Fourth Edition
siltstone	**ST**	see Lithology section. where <10% unit	
silty	**SI**	Containing or showing characteristics of Silt: in the Udden–Wentworth scale, particles between 4 µm and 62.5µm in size.	Oxford Dictionary of Earth Science
smectitic	**SM**	Containing or showing characteristics of Smectite: a family of clay minerals that includes montmorillonite and bentonite.	Oxford Dictionary of Earth Science
sooty	**SX**	Covered with or as if with soot. Blackish or dusky in colour.	The American Heritage® Dictionary of the English Language, Fourth Edition
stony	**SY**	Covered with or full of stones; resembling stone, as in hardness.	Oxford Dictionary of Earth Science
sub arenitic	**AM**	A sandstone type where 15 % to 25 % of rock is lithic or feldspathic (arkose).	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
tillitic	**TI**	Containing or showing characteristics of a Tillite: a lithified deposit of boulder clay or till produced by the action of glaciers.	Oxford Dictionary of Earth Science
tonsteinous	**TN**	Containing or showing characteristics of a Tonstein: a compact, kaolinite-rich mudstone, which developed as a kaolinitic and or smectitic palaeosol, and is frequently found as thin bands within coal seams or resting directly above the coal. Some tonsteins are laterally extensive and are believed to be the product of weathered volcaniclastic ash.	Oxford Dictionary of Earth Science
tuffaceous	**TF**	Containing or showing characteristics of a Tuff: the compacted (lithified) equivalent of a volcanic ash deposit, which has been generated and emplaced by pyroclastic processes or was water lain, and in which the grain size of the pyroclasts is less than 2 mm.	Oxford Dictionary of Earth Science
vitrainous	**VI**	Of or like the coal lithotype Vitrain: black with brilliant, glassy lustre, conchoidal fracture, and cubic *cleavage. It is clean and structureless, and occurs in thin bands or lenses.	Oxford Dictionary of Earth Science
volcanic	**VO**	Produced by or discharged from a volcano.	The American Heritage® Dictionary of the English Language, Fourth Edition
Inclusions		Portions of one mineral or rock type enclosed within another rock type.	The Penguin "Dictionary of Geology"
bands	**BN**	Stratum or lamina conspicuous because they differ in colour and/or grainsize from adjacent layers.	The Penguin "Dictionary of Geology"
blebs	**BL**	Small, usually rounded inclusions of one material in another.	The Penguin "Dictionary of Geology"
clasts	**CT**	The individual constituents of detrital sedimentary rocks produced by the physical disintegration of a larger rock mass.	The Penguin "Dictionary of Geology"
cobbles	**OO**	Sediment with a diameter of 60 to 200 mm.	
concretions	**CI**	Rounded or irregular masses formed by the concentration of certain constituents of sediments around a central nucleus during diagenesis.	The Penguin "Dictionary of Geology"
disseminated	**DS**	Where fine particles of minerals or rock fragments are dispersed through an enclosing rock.	The Penguin "Dictionary of Geology"
fragments	**FR**	Pieces broken off from a larger whole; broken pieces.	Collins Dictionary
grains	**GN**	The particles or discrete crystals which comprise a rock or sediment.	The Penguin "Dictionary of Geology"
granules	**GG**	Sediment with a diameter of 2 to 20 mm.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
gravelly	**GV**	Having gravel sized particles (between 2 and 60 mm). For use when Lithological Qualifier already used for grain size of the majolrity of particles.	
laminae (2-20mm)	**LM**	A layer in a sedimentary rock 2 - 20 mm in thickness that is visually separable from other layers above and below by a discrete change in lithology.	The Penguin "Dictionary of Geology"
layers	**LY**	Beds or stratum of rock.	The Penguin "Dictionary of Geology"
lenses	**LN**	A band or bed of sedimentary rock that is thick in the central part and thins towards the edges.	The Penguin "Dictionary of Geology"
matrix	**MX**	The finer grained material in which larger grains are embedded.	The Penguin "Dictionary of Geology"
nodules	**ND**	A spherical, oval, or similarly rounded concretion not exceeding 200 mm in diameter.	
partings	**PA**	Thin layers of usually fine grained sediment that separates, and along which two coarser grained sedimentary beds readily separate. Also used to describe siliciclastic beds within coal seams	The Penguin "Dictionary of Geology"
pebbles	**PB**	Sediment with a diameter 20 to 60 mm.	
pellets	**PT**	Ovoid particles of sediment, commonly composed only of calcium carbonate, which range in size from 0.20 to 6.0 mm.	
penny bands (<2mm)	**PN**	A laterally continuous layer in a sedimentary rock less than 2 mm in thickness that is visually separable from other layers above and below by a discrete change in lithology. Usually fine grained or tuffaceous.	
phases	**PH**	Sections of rock which differ in some minor respect from the dominant rock type.	The Penguin "Dictionary of Geology"
pods	**PO**	A generally cylindrical inclusion that decreases at both ends.	The Penguin "Dictionary of Geology"
stringers	**SG**	Thin layers of usually fine grained sediment or coal that traverse through a different rock mass.	The Penguin "Dictionary of Geology"
traces	**TR**	Thin irregular discontinuous layers of usually fine grained sediment or coal that traverse through a different rock mass.	The Penguin "Dictionary of Geology"
wisps	**WP**	Thin irregular discontinuous layers of usually fine grained sediment or coal that traverse through a different rock mass.	The Penguin "Dictionary of Geology"
Preposition			
and	**ET**		

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
as	**AS**		
of	**OF**		
on	**ON**		
with	**WI**		
Position			
alternating	**AT**		
near base of unit	**BU**		
near middle of unit	**MU**		
near top and base of unit	**XU**		
near top of unit	**TU**		
tends to	**TT**		
throughout	**TO**		
LITHOLOGY INTERRELATIONSHIP			
coarsely interbedded (> 200mm) with	**CB**	Being positioned between or alternated with other layers of dissimilar character where the layers are > 200mm thick.	Collins Dictionary of Geology (1990 edition)
coarsening up to	**CU**	Increase in grain size in sedimentary rock from base of the bed to its top. Termed reverse grading and is characteristic of some alluvial fan deposits.	Collins Dictionary of Geology (1990 edition)
disseminated with	**DS**	Widely dispersed throughout rock.	www.merriam-webster.com
fining up to	**FU**	Decrease in grain size in sedimentary rock from base of the bed to its top. Termed normal grading and is characteristic of some turbidites and many sedimentary beds deposited in waning flow conditions.	Collins Dictionary of Geology (1990 edition)
grading into	GD	This code is only for historical data as future logging should be more specific and use FU for fining up to or CU for coarsening up to.	
interbedded with	**IB**	Being positioned between or alternated with other layers of dissimilar character.	Collins Dictionary of Geology (1990 edition)
intercalated with	**IC**	Existing or introduced between subordinate layers of a different type. It applies especially to layers of one kind of material that alternate with thicker strata of another material, e.g. Beds of shell intercalated with sandstone.	Collins Dictionary of Geology (1990 edition)

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
interlaminated (<20mm) with	**IL**	Being positioned between or alternated with other laminations of dissimilar character where the layers are less then 20mm thick.	Collins Dictionary of Geology (1990 edition)
intermixed with	**IM**	Existing with lithology(s) of a different type in no regular fashion and not forming regular structures.	Collins Dictionary of Geology (1990 edition)
irregularly interbedded with	**IR**	Being irregularly positioned between or alternated with other layers of dissimilar character.	Collins Dictionary of Geology (1990 edition)
thinly interbedded (60-200mm) with	**TB**	Being positioned between or alternated with other layers of dissimilar character where the layers are between 60 and 200mm thick.	Collins Dictionary of Geology (1990 edition)
very thinly interbedded (20-60mm) with	**UB**	Being positioned between or alternated with other layers of dissimilar character where the layers are between 20 and 60mm thick.	AS1726-2017
with bands of	**BN**	Stratum or lamina distinguishable from adjacent layers by colour or lithological difference.	Collins Dictionary of Geology (1990 edition)
with boulders of	**BO**	Containing sediment with a diameter greater than 200 mm.	
with cement of	**CM**	Chemically precipitated mineral matter that is part of the cementation process.	Collins Dictionary of Geology (1990 edition)
with clasts of	**CT**	Individual fragments of another rock mass; a constituent of a bioclastic or pyroclastic rock.	Collins Dictionary of Geology (1990 edition)
with cobbles of	**OO**	Containing sediment with a diameter of 60 to 200 mm.	
with fragments of	**FR**	Parts broken off, detached or incomplete of another rock, bioclastic or pyroclastic material.	Collins Dictionary of Geology (1990 edition)
with granules of	**GG**	Containing sediment with a diameter 2 to 20 mm.	
with lenses of	**LN**	Discontinuous curved lenses (thick in middle, thinner at edges) of finer sediments (mud or silt) deposited in the troughs or draped over ripples in cross-laminated sands.	Collins Dictionary of Geology (1990 edition)
with matrix of	**MX**	The groundmass of an igneous rock or the finer grained material enclosing larger grains in a sedimentary rock.	Collins Dictionary of Geology (1990 edition)
with nodules of	**ND**	Rounded concretionary mass or lump.	Collins Dictionary of Geology (1990 edition)
with pebbles of	**PB**	Containing sediment with a diameter 20 to 60 mm.	
with pods of	**PO**	An elongate or lenticular inclusion.	
with wisps of	**WP**	Thin strip or fragment.	www.merriam-webster.com
WEATHERING			

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Residual soil	**R**	Soil developed on extremely weathered rock: the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.	AS 1726-1993
Extremely weathered	**E**	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded, in water.	AS 1726-1993
Highly weathered	H		
Distinctly weathered	**D**	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.	AS 1726-1993
Moderately weathered	M		
Slightly weathered	**S**	Rock is slightly discoloured but shows little or no change of strength from fresh rock. Usually penetrative weathering along defect surfaces.	AS 1726-1993
Weathered	W	Degree of weathering not assessed.	
Fresh	**F**	Rock shows no sign of decomposition or staining.	AS 1726-1993
ESTIMATED STRENGTH		see Geotechnical Dictionary for details	
BED SPACING		see Geotechnical Dictionary for details	
DEFECT INTACT		see Geotechnical Dictionary for details	
DEFECT TYPE		see Geotechnical Dictionary for details	
DEFECT SPACING			
extremely wide (>2m)	**EW**	> 2 m	Anon, 1977. The description of rock masses for engineering purposes. Report by the Geological Society Engineering Group Working Party. Q. Jl. Engng Geol. 10 pp355-388. Table 5.
very wide (600-2000mm)	**VW**	600-2000 mm	
wide (200-600mm)	**WI**	200-600 mm	
moderately wide (60-200mm)	**MW**	60-200 mm	
moderately narrow (20-60mm)	**MN**	20-60 mm	
narrow (6-20mm)	**NA**	6-20 mm	
very narrow (<6mm)	**VN**	<6 mm	
CORE STATE			

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Overdrilled core	**O**	The driller attempts to push more core into the core barrel than will fit, resulting in a series of helical fractures up the core. It often results in the core being unable to be retrieved intact from the barrel, as the helical fractures expand and lock in the splits. Core often crushed and pulverised. Typically picked up in crushed or broken state on the subsequent core run.	common observation
Solid core	**S**	No breaks or defects, solid continuous core. Two or less mechanical breaks per metre.	common observation
Broken core	**B**	Broken in part, some defects, with core in relatively good condition and intact. Three to five mechanical breaks per metre.	common observation
Very broken core	**V**	Core is badly broken throughout the section. Six to 20 mechanical breaks per metre.	common observation
Fragmented core	**F**	Core is fragmented and very badly broken up, original structures not easily determinable; any section of core that is broken in such a way that the original defects can only be identified with difficulty. More than 20 mechanical breaks per metre.	common observation
Crushed core	**C**	Core has been crushed down to small fragments, no original structures remain intact.	common observation
Cuttings	**K**	Rock chip fragments from open hole drilling	common observation
MECHANICAL STATE			
Slaking		The crumbling and disintegration of materials due to wetting or drying	
non slaking	**NS**	Does not disintegrate or crumble when exposed to moisture and drying.	American Geological Institute Glossary of Geology
low slaking	**LS**	Small degree of disintegration and crumble when exposed to moisture and drying. Slight to mild surface and edge spall, surface slightly swollen.	
medium slaking	**MS**	Moderate degree of disintegration and crumble when exposed to moisture. Breakdown of pile of small flakes, some swelling and some flocculation.	
high slaking	**HS**	Disintegrates and crumbles easily when exposed to moisture and drying.	
Plasticity			
non plastic	**NP**	Non-plastic, cannot be moulded, even if moisture is added.	
low plasticity	**LP**	Material can be moulded but does not form a continuous worm when water added and moulded.	Monroe, James S., and Reed Wicander. The Changing Earth: Exploring Geology and Evolution, 2nd ed.
intermediate plasticity	**IP**	Worm can be formed when water added and moulded, but crumbles when thinned out.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
high plasticity	**HP**	Will form a thin worm when water added and moulded between hands	
Other			
blocky	**BK**	bedding and jointing in rock mass gives the appearance of blocks with a spacing of 30-100cm	
brecciated	**BR**	Coarse sedimentary rock consisting of angular or nearly angular fragments larger than 0.08 in. (2 mm). Breccia commonly results from processes such as landslides or geologic faulting, in which rocks are fractured.	Britannica Concise Encyclopedia. 1994-2008
brittle	**BL**	Likely to break, snap, or crack, when subjected to pressure. Easily damaged or disrupted; fragile.	Britannica Concise Encyclopedia. 1994-2008
cleated	**CE**	Open fractures / joints in the coal, specific to coal lithology.	American Geological Institute Glossary of Geology
disintegrates on wetting	**DW**	Disintegrates and crumbles easily when exposed to moisture. High degree of slaking.	
expanding clay	**EX**	Large volume change or swelling when exposed to water.	
fissile	**FS**	Refers to the property of rocks to split along planes of weakness into thin sheets. This is commonly observed in shales and in slates and phyllites, which are foliated metamorphic rocks. The fissility in these rocks is caused by the preferred alignment of platy phyllosilicate grains due to compaction, deformation or new mineral growth.	B. Biju-Duval, Sedimentary Geology
fissured	**FI**	Contains long narrow openings; cracks or clefts, has fissures present.	Britannica Concise Encyclopedia. 1994-2008
flaggy	**FG**	bedding and jointing in rock mass with a spacing of 1-10cm	
flaky	**FL**	Rock is flaky (muscovite / biotite like appearance), tends to form or break off in flakes, scale like appearance.	B. Biju-Duval, Sedimentary Geology
fractured	**FR**	A fracture is any local separation or discontinuity plane in a geologic formation, such as a joint or a fault that divides the rock into two or more pieces. A fracture will sometimes form a deep fissure or crevice in the rock.	American Geological Institute Glossary of Geology
fretted	**FT**	Disaggregated core which resulted from change of moisture conditions when retrieved from the ground (ie has shrinkage cracks) or swollen due to release from confining pressure and added moisture while drilling. It is similar to what core may look like after slake durability test.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
friable	**FB**	Friability (or friable) is the ability of a solid substance to be reduced to smaller pieces with little effort. A friable substance is any substance that can be reduced to fibres or finer particles by the action of a small pressure or friction on its mass. Poorly cemented.	
indurated	**IN**	Hardened due to baking or by pressure and cementation.	Penguin Dictionary of Geology
micro faulted	**MF**	Very small scale faulting. Micro-faults are typically of sub-millimetre length, but have been logged up to a maximum of 10 mm in size.	American Geological Institute Glossary of Geology
non-cleated	**NC**	No cleats present within coal.	
powdery	**PO**	Material is powdery in nature, breaks down to powder when scraped (i.e. Kaolinite).	
puggy	**PU**	Soft, pulverized clay-like material, is typically uncemented or unconsolidated and can be easily dug away with your hands. Often found as fault gouge. Easily deformed.	American Geological Institute Glossary of Geology
sheared	**SH**	The unit is sheared. Shear is the response of a rock to deformation usually by compressive stress and forms particular textures. Shear can be homogeneous or non-homogeneous, and may be pure shear or simple shear. The process of shearing occurs within brittle, brittle-ductile, and ductile rocks. Within purely brittle rocks, compressive stress results in fracturing and simple faulting.	American Geological Institute Glossary of Geology
slabby	**SL**	bedding and jointing in rock mass with a spacing of 10-30cm	
slickensided	**SK**	A slickenside is a smoothly polished surface caused by frictional movement between rocks along the two sides of a fault. This surface is normally striated in the direction of movement.	Encyclopedia Americana. 1920
sticky	**ST**	Having the sticky properties of an adhesive, tacky nature when wet.	
subfissile	**SF**	Less fissile or sub, will split along planes but tends to be more blocky and hard. Fissile refers to the property of rocks to split along planes of weakness into thin sheets. This is commonly observed in shales and in slates and phyllites, which are foliated metamorphic rocks. The fissility in these rocks is caused by the preferred alignment of platy phyllosilicate grains due to compaction, deformation or new mineral growth.	Sedimentary Rocks. Pettijohn, F. J., Harper& Brothers New York 1957
TEXTURE			

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
amorphous	**AM**	Lacking definite form.	www.dictionary.com
amygdaloidal	**AG**	Cavity in an extrusive igneous rock filled with secondary crystalline minerals.	Oxford Dictionary of Earth Sciences
aphanitic	**AP**	Mineral grains too small to be seen unaided by the naked eye.	Oxford Dictionary of Earth Sciences
chalky	**CK**	Containing chalk.	see chalk defintion
cherty	**CH**	Containing chert.	see chert definition
clast supported	**CS**	clasts are in contact with each other and matrix fills the spaces between	
concretionary	**CI**	Containing concretions, spherical or elliptical produced as a result of local cementation within a sediment.	Oxford Dictionary of Earth Sciences
crystalline	**XL**	Having crystals.	
earthy	**EA**	Having a non-metallic lustre of porous aggregates such as clays, laterites and bauxite.	Oxford Dictionary of Earth Sciences
equigranular	**EQ**	All grains being the same size.	www.webref.org/geology
fibrous	**FB**	Having an appearance similar to fibres (stringy).	
flaggy	**FG**	Fissility with layers 1 to 5 cm thick.	www.webref.org/geology
flow banded	**FL**	A structure of igneous rocks that is esp. common in silicic lava flows. It results from movement or flow, and is an alternation of mineralogically distinct layers.	www.webref.org/geology
glassy	**GS**	Having a glass like appearance, translucent.	
granular	**GG**	Being 2 to 20 mm in size.	AS1289
gritty	**GT**	Containing a coarse sand fraction	
matrix supported	**MS**	clasts are isolated within the matrix	
nodular	**ND**	Containing nodules, a spherical or elliptical concretion; the habit of a mineral to grow in concentric spheres or ellipses due to chemical precipitation.	Oxford Dictionary of Earth Sciences
oolitic	**OO**	Containing ooids, sub-spherical sand sized carbonate particle made of concentric rings of calcium carbonate around another particle.	Oxford Dictionary of Earth Sciences
pelletal	**PT**	A concretionary texture characterized by minute pellets of colloidal or replacement origin and closely resembling oolites.	www.webref.org/geology
pisolitic	**PS**	A spherical to sub-spherical inorganic carbonate particle 0.02 to 1000 mm in diameter characterized by concentric lamination, some are similar to ooids, others are formed subaerial environments in calcrete.	Oxford Dictionary of Earth Sciences
platey	**PL**	Intermediate between laminar and flaggy.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
porphyritic	**PR**	Containing large well formed crystals in fine grained groundmass.	Oxford Dictionary of Earth Sciences
schistose	**SZ**	Inequant minerals showing preferred orientations.	An Introduction to Igneous and Metamorphic Petrology by Winter
soapy	**SO**	Having a very smooth, greasy or oily texture	www.webref.org/geology
vesicular	**VS**	Having vesicles, ellipsical/spherical/cylindrical voids found in extrusive igneous rocks.	Oxford Dictionary of Earth Sciences
vitreous	**VT**	Glassy lustre.	
vuggy	**VU**	(syn: vughy) Pore spaces formed by solution, can have secondary mineralization.	Oxford Dictionary of Earth Sciences
waxy	**WX**	Smooth with a resinous lustre.	
BASAL CONTACT			
adheres at base	**A**	Lithological boundary sharp but rock mass units do not readily separate.	
basal contact open or readily parts	**B**	Lithological boundary sharp, rock mass units readily separate.	
basal contact deformed	**D**	Lithological boundary plane deformed by post-depositional deformation.	
erosional basal contact	**E**	An unconformity that separates older rocks that have been subjected to erosion from younger sediments that cover them; specif. disconformity. Contact sharp, shows features such as rip-up clasts, scour surfaces and truncated bedding in the underlying unit.	Dictionary of Mining, Mineral and Related Terms
faulted at basal contact	**F**	Lithological boundary sharp, evidence of post-depositional movement on boundary plane.	
gradational basal contact	**G**	Unit boundary indistinct, marked by a change in grain size or composition.	
sharp and irregular basal contact	**I**	Lithological boundary sharp, non-planar.	
jointed at basal contact	**J**	Geotechnical defect occurs at rock mass unit boundary.	
sharp and oblique basal contact	**O**	Lithological boundary sharp, at angle to bedding.	
sharp and planar basal contact	**P**	Lithological boundary sharp, flat, parallel to bedding plane.	
fractured at basal contact	**R**	Geotechnical defect occurs at rock mass unit boundary.	
sheared at basal contact	**S**	Rock mass units separated at boundary due to post-depositional stress.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
sharp and undulose basal contact	**U**	Lithological boundary sharp, non-planar due to undulating surfaces at the time of deposition.	
SEDIMENTARY FEATURE **Bedding**			
contorted bedding	**CT**	Contorted bedding typically occurs in cross-laminated sediments, with the lamination deformed into small anticlines and sharp synclines.	Miall. Andrew D. Principles of Sedimentary Basin Analysis
convoluted bedding	**CV**	Convolute bedding typically occurs in cross-laminated sediments, with the lamination deformed into rolls, small anticlines and sharp synclines. Such convolutions are commonly asymmetric and overturned in the palaeocurrent direction, typically confined to a single layer of sediment.	McGraw-Hill (2003) Dictionary of Geology
current bedding	**CB**	Current bedding or cross stratification is an internal sedimentary structure of many sand-grade, and coarser, sedimentary rocks and consists of a stratification at an angle to the principal bedding direction.	Pyroclastic density currents and the sedimentation of ignimbrites By Michael J. Branney, B. Peter Kokelaar, Geological Society of London
diffuse bedding	**DF**	Diffuse bedding is marked by size and concentration grading of different sedimentary materials, it ranges from trains of single clasts to units over 200 mm thick. There is no sharp bedding planes and the lithofacies typically locally transitional into massive bedding.	Pyroclastic density currents and the sedimentation of ignimbrites By Michael J. Branney, B. Peter Kokelaar, Geological Society of London
disturbed bedding	**DB**	Any bedding which has been disturbed including convolute and contorted bedding. Convolute bedding produced by subaqueous slumping, water injection or expulsion, or lateral movement of newly deposited sediment.	McGraw-Hill (2003) Dectionary of Geology
flasar bedding	**FL**	In some areas of ripple formation, the ripples of silt and sand move periodically and mud is deposited out of suspension at times of slack water. Flasar bedding is characterised by cross laminated sand containing mud streaks, usually in the ripple troughs.	Miall. Andrew D. Principles of Sedimentary Basin Analysis, Reineck, H.E.; Wunderlich, F. (1968). "Classification And Origin Of Flaser And Lenticular Bedding". Sedimentology
graded bedding	**GB**	Bedding characterized by a systematic change in grain or clast size from the base of the bed to the top. Most commonly this takes the form of normal grading, with coarser sediments at the base, which grade upward into progressively finer ones. Reverse grading can occur.	Monroe, James S., and Reed Wicander. The Changing Earth: Exploring Geology and Evolution, 2nd ed.

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
lenticular bedding	**LB**	In some areas of ripple formation, the ripples of silt and sand move periodically and mud is deposited out of suspension at times of slack water. Lenticular bedding is where mud dominates and is interbedded with cross-laminated sand occurring in isolated lenses. Lenticular bedding is classified by its large quantities of mud relative to sand, whereas a flaser bed consists mostly of sand.	Miall. Andrew D. Principles of Sedimentary Basin Analysis, Reineck, H.E.; Wunderlich, F. (1968). "Classification And Origin Of Flaser And Lenticular Bedding". Sedimentology
planar bedding	**PL**	Consists of parallel bedded units with essentially planar bounding surfaces.	Miall. Andrew D. Principles of Sedimentary Basin Analysis
poorly developed bedding	**PD**	Bedding planes are poorly defined and difficult to distinguish.	
ripple bedding	**RI**	A bedding surface characterized by ripple marks, refer to ripple marks.	American Geological Institute Glossary of Geology
wavy bedding	**WB**	In some areas of ripple formation, the ripples of silt and sand move periodically and mud is deposited out of suspension at times of slack water. Wavy bedding is where thin-ripple cross-laminated sandstones alternate with mud rock.	Miall. Andrew D. Principles of Sedimentary Basin Analysis
well-developed bedding	**WD**	Bedding is well defined and surfaces easily identified.	
Cross Bedding			
high angle cross bedding (>30°)	**HX**	Cross bedding where the angle of repose of the cross bed set is greater than 30 degrees from the horizontal.	Middleton, G., 2003, Encyclopedia of Sedimentary Rocks
medium angle cross bedding (10°-30°)	**MX**	Cross bedding where the angle of repose of the cross bed set is between 10 and 30 degrees from the horizontal.	Middleton, G., 2003, Encyclopedia of Sedimentary Rocks
low angle cross bedding (<10°)	**LX**	Cross bedding where the angle of repose of the cross bed set is less than 10 degrees from the horizontal.	Middleton, G., 2003, Encyclopedia of Sedimentary Rocks
cross bedding	**XB**	Cross bedding refers to (near-) horizontal units that are internally composed of inclined layers. The original depositional layering is tilted and the tilting is not a result of post-depositional deformation. Cross beds or "sets" are the groups of inclined layers, and the inclined layers are known as cross strata. Cross bedding forms when small-scale erosion occurs during deposition, cutting off part of the beds. Newer beds then form at an angle to older ones.	Middleton, G., 2003, Encyclopedia of Sedimentary Rocks
fine cross bedding	**FX**	Fine, small scale cross bedding (refer to cross bedding).	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
tabular cross bedding	**TX**	Tabular (planar) cross beds consist of cross bedded units that have large horizontal extent relative to set thickness and that have essentially planar bounding surfaces. The foreset laminae of tabular cross beds have curved laminae that have a tangential relationship to the basal surface.	Middleton, G., 2003, Encyclopedia of Sedimentary Rocks
trough cross bedding	**RX**	Trough cross beds have lower surfaces which are curved or scoop shaped and truncate the underlying beds. The foreset beds are also curved and merge tangentially with the lower surface.	Middleton, G., 2003, Encyclopedia of Sedimentary Rocks
Laminations			
large scale cross laminations (>2m)	**LL**	Large cross laminations are ripples with a height greater than two meters, and a thickness equivalent to two meters or greater. Some ripples that may fit this category would be high energy river-bed bars, sand waves, epsilon cross bedding and Gilbert-type cross bedding.	Greeley, Ronald, and James D. Iversen. Wind as a Geological Process On Earth, Mars, Venus and Titan (Cambridge Planetary Science Old). New York: Cambridge UP, 1987
medium scale cross laminations (200 - 2000mm)	**ML**	Medium cross laminations are ripples with a height greater than twenty centimetres, and less than two meters in thickness. Some ripples that may fit this category would be current-formed sand waves, and storm-generated hummocky cross stratification.	Greeley, Ronald, and James D. Iversen. Wind as a Geological Process On Earth, Mars, Venus and Titan (Cambridge Planetary Science Old). New York: Cambridge UP, 1987
small scale cross laminations (<200mm)	**SL**	Small cross laminations are ripples set at a height less than twenty centimetres, while the thickness is only a few millimetres. Some ripples that may fit this category are wind ripples, wave ripples, and current ripples.	Greeley, Ronald, and James D. Iversen. Wind as a Geological Process On Earth, Mars, Venus and Titan (Cambridge Planetary Science Old). New York: Cambridge UP, 1987
wavy laminations	**WL**	Very small cross lamination means that the ripple height is roughly one centimetre or less. It is lenticular and wavy lamination.	Greeley, Ronald, and James D. Iversen. Wind as a Geological Process On Earth, Mars, Venus and Titan (Cambridge Planetary Science Old). New York: Cambridge UP, 1987
Shape			
very angular grains	**VG**	Grains are very angular, have numerous sharp edges, no smooth sections, refer to diagram.	Pettijohn, 1973
angular grains	**AG**	Grains are angular, have sharp edges, minor smooth sections, edges not so pronounced, refer to diagram.	Pettijohn, 1973
subangular grains	**GG**	Sharp edges have been smoothed to some extent, but the grain is still distinctly angular, but edges not so pronounced, refer to diagram.	Pettijohn, 1973
well rounded grains	**WG**	Grains are smooth, without any sharp edges, refer to diagram.	Pettijohn, 1973

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
rounded grains	**RG**	Grains are smooth, with no sharp edges, but some minor angularity, refer to diagram.	Pettijohn, 1973
subrounded grains	**BG**	Grains are relatively smooth, with occasional sharp edges and minor angularity, refer to diagram.	Pettijohn, 1973
bladed grains	**DG**	All dimensions are very different, belt like, longer and thinner than tabular.	Th. Zingg, 1935
prolate grains	**LG**	Grains are elongated at the poles, cigar shaped.	Th. Zingg, 1935
tabular grains	**TG**	Grains have a flat, plane surface shape.	Th. Zingg, 1935
very angular fragments	**VF**	Fragments have numerous sharp edges, no smooth sections, refer to roundness and sphericity diagram.	Pettijohn, 1973
angular fragments	**AF**	Fragments have sharp edges, minor smooth sections, edges pronounced, refer to roundness and sphericity diagram.	Pettijohn, 1973
subangular fragments	**GF**	Sharp edges have been smoothed to some extent, but the grain is still distinctly angular, but edges not so pronounced, refer to roundness and sphericity diagram.	Pettijohn, 1973
well rounded fragments	**WF**	Fragments are smooth, without any sharp edges, refer to roundness and sphericity diagram.	Pettijohn, 1973
rounded fragments	**RF**	Fragments are smooth, with no sharp edges, but some minor angularity, refer to roundness and sphericity diagram.	Pettijohn, 1973
subrounded fragments	**BF**	Fragments are relatively smooth, with occasional sharp edges and minor angularity, refer to roundness and sphericity diagram.	Pettijohn, 1973
very angular pebbles	**VP**	Pebbles have numerous sharp edges, no smooth sections, refer to roundness and sphericity diagram.	Pettijohn, 1973
angular pebbles	**AP**	Pebbles have sharp edges, minor smooth sections, edges not so pronounced, refer to roundness and sphericity diagram.	Pettijohn, 1973
subangular pebbles	**GP**	Sharp edges have been smoothed to some extent, but the grain is still distinctly angular, but edges not so pronounced, refer to roundness and sphericity diagram.	Pettijohn, 1973
well rounded pebbles	**WP**	Pebbles are smooth, without any sharp edges, refer to roundness and sphericity diagram.	Pettijohn, 1973
rounded pebbles	**RP**	Pebbles are smooth, with no sharp edges, but some minor angularity, refer to roundness and sphericity diagram.	Pettijohn, 1973

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
subrounded pebbles	**BP**	Pebbles are relatively smooth, with occasional sharp edges and minor angularity, refer to roundness and sphericity diagram.	Pettijohn, 1973
Sorting		Segregation by grain sizes. "Poor" means a wide range of grain sizes such as silty sandy gravel; "good" means a narrow range of grain sizes such as sand.	
well sorted	**WS**	Refers to a sedimentary deposit or rock composed of grains that are of similar size and/or density, narrow range of grain sizes such as sand.	
moderately sorted	**MS**	Refers to a sedimentary deposit or rock composed of similar (but not same) sizes of sediment grains.	
poorly sorted	**PS**	Refers to a sedimentary deposit or rock composed of many different sizes of sediment grains from one another, "Poor" means a wide range of grain sizes such as silty sandy gravel. Smaller particles fill the gaps between larger particles.	
bimodal sorting	**BS**	Refers to a sedimentary deposit or rock having or exhibiting two contrasting modes or forms. Contains particles / grains of two distinct sizes and populations, common in coarse gravels.	
polymodal sorting	**YS**	Refers to a sedimentary deposit or rock having or exhibiting two or more contrasting modes or forms. Contains particles / grains of two or more distinct sizes and populations, common in coarse gravels.	
coarsening upwards	**CU**	Refers to a sedimentary deposit or rock where the grain sequence coarsens upwards, with fine grained material at the base of the unit and coarsening up the sequence.	
fining upwards	**FU**	Refers to a sedimentary deposit or rock where the grain sequence fines upwards, with coarse grained material at the base of the unit and fining up the sequence.	
Permeability/Porosity			
impermeable (<0.1 mD)	**IR**	Does not allow fluid to pass through it; 0.0001 to 0.1 mD	Bear, 1972
low permeability (0.1-10 mD)	**LP**	Allows some fluids to pass through it; 0.1 to 10 mD.	Bear, 1972
medium permeability (10-10000 mD)	**MP**	Allows moderate amount of fluids to pass through it; 10 to 10000 mD.	Bear, 1972

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
high permeability (>10000 mD)	**HP**	Allows significant amount of fluids to pass through it; 10000 to 10+8 mD.	Bear, 1972
permeable	**PE**	Allows fluid to pass through it. Permeability is a measure of the ability of a porous material to allow fluids to pass through it. Permeability is typically determined in the lab by application of Darcy's law under steady state conditions and is measured in Millidarcy's (mD).	Bear, 1972
porous	**PO**	The unit is porous. Porosity or void fraction is a measure of the void (i.e., "empty") spaces in a material, and is a fraction of the volume of voids over the total volume, between 0–1, or as a percentage between 0–100 %. Porosity of a porous medium (such as rock or sediment) describes the fraction of void space in the material, where the void may contain, for example, air or water. It is defined by the ratio.	
Cracks			
dessication cracks	**DC**	Desiccation cracks are sedimentary structures formed as muddy sediment dries and contracts. Desiccation mud cracks are usually continuous, polygonal, and have U- or V- shaped cross sections that would have been filled in with sediment from above.	Jackson, J.A., 1997, Glossary of Geology (4th ed.), American Geological Institute, Alexandria, VA
intraformational cracks	**IC**	A crack confined to a sedimentary layer lying between undeformed beds. Being or occurring within a geologic formation: originating more or less contemporaneously with the enclosing geologic material.	Britannica Concise Encyclopedia. 1994-2008
mud casts/cracks	**MC**	Mud Casts form when organic material (flora and/or flora) has been buried in sediments before decomposing. The weight of the sediments leaves an impression of the organism in the sediment, the cast forms when the organic material decomposes and new materials fill the spaces and solidify into rock (i.e. Fossils). Mud cracks are sedimentary structures formed as muddy sediment dries and contracts. Mud cracks are usually continuous, polygonal, and have U- or V- shaped cross sections that would have been filled in with sediment from above.	Jackson, J.A., 1997, Glossary of Geology (4th ed.), American Geological Institute, Alexandria, VA
shrinkage cracks	**SC**	A sedimentary structure developed by the shrinkage of sediment related to desiccation. A small crack produced in fine-grained sediment or rock by the loss of contained water during drying or dehydration. They commonly occur in thin mudstones interbedded with sandstones.	Pettijohn, F.J.; Potter, P.E. (1964). Atlas and Glossary of Primary Sedimentary Structures. Berlin: Springer-Verlag.

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
syneresis cracks	**YC**	Syneresis cracks (also known as subaqueous shrinkage cracks) are a sedimentary structure developed by the shrinkage of sediment during drying. Syneresis is the expulsion of a liquid from a gel-like substance. Syneresis cracks are formed by the contraction of clay in response to changes in the salinity of a liquid surrounding a deposit. Syneresis cracks, however, are usually discontinuous, spindle or sinuous in shape, and have U- or V- shaped cross sections that have been filled in with sediment from above or below.	Pettijohn, F.J.; Potter, P.E. (1964). Atlas and Glossary of Primary Sedimentary Structures. Berlin: Springer-Verlag.
Structures			
bioturbated	**BT**	Displaced and mixed sediment particles (i.e. sediment reworking) and solutes by fauna (animals) or flora (plants). This includes burrowing, ingestion and defecation of sediment grains, construction and maintenance of galleries, and infilling of abandoned dwellings, that displace sediment grains and mix the sediment matrix.	Encyclopædia Britannica. 2010
boudinage	**BD**	Boudinage describes structures formed by extension, where a rigid tabular body is stretched and deformed amidst less competent surroundings. The competent bed begins to break up, forming sausage-shaped boudins. In three dimensions, the boudinage may take the form of ribbon-like boudins or chocolate-tablet boudins, depending on the axis and isotropy of extension. They range in size from about 20 m thick to about 1 cm.	Encyclopædia Britannica. 2010
bounce marks/prod casts	**PC**	Bounce marks are rows of more symmetrical marks due objects being swept or bounced along the bottom of a stream during the formation of the material. Prod casts show where an object has dug down into the clay and then been plucked out again by the current. As a result the steep side of prod marks is the downstream side.	Petroleum Geology By Knut Bjorlykke, Per Avseth
burrowing	**BW**	A form of bioturbation, where displaced and mixed sediment particles and solutes by fauna (animals) in the form of burrowing, formed by the ingestion and defecation of sediment grains and infilling of abandoned dwellings, that displace sediment grains and mix the sediment matrix.	Encyclopædia Britannica. 2010

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
climbing ripples	**CR**	The synthetic laminae commonly left (but not isolated to) by wind-ripples are called climbing ripples, reflecting that the deposits have the appearance of having been created by the translation of the ripple surface. They form when several trains of ripples are superimposed on each other and they seem to 'climb', by generating stratigraphic surfaces that are tilted in an up current direction.	Glossary of Geology, American geological Institute
colloidal iron deposit	**CI**	Has iron particles dispersed evenly throughout the unit. A colloid is a substance microscopically dispersed evenly throughout another substance.	
compaction feature	**CF**	Contains structures or features resulting from compaction. Features such as folds can be generated in a younger sequence by differential compaction over older structures such as fault blocks and reefs.	
drop pebbles	**DP**	A clast dropped through the water column into soft sediments, typically released from ice.	The New Penguin Dictionary of Geology
flame structures	**FS**	A flame structure is a type of soft-sediment deformation that forms in unlithified sediments. Flame structures consist of sharp-crested wave or flame-shaped plumes of mud that have risen irregularly upward into an overlying layer, generally a rapidly deposited sand. The flames, though irregular in shape are generally overturned predominately in one direction, which is the paleocurrent direction of the overlying rock.	Encyclopedia of sediments and sedimentary rocks By Gerard V. Middleton
imbricate clasts	**IM**	A deposit of similarly orientated clasts, often regularly overlapping, or shingling, of non-spherical geometry and the result of their deposition by fluids.	The dictionary of physical geography By David S. G. Thomas, Andrew Goudie
load cast	**LC**	An irregularity at the base of an overlying stratum, usually sandstone, that projects into an underlying stratum, usually shale or clay.	The dictionary of physical geography By David S. G. Thomas, Andrew Goudie
pebble lag	**PG**	Conglomerates/pebbles confined to the basal part of a channel fill sequence. High energy water flow suspended and carried the pebbles in the stream. When the water energy decreased, the stream was no longer powerful enough to carry the pebbles and they were deposited resulting in the pebble lag formation.	The dictionary of physical geography By David S. G. Thomas, Andrew Goudie
reworked	**RW**	Any geologic material that has been removed or displaced by natural agents from its origin and incorporated in a younger formation.	Encyclopædia Britannica. 2010

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
ripple marks	**RM**	A pattern of wavy lines formed along the top of a bed by wind, water currents, or waves. One of a series of small marine, lake, or riverine topographic features, consisting of repeating wavelike forms with symmetrical slopes, sharp peaks, and rounded troughs.	Encyclopædia Britannica. 2010
rip-up clasts	**RU**	Rip-up clasts are created by vigorous flows of sediment, entraining and redepositing underlying sedimentary beds, or beds eroded from the sides of a channel. A few of these clasts are preserved as mudstone. They may also be called mudstone clasts, intraformational or intrabasinal clasts, or clay chips.	Encyclopædia Britannica. 2010
rootlet beds	**RB**	An estuarine type deposit of clay, sand, and gravel, the upper part of which was subsequently weathered into a soil and penetrated by small roots forming a Rootlet Bed.	
scour and fill	**SF**	Structure formed during the process of first digging out and then refilling a channel instigated by the action of a stream or tide; refers particularly to the process that occurs during a period of flood. Flows of sediment are repeatedly eroded, then fills channels (scours) in the underlying sediment.	Allen, John R. L. Sedimentary Structures, Their Character and Physical Basis. Vol. 2. Amsterdam: Elsevier Scientific Pub., 1982
sedimentary dyke	**DY**	A clastic/sedimentary dyke is a seam of sedimentary material that fills a crack in and cuts across sedimentary strata. Clastic dykes form rapidly by fluidized injection (mobilization of pressurized pore fluids) or passively by water, wind, and gravity (sediment swept into open cracks). Clastic dykes are commonly vertical or near-vertical. Centimetre-scale widths are common, but thicknesses range from millimetres to metres. Length is usually many times width.	The dictionary of physical geography By David S. G. Thomas, Andrew Goudie
slumping	**SP**	Slump structures are mainly found in sandy shales and mudstones, but may also be in limestones, sandstones, and evaporites. They are a result of the displacement and movement of unconsolidated sediments, and are found in areas with steep slopes and fast sedimentation rates.	Allen, John R. L. Sedimentary Structures, Their Character and Physical Basis. Vol. 2. Amsterdam: Elsevier Scientific Pub., 1982
soft sediment deformation	**DE**	Soft-sediment deformation structures develop at deposition or shortly after, during the first stages of the sediment's consolidation. The most common places for soft-sediment deformations to materialize are in deep water basins with turbidity currents, rivers, deltas, and shallow-marine areas.	Allen, John R. L. Sedimentary Structures, Their Character and Physical Basis. Vol. 2. Amsterdam: Elsevier Scientific Pub., 1982

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
stylolites	**ST**	Stylolites (Greek: stylos, pillar; lithos, stone) are serrated surfaces at which mineral material has been removed by pressure dissolution, in a process that decreases the total volume of rock. Insoluble minerals like clays, pyrite, oxides remain within the stylolites and make them visible. Stylolites usually form parallel to bedding, because of overburden pressure.	Allen, John R. L. Sedimentary Structures, Their Character and Physical Basis. Vol. 2. Amsterdam: Elsevier Scientific Pub., 1982
varving	**VV**	A varve is a demonstrably annual sedimentary deposit, with each varve representing a yearly cycle of deposition. The depositional environment is normally aquatic, although varves can be deposited sub aerially. Clastic varves normally consist of fine grained sediments deposited in low energy environments when inflow of water and sediment is low and coarser sediment deposited in response to large inflows, producing the dark and light couplets typically associated with glaciolacustrine varves.	Encyclopedia of sediments and sedimentary rocks By Gerard V. Middleton
water escape structures	**WE**	Water escape or soft-sediment deformation structures develop at deposition or shortly after, during the first stages of the sediment's consolidation. Water escape structures include convolute bedding, flame structures, slump structures, dish structures, pillar structures and sole markings.	Allen, John R. L. Sedimentary Structures, Their Character and Physical Basis. Vol. 2. Amsterdam: Elsevier Scientific Pub., 1982
Position			
in part	**IP**	Forming a proportion; partially; not completely.	
near base of unit	**BU**	Located towards the base of the unit.	
near middle of unit	**MU**	Located near the middle of the unit.	
near top and base of unit	**XU**	Located both near the top and the base of the unit.	
near top of unit	**TU**	Located towards the top of the unit.	
throughout	**TO**	Distributed completely throughout the unit.	
ABUNDANCE			
abundant (30-60%)	**A**	A component present in the range of 30 to 60 %.	Dictionary of Mining, Mineral and Related Terms
accessory	**E**	Applied to minerals occurring in small quantities in a rock. The presence or absence of these minor minerals does not affect the classification or the naming of the rock.	Dictionary of Mining, Mineral and Related Terms
common (15-30%)	**C**	A component present in the range of 15 to 30 %.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
dominant (>60%)	**N**	A component present in the range of 60 to 100 %.	
minor (1-15%)	**M**	A component present in the range of 1 to 15%.	Dictionary of Mining, Mineral and Related Terms
rare (<1%)	**R**	A component present in the range of 0 to 1%.	
secondary	**D**	A mineral deposit formed when a primary mineral deposit is subjected to alteration through chemical and/or mechanical weathering.	Dictionary of Mining, Mineral and Related Terms
MINERAL / FOSSIL			
Minerals			Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
ankerite	**AN**	White, grey or reddish-yellowish brown in colour. Relatively hard (3.5-4). Rhombohedral crystals. Vitreous or pearly lustre. Sub-conchoidal fractures.	http://www.mindat.org/min-239.html
apatite	**AP**	White to grey green globular masses or reniform at times with a sub-fibrous, scaly, or imperfectly columnar structure or as fibrous crusts.	http://www.mindat.org/min-29229.html
bauxite	**BA**	White, grey, yellow, red in colour with a dull to earthy lustre. Pisolitic structure. Usually produces a white streak, however this can vary if the specimen is stained.	http://geology.com/minerals/bauxite.shtml
biotite	**BT**	Black/dark brown/dark green usually platy appearance. Perfect basal cleavage. White to grey streak. Vitreous lustre.	
calcite	**CA**	Usually white but can also be colourless, grey, red, green, blue, yellow, brown, orange. White streak, vitreous lustre. Perfect rhombohedral cleavage. Low Mohs hardness (3). Dissolves in cold dilute HCl.	http://geology.com/minerals/calcite.shtml
carbonate	**CB**	White in colour. Soft and brittle. Fizzes violently with diluted HCl.	
chalcedony	**CD**	Varying colours dependent on embedded minerals - multicoloured not uncommon Waxy/dull lustre. White streak. No observable cleavage. Very hard (6.5-7). Usually fibrous.	http://www.mindat.org/min-960.html
chalcopyrite	**CC**	Brass yellow often tarnished. Metallic lustre. Greenish black streak. Poor/indistinct cleavage. Appears similar to pyrite however is softer.	http://www.mindat.org/min-955.html
chert	**CH**	Rock. Very hard. Microcrystalline structure (Quartz). Conchoidal fracture. Varying colours. Can occur as nodules, concretionary masses and layered deposits.	
chlorite	**CR**	Varying shades of green, yellow, pink - usually lightly coloured. Vitreous to pearly lustre. Perfect basal cleavage. Relatively soft (2-2.5).	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
clay	**CL**	Very fine grained sediment with platy minerals. Soft.	
common opal	**OP**	Varying colours. White streak. Hard (5.5-6.5). Conchoidal/splintery fracture. No cleavage. Alteration mineral.	
dickite	**DI**	White or slightly tinted. Transparent. Waxy feel with a satiny lustre. Soft (2-2.5). Perfect cleavage.	http://www.mindat.org/min-1287.html
dolomite	**DM**	Colourless, white, grey, reddish-white, brownish white or pink in colour. Hard (3.5-4). Usually occurring as small clusters of small rhombohedral crystals. Sub-conchoidal fracture. Fizzes gently with HCl - if crushed will fizz more noticeably.	
epidote	**EP**	Yellowish-green, green, brownish-green or black in colour. Very Hard (6). Colourless streak. Irrregular/uneven fracture. Found in regional and contact metamorphic rocks.	http://www.mindat.org/min-1389.html
feldspar	**FS**	White (plagioclase) to pink (K-feldspar) in colour. Very hard. Simple twinning sometimes observable for plagioclase. Rectangular. Common mineral in granite.	
galena	**GA**	The major ore mineral of lead. Grey in colour - sometimes tarnished. Usually cubic in shape. Metallic/dull lustre. Opaque. Soft (2.5).	
garnet	**GR**	Rhomb shaped, commonly red however can be observed as a green/yellow colour. Glassy. Very hard.	
glauconite	**GC**	Dark-olive green. Platy-micaceous mineral. Very soft (2). Indicative of shallow marine/coastal shelf environment.	
goethite	**GO**	Primary hydrothermal mineral, bog and marine environments. Brownish black, yellow-brown, reddish brown in colour. Hard (5-5.5). Minerals form prismatic needle-like crystals but more often massive. Opaque to sub translucent. Dull lustre. Uneven to splintery fracture.	http://en.wikipedia.org/wiki/Goethite
graphite	**GP**	Grey-black in colour. Very soft (1-2). Usually occurs in flakes but can also be observed as tabular or granular. Metallic/earthy lustre. Black streak.	
gypsum	**GY**	White to colourless; impurities can give it a coloured hue. Can be nodular but more often found as a fibrous or laminated (flat) crystal. Common twinning visible in hand specimen. Soft (1.5-2). Distinctive evaporitic deposit.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
haematite	**HE**	A major ore mineral of iron, also found as an accessory mineral in many rocks; rather variable in its appearance - it can be in reddish brown, ochrous masses, dark silvery-grey scaled masses, silvery-grey crystals, and dark-grey masses, to name a few. They all have a rust-red streak.	http://www.mindat.org/min-1856.html
heavy minerals	**HM**	As, Cd, Cu, Pb, Ni, Ag	
illite	**IL**	A common clay mineral. Found in a wide variety of environments. Grey-white to silvery-white or greenish-grey in colour. Prismatic crystals - similar to mica. Pearly to dull lustre. White streak. Translucent. Very soft (1-2).	http://en.wikipedia.org/wiki/Illite
ilmenite	**IM**	An iron-titanium oxide ore mineral, also occurring as an accessory mineral in many rocks. Iron-black or black in colour. Very hard (5-6). Granular to massive crystals but can also occur as lamellar exsolutions in haematite or magnetite. Metallic-submetallic lustre. Black streak. Weakly magnetic.	http://en.wikipedia.org/wiki/Ilmenite
iron oxide	**IO**	Comes in three main forms (Fe, Fe2 and Fe3). Usually all display "earthy" colours yellow/orange/red/brown/black.	http://en.wikipedia.org/wiki/Iron_oxide
ironstone	**IS**	Grey on fresh surface. Usually reddish-brown when weathered. Sedimentary rock. Can occur in a red and black banded form.	http://en.wikipedia.org/wiki/Ironstone
kaolinite	**KA**	Found largely in masses - clay beds - with a whitish, pale yellow to light brown colour. Relatively soft (2-2.5). Translucent-opaque. Waxy lustre.	http://www.mindat.org/min-2156.html
limonite	**LI**	Various shades of brown and yellow. No visible crystals. Occurs as a fine grained aggregate or powdery coating. Relatively hard (4-5.5) although can be very soft if heavily weathered.. Yellowish brown-red streak. Earthy lustre.	http://en.wikipedia.org/wiki/Limonite
magnetite	**MT**	Black, grey in colour. Occurs as octahedral, finely granular to massive crystals. Hard-Very Hard (5.5-6.5). Metallic lustre. Highly magnetic.	http://en.wikipedia.org/wiki/Magnetite
manganese	**MG**	Silvery grey to steel-grey in colour. Very hard (6.5). Metallic lustre. Dark grey streak.	http://www.mindat.org/min-11478.html

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
marcasite	**MC**	Tin-white on fresh surface, pale bronze-yellow, darkening on exposure, iridescent tarnish. Tabular or pyramidal crystals, often with curved faces; it may also be stalactic, globular, or reniform with a radiating internal structure. Very hard (6-6.5). Metallic lustre. Dark-grey to black streak. Frequently found replacing organic matter, forming fossils, in sedimentary beds, particularly coal beds. May be intergrown with or replaced by pyrite.	http://en.wikipedia.org/wiki/Marcasite
mica	**MI**	Translucent to black sheet silicates characterised by a platy morphology and perfect basal cleavage. Breaks in thin sheets. Common types are Muscovite (white). Biotite (black). Often found in granites. Soft.	
montmorillonite	**ML**	White, buff, yellow, green, rarely pale pink to red in colour. White streak. Dull, earthy lustre. Soft (1-2). Prismatic crystal structures not visible in hand specimen due to fine grained nature.	http://www.mindat.org/min-2821.html
muscovite	**MV**	White mica. White, grey, silvery in colour. Massive to platy crystals. Vitreous, silky, pearly lustre. Hardness: 2-2.5. Appears most commonly as sparkly flecks in rocks.	http://www.mindat.org/min-2815.html
olivine	**OL**	Yellow-yellow-green, bottle/olive green to black in colour. Massive to granular crystals. Translucent/transparent. No cleavage. "Curving cracks" (conchoidal fractures) sometimes visible under hand lens. Very hard (6.5-7). Vitreous lustre. White streak. Common in basalts and can be found infilling vesicles.	
opaque minerals	**OM**	A mineral appearing black in thin section transmitted plane-polarized light.	
orthoclase	**OR**	Colourless, greenish, greyish, yellow, white or pink in colour. Can be anhedral or euhedral. Grains are commonly elongate with a tabular appearance. Vitreous lustre (pearly on cleavages). Transparent to translucent. Typically displays multiple twinning. Hard (6). White streak. Common in granites.	http://en.wikipedia.org/wiki/Orthoclase
phosphates	**PP**	An igneous or sedimentary rock with a high concentration of phosphate minerals, commonly the francolite-apatite series.	
plagioclase	**PG**	A series of feldspars with compositions ranging from Na- rich to Ca- rich. Generally white in colour although some display iridescence (Labradorite). All forms are hard (6) and display a white streak. Elongate crystals (needle-like in some cases).	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
pyrite	**PY**	Pale brass-yellow, tarnishes darker and iridescent. Crystals are usually cubic, faces may be striated, but also frequently octahedral and pyritohedron. Often inter-grown, massive, radiated, granular, globular and stalactitic. Very hard (6-6.5). Metallic lustre. Paramagnetic. Metallic glistening lustre.	http://en.wikipedia.org/wiki/Pyrite
quartz	**QZ**	Colourless/White. No cleavage. Very hard (7). Occurs as drusy, fine-grained to microcrystalline, massive crystals. Conchoidal fracturing. Transparent to nearly opaque. Vitreous lustre but can also be observed as waxy-dull when massive.	
siderite	**SD**	A carbonate mineral of iron, sometimes of importance as an ore. Crystals typically found as brown to tan rhombohedrons in clusters, faces often curved or composites; more often found as medium to dark brown massive fine grained material or as massive crystalline material with exposed curved cleavage surfaces. Relatively hard (3.75-4.25). Vitreous or silky to pearly lustre. Translucent to subtranslucent. Most often found in bedded sedimentary deposits with a biological component, with shales, clays and coal beds.	http://www.mindat.org/min-3647.html
silica	**SC**	Found as mainly as the chemical compound silica dioxide (SiO_2). It is the main constituent of Quartz (sand) and can also be found in the walls of diatoms.	
sulphides	**SU**	Metal sulphide compounds which make up the single most important group of ore minerals, classified by crystal structure.	
talc	**TA**	Light to dark green, brown, white in colour. Almost always in foliated masses, rarely platey to pyramidal crystals. Very soft (1). Waxlike or pearly lustre. Translucent. White to very pearly green streak. Usually found in metamorphic rocks with abundant carbonate minerals associated.	http://en.wikipedia.org/wiki/Talc
unidentified mineral	**UN**	An accessory mineral is observed but cannot be classified.	
vivianite	**VV**	Colourless, very pale green, becoming dark blue, dark greenish blue, indigo-blue, then black with oxidation. Usually found as deep blue to deep bluish green prismatic to flattened crystals, most crystals rather small to microscopic, larger ones rather rare. Fibrous fracture. Soft (1.5-2). Vitreous lustre (pearly on the cleavage) can be dull when earthy colour. Transparent to translucent.	http://www.mindat.org/min-4194.html

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
zeolite	**ZE**	Generally white to colourless in the pure state but often coloured by the presence of iron oxides or other impurities. Occur in amygdales and fissures in basic volcanic rocks, as authegenic minerals in sedimentary rocks, in tuffs and in low grade metamorphic rocks as a result of hydrothermal alteration. Morphology is variable as is hardness and lustre.	http://en.wikipedia.org/wiki/Zeolite
Fossils			
bivalves	**BI**	Equivalve aquatic mollusc of the class Bivalvia. Bivalves have a shell consisting of two asymmetrically rounded halves called valves that are mirror image of each other, joined at one edge by a flexible ligament called the hinge.	Collins Dictionary of Geology (1990 edition) & Wikipedia
brachiopods	**BR**	Aquatic mollusc with two bilaterally symmetrical valves of unequal size, the pedicle valve and the brachial valve. A brachiopod is sessile (fixed to a stratum) by a stalk called the pedicle.	Collins Dictionary of Geology (1990 edition)
bryozoans	**BZ**	Aquatic invertebrate characterised mainly by colonial growth and an encrusting, branching or fanlike structure forming a colony (zooarium) a few cm across.	Collins Dictionary of Geology (1990 edition)
carbonaceous remains	**XR**	Plant fragments that have undergone some form of coalification.	
carbonaceous root traces	**RC**	Roots of plant organisms that have undergone coalification commonly found in close proximity to coal seams.	
charcoal	**FB**	Dark grey/black residue/solid formed from the incomplete combustion of organic material usually in the absence of oxygen. It is extremely light and can sometimes display plant structure.	Wikipedia
coprolites	**CP**	Fossilised faecal pellets or castings of animal droppings.	Collins Dictionary of Geology (1990 edition)
faecal remains	**FR**	Remnants of whole fossilised faecal pellets or castings of animal droppings.	
foraminifera	**FM**	Protozoa. An informal name for minute aquatic or parasitic protists that consist of a single cell or a colonial aggregate of cells. Generally difficult to view in hand specimen due to their size.	Collins Dictionary of Geology (1990 edition)

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
fossil wood	**FW**	A material formed by the silica permineralisation of wood in such a manner that the original shape and structural detail (grain, growth rings etc) are preserved. The silica is generally in the form of chalcedony or opal.	Collins Dictionary of Geology (1990 edition)
fossils	**FO**	Umbrella term for the preserved traces or remains of organisms from the remote geological past.	Wikipedia
gastropods	**GT**	Aquatic (marine or fresh water) and terrestrial mollusc that secrete a single calcareous shell, closed at the apex. The shell typically is spirally coiled either dextral or sinistral, although in some forms only the protoconch is coiled and the fully grown shell is cap-shaped. Modern varieties include winkles, whelks, limpets, snails and slugs.	Collins Dictionary of Geology (1990 edition)
marine fossils	**MF**	Umbrella term for the preserved traces or remains of organisms from the remote geological past that occupied marine environments.	Wikipedia
pelycepods	**PE**	marine or freshwater molluscs having a soft body with platelike gills enclosed within two shells hinged together - (see Bivalves).	Wikipedia
plant fragments	**PF**	Parts broken off, detached or incomplete fossil remains of plant material.	
plant impressions	**PI**	Fossil imprint of plant material (leaves, woody parts) in lithified sediments, typically mudstones or siltstones.	
resin	**RS**	*Amber.* Fossil tree resin that has achieved a stable state after ground burial, through chemical change and the loss of volatile constituents. Usually orange in colour and very hard.	Collins Dictionary of Geology (1990 edition)
resin aggregates	**RA**	An aggregate of resin.	
root traces	**RT**	Trace fossil impressions/marks made by roots in surrounding sediment.	
rootlets	**RO**	Roots of plant organisms that have undergone fossilisation.	
sediment filled root traces	**SR**	Sediment that has infilled voids left after the removal of root structures.	
shells	**HY**	Shells of terrestrial or aquatic organisms that have not undergone fossilisation.	
vertabrata	**VB**	Fossil from animal with a backbone.	
woody fragments	**WF**	Parts broken off, detached or incomplete of woody parts of plant material that has not undergone fossilisation.	
MINERAL ASSOCIATION			

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
amorphous	**AM**	A mineral with no regular arrangement of atoms (not crystalline).	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
in amygdules	**AG**	infilling amygdules (gas bubbles or vesicles) in an extrusive igneous rock	
bands	**BN**	Thin layers or stratum of rock, noticeable by differing properties to adjacent layers.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc, New York, USA
cement	**CM**	Any chemically precipitated material occurring in the interstices of clastic rocks.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc, New York, USA
clasts	**CT**	Particles of rock which have been derived from weathering and erosion.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
coarse grains	**CC**	Grains ranging from 0.60 mm to 2.00 mm in diameter.	
coating	**OU**	A surface film of another mineral on a rock/mineral.	
concentrated at base	**CB**	Feature occurs predominantly at base of unit.	
concentrated at top	**CN**	Feature occurs predominantly at top of unit.	
concretions	**CI**	A nodule without a concentric structure. Usually on a larger scale than a nodule.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
cone in cone structure	**KK**	A mineral structure in the form of a series of nested, concentric cones.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
crystals	**XL**	A regular arrangement of atoms making up a crystalline solid, formed from the processes of nucleation and precipitation from solution.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
detrital	**DE**	Particles derived from an existing rock by weathering or erosion.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
disseminated	**DS**	Where the described feature is dispersed throughout the host rock.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
fibrous	**FB**	A texture with the appearance of a mass of fibres (e.g.: asbestos).	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
fine grains	**FF**	Grains ranging from 0.06 mm to 0.20mm in diameter.	
fragments	**FR**	Descriptive of broken particles of clasts.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
glendonites	**GD**	A variety of calcite pseudomorph after ikaite. Ikaite is the mineral name for the hexahydrate of calcium carbonate, CaCO3·6H2O. It is formed in seawater near freezing temperatures (less than 5oC) in organic rich mud in water with higher than normal alkalinity.	
grains	**GN**	Particles or discrete crystals which make up a sediment or rock.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc., New York, USA
in blebs	**BL**	Small, usually spherical inclusions within a rock mass.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc., New York, USA
in cavities	**CV**	In naturally formed caverns within rock, commonly resultant of dissolution.	Stow, D.,2005, Sedimentary Rocks in the Field, Manson Publishing Ltd, London, U.K
in cleat	**CE**	In closely spaced joining within coal.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
in pods	**PO**	Of elongate, lenticular shape.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc, New York, USA
in veins	**VN**	A mineralised body formed by complete or partial infilling of a fracture within a rock.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
in vesicles	**VS**	Gas filled cavity in a magma or volcanic rock. If mineralised then known as Amygdales.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
in vughs	**VU**	In small irregular cavities within intrusive rock or carbonate sediments.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
infilling fault discontinuities	**FD**	Infilling of the plane or surface of a fault.	
infilling of burrows	**IB**	Infilling of a cavity created by the passage/burrowing/nesting of an organism.	
infilling vesicles	**IV**	Infilling of cavities in a magma or volcanic rock which were formed by the entrapment of gas bubbles during solidification.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc, New York, USA
intercalations	**IC**	A type of interbedding, specifically where layers of one material alternate with thicker layers of another material (e.g.: beds of shell intercalated in sandstone).	Lapidus, D., and Winstanley, I.,1987, Collins Dictionary of Geology, Facts on File Publications, New York, U.S.A

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
laminae	**LM**	Thin (less than 1 cm) layer of sediment/sedimentary rock, noticeable by differing properties to adjacent layers.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc, New York, USA
lenses	**LN**	A feature which is lens-shaped, thick in the middle and converges towards the edges.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc, New York, USA
matrix	**MX**	The fine grained material separating clasts in a sedimentary rock.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
microflakes	**MF**	Platelet shaped grains of microscopic scale.	
nodules	**ND**	Irregular, spherical to ellipsoidal, flattened to cylindrical bodies, composed commonly of calcite, siderite, pyrite, gypsum and chert.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
on bedding planes	**BP**	On the surfaces separating beds in a sediment.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
on fracture planes	**FP**	On the surfaces of discontinuities where separation has occurred.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
on joints	**JN**	On the surfaces of discontinuities where no shear displacement has occurred.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
oolites	**OO**	A rock composed mainly of ooids. A small type of carbonate or iron coated grain with cortex of concentric fine laminae, lacking biogenic features and a nucleus, often a shell fragment or sand grain.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
pebbles	**PB**	Rounded rock fragments of 20mm - 60mm in diameter.	
pellets	**PT**	Small ovoid to spherical particles with no internal structure.	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
phenocrysts	**PH**	Large mineral grains within the fine grained matrix of an igneous rock, representing two cooling phases (slow and fast).	Keary, P., 2001, Dictionary of Geology, Second Edition, Penguin Books, London.
radial filaments	**FL**	Fine thread-like structures which radiate from a central point (similar to spokes on a wheel).	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc, New York, USA
replacement	**RE**	The growth of a new mineral within the body of a pre-existing mineral by simultaneous solution and deposition.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc, New York, USA

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
replacing fossils	**RF**	The substitution of organic fossil material (shell, bone, tissue) with inorganic material or minerals.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc, New York, USA
resinous	**RS**	An appearance or lustre like resembling that of resin, commonly shown by sphalerite, opal, pitchstone, amber and native sulphur.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc, New York, USA
rhombs	**RH**	Minerals of rhombus shape (parallelogram - 4 equal length sides, with no 90 degree internal angles), e.g. diamond shape.	
staining	**SN**	Discoloration of rock, particularly common on fracture surfaces through which fluid flow has occurred.	
throughout	**TO**	Distributed completely throughout the unit.	
traces	**TR**	Describes a feature observed in a small quantity, or a record of previous activity, .e.g. trace fossils.	McGraw Hill, 2003, Dictionary of Geology and Mineralogy, Second Edition, McGraw-Hill Companies Inc, New York, USA
wisps	**WP**	Fine irregular wispy features.	
GAS			
trace (<1m3/t)	**T**	< 1 m3/t	
low gas present (1-5m3/t)	**L**	1 – 5 m3/t	
moderate gas present (5-10m3/t)	**M**	5 – 10 m3/t	
high gas present (10-15m3/t)	**H**	10 - 15 m3/t	
very high gas present (>15m3/t)	**V**	> 15 m3/t	
H2S not detected	**N**	No hydrogen sulphide detected	
H2S present	**P**	Hydrogen sulphide detected	
Water Observation Items			
TEST TYPE			
305mm Board	**3**		
610mm Board	**6**		
914mm Board	**9**		

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
bucket	**B**		
driller injected	**I**		
dry	**D**		
estimate	**E**		
observed damp	**M**		
observed wet	**W**		
v-notch	**V**		
RMU & Defect Items			
RMU TYPE		Any defect less than 200 mm thick is logged as a defect.	The RMU Type is chiefly an indicator to software on what data must be recorded for the RMU and how the unit should be treated for the calculation of parameters such as RQD (Rock Quality Designation) and Fracture Frequency. **RQD** **Fracture Frequency**
broken zone	**B**	Zone greater than 200 mm with numerous defects, and individual defects are difficult to delineate.	0 arbitrary high number
core loss	**L**	Core drilling but no core returned.	0 arbitrary high number
core with defects	**D**	Individual defects can be identified and described.	calculated directly from the defects
not recorded	**N**	No geotechnical information has been recorded for the unit.	blank blank
open hole drilling	**O**	Only chip returns. Only geotechnical information possibly available is weathering and estimated strength.	blank blank
soil properties	**S**	Unconsolidated material.	0 blank
unbroken core	**U**	Core not containing any breaks.	100 0
WEATHERING		see Lithology Dictionary for details	
ALTERATION		As distinct from WEATHERING which is a special and common case of alteration at surface and near-surface temperatures and pressures associated with air and water; is more common in volcanic and metamorphic rock types.	AS 1726-1993 and Oxford Dictionary of Earth Sciences: Change produced in a rock by chemical or physical action.
extremely altered	**E**	Rock is altered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded, in water.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
distinctly altered	**D**	Rock strength and mineralogy usually changed by alteration. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.	
slightly altered	**S**	Rock is slightly discoloured but shows little or no change of strength from fresh rock. Usually penetrative alteration along defect surfaces	
altered	**A**	Degree of alteration not assessed.	
fresh	**F**	Rock shows no sign of decomposition or staining.	
ESTIMATED STRENGTH			
Unconsolidated Cohesive			AS1726-1993 Table A4
very soft	**C1**	su < 12 kPa; exudes between the fingers when squeezed in hand	
soft	**C2**	su 12 - 25 kPa; can be moulded by light finger pressure	
firm	**C3**	su 25 - 50 kPa; can be moulded by strong finger pressure	
stiff	**C4**	su 50 - 100 kPa; cannot be moulded by fingers, can be indented by thumb	
very stiff	**C5**	su 100 - 200 kPa; can be indented by thumb nail	
hard	**C6**	su > 200 kPa; can be indented with difficulty by thumbnail	
Unconsolidated Cohesionless			AS1726-1993 Table A5
very loose	**S1**	Density Index <15 %; easily dissociated with flicks of finger nail.	
loose	**S2**	Density Index 15 % - 35 %; easily penetrated by knife blade, readily dissociated by scratching with finger nail.	
medium dense	**S3**	Density Index 35 % - 65 %; penetrated by knife only with firm pressure, readily indented by thumb pressure, dissociated with difficulty by scratching with finger nail.	
dense	**S4**	Density Index 65 % - 85 %; difficult to indent by thumb pressure, dissociated readily by knife blade.	
very dense	**S5**	Density Index > 85 %; cannot be indented by thumb pressure, dissociated only by firm pressure with knife blade.	
Rock			Adapted from Anon, 1977. The Description of rock masses for engineering purposes. Report by the Geological Society
extremely low strength rock	**R1**	UCS < 1 MPa; may be broken by hand and remoulded (with the addition of water if necessary) to a material with soil properties.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
very low strength rock	**R2**	UCS 1 - 5 MPa; crumbles under a single firm hammer blow, can be peeled with a knife.	Engineering Group Working Party. Q. Jl. Engng Geol. 10 pp355-388.
low strength rock	**R3**	UCS 5 - 10 MPa; breaks under a single firm hammer blow, scored but not peeled with a knife.	
medium strength rock	**R4**	UCS 10 - 25 MPa; breaks under 1 to 3 hammer blows, can be scratched but not scored with a knife.	
high strength rock	**R5**	UCS 25 - 50 MPa; breaks under 3 to 5 hammer blows, hard to scratch with a knife, can be scratched with tungsten-tipped tool, hard sound when struck with hammer.	
very high strength rock	**R6**	UCS 50 - 100 MPa; breaks under 1 hammer blow if resting on solid surface, cannot be scratched by knife, scratched with difficulty by a tungsten-tipped tool, dull ringing sound when struck with hammer.	
extremely high strength rock	**R7**	UCS > 100 MPa; difficult to break with hammer even if resting on solid surface, bright ringing sound when struck with hammer.	
BED SPACING		NB descriptions are twice size of those in common use	
massive/absent bedding	**MA**	No bedding evident within Rock Mass Unit	AS1726-2017
very thickly bedded (>2m)	**VB**	> 2 m	
thickly bedded (600-2000mm)	**CB**	600-2000 mm	
medium bedded (200-600mm)	**MB**	200-600 mm	
thinly bedded (60-200mm)	**TB**	60-200 mm	
very thinly bedded (20-60mm)	**UB**	20-60 mm	
thickly laminated (6-20mm)	**LM**	6-20 mm	
thinly laminated (<6mm)	**LL**	<6 mm	
irregular spaced bedding	**IR**	Bedding spacing encompasses at least two separation classes	
MOISTURE SENSITIVITY			
not sensitive	**N**	No change to fragments.	common observation

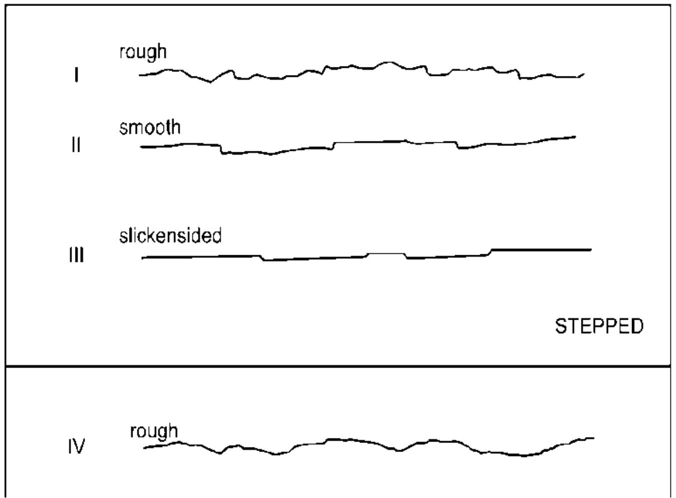
CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
low sensitivity	**L**	Slight fracturing of fragments, slight rounding of edges, surfaces are clean and not sticky.	common observation
medium sensitivity	**M**	Fragments break into smaller pieces, edges become rounded and surfaces are slightly sticky.	common observation
high sensitivity	**H**	Fragments show marked disintegration, surfaces are sticky and fragments disintegrate when rolled between fingers.	common observation
PLASTICITY			
non plastic	**N**	Visual-Tactile: Behaves as a cohesionless material which may exhibit a dilatancy reaction when shaken but which cannot be moulded into a plastic solid including being rolled into a 3 mm diameter thread. Laboratory: Either or both the Plastic Limit and Liquid Limit cannot be determined by the test methods.	AS1726-1993
brittle	**B**	Visual-Tactile: Behaves as a cohesive material but does not exhibit a dilatancy reaction and cannot be remoulded into a 3 mm thread. Laboratory: The Plastic Limit may or may not be measurable but the Liquid Limit cannot be measured by the test methods.	AS1726-1993
low plasticity	**L**	Visual-Tactile: Behaves as a cohesive material, may or may not exhibit dilatancy, and feels smooth but gritty. Dried crumbs are easily broken down by finger pressure, dries rapidly from a thin film on a finder to a powdery consistency. Laboratory: Has measureable Plastic and Liquid Limits and the Liquid Limit is 35% or less. Can be subdivided into low plasticity silt (Plasticity Index below A-Line on Casagrande Plot) and low plasticity clay (Plasticity Index above A-Line on Casagrande Plot).	AS1726-1993
intermediate plasticity	**I**	Visual-Tactile: Behaves as a cohesive material, may or may not exhibit dilatancy, and feels smooth. Dried crumbs can be ruptured with moderate finger pressure, dries slowly from a thin film on a finger to a cake consistency. Laboratory: Has measureable Plastic and Liquid Limits and the Liquid Limit is greater than 35% but not greater than 50%. Can be subdivided into intermediate plasticity silt and clay based on position relative to A-Line on Casagrande Plot.	AS1726-1993

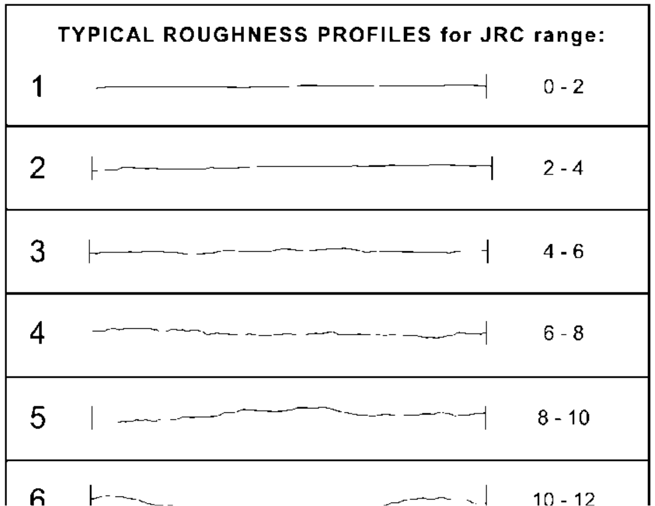
CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
high plasticity	**H**	Visual-Tactile: Behaves as a cohesive material, will not readily exhibit dilatancy, and feels very smooth like butter or grease. Dried crumbs are difficult to rupture with strong finger pressure, dries very slowly and in a sticky manner from a thin film on a finger to a hard cake consistency. Laboratory: Has measureable Plastic and Liquid Limits and the Liquid Limit is greater than 50%. Can be subdivided into high plasticity silt and clay based on position relative to A-Line on Casagrande Plot.	AS1726-1993
DEFECT TYPE **Natural**			
Bedding plane	**BP**	Bedding in sedimentary rocks and some volcanic rocks is a visible arrangement of mineral grains of similar composition or lithic grains of similar size into approximately parallel layers.	Oxford Dictionary of Earth Sciences
Broken zone	**BZ**	Section of core fragmented along natural defects into pieces mostly < core diameter size; not completely disaggregated by drilling or handling.	common observation
Clay band	**CL**	Band or seam of any type of clay that may be the product of rock substance weathering or alteration.	common observation
Coal cleat	**CE**	A distinct feature of most coal seams developed as variably spaced structures that tend to be orthogonal to each other and to bedding in the coal.	Oxford Dictionary of Earth Sciences
Contraction fracture	**CF**	Generally curviplanar features developed in volcanic lavas or in country rock adjacent to intrusive dykes and sills.	common observation. Brittle shear fracture: W D Ortlepp 1967. Rock Fracture and Outbursts. SAIMM.
Cross bedding	**XB**	Cross-bedding is a feature commonly observable in sandstones deposited in floodplain, nearshore and aeolian environments; cross-bedding and true bedding exhibit distinctly different angles relative to each other over short vertical distances.	Oxford Dictionary of Earth Sciences
Dyke	**DY**	A feature of igneous origin, cuts across country rock. Baked margin on both sides.	Oxford Dictionary of Earth Sciences
Fault	**FT**	A geological structure within a rockmass along which relative movement is discernible; faults as defects in core can be from <1 mm to > 1m thickness.	Oxford Dictionary of Earth Sciences
Foliation	**FO**	The visible fabric developed in regional metamorphic rocks such as phyllite, schist and gneiss (other terms are cleavage, schistosity, gneissosity).	Oxford Dictionary of Earth Sciences

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
Fracture (undifferentiated)	**FR**		
Joint	**JN**	A discernible rockmass structure developed from tectonic or thermal contraction processes along which no relative movement is obvious.	G Mandl 2005. Rock Joints the Mechanical Genesis. Springer.
Shear zone	**SH**	A region, narrow compared with its length, within which rocks have undergone intense deformation. The two end-members are brittle shear and ductile shear, and both may occur as parallel or conjugate sets; has variable thickness and comprises roughly parallel boundaries separating a section of core with closely spaced to very closely spaced joints	Oxford Dictionary of Earth Sciences; AS1726-1993, Table A10
Sill	**SI**	A feature of igneous origin, intruded within layers of country rock.	Oxford Dictionary of Earth Sciences
Softened zone (non-tectonic)	**SO**	Zone with any shape having reduced rock substance strength and possibly also discolouration.	common observation
Vein	**VN**	A feature of igneous origin usually comprising one main mineral (e.g. quartz or calcite), generally with irregular shape and variable thickness; some healed joints at core scale may be veins at outcrop or face exposure scale.	Oxford Dictionary of Earth Sciences
Induced			
Discing	**DS**	Generally a result of poor drilling equipment or practice in closely bedded or laminated rock types producing discs of core broken along bedding or other structure normal to the core axis.	common observation
Drilling induced break	**DB**	A core break identified as being caused by drilling, extrusion from the inner tube or handling; core breaks are not always easily distinguishable from natural defects but mostly have irregular shape and rough surface.	common observation
Drilling induced broken zone	**DZ**	Section of core fragmented by drilling and/or handling into pieces mostly < core diameter size up to twice core diameter size.	common observation
DEFECT INTACT			
Intact	**I**	Can be applied to any Natural Defect except for 'broken zone' or 'coal cleat'. Does not contribute to RQD	
DEFECT CONTINUITY			
continuous across core width	**C**	Extends through core diameter	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
discontinuous across core width	**D**	Does not extend through core diameter	
divaricates (splits)	**V**	Joint splits into two	
truncated within core width	**T**	Ends against another structure	
DIP ORIENTATION METHOD			
directly measured from reference line	**D**		
estimated	**E**		
indirectly measured	**I**		
measured from televiewer	**A**	Measured from acoustic or optical scanner	
SURFACE SHAPE		The shape of the defect surface across the core.	from ISRM, 1981 (Fig 17 below), Suggested methods for the quantitative description of discontinuities in rock masses and common observations
concave/convex	**C**	one trough or crest across a core width	
irregular	**I**	many sharp troughs and crests in all directions across a core width	
planar	**P**	a surface with no obvious curves or irregularities across the core width	
stepped	**S**	distinct steps in any direction across the core width	
undulose	**U**	rounded crests and troughs in one or more directions across the core width	
SURFACE ROUGHNESS		Inherent surface roughness and shape relative to the mean plane of a logged defect	from ISRM, 1981 (Fig 19 below), Suggested methods for the quantitative description of discontinuities in rock masses
polished	**P**	smooth but without striations - reflects light	
rough	**R**	rough to touch - sandpaper feel	
slickensided	**K**	striations visible on defect surface that may or may not be polished (the angle of the striations to the dip direction of the defect should be noted)	
smooth	**S**	smooth to feel but not polished or slickensided	
JRC		joint roughness coefficient	
INFILL TYPE			

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
apatite	**AP**	White to grey green globular masses or reniform at times with a sub-fibrous, scaly, or imperfectly columnar structure or as fibrous crusts.	
calcite	**CA**	Usually white but can also be colourless, grey, red, green, blue, yellow, brown, orange. White streak, vitreous lustre. Perfect rhombohedral cleavage. Low Mohs hardness (3). Dissolves in cold dilute HCl.	
carbonaceous remains	**XR**	Plant fragments that have undergone some form of coalification.	
carbonate	**CB**	White in colour. Soft and brittle. Fizzes violently with diluted HCl.	
chlorite	**CR**	Varying shades of green, yellow, pink - usually lightly coloured. Vitreous to pearly lustre. Perfect basal cleavage. Relatively soft (2-2.5).	
clay	**CL**	Very fine grained sediment with platy minerals. Soft.	
coal	**CO**	Carbon rich mineral deposit formed from the accumulation of organic matter and containing less than 50% ash yield on combustion; coal streaks brown (low rank) to black (high rank) when scratched with a metal tool.	
crushed rock	**CU**	breccia.	
dickite	**DI**	White or slightly tinted. Transparent. Waxy feel with a satiny lustre. Soft (2-2.5). Perfect cleavage.	
fossils	**FO**	Umbrella term for the preserved traces or remains of organisms from the remote geological past.	
glauconite	**GC**	Dark-olive green. Platy-micaceous mineral. Very soft (2). Indicative of shallow marine/coastal shelf environment.	
gypsum	**GY**	White to colourless; impurities can give it a coloured hue. Can be nodular but more often found as a fibrous or laminated (flat) crystal. Common twinning visible in hand specimen. Soft (1.5-2). Distinctive evaporitic deposit.	





CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
haematite	**HE**	A major ore mineral of iron, also found as an accessory mineral in many rocks; rather variable in its appearance - it can be in reddish brown, ochrous masses, dark silvery-grey scaled masses, silvery-grey crystals, and dark-grey masses, to name a few. They all have a rust-red streak.	
illite	**IL**	A common clay mineral. Found in a wide variety of environments. Grey-white to silvery-white or greenish-grey in colour. Prismatic crystals - similar to mica. Pearly to dull lustre. White streak. Translucent. Very soft (1-2).	
iron oxide	**IO**	Comes in three main forms (Fe, Fe2 and Fe3). Usually all display "earthy" colours yellow/orange/red/brown/black.	
kaolinite	**KA**	Found largely in masses - clay beds - with a whitish, pale yellow to light brown colour. Relatively soft (2-2.5). Translucent-opaque. Waxy lustre.	
limonite	**LI**	Various shades of brown and yellow. No visible crystals. Occurs as a fine grained aggregate or powdery coating. Relatively hard (4-5.5) although can be very soft if heavily weathered. Yellowish brown-red streak. Earthy lustre.	
magnetite	**MT**	Black, grey in colour. Occurs as octahedral, finely granular to massive crystals. Hard-Very Hard (5.5-6.5). Metallic lustre. Highly magnetic.	
manganese	**MG**	Silvery grey to steel-grey in colour. Very hard (6.5). Metallic lustre. Dark grey streak.	
marcasite	**MC**	Tin-white on fresh surface, pale bronze-yellow, darkening on exposure, iridescent tarnish. Tabular or pyramidal crystals, often with curved faces; it may also be stalactic, globular, or reniform with a radiating internal structure. Very hard (6-6.5). Metallic lustre. Dark-grey to black streak. Frequently found replacing organic matter, forming fossils, in sedimentary beds, particularly coal beds. May be intergrown or replaced by pyrite.	
mica	**MI**	Translucent to black sheet silicates characterised by a platy morphology and perfect basal cleavage. Breaks in thin sheets. Common types are Muscovite (white). Biotite (black). Often found in granites. Soft.	
montmorillonite	**ML**	White, buff, yellow, green, rarely pale pink to red in colour. White streak. Dull, earthy lustre. Soft (1-2). Prismatic crystal structures not visible in hand specimen due to fine grained nature.	
other	**OT**	Only for historical data.	
plant fragments	**PF**	Parts broken off, detached or incomplete fossil remains of plant material.	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
pyrite	**PY**	Pale brass-yellow, tarnishes darker and iridescent. Crystals are usually cubic, faces may be striated, but also frequently octahedral and pyritohedron. Often inter-grown, massive, radiated, granular, globular and stalactitic. Very hard (6-6.5). Metallic lustre. Paramagnetic. Metallic glistening lustre.	
quartz	**QZ**	Colourless/White. No cleavage. Very hard (7). Occurs as drusy, fine-grained to microcrystalline, massive crystals. Conchoidal fracturing. Transparent to nearly opaque. Vitreous lustre but can also be observed as waxy-dull when massive.	
sand	**SA**	Majority of particles are between 0.06 and 2 mm.	
siderite	**SD**	A carbonate mineral of iron, sometimes of importance as an ore. Crystals typically found as brown to tan rhombohedrons in clusters, faces often curved or composites; more often found as medium to dark brown massive fine grained material or as massive crystalline material with exposed curved cleavage surfaces. Relatively hard (3.75-4.25). Vitreous or silky to pearly lustre. Translucent to subtranslucent. Most often found in bedded sedimentary deposits with a biological component, with shales, clays and coal beds.	
silt	**SI**	Majority of particles are between 0.002 and 0.06 mm.	
talc	**TA**	Light to dark green, brown, white in colour. Almost always in foliated masses, rarely platey to pyramidal crystals. Very soft (1). Waxlike or pearly lustre. Translucent. White to very pearly green streak. Usually found in metamorphic rocks with abundant carbonate minerals associated.	
zeolite	**ZE**	Generally white to colourless in the pure state but often coloured by the presence of iron oxides or other impurities. Occur in amygdales and fissures in basic volcanic rocks, as authegenic minerals in sedimentary rocks, in tuffs and in low grade metamorphic rocks as a result of hydrothermal alteration. Morphology is variable as is hardness and lustre.	
INFILL MODE			
absent	**A**	no obvious staining or mineral coating on defect surface across full core width	
blebs	**L**	discrete circular to irregular shaped particles or grains adhered to defect surface	
breccia	**B**	angular fragments or clasts in finer grained clayey or cemented matrix	

CoalLog Dictionary v3.1			
Item	**Code**	**Description**	**Source**
gouge	**G**	a mixture of fine grained cohesive and non-cohesive material (rock flour) formed during fault movement	
healed (cemented)	**H**	intact fault, joint, bedding or foliation with non-clay mineral infill (e.g. calcite, limonite or quartz)	
open	**O**	defect surfaces not in contact	
rubble	**R**	fragmented material constituting broken zones or fault zones	
surface completely coated	**C**	defect surface across full core width has mineral coating	
surface partly coated	**P**	defect surface across part of core width has mineral coating	
surface staining	**S**	defect surface is stained rather than coated (most commonly by limonite)	
trace	**T**	<10% of defect surface across core width has mineral coating	
Point Load Items			
SAMPLE STATE			
dry	**D**		
wet	**W**		
TEST TYPE			
axial	**A**		
diametral	**D**		
irregular	**I**		
FAILURE MODE			
bedding plane	**B**		
invalid	**I**		
joint	**J**		
penetrative	**P**		
valid	**V**	only for historical data.	

6 Coal Quality

For some time, it was considered that a standard for the transferral of coal quality data would be useful, primarily for the passing of data from the laboratories to their clients but also for passing data between computer systems as well as from mining companies to consultants, company or property purchasers or the government. After much discussion with both laboratories and data users, a system for the transfer of coal quality data has been added to CoalLog. No logging sheets have been provided for this data as it is expected that the data will be entered directly into the computer.

The system includes the following five file formats. The first two for actual results and the later three for metadata associated with the results:

1) **Coal Quality Results** for reporting all analyses except Reflectance. It can be used for reporting ply and composite results, and for particular float and sizing fractions.
2) **Reflectance Results.**
3) **Composite Constituents**, for listing the sample number of all the individual ply or composite samples that have been included in each composite.
4) **Clean Coal Composite Definitions**, for listing the parameters such as size fractions and density cut-points that have been included in a Clean Coal Composite (CCC).
5) **Test Specifications**, for each test as identified by its Report Number and Variable Name and listing:
    - the standard to which it was tested
    - the lower detection limit of the testing
    - the upper detection limit of the testing

The specifications for all the above files can be found in the file *CoalLog v3.1 Data Table Specifications.xlsx* which can be downloaded from the CoalLog website (see Appendix A).

6.1 Coal Quality Results File Format

This format is for transferring all Coal Quality Results apart from Reflectance. The CoalLog standard specifies the units and basis for each variable recorded in a CoalLog standard Coal Quality Results file. This file is described in detail in the specification file *CoalLog v3.1 Data Table Specifications.xlsx* and includes the following information for each variable in addition to the information shown for variables in other data tables:

- **analysis group**, this is the name for a set of analyses that are generally grouped together, for example Proximate Analyses, Ultimate Analyses, Trace Elements, Ash Analyses.
- the moisture **basis** that must be used for values of this variable, for example air dried or dry ash free
- whether it is a **calculated field**. In general, it is poor practice to include calculated fields in a database because, as opposed to a spreadsheet, when a value that contributes to the calculation is modified in the database the calculated field is not. It is best practice to calculate calculated values when required rather than storing them. However, the following calculated variables are routinely calculated by laboratories and included with results and as such have been included in the CoalLog Coal Quality Results file format:
  - Fixed Carbon (**FC_ad_pct**)
  - Oxygen (**O_daf_pct**)
  - Total Oxides (**Tot_Ox_domf_pct**)
- the **minimum** allowable value
- the **maximum** allowable value

The specification file lists 23 metadata fields that describe the sample or test and another 210 fields that record the results. The fields have been designed to include all possible variables that may be recorded. It is not anticipated though that any one explorer would use all these variables.

Coal Quality Test results are not only defined by their **Sample Identification** but also by their **Sample Preparation**, **Lab Particulars** and for results on composite or cumulative samples a **Calculated** flag that indicates if the results were from an analysed sample or calculated from the results for the individual components of the composite or cumulation.

<u>Sample Identification</u>

Samples are uniquely identified by a combination of:

- **Project_Name**
- **Borehole_Name**
- **Sample_Type** - which has a value of:
  - **Ply** for individual samples
  - **Comp** for analysed composited samples
  - **Calc** for calculated composited samples

  These can be in upper, lower or a mixture of cases.
- **Sample_No** - which can be a valid individual/ply sample number or a composite sample number.

- **CCC_Type** – Clean Coal Composite Type which is a name the user or the laboratory has assigned to a Clean Coal Composite to identify its composition, (e.g. TC1 for Thermal Coal Product 1, PCI2 for PCI Product 2). This name is user defined and is not validated against the CoalLog dictionary. The components of each **CCC_Type** should be recorded in a **CCC Definition** table. Raw composites should not be given a **CCC_Type**. If a **CCC_Type** is included then all the Sample Preparation values, that is **Pre_Treatment**, **Drop_Count**, **Size_Type**, **Plus_Size**, **Minus_Size**, **Sink**, **Float** and **Froth** must be blank as for Clean Coal Composites, this information is stored in a Clean Coal Composite Definition (see Section 6.4).

All these fields are mandatory except **CCC_Type** which is only mandatory for Clean Coal Composites.

Any **Sample_No** can be used in more than one borehole as the **Borehole_Name** is part of the unique identification of a sample. This means that it is unnecessary to include the Borehole Name in the **Sample_No**.

Both **Borehole_Names** and **Sample_Nos** can contain any ASCII text that the user chooses, that is letters, numbers and special characters are all acceptable though special characters, for example it is recommended that &, $, % etc, should be avoided. The only restrictions are that they are a maximum of 16 characters, do not contain any embedded blanks and are not case sensitive. For example, sample numbers of TS001, Ts001 and ts001 could all be used at different times to identify the same borehole or sample but the strings TS1, TS01 and TS001 identify three different boreholes or samples, though this would be a poor choice of names.

The other non-mandatory Sample Identification data are:

- **From_Depth** - the sample's from depth in metres
- **To_Depth** - the sample's to depth in metres
- **Thickness** - the sample's thickness in metres
- **Depth_Adjusted** - whether the depths have been adjusted to geophysics. This can be **True** or **False** in upper, lower or a mixture of cases.
- **Linear_Recovery** – recovery based on length of non-core loss in the sample.
- **Volume_Recovery** – recovery based on mass compared to theoretical mass calculated from core length, diameter and relative density.
- **Sample_Lith** - which can have a value of **Coal**, **Stone**, **Parting**, **Floor** or **Roof**. These can be in upper, lower or a mixture of cases.
- **Dispatch_No** – number for dispatch to laboratory
- **Previous_Test** - previous testing that the sample has undergone. This can have values of **GD** for Gas Desorption or **GT** for Geotech. These can be in upper, lower or a mixture of cases.

Even though **From_Depth** and **To_Depth** can be in the results files they are not mandatory as they do not make up part of the unique sample identifier.

Laboratory Particulars

The Lab Particulars include:

- **Lab_Name -** where the test was performed. Codes for this can be found in the *CoalLog Reference Items Dictionary*.
- **Report_No** - the laboratory report number for the report providing the result
- **Report_Date** - date of laboratory report.
- **Lab_Sample_No -** the laboratory's sample identifier. This can be any text and/or numbers.

Lab_Name and **Report_No** are mandatory.

Sample Preparation

The Sample Preparation details include:

- **Pre_Treatment -** which can have the following values:
    - **CRSH** for crushed
    - **DROP** for drop shatter
    - **DPHK** for drop shatter followed by hand knapping
    - **DPHD** for drop shatter, hand knapped, dry tumbled
    - **DPHW** for drop shatter, hand knapped, wet tumbled
    - **CLPV** for coal pulverisation sieve analysis
    - **CKPP** for coke properties sieve analysis
    - **GSUN** for uncrushed gas sample
    - **GSCR** for crushed gas sample

  These text values can be in upper, lower or a mixture of cases. **Pre_Treatment** is mandatory if **Drop_Count, Size_Type, Minus_Size** or **Plus_Size** is specified.
- **Drop_Count** - the number of drops before sizing. **Drop_Count** is mandatory if **Pre_Treatment** is DROP, DPHD, DPHK or DPHW (see Table 6.1). If **Pre_Treatment** is blank, **Drop_Count** should also be blank.
- **Size_Type** - which can have the following values:
    - **W** for wet
    - **D** for dry

  These values can be in upper, lower or a mixture of cases. **Size_Type** is mandatory if **Pre_Treatment** is CKPP, CLPV, DPHW, GSCR or GSUN. **Size_Type** is not required if **Pre_Treatment** is DPHD, DPHK or DROP as in these instances **Size_Type** will always be D (dry) (see Table 6.1). If **Pre_Treatment** is blank, **Size_Type** should also be blank.

Table 6.1: Drop_Count and Size_Type requirements for various Pre_Treatments

Code	Pre_Treatment	Drop_Count Required	Size_Type Required
CKPP	Coke Properties sieve analysis	-	Y
CLPV	Coal Pulverisation sieve analysis	-	Y
CRSH	Crushed	-	-
DPHD	Drop Shatter, then Hand Knapped, Dry Tumbled	Y	-
DPHK	Drop Shatter then Hand Knapped	Y	-
DPHW	Drop Shatter, then Hand Knapped, Wet Tumbled	Y	Y
DROP	Drop Shatter	Y	-
GSCR	Gas - Crushed sample	-	Y
GSUN	Gas - Uncrushed sample	-	Y

- **Minus_Size** - the upper sizing cut-off in millimetres
- **Plus_Size** - the lower sizing cut-off in millimetres
- **Sink** - the sink density in g/cm^3 for the fraction
- **Float** - the float density in g/cm^3 for the fraction
- **Froth** - the froth fraction. For example, C1, C2 etc for froths and T1, T2 etc for tails. The names used are defined by the user but can only be a maximum of three characters and can be upper or lower case.

Any of these may be empty for some results, in which case they should not be populated in the CoalLog Data Transfer file. Table 6.2 provides a guide as to what fields are needed for various analysis types.

Table 6.2: Guide to what Fields are Required for Various Analysis Types (courtesy of Peter Handley and Stuart Whyte)

Analysis_Type	CCC_Type	Pre_Treatment	Plus_Size	Minus_Size	Sink	Float	Froth
Raw	-	-	-	-	-	-	-
Quick Float	-	-	-	-	Y	Y	-
Drop Shatter Sizing	-	Y	Y	Y	-	-	-
Dry/Wet Tumble sizing	-	Y	Y	Y	-	-	-
Wash Density	-	Y	Y	Y	Y	Y	-
Froth Flotation	-	Y	Y	Y	-	-	Y
Clean Coal Comp	Y	-	-	-	-	-	-

Database Primary Key

The primary key for database tables comprises the fields: **Project_Name, Borehole_Name, Sample_Type, Sample_No., Lab_Name, Report_No, CCC_Type, Pre_Treatment, Drop_Count, Size_Type, Minus_Size, Plus_Size, Sink, Float, Froth.**

Results

The CoalLog standard for Coal Quality data transfer specifies a particular basis and measuring unit for each of its listed Coal Quality result variables. To prevent ambiguity, both the basis and the units are incorporated in the field name for each variable that are shown on the first line of the transfer file. For example, the field name for the Ash result is **Ash_ad_pct** indicating that the value being transferred is on an air dried basis and as a percentage.

Each of the fields in the results is one of the following three types:

- **Numeric.** Numeric fields can also contain the following character values:
    - < plus a detection limit
    - > plus a detection limit
    - IS for insufficient sample
    - NS for not sampled
    - NR for not reported
    - TBA for to be advised

  The fields **Dila_MDT_degC** and **Dila_MD_pct** can also contain:
    - CO for contraction only

  The fields **Gies_Date**, **Gies_MF_ddpm**, **Gies_Log**, **Gies_IST_degC**, **Gies_MFT_degC**, **Gies_RST_degC**, **Gies_PR_degC**, **Gies_Fusion_degC**, **Gies_5F_degC** and **Gies_FF_ddpm** can also contain:
    - NF for no fluidity

  Any software that reads a CoalLog data transfer files of Quality Results must be able to handle these character values though it is up to the software how they are handled.

- **Date.** These must be in the format dd/mm/yyyy. A date field has been attached to each result that is likely to change over time. These tests are:
    - Gieseler Plastometer
    - Dilatometer
    - Gray-King
    - Roga Index
    - Thermal Rheology: Caking (G) Index
    - Sapozhnikov Plastometer
    - Petrography
    - Coke Strength after Reaction
    - Coke Reactivity Index
    - Coke Yield
    - Carbonization

- **Character.** The only character field in the results is Gray-King Test and this can only have the values: A, B, C, D, E, F, G, G1 to G9. These can be in upper or lower case.

Figures 6.1, 6.2, 6.3 and 6.4 are examples of Coal Quality Results data in CoalLog format. Required data are shown in red, other metadata in blue and actual results in black. Note in Figure 6.2, the use of < signs plus the detection limit to indicate results below detection limit and IS indicating insufficient sample to test.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Project_Name	Borehole_Name	Sample_Type	Sample_No	From_Depth	To_Depth	Thickness	Depth_Adjusted	Lab_Name	Report_No	Report_Date	Lab_Sample_No	Mass_ar_kg	Mass_ad_kg	ARD_gpcm3	RD_ad_gpcm3	MIAS_ad_pct	Ash_ad_pct	VM_ad_pct	FC_ad_pct	CV_ad_kcalpKg
2	TESTPROJ	HOLE001	Ply	100001	46.780	47.070	0.290	TRUE	BVNTL	REP001	1/04/2017	LAB-001	1.032	1.028	1.27	1.32	4.5	6.6	34.3	54.6	7259
3	TESTPROJ	HOLE001	Ply	100002	47.070	47.410	0.340	TRUE	BVNTL	REP001	1/04/2017	LAB-002	1.253	1.250	1.31	1.34	4.7	8.0	35.2	52.1	7068
4	TESTPROJ	HOLE001	Ply	100006	56.800	56.940	0.140	TRUE	BVNTL	REP001	1/04/2017	LAB-003	0.535	0.534	1.30	1.33	3.0	9.1	36.7	51.2	7256
5	TESTPROJ	HOLE001	Ply	100007	56.940	57.190	0.250	TRUE	BVNTL	REP001	1/04/2017	LAB-004	0.881	0.879	1.27	1.28	3.7	3.9	37.8	54.6	7648
6	TESTPROJ	HOLE001	Ply	100008	57.960	58.160	0.200	TRUE	BVNTL	REP001	1/04/2017	LAB-005	0.758	0.756	1.35	1.38	2.9	12.1	31.5	53.5	7002
7	TESTPROJ	HOLE001	Ply	100009	58.160	59.090	0.930	TRUE	BVNTL	REP001	1/04/2017	LAB-006	3.402	3.388	1.35	1.36	3.1	9.2	31.4	56.3	7228
8	TESTPROJ	HOLE001	Ply	100010	59.090	59.370	0.280	TRUE	BVNTL	REP001	1/04/2017	LAB-007	0.938	0.934	1.29	1.30	2.9	4.9	37.7	54.5	7608
9	TESTPROJ	HOLE001	Ply	100011	59.370	59.430	0.060	TRUE	BVNTL	REP001	1/04/2017	LAB-008	0.258	0.257	1.30	1.30	2.4	8.4	40.2	49.0	7485
10	TESTPROJ	HOLE001	Ply	100012	59.430	59.650	0.220	TRUE	BVNTL	REP001	1/04/2017	LAB-009	0.849	0.847	1.29	1.30	2.8	6.4	39.1	51.7	7516
11	TESTPROJ	HOLE001	Ply	100013	59.650	60.060	0.410	TRUE	BVNTL	REP001	1/04/2017	LAB-010	1.444	1.440	1.29	1.33	3.0	7.5	38.5	51.0	7386
12	TESTPROJ	HOLE001	Ply	100014	61.580	61.930	0.350	TRUE	BVNTL	REP001	1/04/2017	LAB-011	1.224	1.223	1.29	1.30	2.6	7.2	39.8	50.4	7458
13	TESTPROJ	HOLE001	Ply	100015	61.930	62.180	0.250	TRUE	BVNTL	REP001	1/04/2017	LAB-012	0.920	0.917	1.41	1.44	3.1	15.5	38.1	43.3	6215
14	TESTPROJ	HOLE001	Ply	100016	62.180	62.330	0.150	TRUE	BVNTL	REP001	1/04/2017	LAB-013	0.535	0.533	1.31	1.32	2.8	7.7	39.2	50.3	7375
15	TESTPROJ	HOLE001	Ply	100017	65.300	65.640	0.340	TRUE	BVNTL	REP001	1/04/2017	LAB-014	1.260	1.257	1.34	1.36	2.6	12.8	34.2	50.4	7009
16	TESTPROJ	HOLE001	Ply	100018	67.280	67.490	0.210	TRUE	BVNTL	REP001	1/04/2017	LAB-015	0.754	0.753	1.28	1.29	2.1	7.0	41.4	49.5	7606
17	TESTPROJ	HOLE001	Ply	100019	67.490	67.800	0.310	TRUE	BVNTL	REP001	1/04/2017	LAB-016	1.102	1.101	1.31	1.32	2.2	10.1	40.1	47.6	7288
18	TESTPROJ	HOLE001	Ply	100020	67.800	68.240	0.440	TRUE	BVNTL	REP001	1/04/2017	LAB-017	1.631	1.629	1.28	1.29	2.2	5.4	40.9	51.5	7748
19	TESTPROJ	HOLE001	Ply	100021	68.240	68.260	0.020	TRUE	BVNTL	REP001	1/04/2017	LAB-018	0.134	0.133	2.38	2.08	2.1	45.5	30.3	22.1	3306
20	TESTPROJ	HOLE001	Ply	100022	68.260	68.510	0.250	TRUE	BVNTL	REP001	1/04/2017	LAB-019	0.903	0.902	1.28	1.31	2.2	7.5	39.3	51.0	7543
21	TESTPROJ	HOLE001	Ply	100023	74.160	74.650	0.490	TRUE	BVNTL	REP001	1/04/2017	LAB-020	1.653	1.650	1.29	1.31	1.7	6.6	36.1	55.6	7763

Figure 6.1: Example Raw Ply Results

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	Project_Name	Borehole_Name	Sample_Type	Sample_No	Lab_Name	Report_No	Report_Date	Free_Moist_ar_pct	MHC_pct	Ash_ad_pct	C_daf_pct	H_daf_pct	N_daf_pct	S_daf_pct	O_daf_pct	PS_ad_pct	SO4_ad_pct	HGI	Def_Red_degC	Sph_Red_degC	Hemi_Red_degC	Flow_Red_degC	SiO2_domf_pct	Al2O3_domf_pct	Fe2O3_domf_pct	CaO_domf_pct
2	TESTPROJ	HOLE001	Comp	10000102	PTSGLT	REP001	1/04/2017	5.3	6.2	8.4	71.3	4.66	1.78	<0.01	22.22	0.07	<0.01	IS	1260	1280	1300	1360	54.9	11.9	4.24	13.7
3	TESTPROJ	HOLE001	Comp	10000607	PTSGLT	REP001	1/04/2017	4.1	5.4	5.5	75.0	5.12	1.79	<0.01	18.14	0.04	<0.01	IS	1420	1460	1500	1540	69.6	20.2	2.38	2.09
4	TESTPROJ	HOLE001	Comp	10000812	PTSGLT	REP001	1/04/2017	3.9	6.0	8.2	73.5	4.76	1.75	0.01	19.96	0.15	0.01	41	1400	1440	1460	1500	64.9	21.3	3.34	2.74
5	TESTPROJ	HOLE001	Comp	10001315	PTSGLT	REP001	1/04/2017	3.4	5.1	11.3	69.4	4.82	1.63	0.04	24.10	0.56	0.04	IS	1120	1140	1150	1180	27.6	10.4	24.0	14.0
6	TESTPROJ	HOLE001	Comp	100016	PTSGLT	REP001	1/04/2017	3.1	4.6	12.9	70.5	4.58	1.65	<0.01	23.23	0.04	<0.01	IS	1520	1540	>1560	>1560	79.2	15.9	1.06	0.39
7	TESTPROJ	HOLE001	Comp	10001721	PTSGLT	REP001	1/04/2017	2.5	3.5	8.5	73.8	5.23	1.70	0.02	19.28	0.63	0.02	35	1270	1310	1330	1390	54.3	21.1	16.7	2.07
8	TESTPROJ	HOLE001	Comp	10002224	PTSGLT	REP001	1/04/2017	1.8	3.2	9.3	76.1	4.85	1.74	0.01	17.30	0.51	0.01	47	1220	1220	1260	1320	58.3	18.3	10.2	4.31
9	TESTPROJ	HOLE001	Comp	100025	PTSGLT	REP001	1/04/2017	2.8	4.7	19.8	69.9	0.71	0.82	<0.01	28.55	0.22	<0.01	40	1220	1220	1230	1250	42.9	7.9	6.5	22.9
10	TESTPROJ	HOLE001	Comp	10002627	PTSGLT	REP001	1/04/2017	2.1	4.0	12.9	76.6	2.66	1.80	<0.01	18.94	0.14	<0.01	36	1170	1190	1220	1260	51.3	13.2	8.4	10.7
11	TESTPROJ	HOLE001	Comp	10002829	PTSGLT	REP001	1/04/2017	2.5	3.5	7.6	76.6	4.81	1.67	0.01	16.93	0.08	0.01	IS	1500	1520	1540	1550	73.5	18.3	2.88	0.89
12	TESTPROJ	HOLE001	Comp	10003034	PTSGLT	REP001	1/04/2017	3.7	5.8	5.2	76.8	4.85	1.65	0.02	16.70	0.25	0.02	48	1400	1410	1420	1480	63.1	22.2	6.8	2.75
13	TESTPROJ	HOLE001	Comp	10003543	PTSGLT	REP001	1/04/2017	3.7	4.6	7.7	74.2	4.65	1.55	0.02	19.63	0.22	0.02	49	1220	1230	1240	1280	36.8	21.5	4.56	27.6
14	TESTPROJ	HOLE001	Comp	10004447	PTSGLT	REP001	1/04/2017	3.6	6.7	18.2	63.1	3.90	1.24	<0.01	31.77	0.19	<0.01	55	1120	1140	1160	1210	23.8	12.0	14.6	39.2

Figure 6.2: Example Raw Composite Results

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	Project_Name	Borehole_Name	Sample_Type	Sample_No	Lab_Name	Report_No	Report_Date	Pre_Treatment	Drop_Count	Size_Type	Plus_Size	Minus_Size	Sink	Float	Mass_ad_kg	Mass_pct	RD_ad_gpcm3	MIAS_ad_pct	Ash_ad_pct	VM_ad_pct	TS_ad_pct	CSN
2	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	D	10	11.2			0.439	22.1						
3	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	D	8	10			0.267	13.4						
4	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	D	4	8			0.734	36.9						
5	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	D	2	4			0.215	10.8						
6	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	D	1	2			0.153	7.7						
7	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	D	0.71	1			0.046	2.3						
8	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	D	0.5	0.71			0.040	2.0						
9	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	D	0.25	0.5			0.047	2.4						
10	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	D	0	0.25			0.046	2.4						
11	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	10	11.2			0.160	9.3			7.4		0.60	
12	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	8	10			0.188	11.0			7.4		0.60	
13	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	4	8			0.547	31.9			7.4		0.60	
14	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	2	4			0.274	16.0			7.4		0.60	
15	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	1.4	2			0.120	7.0			8.1		0.56	
16	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	1	1.4			0.081	4.7			8.1		0.56	
17	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	0.71	1			0.064	3.7			8.1		0.56	
18	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	0.5	0.71			0.072	4.2			8.1		0.56	
19	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	0.25	0.5			0.060	3.5			8.1		0.56	
20	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	0.125	0.25			0.031	1.8			8.1		0.56	
21	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	0	0.125			0.087	6.9	1.5	3.9	19.7	29.1	0.74	
22	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	2	11.2		1.3		85.1			4.5		0.61	5
23	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	2	11.2	1.3	1.4		6.8			11.2		0.65	1
24	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	2	11.2	1.4	1.5		1.2			25.5		0.55	0
25	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	2	11.2	1.5	1.6		1.6			25.5		0.55	0
26	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	2	11.2	1.6	1.7		1.5			38.4		0.28	0
27	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	2	11.2	1.7	1.75		1.1			39.4		0.49	0
28	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	2	11.2	1.75	1.8		1.2			39.4		0.49	0
29	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	2	11.2	1.8	2		0.9			45.4		0.20	
30	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	2	11.2	2	2.2		0.3			45.4		0.20	
31	TESTPROJ	HOLE001	Comp	10000102	BVMKY	REP001	1/04/2017	Drop	20	W	2	11.2	2.2			0.3			45.4		0.20	

Figure 6.3: Example Sizing & Washability Results

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	Project_Name	Borehole_Name	Sample_Type	Sample_No	CCC_Type	Lab_Name	Report_No	Report_Date	Mass_pct	RD_ad_gpcm3	MIAS_ad_pct	Ash_ad_pct	VM_ad_pct	FC_ad_pct	CV_ad_kcalpKg	C_daf_pct	H_daf_pct	N_daf_pct	TS_ad_pct	PS_ad_pct	SO4_ad_pct	OS_ad_pct	HGI
2	TESTPROJ	HOLE001	Comp	10000102	PRODUCT1	PTSROK	REP001	1/04/2017	88.0	1.32	3.8	5.4	34.8	56.0	7421	74.4	4.60	1.89		0.05	<0.01	0.55	57
3	TESTPROJ	HOLE001	Comp	10000607	PRODUCT1	PTSROK	REP001	1/04/2017	94.3	1.30	3.4	5.3	36.9	54.4	7545	76.5	5.20	1.85		0.05	<0.01	0.85	46
4	TESTPROJ	HOLE001	Comp	10000812	PRODUCT1	PTSROK	REP001	1/04/2017	96.6	1.34	3.4	7.4	34.4	54.8	7250	73.9	4.75	1.76		0.13	0.01	0.67	41
5	TESTPROJ	HOLE001	Comp	10001315	PRODUCT1	PTSROK	REP001	1/04/2017	87.6	1.32	3.0	6.6	39.0	51.4	7382	74.2	5.04	1.85		0.17	0.02	0.66	40
6	TESTPROJ	HOLE001	Comp	100017	PRODUCT1	PTSROK	REP001	1/04/2017	95.0	1.38	2.7	11.7	34.0	51.6	6987	70.3	4.47	1.65		0.03	<0.01	0.65	37
7	TESTPROJ	HOLE001	Comp	10001721	PRODUCT1	PTSROK	REP001	1/04/2017	94.0	1.30	2.3	6.3	40.4	51.0	7586	75.2	5.31	1.79		0.05	<0.01	0.84	36
8	TESTPROJ	HOLE001	Comp	10002224	PRODUCT1	PTSROK	REP001	1/04/2017	90.4	1.33	1.9	6.7	32.1	59.3	7773	76.6	4.79	1.81		0.13	<0.01	0.67	47
9	TESTPROJ	HOLE001	Comp	10002829	PRODUCT1	PTSROK	REP001	1/04/2017	95.3	1.36	2.5	7.3	31.3	58.9	7449	75.5	4.55	1.72		0.10	<0.01	0.65	45
10	TESTPROJ	HOLE001	Comp	10003034	PRODUCT2	PTSROK	REP001	1/04/2017	85.0	1.34	3.1	4.7	34.9	57.3	7614	76.1	4.67	1.74		0.10	<0.01	0.69	46
11	TESTPROJ	HOLE001	Comp	10003543	PRODUCT2	PTSROK	REP001	1/04/2017	94.2	1.36	3.0	6.7	33.9	56.4	7324	75.0	4.50	1.63		0.17	0.01	0.64	48

Figure 6.4: Example Clean Coal Composite Results

6.2 Coal Quality Reflectance Results File Format

This format is for transferring Coal Quality Reflectance results. It is described in detail in the specification file *CoalLog v3.1 Data Table Specifications.xlsx.*

Metadata

As with the Coal Quality Results Format, the Sample Identification fields: **Project_Name, Borehole_Name**, **Sample_Type** and **Sample_No**, and Laboratory Particulars: **Lab_Name** and **Report_No** are all mandatory. As is **CCC_Type** for Clean Coal Composite samples.

The field **Vitrinite_Type** which can have the values (case insensitive):

- **Telo** for telovitrinite
- **Detro** for detrovitrinite
- **All** for teleovitrinite plus detrovitrinite

is also mandatory.

The fields:

- **Step_Min_pct** - the minimum reflectance value for the step
- **Step_Max_pct** - the maximum reflectance value for the step

are mandatory for all records with a **Step_Freq_pct** result. Where V-Steps increase by one, a V-Step of V8 would have a **Step_Min_pct** of 0.8 and **Step_Max_pct** of 0.9. Where using half V-Steps a V-Step of V8.5 would have a **Step_Min_pct** of 0.85 and **Step_Max_pct** of 0.9.

The other metadata fields are:

- **From_Depth -** the sample's from depth in metres
- **To_Depth -** the sample's to depth in metres
- **Thickness** - the sample's thickness in metres
- **Depth_Adjusted** - whether the depths have been adjusted to geophysics. This can be **True** or **False** in upper, lower or a mixture of cases.
- **Dispatch_No** – number for dispatch to laboratory
- **Report_Date** - date of laboratory report.
- **Lab_Sample_No -** the laboratory's sample identifier which can be any combination of text and numbers.

Database Primary Key

The primary key for database tables comprises: **Project_Name, Borehole_Name, Sample_Type, Sample_No., Lab_Name, Report_No, CCC_Type, Vitrinite_Type, Step_Min_pct** and **Step_Max_pct.**

Results

The seven results fields are:

- **RoMax_pct** - the mean maximum vitrinite reflectance
- **No -** the number of readings
- **Freq_pct** – frequency for the particular vitrinite type
- **RvMin_pct** - the minimum vitrinite reflectance in oil
- **RvMax_pct** - the maximum vitrinite reflectance in oil
- **SD_pct** - the standard deviation of the mean
- **Step_Freq_pct** - the frequency of vitrinite reflectance for a particular step

For each sample number, only one line for each **Vitrinite_Type** can have results for **RoMax_pct**, **No**, **Freq_pct**, **RvMin_pct**, **RvMax_pct** and **SD_pct**.

For all other lines for the sample number and **Vitrinite_Type,** must have values for **Step_Min_pct**, **Step_Max_pct** and **Step_Freq_pct**.

Figure 6.5 is an example of Reflectance Results data in CoalLog format. Required data are shown in red, other metadata in blue and actual results in black.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Project_Name	Borehole_Name	Sample_Type	Sample_No	From_depth	To_Depth	Thickness	Lab_Name	Report_No	Report_Date	Lab_Sample_No	Vitrinite_Type	RoMax_pct	No	Freq_pct	RvMin_pct	RvMax_pct	SD_pct	Step_Min_pct	Step_Max_pct	Step_Freq_pct
2	TESTPROJ	HOLE001	Comp	10000102	70.00	71.00	1.00	BVMKY	Report01	1/04/2017	Lab001	Telo	0.63	41	82	0.54	0.71	0.05	5.0	6.0	0
3	TESTPROJ	HOLE001	Comp	10000102	70.00	71.00	1.00	BVMKY	Report01	1/04/2017	Lab001	Telo							6.0	7.0	70
4	TESTPROJ	HOLE001	Comp	10000102	70.00	71.00	1.00	BVMKY	Report01	1/04/2017	Lab001	Telo							7.0	8.0	12
5	TESTPROJ	HOLE001	Comp	10000102	70.00	71.00	1.00	BVMKY	Report01	1/04/2017	Lab001	Detro	0.59	9	18	0.53	0.69	0.05	5.0	6.0	6
6	TESTPROJ	HOLE001	Comp	10000102	70.00	71.00	1.00	BVMKY	Report01	1/04/2017	Lab001	Detro							6.0	7.0	12
7	TESTPROJ	HOLE001	Comp	10000102	70.00	71.00	1.00	BVMKY	Report01	1/04/2017	Lab001	Detro							7.0	8.0	0
8	TESTPROJ	HOLE001	Comp	10000102	70.00	71.00	1.00	BVMKY	Report01	1/04/2017	Lab001	All	0.62	50	100	0.53	0.71	0.053	5.0	6.0	6
9	TESTPROJ	HOLE001	Comp	10000102	70.00	71.00	1.00	BVMKY	Report01	1/04/2017	Lab001	All							6.0	7.0	82
10	TESTPROJ	HOLE001	Comp	10000102	70.00	71.00	1.00	BVMKY	Report01	1/04/2017	Lab001	All							7.0	8.0	12

Figure 6.5: Example Reflectance Results

6.3 Composite Constituent Sample Numbers File Format

Each composite sample for testing must have a composite sample number that is unique within each borehole. CoalLog has a composite constituent sample numbers file format, for recording the sample numbers contained in a composite sample. Constituent sample numbers may be individual ply sample numbers as recorded in the lithology data or other composite sample numbers that have previously been defined. Where composite samples are contained in the dataset being transferred it is mandatory to populate this sheet so that a record of the composite composition is maintained.

The file includes a separate record for each constituent sample within each composite. It contains the following fields which are all mandatory:

- **Project_Name**
- **Borehole_Name** - the name of the borehole form which the constituent sample numbers come from
- **Composite_No** - the composite number for the composite which contains the sample **Sample_No**
- **Sample_Type** – for the **Sample_No**. **Sample_Type** can have a value of:
  - **Ply** for individual samples
  - **Comp** for analysed composited samples
- **Sample_No** - the sample number of one of the constituents of **Composite_No.**

The CoalLog system assumes that where a constituent is included in a composite that the constituent sample represents the entire thickness of the sample labelled by the **Sample_No**.

This file may be supplied either from the client to the laboratory as instructions on how to make up the composite samples and/or from the laboratory to the client to describe the final, actual makeup of the composites. The actual name of each composite is at the user's discretion and so does not have to reflect the individual sample numbers contained in the composite.

Figure 6.6 is an example of Composite Constituents data in CoalLog format. All required data are shown in red.

	A	B	C	D	E
1	Project_Name	Borehole_Name	Composite_No	Sample_Type	Sample_No
2	TESTPROJ	HOLE001	10000102	Ply	100001
3	TESTPROJ	HOLE001	10000102	Ply	100002
4	TESTPROJ	HOLE001	10000607	Ply	100006
5	TESTPROJ	HOLE001	10000607	Ply	100007
6	TESTPROJ	HOLE001	10000810	Ply	100008
7	TESTPROJ	HOLE001	10000810	Ply	100009
8	TESTPROJ	HOLE001	10000810	Ply	100010
9	TESTPROJ	HOLE001	10000812	Comp	10000810
10	TESTPROJ	HOLE001	10000812	Ply	100011
11	TESTPROJ	HOLE001	10000812	Ply	100012
12	TESTPROJ	HOLE001	10000812	Ply	100013
13	TESTPROJ	HOLE001	10001315	Ply	100014
14	TESTPROJ	HOLE001	10001315	Ply	100015

Figure 6.6 Example Composite Constituent Sample Numbers

6.4 Clean Coal Composite (CCC) Definitions File Format

Each Clean Coal Composite (CCC) result in the Coal Quality Results must include a user defined **CCC_Type.** The components of each **CCC_Type** must be defined in an accompanying CCC Definitions file. This file includes a separate record for each constituent in each **CCC_Type** for each Clean Coal Composite sample. A CCC Definition file must accompany Coal Quality Results that include results for Clean Coal Composites.

Metadata

Each constituent is identified by the following fields:

- **Project_Name**
- **Borehole_Name**
- **Sample_Type** - which has a value of **Ply** for individual samples or **Comp** for composite samples. These can be in upper, lower or a mixture of cases.
- **Sample_No** - which can be a valid individual/ply sample number or a composite sample number.
- **CCC_Type** – Clean Coal Composite Type which is a name the user or the laboratory has assigned to a Clean Coal Composite to identify its composition, (e.g. TC1 for Thermal Coal Product 1, PCI2 for PCI Product 2). This name is user defined and is not validated against the CoalLog dictionary. The components of each **CCC_Type** should be recorded in a **CCC Definition** table. Raw composites should not be given a **CCC_Type**.

There can be considerable variation between projects on how Clean Coal Composites are defined. For some projects, the same definition may apply across all holes while for others the particular Froth fractions may vary depending on the Borehole and Sample. Therefore, only **Project_Name** and **CCC_Type** are compulsory.

Database Primary Key

The primary key for database tables consist of all the above metadata fields: **Project_Name, Borehole_Name, Sample_Type, Sample_No** and **CCC_Type.**

Constituent Definition

For each constituent, the user may specify **Size_Type, Minus_Size, Plus_Size, Sink, Float, Froth** and **Comments**. **Comments** can be used to describe any other preparation procedures that a constituent has undergone that cannot be adequately described by the other fields. **Size_Type** must be specified if **Minus_Size** or **Plus_Size** is specified.

Figure 6.7 is an example of Clean Coal Composite Definition data in CoalLog format. Required data are shown in red and other data in black.

Project_Name	Borehole_Name	Sample_Type	Sample_No	CCC_Type	Size_Type	Plus_Size	Minus_Size	Sink	Float	Froth	Comments
TESTPROJ	HOLE001	COMP	10000812	PRODUCT1	W	2	50		1.35		
TESTPROJ	HOLE001	COMP	10000812	PRODUCT2	W	0.25	2		1.5		
TESTPROJ	HOLE001	COMP	10000812	PRODUCT2	W	0	0.25			C1	
TESTPROJ	HOLE001	COMP	10000812	PRODUCT2	W	0	0.25			C2	
TESTPROJ	HOLE001	COMP	10000812	PRODUCT2	W	0	0.25			C3	
TESTPROJ	HOLE001	COMP	10000812	PRODUCT2	W	0	0.25			C4	
TESTPROJ	HOLE001	COMP	10000812	PRODUCT2	W	0	0.25			C5	
TESTPROJ	HOLE001	COMP	10000812	PRODUCT2	W	0	0.25			C8	
TESTPROJ	HOLE001	COMP	10000812	PRODUCT2	W	0	0.25			C7	
TESTPROJ	HOLE001	COMP	10000812	PRODUCT2	W	0	0.25			C6	

Figure 6.7 Example Clean Coal Composite Definition

6.5 Quality Test Specifications File Format

The Test Specification file lists the standards to which tests were done. It is described in detail in the specification file *CoalLog v3.1 Data Table Specifications.xlsx*.

Metadata

Each test is identified by a combination of the following mandatory fields:

- **Project_Name**
- **Lab_Name -** where the test was performed. Codes for this can be found in the *CoalLog Reference Items Dictionary*.
- **Report_No** - the laboratory report number for the report providing the result
- **Variable** - the CoalLog field name as listed in the Coal Quality Results File Format specification and as appears on the header line of CoalLog Coal Quality Results files

The other optional metadata field is:

- **Report_Date** - date of laboratory report.

Database Primary Key

The primary key for database tables comprises **Project_Name**, **Lab_Name, Report_No** and **Variable.**

Test Specification Fields

The test specification fields are:

- **Standard -** the standard to which the test was done
- **Lower_Limit -** the lower detection limit of the testing equipment
- **Upper_Limit -** the upper detection limit of the testing equipment

The **Lower_Limit** field is mandatory.

Figure 6.8 is an example of Test Specifications data in CoalLog format. Required data are shown in red and other metadata in black.

	A	B	C	D	E	F	G
1	Project_Name	Lab_Name	Report_No	Variable	Standard	Lower_Limit	Upper_Limit
2	TESTPROJ	BVMKY	Report01	Def_Red_degC	AS1038.15	1000	1550
3	TESTPROJ	BVMKY	Report01	Sph_Red_degC	AS1038.15	1000	1550
4	TESTPROJ	BVMKY	Report01	Hemi_Red_degC	AS1038.15	1000	1550
5	TESTPROJ	BVMKY	Report01	Flow_Red_degC	AS1038.15	1000	1550
6	TESTPROJ	BVMKY	Report01	Def_Ox_degC	AS1038.15	1000	1550
7	TESTPROJ	BVMKY	Report01	Sph_Ox_degC	AS1038.15	1000	1550
8	TESTPROJ	BVMKY	Report01	Hemi_Ox_degC	AS1038.15	1000	1550
9	TESTPROJ	BVMKY	Report01	Flow_Ox_degC	AS1038.15	1000	1550

Figure 6.8 Example Test Specifications

7 Data Transfer Format

7.1 Introduction

Each of the software systems that handle Australian coal exploration data have their own conventions for the structure of text files for transferring data. This variability is most apparent in how each system handles a single lithological unit consisting of multiple lithologies and/or multiple records. This variability has also greatly hindered the transfer of data between systems even where two systems have the same fields and dictionary codes. To overcome this, a standard transfer format has been incorporated into the CoalLog Standard. This format has its own conventions. To be compatible with the Standard, software vendors do not have to adopt these conventions internally but must provide a set of utilities to import and export data to and from their system using these conventions. This chapter explains the conventions.

7.2 CSV File Format

Comma delimited files, commonly referred to as CSV files are used for CoalLog data transfer. The possibility of using XML format files was discussed in the preparation of this standard. XML format has the advantage that the files are self-documenting and so data files can also include the relevant dictionary and validation rules along with the data in a single file. The main disadvantages are that they would require considerably more effort on the part of the software vendors to create import/export utilities, and users using general spreadsheet or database programs such as Excel or Access to store their data would require specific import/export utilities to be written.

Unfortunately, there is no standard that defines CSV files and so there can be some slight variations amongst systems. The following from Shafranovich, 2005 documents the format as used by most implementations of CSV files. Note that in this description CR and LF refer to the ASCII characters denoted by the numbers 13 and 10 respectively:

1. Each record is located on a separate line, delimited by a line break (CRLF). For example:

```
aaa,bbb,ccc CRLF
zzz,yyy,xxx CRLF
```

2. The last record in the file may or may not have an ending line break. For example:

```
aaa,bbb,ccc CRLF
zzz,yyy,xxx
```

3. There maybe an optional header line appearing as the first line of the file with the same format as normal record lines. This header will contain names corresponding to the fields in the file and should contain the same number of fields as the records in the rest of the file. For example:

```
field_name,field_name,field_name CRLF
aaa,bbb,ccc CRLF
zzz,yyy,xxx CRLF
```

4. Within the header and each record, there may be one or more fields, separated by commas. Each line should contain the same number of fields throughout the file. Spaces are considered part of a field and should not be ignored. The last field in the record must not be followed by a comma. For example:

```
aaa,bbb,ccc
```

5. Each field may or may not be enclosed in double quotes. If fields are not enclosed with double quotes, then double quotes may not appear inside the fields. For example:

```
"aaa","bbb","ccc" CRLF
zzz,yyy,xxx
```

6. Fields containing line breaks (CRLF), double quotes, and commas should be enclosed in double-quotes. For example:

```
"aaa","b CRLF
bb","ccc" CRLF
zzz,yyy,xxx
```

7. If double-quotes are used to enclose fields, then a double-quote appearing inside a field must be escaped by preceding it with another double quote. For example:

```
"aaa","b""bb","ccc"
```

The CoalLog Standard makes two departures from the description above:
As opposed to item 3 above, it is compulsory to have a header in a CoalLog Standard CSV file
As opposed to item 4 above, it is acceptable to have fewer fields on a particular record than defined by the file header. For example, all four data records below are acceptable:

```
field_name,field_name,field_name CRLF
aaa,bbb,ccc CRLF
xxx,, CRLF
yyy, CRLF
zzz CRLF
```

In many countries, commas are used as the decimal point marker. In these countries, CSV format files often use a different field separator, commonly a semi-colon (;). As the CoalLog Standard is for the use of the Australian Coal Industry, there is no requirement for software to be able to support field separators apart from a comma.

7.3 File Names for Transfer Files

The CSV files of data should have a name consisting of the data set name followed by the either a blank or underscore followed by the data type and then .csv:

- there is no limit to the size of the data set name or what characters it contains apart from the standard conventions for file names

- where a file contains the data for a single hole the data set name should be the borehole name. Where a file contains all the data for a project then it should be the project name. Where the data contains more than one hole but not the entire project it should be a meaningful name such as a range of holes, a section line name, a drill hitch date range, an EPC reporting period, etc.
- the data type for file naming must be one of those listed in Table 7.1 below. The name can be abbreviated but must contain at least the first four letters of the data type as indicated by the underlined sections of the data types in Table 7.1. The data type name may be in upper case, lower case or a mixture of the two.

For example, the file containing the Lithology data for hole TST0023 could be called TST0023_Lith.csv, TST0023_LITHO.csv or TST0023_lithology.csv.

Table 7.1 Naming convention for file transfer Data Type

Data Table Name	Data Type Name for Files
Dictionary	`Dictionary`
Header	`Headers`
Geologists	`Geologists`
Casing	`Casing`
Cementing	`Cementing`
Drilling	`Drilling`
Lithology	`Lithology`
Sample Dispatch	`SampleDispatch`
Water Observations	`WaterObservations`
RMU & Defects	`Defects`
Point Loads	`PointLoads`
Quality - Results	`Quality`
Quality - Reflectance	`Reflectance`
Quality - Composites	`Composites`
Quality - CCC Definitions	`CCCDefinitions`
Quality – Test Specifications	`TestSpecifications`

Dictionaries for specific data types should have the word Dictionary prefixed by the data type that the dictionary refers to, for example a dictionary of the seams for a project named TEST would be called TEST_Seam_Dictionary.csv or maybe TEST Seam Dictionary.csv.

Where the data for all data types for a particular data set are zipped together the resulting compressed file should be given the name of the data set.

7.4 CSV File Fields and Header Line

To make CoalLog as flexible as possible, only a minimal number of fields are compulsory (see Table 7.2) and fields may be in any order. Each field has been given a standard name and these have been listed in the Data Table Specifications that can be downloaded from the CoalLog web-site. The data transfer files must include a header line on the first line of the file using the standard field names. This header line defines both the fields in the file and their order. The standard field names are a maximum of 16 characters and do not contain any blank characters within their name. Even though all the field names are shown in the specification in a mixture of upper and lower case, the user may list them in the file header in upper case, lower case, or any mixture of the two.

The user may include non-CoalLog fields in the file. These though will be generally ignored by other applications using the file. Any columns in the file that are for non-CoalLog fields must also be given a name on the header line. These names must start with the string *Custom_* or *NC_*. They may be longer than 16 characters but must not contain any blanks.

Fields marked with an asterisk in Table 7.2 must be included in the file but do not need to have data values on every line of the data transfer file. Note that with Lithology data, the **Litho_Perc** and **Litho_Interrel** columns may be omitted if all lithology units in the file consist only of a single lithology. For more information regarding when they are required see the Section 7.11 Validation of CoalLog Data Transfer Files below.

Table 7.2 Mandatory fields to include in data transfer files

	A	B
1	**Data Table Name**	**Required Fields**
2	Dictionary	Category, Code, Description
3	Header	Project_Name, Borehole_Name
4	Geologists	Project_Name, Borehole_Name, From_Depth, To_Depth
5	Casing	Project_Name, Borehole_Name, From_Depth, To_Depth
6	Cementing	Project_Name, Borehole_Name, From_Depth, To_Depth
7	Drilling	Project_Name, Borehole_Name, From_Depth, To_Depth, Drill_Date, Bit_Type, Run_No*
8	Lithology	Project_Name, Borehole_Name, From_Depth, To_Depth, Record_Seq_Flag, Litho_Perc*, Litho_Type*, Litho_Interrel*
9	Sample Dispatch	Project_Name, Borehole_Name, Sample_No, Sample_Purpose
10	Water Observations	Project_Name, Borehole_Name, Test_Depth
11	RMU & Defects	Project_Name, Borehole_Name, From_Depth, To_Depth, RMU_Type, Defect_Depth, Defect_Type
12	Point Loads	Project_Name, Borehole_Name, From_Depth, To_Depth, Sample_Length*, Sample_State*, Sample_Sub_Id, PL_Test_Type, Platen_Sep, Width, Failure_Load, Failure_Mode
13	Quality - Results	Project_Name, Borehole_Name, Sample_Type, Sample_No, Lab_Name, Report_No
14	Quality - Reflectance	Project_Name, Borehole_Name, Sample_Type, Sample_No, Lab_Name, Report_No, Vitrinite_Type
15	Quality - Composite Nos	Project_Name, Borehole_Name, Composite_No, Sample_Type, Sample_No
16	Quality - CCC Constituents	Project_Name, CCC_Type
17	Quality - Test Specifications	Project_Name, Lab_Name, Report_No, Variable, Lower_Limit

7.5 Transfer of Dictionaries

Under CoalLog, users may create their own codes for those categories that appear in the CoalLog Reference Items Dictionary (see Table 7.3) but only if they have items in these categories that do not currently appear in the provided CoalLog Reference Items Dictionary. Users must not create their own codes for those categories that appear in the CoalLog Standard Items Dictionary. If they feel further items need to be added to either dictionary they should send a request for their additions to coallog@ausimm.com.au. Where users have created their own codes for items in the Reference Items Dictionary, any data transfer files containing these codes must also have an accompanying dictionary containing these codes.

Where the same category appears in the CoalLog Data Table Specifications for more than one data type, (e.g. **Est_Strength** in both the Lithology and Defect data types), the same set of dictionary codes apply for both. Therefore, one dictionary file can be generated covering all data types, or separate dictionary files can be produced for each data type.

Table 7.3 CoalLog Reference Items Categories

Data Type	Reference Dictionary Categories
Header	`Basin, Lease_No, Survey_Source, Geolog_Organiz, Geophys_Company`
Drilling	`Drill_Company, Rig_Type`
Lithology	`Seam, Ply, Horizon`
Sample Dispatch	`Lab_Name`
Quality – Results	`Lab_Name`
Quality - Reflectance	`Lab_Name`
Quality – Test Specifications	`Lab_Name`

7.6 Date, Time and Logical Data

Date fields in the data such as **Rehab_Date** in the Header data are transferred in the format dd/mm/yyyy. For example, the 6th February 2010 would be exported as 06/02/2010.

Time data as in **Time_Started** and **Time_Completed** in the drilling data is transferred in the format *hhmm*. For example, 6:06am would be 0606 and 6:06pm would be 1806.

Logical fields, such as **Core_Photos** in the Header data are transferred as True, False, or blank. The True and False can be in upper case, lower case, or a mixture of the two.

7.7 Continuation Lines in the Lithology Data

Since the advent of recording Australian coal exploration lithological data on computers, there has been a convention that a single lithological unit between two depths may contain more than one lithology, and that each lithology may have multiple records for its description. Most systems also have not had a limit on the number of lithologies in a unit or the number of records for each lithology. Most systems also had a methodology to store free format comments for a lithological unit without any limit on the size of these comments. Various software packages have had various conventions for how these multiple lithologies, multiple records, and free format comments are denoted. Therefore, an essential part of CoalLog is providing a standard way of indicating this data.

7.8 Multiple Lithologies in a Lithological Unit

To denote multiple lithologies in a single unit, the transfer file needs to contain a record for each lithology containing the **From_Depth** and the **To_Depth** of the lithological unit, a **Record_Seq_Flag**, the **Litho_Type**, and its corresponding **Litho_Perc** of the unit. Each record in a unit must be assigned a unique **Record_Seq_Flag** which can be the numbers 0 to 9 or the upper case letters A to Z. This flag will denote the order of the records within a lithological unit with the numbers 0 to 9 coming first in order, followed by the letters A to Z in order. The **Litho_Perc**'s for the unit must add to 100%. Two different lithologies within a unit may actually have the same **Litho_Type** but may be different in other ways. For example, a lithological unit consisting of 40% medium to coarse grained quartzose sandstone, 35% siltstone, and 25% fine to medium grained arkosic sandstone would be recorded as follows:

Table 7.4 Example of coding multiple lithologies within one interval

From Depth	To Depth	Record Sequence Flag	Lithology %	Lithology	Lithology Qualifier	Shade	Hue	Colour	Adjective 1
19.82	23.56	1	40	SS	MC	L		B	QZ
19.82	23.56	2	35	ST		D		G	
19.82	23.56	3	25	SS	FM	D	E	G	AK

Normally the **Record_Seq_Flag** would use each of the numbers and then each of the letters but there is no requirement to use every one of the available values in the sequence. The only requirement is that the **Record_Seq_Flag** for each record in a unit is unique within the unit and that they are in order. For example, the first record in the unit could have the flag 3, the second 6, the third C and the fourth K. It is recommended that the first **Litho_Type** listed in a unit will be the one which is the largest component of the unit, the second **Litho_Type** the second largest etc, but this is not a CoalLog requirement.

It is envisaged that **From_Depth**'s and **Record_Seq_Flag**'s would not be manually entered but rather generated automatically by a software package's export utility.

Where there is more than one lithology in a unit, the **Litho_Interrel** field must be filled out on one of the rows for every specified **Litho_Type** that is followed by another specified **Litho_Type**. This requirement though can be dropped for historical data.

7.9 Multiple Records within a Lithology

Where a single lithology within a lithological unit consists of multiple records, the conventions above for Multiple Lithologies in a Lithological Unit are also used for the **From_Depth**'s, **To_Depth**'s and **Record_Seq_Flag**'s but the values in the **Litho_Type** and **Litho_Qual** fields are left blank on the record continuing the description of a lithology. For example, a lithological unit consisting of three lithologies where the first lithology has a colour of light brown to medium yellow would be recorded as follows:

Table 7.5 Example of coding single lithologies with multiple records

From Depth	To Depth	Record Sequence Flag	Lithology %	Lithology	Lithology Qualifier	Shade	Hue	Colour	Adjective 1
19.82	23.56	1	40	SS	MC	L		B	QZ
19.82	23.56	2				M		Y	
19.82	23.56	3	35	ST		D		G	
19.82	23.56	4	25	SS	FM	D	E	G	AK

7.10 Comment Lines

Coal exploration data is now generally stored in relational databases. However, before the introduction of these, text files were generally used for storing this data and comments were placed on their own separate lines within the file. In relational databases, the comments are generally stored in their own field on the database record to which they refer. This removes the necessity to have a specific continuation type to denote comments. Most database systems require a maximum specified size for each field, however CoalLog has no restriction on the size of individual comments. The user is also free to include non-printable characters such as <NewLines> and <Tabs> in comments. Some software systems may need to split individual comments over several records in order to handle these features of comments.

7.11 clCertify – CoalLog Certification App

The CoalLog standard includes a free app called clCertify for checking that CoalLog Data Transfer files are compliant to the standard. All the checks that it performs are listed in its accompanying Technical Guide. It also has a function to reformat CoalLog Data transfer Files that complied to earlier versions of the CoalLog standard to the current version.

This app can be downloaded from the CoalLog web page. Once installed, the user can view its User Guide by selecting Help > clCertify User Guide from its drop-down menus. It also includes a Technical Guide that can be viewed by selecting Help > clCertify Technical Guide from its drop-down menus. The technical guide lists all the checks that clCertify performs on the data and the modifications that it makes to files when reformatting older CoalLog Transfer Files to the current version.

7.12 References

Shafranovich,Y., 2005, “Common Format and MIME Type for Comma-Separated Values (CSV) Files”, October 2005, <http://www.ietf.org/rfc/rfc4180.txt>

8 Las Parameters

"The LAS standard was introduced by the Canadian Well Logging Society in 1989 to standardize the organization of digital log curve information for use on personal computers. It did this very successfully and the standard became popular worldwide. Version 1.2 was the first version and was followed in September 1992 by LAS version 2.0 to address some inconsistencies. The LAS 2.0 version is viewed as a log data exchange format and remains the dominant product.

In 1999, the LAS 3.0 version was introduced to provide expanded data storage capabilities that include not only log curve data, but also core, inclinometry, drilling, formation tops and test data. LAS 3.0 is viewed as a wellbore data storage format and continues to see limited implementation." (CWLS, 2017)

All the LAS formats have the following three compulsory sections for compulsory metadata:

- Version (indicated with a ~V) for information regarding the format of the file
- Well (~W) for information pertaining to the borehole including hole name, service company, date logged etc
- Curve (~C) providing the names of the individual curves, their units and descriptions

In addition, they have an optional Parameter (~P) section for user defined parameters and their values and an optional Other (~O) section which has no formatting requirements.

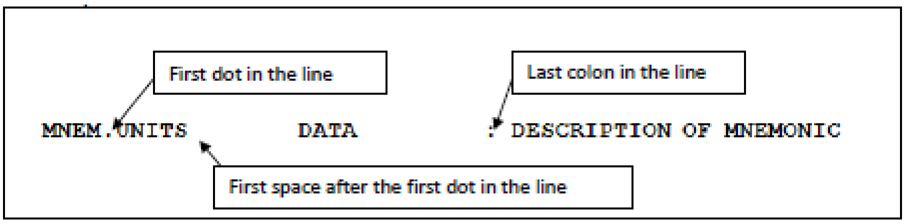
For LAS 2.0 and 3.0:

"Three line delimiters are used in the "~V", "~W", "~C", and "~P" sections of LAS files. The line delimiters are as follows:

a) the first dot in a line,
b) the first space after the first dot in a line
c) the last colon in a line

All non-comment lines in these sections must contain all three of the above delimiters.

An example line is as follows:



Where:

MNEM = mnemonic. This mnemonic can be of any length but must not contain any internal spaces, dots, or colons. Spaces are permitted in front of the mnemonic and between the end of the mnemonic and the dot.

UNITS = units of the mnemonic (if applicable). The units, if used, must be located directly after the dot. There must be no spaces between the units and the dot. The units can be of any length but must not contain any colons or internal spaces.

DATA = value of, or data relating to the mnemonic. This value or input can be of any length and can contain spaces, dots or colons as appropriate. It must be preceded by at least one space to demarcate it from the units and must be to the left of the last colon in the line.

DESCRIPTION = description or definition of the mnemonic. It is always located to the right of the last colon. The length of the line is no longer limited." (CWLS, 2017)

8.1 CoalLog Las Parameters

Over time, more and more logging companies have added Parameters (~P) and/or Other (~O) sections to their LAS file output to record important metadata for the accompanying downhole geophysical data. Unfortunately, there has been no agreement as to what data should be recorded in these sections. Some companies may only record one or two parameters such as Total Depth, Logged by and Witness whereas others record a plethora of information. There has also been no agreement as to what mnemonic to use for each particular parameter in the Parameter section or what format to use in the Other section. This means this data can only be accessed manually not by any automated methods. One example of the variety of mnemonics are the mneumonics used by various service companies to record Casing Diameter:

- CASD - Century
- CASI - Slimline Logging Services
- CasingSize – Geolog
- CSGS – Weatherford
- CAS-ID, CAS-OD – DGRT who actually record both inside and outside diameter

On reviewing the parameters in the LAS files from a range of providers, a number of issues became apparent. Firstly, some parameters such as Tool No refer to the tool used to collect the data, however, a single LAS file can contain not only data from a single borehole but may contain curves recorded by a number of tools and it is not clear how to record tool specific metadata such as date run for a number of tools and/or record what curves were recorded by what tool. Secondly, the only metadata that can be recorded for each individual curve are units and description. Therefore, there is no clear way to record metadata such as filter used on an individual curve.

From the review, the following list of required and optional Parameters plus associated mnemonics has been developed as part of the CoalLog standard to facilitate the automatic analysis of LAS metadata. The LAS standard places no restriction on the size of the mnemonics though most companies restrict their mnemonics to 4 characters. This convention has been preserved here.

Table 8.1: CoalLog Required Las Parameters

Description	Mnemonic	Units or Possible Values
Bit Size	BS	mm
Casing Depth Logger	CSGL	m
Casing Outside Size	CSGS	mm
Casing Stickup	CSUP	m
Casing Type	CSGT	PVC, Steel
Datum Logger (measured from)	LMF	GL, KB
Fluid Level	FL*	m
Logging Engineer	ENG	
Total Depth Logger	TDL	m
Witness	WIT	

*where the borehole is entirely dry the Fluid Level should be given a value of whatever the NULL value as defined in the ~Well section of the file.

Table 8.2: CoalLog Optional Las Parameters

Description	Mnemonic	Units or Possible Values
Azimuth	AZIM	degs
Casing Density	CSGW	g/cm^3
Casing Depth Driller	CSGD	m
Casing Inside Size	CSGI	mm
Casing Thickness	CSGT	mm
Datum Driller	DMF	GL, KB
Drilled by	DRBY	
Drill Completion Date	DRCP	dd/mm/yyyy
Drill Start Date	DRST	dd/mm/yyyy
Easting	EAST	m
Elevation	ELEV	m
Fluid Density	FDEN	g/cm^3
Fluid Type	FTYP	mud, water
Geodetic Datum	GDAT	AGD, GDA
Inclination	INCL	degs
Northing	NORT	m
Other Services	OTHE	
Total Depth Driller	TDD	m
Logging Unit No	UNIT	

Table 8.3: CoalLog Optional Tool Las Parameters

Description	Mnemonic	Units or Possible Values
Calibration Date	CALD	dd/mm/yyyy
Calibration Time	CALT	hhmm
Logging Date	LOGD	dd/mm/yyyy
Logging Speed	LOGS	m/min
Logging Tool Number	LOGU	
Tool Type	TOOL	

8.2 References

CWLS, 2017. *Las Version 2.0: A Digital Standard for Logs, Update February 2017*. Canadian Well Logging Society (www.cwls.org).

9 Standards for Displaying Lithology

Until the advent of CoalLog v2.0, the only standard for displaying lithologies from Australian coal exploration programs was Australian Standard AS2916-2007 *Symbols for Graphic Representation of Coal Seams and Associated Strata*. However, this set of patterns only covers a total of 30 lithotypes and lithological qualifiers. CoalLog v3.1 has over 100 lithotypes and over 100 unique lithotype and lithology qualifier combinations. The CoalLog standard defines a pattern for each of these.

Where a user would like to represent different lithologies by a colour, either by itself or in combination with a pattern, there has never been any standard in the Australian coal industry for which colours should be used for which lithologies. There has always been some general conventions, such as yellow for sandstone, but these have never been formalized into a standard. CoalLog now provides a suggested set of such colours, however, rather than providing a colour for every lithotype and lithology qualifier, it provides a colour for various groups of lithologies. It should be emphasised though that these are a suggested list and it is up to the users discretion whether they use them.

9.1 CoalLog Lithology Patterns

Across the literature the terms plotting pattern and symbol have been used interchangeably. For clarity, CoalLog uses the term pattern for the actual overall pattern used for an item and symbol for the individual symbols that form the pattern.

CoalLog specifies a pattern for each individual **Litho_Type** for use on general scale plots. CoalLog also specifies a pattern for each valid combination of **Litho_Type** and **Litho_Qual** for use on detail scale plots. The criteria for categorizing items as **Litho_Qual**'s rather than **Adjective**'s is that **Litho_Qual**'s are items that the geologist considers important enough that they want to see a unique pattern for them on a detail scale plot. When plotting detail scale plots and no lithology qualifier is recorded then the pattern for the lithotype should be used.

Like codes and coding sheets before the advent of CoalLog, many different sets of patterns for the various Lithotypes and Lithological Qualifiers have been in use in the Australian Coal industry. Having a variety of patterns being used for the same lithotype can clearly lead to confusion and potential mistakes being made. This is especially true when the analysing geologist moves between projects or for that matter even different drilling campaigns on the same project are undertaken by different organizations.

The following procedure was undertaken to develop the CoalLog set of patterns:

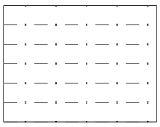
1) Unless there was very good reason, the pattern in the Australian Standard AS2916-2007 *Symbols for Graphic Representation of Coal Seams and Associated Strata* was adopted;
2) Where a lithology was not present in the Australian Standard but was present in the Australasian Institute of Mining and Metallurgy (AusIMM) *Field Geologists' Manual*, (FGM) then this pattern was adopted where possible;

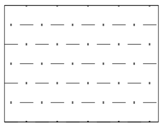
3) Where lithologies were not present in either of the above then a pattern was adopted from the pattern sets used by one of the large coal companies operating in Australia, including Anglo, BMA, Peabody, Rio Tinto and Whitehaven;
4) Where lithologies were not present in any of the above then a pattern was adopted from one of the following documents:
    - *FGDC Digital Cartographic Standard for Geologic Map Symbolization* from the United States Geological Survey (USGS),
    - *The Preparation of Maps and Plans in terms of Engineering Geology* from the UK Geological Society Engineering Group (UK GSEG),
    - *Cartographic Standard Geological Symbol Index*. Version 3 from the British Geological Survey (BGS),
    - *Standard Legend 1995* from Shell International Exploration and Production B.V. (Shell),
    - *Standards for Regional Geologic Mapping* from the Ethiopian Ministry for Mines and Energy (EMME);
5) Where no appropriate pattern was present in any of the above, a pattern was created that represented some physical aspect of the lithology.

A number of conventions were adopted in developing the patterns:

1) Where the same sediments can be in an unconsolidated or consolidated form, the same symbol is used for both but is offset horizontally between alternate lines in the consolidated form. This convention was adopted as the offset symbols appear more cohesive than the non-offset symbols;

    For example, silt is displayed as: and siltstone as:

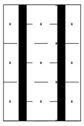


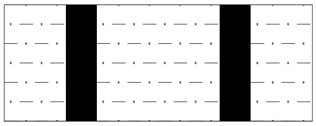


2) Symbols should not be too large or too widely spaced so that they are still legible for thin units;
3) Patterns should not include continuous horizontal solid lines that could be confused with bed boundaries;
4) The same symbol has been used to represent cobbles and boulders due to the rarity of being able to identify boulders in borehole core.

The patterns fall into two categories when plotted:

1) Those where the individual symbols are a fixed size and repeat across the column area to fill it, as demonstrated by the siltstone symbols in the following two examples of carbonaceous siltstone;
2) Those where the position and width of the individual symbol is proportional to the width of the column area being plotted, as demonstrated by the carbonaceous bars in the following examples:





Where a unit consists of two or more discrete **Litho_Type**'s, each is plotted with its width being proportional to its abundance in the unit. For example, the following depicts a unit that is 75% sandstone and 25% siltstone:

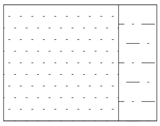


Table 9.1 lists the pattern for each **Litho_Type** and Table 9.2 lists the patterns for each valid **Litho_Type** + **Litho_Qual** combination. The latter are for detail scale plots.

For each pattern in Tables 9.1 and 9.2, the tables show:

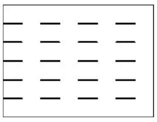
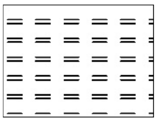
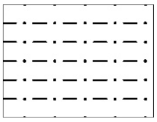
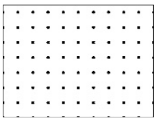
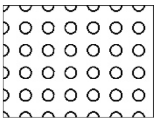
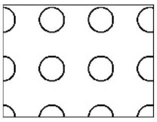
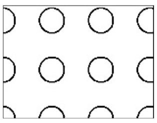
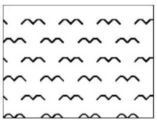
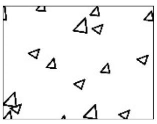
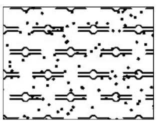
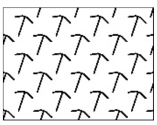
- the CoalLog code
- the description for the code
- an image of the pattern
- whether the pattern must be plotted proportional to the width of the column;
- the source of the pattern and for those without a source an explanation of their design.

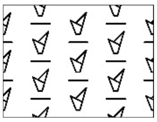
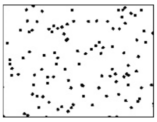
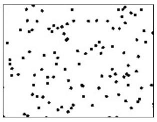
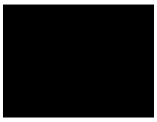
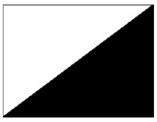
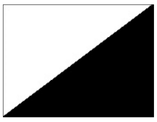
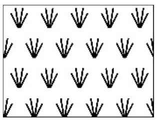
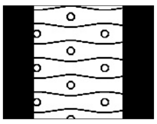
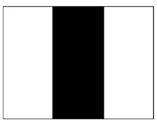
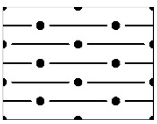
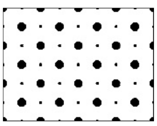
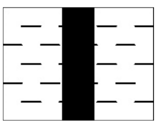
Appendix F lists and describes the additional files that can be downloaded from the CoalLog website to assist software developers to set up the standard patterns.

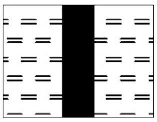
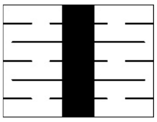
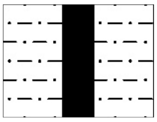
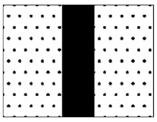
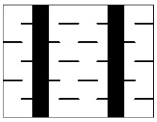
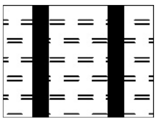
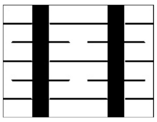
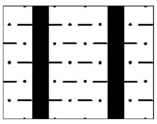
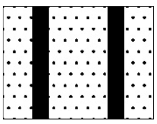
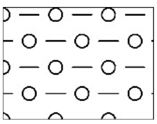
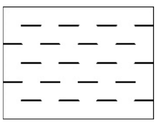
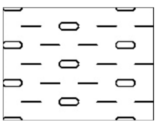
9.2 CoalLog Lithology Colours

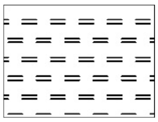
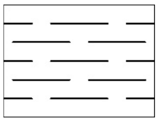
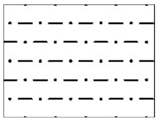
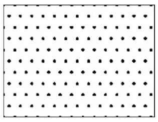
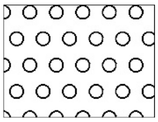
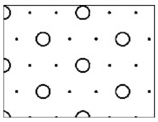
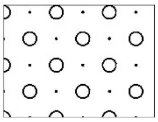
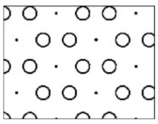
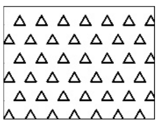
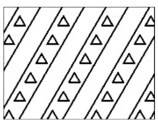
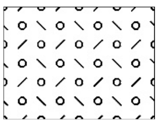
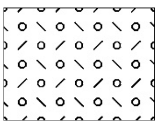
A set of recommended background colours has been developed for plotting CoalLog **Litho_Type**'s (Table 9.3). In order to highlight carbonaceous material, it is also recommended to use red for coal **Litho_Type**'s, and carbonaceous and coaly bars (Table 9.4). It is left to the user's discretion whether they use colours when plotting any particular **Litho_Type** but if they are going to use colour then they should use the standard set of colours provided here.

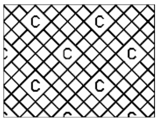
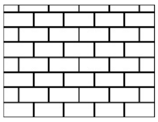
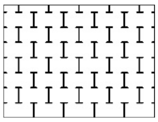
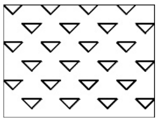
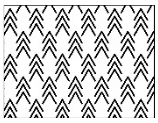
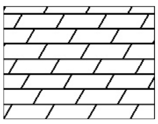
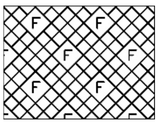
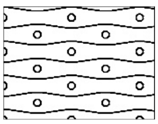
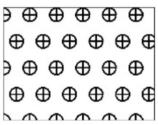
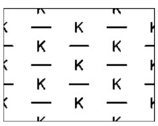
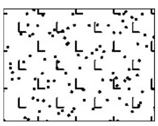
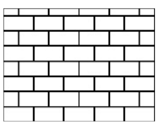
Table 9.1 Patterns for Litho_Type Codes

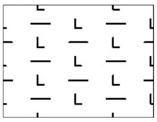
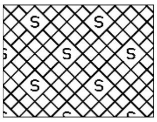
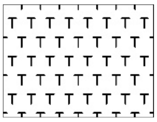
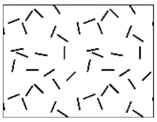
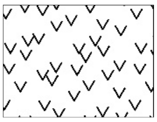
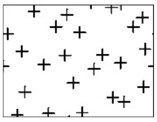
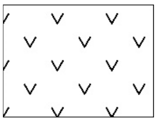
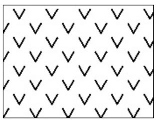
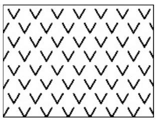
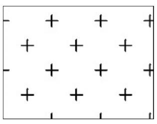
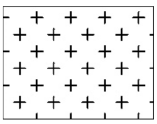
Code	Description	Pattern	Proportional	Source / Explanation
Unconsolidated Sediments with distinct grain/clast sizes				
CL	Clay			Derived from the AS2916 pattern for Claystone.
MD	Mud			Derived from the AS2916 pattern for Mudstone.
SI	Silt			Derived from the AS2916 pattern for Siltstone.
SA	Sand			Derived from the AS2916 pattern for Sandstone.
GV	Gravel			Derived from the AS2916 pattern for Conglomerate.
OB	Cobbles			Gravel pattern with larger circles. Same pattern also used for Boulders.
BO	Boulders			Gravel pattern with larger circles. Same pattern also used for Cobbles.
Unconsolidated Sediments without distinct grain/clast sizes (in alphabetical order)				
AL	Alluvium			FMG pattern for Alluvium.
CV	Colluvium			Unsorted and non-rounded fragments.
DE	Diatomaceous Earth			USGS symbols for diatoms plus CoalLog pattern for Soil.
FI	Fill/Spoil			Picks representing material that has been mined.

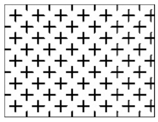
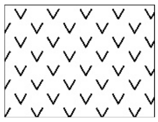
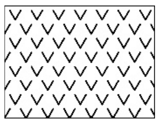
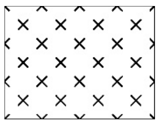
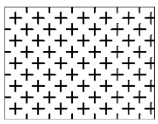
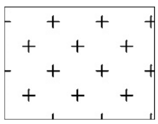
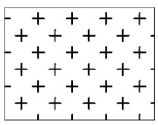
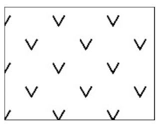
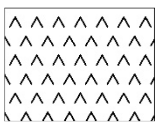
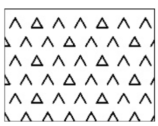
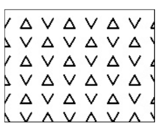
Code	Description	Pattern	Proportional	Source / Explanation
FC	Fireclay			Flame symbols plus CoalLog pattern for Clay.
LO	Loam			FMG pattern for Soil. Same pattern also used for Soil.
SO	Soil			AusIMM pattern for Soil. Same pattern also used for Loam.
		Carbonaceous		
CO	Coal		Yes	AS2916 pattern for Coal.
LG	Lignite		Yes	Derived from AS2916 Brown Coal darkness patterns. Same pattern also used for Brown Coal.
BC	Brown Coal		Yes	Derived from AS2916 Brown Coal darkness patterns. Same pattern also used for Lignite.
PE	Peat			UK GSEG pattern for Peat.
BW	Burnt Wood / Charcoal		Yes for Cindered bars on edge	Wood knots in horizontal lying tree trunk with bars like Coal, Cindered
CW	Weathered Coal		Yes	AS2916 pattern for Coal, weathered.
OS	Oil Shale			Shale pattern with solid black circles for Oil.
TS	Tar Sand			Sand pattern with solid black circles for Tar.
ZC	Coaly Claystone		Yes for Coaly bar	Claystone pattern plus single wide black bar for Coaly.

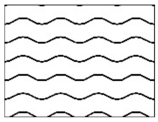
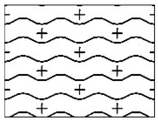
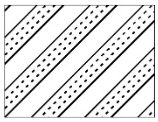
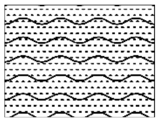
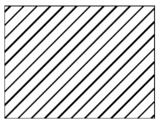
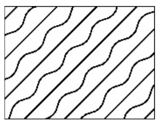
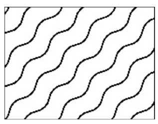
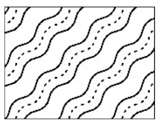
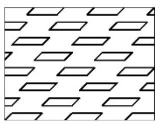
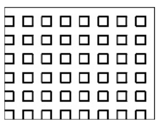
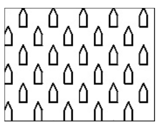
Code	Description	Pattern	Proportional	Source / Explanation
ZM	Coaly Mudstone		Yes for Coaly bar	Mudstone pattern plus single wide black bar for Coaly.
ZH	Coaly Shale		Yes for Coaly bar	Shale pattern plus single wide black bar for Coaly.
ZT	Coaly Siltstone		Yes for Coaly bar	Siltstone pattern plus single wide black bar for Coaly.
ZS	Coaly Sandstone		Yes for Coaly bar	Sandstone pattern plus single wide black bar for Coaly.
XC	Carbonaceous Claystone		Yes for Carbonaceous bars	Modified from AS2916 pattern for Carbonaceous Lutites.
XM	Carbonaceous Mudstone		Yes for Carbonaceous bars	AS2916 pattern for Carbonaceous Mudstone.
XH	Carbonaceous Shale		Yes for Carbonaceous bars	AS2916 pattern for Carbonaceous Shale.
XT	Carbonaceous Siltstone		Yes for Carbonaceous bars	AS2916 pattern for Carbonaceous Siltstone.
XS	Carbonaceous Sandstone		Yes for Carbonaceous bars	AS2916 pattern for Carbonaceous Sandstone.
Clastic Sedimentary				
SU	Sedimentary Rock, undifferentiated			Combination of Claystone and Conglomerate symbols.
CS	Claystone			Modified from AS2916 for Lutites.
PC	Pellet Claystone			Pellet symbols added to Claystone pattern.

Code	Description	Pattern	Proportional	Source / Explanation
MS	Mudstone			AS2916 pattern for Mudstone.
SH	Shale			AS2916 pattern for Shale.
ST	Siltstone			AS2916 pattern for Siltstone.
SS	Sandstone			AS2916 pattern for Sandstone.
CG	Conglomerate			AS2916 pattern for Conglomerate.
M1	Conglomerate (>65% matrix)			Conglomerate pattern with 2 out of 3 circles replaced with sand grain dots.
M2	Conglomerate (35-65% matrix)			Conglomerate pattern with 1 out of 2 circles replaced with sand grain dots.
M3	Conglomerate (<35% matrix)			Conglomerate pattern with 1 out of 3 circles replaced with sand grain dots.
BR	Breccia			AS2916 pattern for Breccia.
FB	Fault Breccia			Breccia symbols superimposed on fault zones.
DI	Diamictite			Shell Oil pattern for Diamictite. Same pattern also used for Tillite.
TI	Tillite			Shell Oil pattern for Diamictite. Same pattern also used for Diamictite.

Code	Description	Pattern	Proportional	Source / Explanation
		Chemical Sedimentary (in alphabetical order)		
CC	Calcrete			Dense mesh representing hard material plus C for Calcrete.
CB	Carbonate			AS2916 pattern for Limestone. Same pattern also used for Limestone.
CK	Chalk			Shell Oil pattern for Chalk.
CH	Chert			Shell Oil pattern for Chert.
KK	Cone in Cone Carbonate			Shell Oil pattern for Cone in Cone.
DM	Dolomite			USGS, UK GSEG, BGS & Shell Oil pattern for Dolomite.
FK	Ferricrete			Dense mesh representing hard material plus F for Ferricrete.
FW	Fossil Wood			Wood knots in horizontal lying tree trunk.
IS	Ironstone			USGS pattern for Limonite.
KA	Kaolinite			Clay pattern plus K for Kaolinite.
LA	Laterite			Soil pattern plus L for Laterite.
LS	Limestone			AS2916 pattern for Limestone. Same pattern also used for Carbonate.

Code	Description	Pattern	Proportional	Source / Explanation
LI	Limonite			Clay pattern plus L for Limonite.
SC	Silcrete			Dense mesh representing hard material plus S for Silcrete.
TN	Tonstein			T symbols for Tonstein.
		Igneous, undifferentiated		
IG	Igneous Rock, undifferentiated			Derived from FMG pattern for Hypabyssal Igneous rocks, random pattern representing undifferentiated.
VR	Volcanic Rock, undifferentiated			Derived from AS2916 & FMG pattern for Volcanic rocks, random spacing representing undifferentiated.
IN	Intrusive Rock, undifferentiated			Derived from AS2916 & FMG pattern for Intrusive rocks, random spacing representing undifferentiated.
		Igneous, differentiated by origin		
AV	Acid/Felsic Volcanic			Derived from AS2916 & FMG, low density of symbols representing the light colour of acid / felsic rocks. Same pattern also used for Rhyolite.
IV	Intermediate Volcanic			Derived from AS2916 & FMG, medium density of symbols representing the medium colour of intermediate rocks. Same pattern also used for Andesite.
BV	Basic/Mafic Volcanic			Derived from AS2916 & FMG, high density of symbols representing the dark colour of basic/mafic rocks. Same pattern also used for Basalt.
AI	Acid/Felsic Intrusive			Derived from AS2916 & FMG, low density of symbols representing the light colour of acid/felsic rocks. Same pattern also used for Granite.
II	Intermediate Intrusive			Derived from AS2916 & FMG, medium density of symbols representing the medium colour of intermediate rocks. Same Pattern also used for Granodiorite.

Code	Description	Pattern	Proportional	Source / Explanation
BI	Basic/Mafic Intrusive			Derived from AS2916, high density of symbols representing the dark colour of basic/mafic rocks. Same pattern also used for Gabbro.
Igneous, differentiated by petrological name (in alphabetical order)				
AN	Andesite			Same pattern as used for Intermediate Volcanic.
BS	Basalt			Same pattern as used for Basic/Mafic Volcanic.
DO	Dolerite			Derived from Shell Oil pattern for Dolerite.
GB	Gabbro			Same pattern as used for Basic/Mafic Intrusive.
GR	Granite			Same pattern as used for Acid/Felsic Intrusive.
GD	Granodiorite			Same pattern as used for Intermediate Intrusive.
RH	Rhyolite			Same pattern as used for Acid/Felsic Volcanic.
TF	Tuff			AS2916 pattern for Tuff.
TT	Tuffite			Combination of Tuff and Breccia symbols.
VB	Volcanic Breccia			Combination of Volcanic and Breccia symbols.

Code	Description	Pattern	Proportional	Source / Explanation
Metamorphic				
MM	Metamorphic Rock, undifferentiated			Derived from UK GSEG Metamorphic patterns.
BU	Basement undifferentiated			Combination of Metamorphic Rock, undifferentiated and Intrusive symbols.
MY	Mylonite			Fault zone symbols combined with Sand grain symbols.
QT	Quartzite			Derived from Sandstone and Metamorphic symbols.
SL	Slate			Flattened version of Schist pattern.
PH	Phyllite			Combination of Slate and Schist patterns.
SZ	Schist			Shell Oil pattern for Schist.
GN	Gneiss			Derived from UK GSEG and USGS patterns for Gneiss.
Minerals (in alphabetical order)				
CA	Calcite			Represents rhombohedral cleavage.
PY	Pyrite			Represents cubic crystal structure.
QZ	Quartz			Represents prismatic crystals terminating with pyramids.

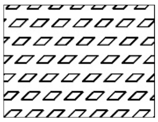
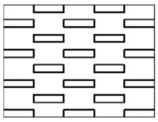
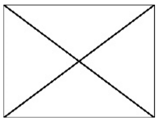
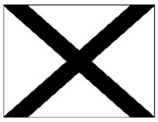
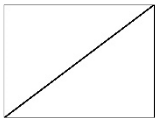
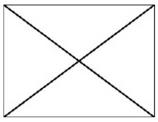
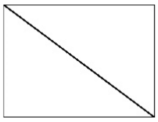
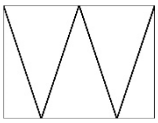
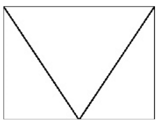
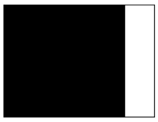
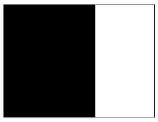
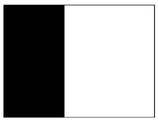
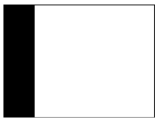
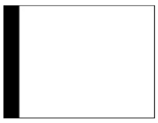
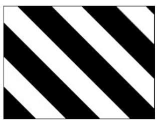
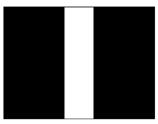
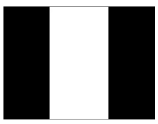
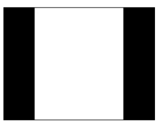
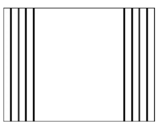
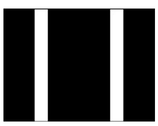
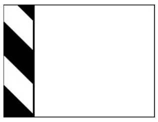
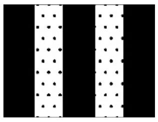
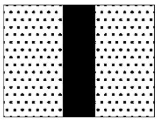
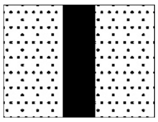
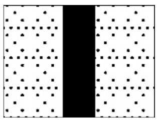
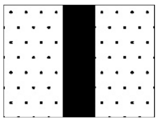
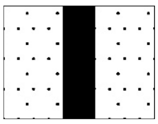
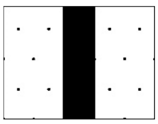
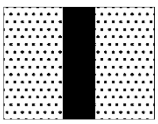
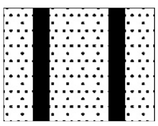
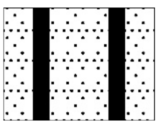
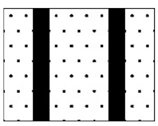
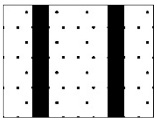
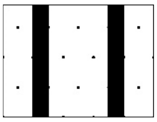
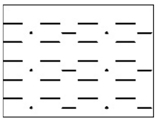
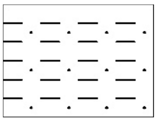
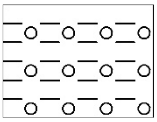
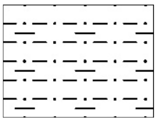
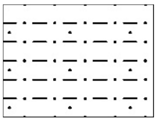
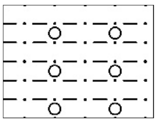
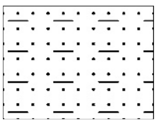
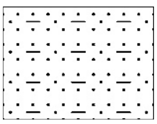
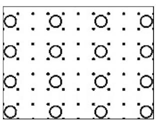
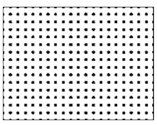
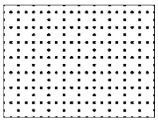
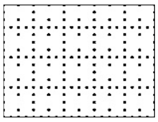
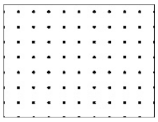
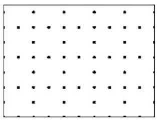
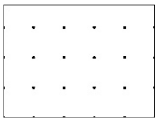
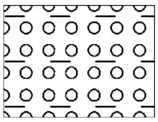
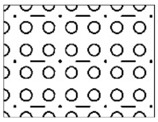
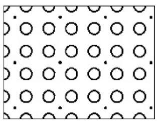
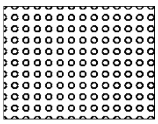
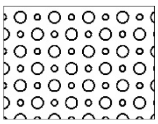
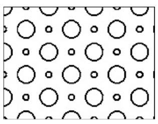
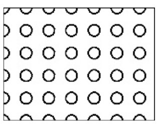
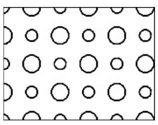
Code	Description	Pattern	Proportional	Source / Explanation
SD	Siderite			Represents rhombohedral crystal structure.
TA	Talc			Represents tabular crystal structure.
Other (in alphabetical order)				
KL	Core Loss		Yes	AS2916 pattern for Not Sampled.
LC	Lost Coal (from geophysics)		Yes	AS2916 pattern for Not Sampled thickened to represent Coal
MR	Missing Record		Yes	Modification of Not Logged.
NR	No Recovery		Yes	AS2916 pattern for Not Sampled.
NL	Not Logged		Yes	Derived from N for Not Logged.
OW	Old Workings		Yes	Derived from W for Old Workings.
VD	Void		Yes	Derived from V for Void.

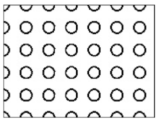
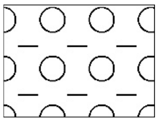
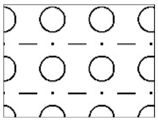
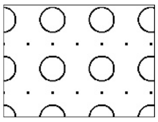
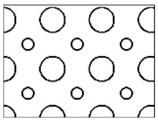
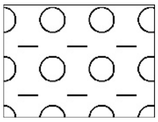
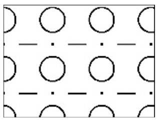
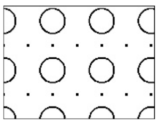
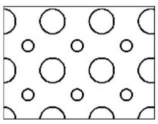
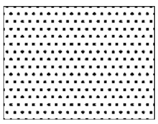
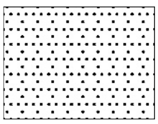
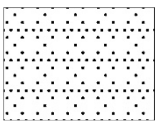
Table 9.2 Patterns for Litho_Type + Litho_Qual Combinations

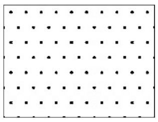
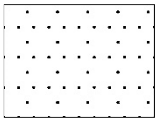
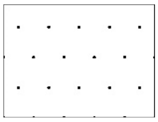
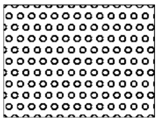
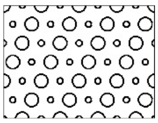
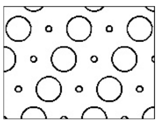
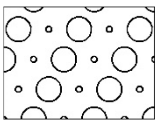
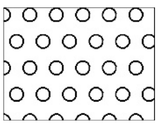
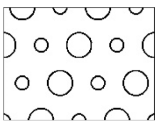
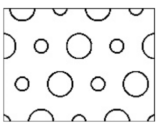
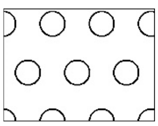
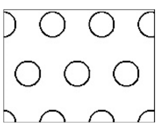
Code	Description	Pattern	Proportional	Source / Explanation
Carbonaceous				
COBR	Coal, bright (>90% bright coal)		Yes	AS2916 pattern for Coal, bright.
COBB	Coal, bright with dull bands (60-90% bright coal)		Yes	AS2916 pattern for Coal, bright with dull bands.
COBD	Coal, interbanded dull and bright (40-60% bright coal)		Yes	AS2916 pattern for Coal, interbanded dull and bright.
CODB	Coal, dull with frequent bright bands (10-40% bright coal)		Yes	AS2916 pattern for Coal, dull with frequent bright bands.
CODM	Coal, dull with minor bright bands (1-10% bright coal)		Yes	AS2916 pattern for Coal, dull with minor bright bands.
CODD	Coal, dull (<1% bright coal)		Yes	AS2916 pattern for Coal, dull.
COCU	Coal, undifferentiated		Yes	AS2916 pattern for Coal, undifferentiated.
COHA	Coal, heat affected		Yes	Derived from Coal, cindered pattern. More black area than Coal, coked indicating less heat affected than Coal, coked.
COKC	Coal, coked		Yes	Derived from Coal, cindered pattern. More black area than Coal, coked indicating less heat affected than Coal, cindered.
COCI	Coal, cindered		Yes	Derived from AS2916 for Coal, heat altered.
COFU	Coal, fusainous		Yes	Derived from Coal, cindered.
COAN	Coal, anthracite		Yes	Pattern with lots of black but different from Coal, bright.

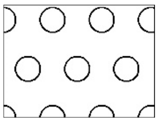
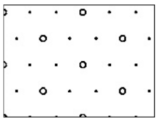
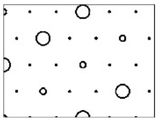
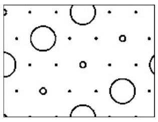
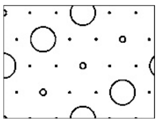
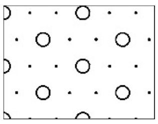
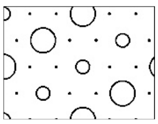
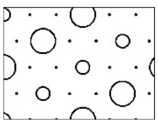
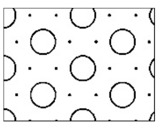
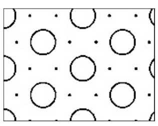
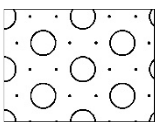
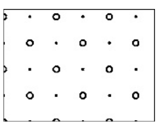
Code	Description	Pattern	Proportional	Source / Explanation
CODC	Coal, dull conchoidal		Yes	Combination of dull and sapropelic patterns.
COSP	Coal, sapropelic		Yes	AS2916 pattern for Coal, sapropelic.
COSY	Coal, stony		Yes for coal bars	Coal, inferior pattern from AS2916 plus Sand grain symbols.
ZSFF	Coaly Sandstone, fine grained		Yes for Coaly bar	Sandstone, fine grained pattern plus Coaly pattern.
ZSFM	Coaly Sandstone, fine to medium grained		Yes for Coaly bar	Sandstone, fine to medium grained pattern plus Coaly pattern.
ZSFC	Coaly Sandstone, fine to coarse grained		Yes for Coaly bar	Sandstone, fine to coarse grained pattern plus Coaly pattern.
ZSMM	Coaly Sandstone, medium grained		Yes for Coaly bar	Sandstone, medium grained pattern plus Coaly pattern.
ZSMC	Coaly Sandstone, medium to coarse grained		Yes for Coaly bar	Sandstone, medium to coarse grained pattern plus Coaly pattern.
ZSCC	Coaly Sandstone, coarse grained		Yes for Coaly bar	Sandstone, coarse grained pattern plus Coaly pattern.
XSFF	Carbonaceous Sandstone, fine grained		Yes for Carbonaceous bars	Sandstone, fine grained pattern plus Carbonaceous pattern from AS2916.
XSFM	Carbonaceous Sandstone, fine to medium grained		Yes for Carbonaceous bars	Sandstone, fine to medium grained pattern plus Carbonaceous pattern from AS2916.
XSFC	Carbonaceous Sandstone, fine to coarse grained		Yes for Carbonaceous bars	Sandstone, fine to coarse grained pattern plus Carbonaceous pattern from AS2916.
XSMM	Carbonaceous Sandstone, medium grained		Yes for Carbonaceous bars	Sandstone, medium grained pattern plus Carbonaceous pattern from AS2916.

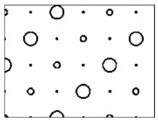
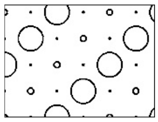
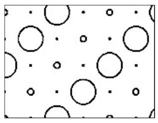
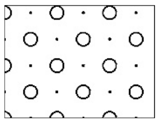
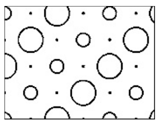
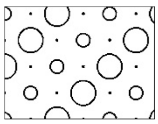
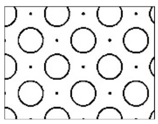
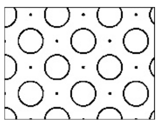
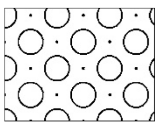
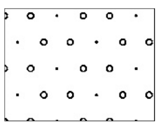
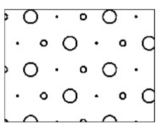
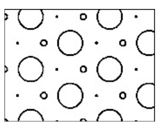
Code	Description	Pattern	Proportional	Source / Explanation
XSMC	Carbonaceous Sandstone, medium to coarse grained		Yes for Carbonaceous bars	Sandstone, medium to coarse grained pattern plus Carbonaceous pattern from AS2916.
XSCC	Carbonaceous Sandstone, coarse grained		Yes for Carbonaceous bars	Sandstone, coarse grained pattern plus Carbonaceous pattern from AS2916.
Unconsolidated Sediments				
CLSI	Clay, silty			Clay pattern plus sparser Silt symbols.
CLSA	Clay, sandy			Clay pattern plus sparser Sand symbols.
CLGV	Clay, gravelly			Clay pattern plus sparser Gravel symbols.
SICL	Silt, clayey			Silt pattern plus sparser Clay symbols.
SISA	Silt, sandy			Silt pattern plus sparser Sand symbols.
SIGV	Silt, gravelly			Silt pattern plus sparser Gravel symbols.
SACL	Sand, clayey			Sand pattern plus sparser Clay symbols.
SASI	Sand, silty			Sand pattern plus sparser Silt symbols.
SAGV	Sand, gravelly			Sand pattern plus sparser Gravel symbols.
SAFF	Sand, fine grained			Sand pattern with small spacing between symbols.

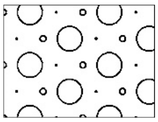
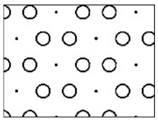
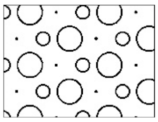
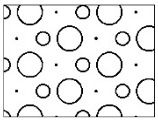
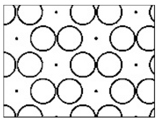
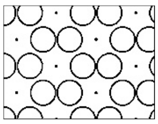
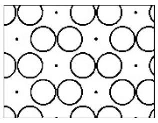
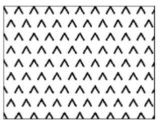
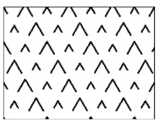
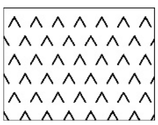
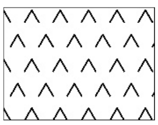
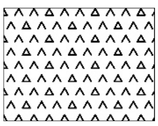
Code	Description	Pattern	Proportional	Source / Explanation
SAFM	Sand, fine to medium grained			Interlayered fine and medium grain Sand patterns.
SAFC	Sand, fine to coarse grained			Interlayered fine, medium and coarse grain Sand patterns.
SAMM	Sand, medium grained			Sand symbols with medium spacing between symbols.
SAMC	Sand, medium to coarse grained			Interlayered medium and coarse grain Sand patterns.
SACC	Sand, coarse grained			Sand symbols with large spacing between symbols.
GVCL	Gravel, clayey			Gravel pattern plus sparser Clay symbols.
GVSI	Gravel, silty			Gravel pattern plus sparser Silt symbols.
GVSA	Gravel, sandy			Gravel pattern plus sparser Sand symbols.
GVFF	Gravel, fine			Small Gravel symbols with small spacing between symbols.
GVFM	Gravel, fine to medium			Small and medium Gravel symbols using the average of the spacings for fine Gravel and medium Gravel.
GVFC	Gravel, fine to coarse			Small and large Gravel symbols using the average of the spacings for fine Gravel and coarse Gravel.
GVMM	Gravel, medium			Medium Gravel symbols with medium spacing between symbols.
GVMC	Gravel, medium to coarse			Medium and large Gravel symbols using the average of the spacings for medium Gravel and coarse Gravel.

Code	Description	Pattern	Proportional	Source / Explanation
GVCC	Gravel, coarse			Large Gravel symbols with large spacing between symbols.
OBCL	Cobbles, clayey			Cobbles pattern plus sparser Clay symbols.
OBSI	Cobbles, silty			Cobbles pattern plus sparser Silt symbols.
OBSA	Cobbles, sandy			Cobbles pattern plus sparser Sand symbols.
OBGV	Cobbles, gravelly			Cobbles pattern plus sparser Gravel symbols.
BOCL	Boulders, clayey			Same pattern as used for Cobbles, clayey.
BOSI	Boulders, silty			Same pattern as used for Cobbles, silty.
BOSA	Boulders, sandy			Same pattern as used for Cobbles, sandy.
BOGV	Boulders, gravelly			Same pattern as used for Cobbles, gravelly.
Sandstones				
SSFF	Sandstone, fine grained			Sandstone pattern with small spacing between symbols.
SSFM	Sandstone, fine to medium grained			Interlayered fine and medium grain Sandstone patterns.
SSFC	Sandstone, fine to coarse grained			Interlayered fine, medium and coarse grain Sandstone patterns.

Code	Description	Pattern	Proportional	Source / Explanation
SSMM	Sandstone, medium grained			Sandstone pattern with medium spacing between symbols.
SSMC	Sandstone, medium to coarse grained			Interlayered medium and coarse grain Sandstone patterns.
SSCC	Sandstone, coarse grained			Sandstone pattern with large spacing between symbols.
		Conglomerates		
CGGG	Conglomerate, granular			Small Conglomerate symbols with small spacing between symbols.
CGGP	Conglomerate, granular to pebbly			Small and medium Conglomerate symbols using the average of the spacings for granular Conglomerate and pebbly Conglomerate.
CGGO	Conglomerate, granular to cobbly			Small and large Conglomerate symbols using the average of the spacings for granular Conglomerate and cobbly Conglomerate.
CGGU	Conglomerate, granular to bouldery			Same pattern as used for Conglomerate, granular to cobbly.
CGPP	Conglomerate, pebbly			Medium Conglomerate symbols with medium spacing between symbols.
CGPO	Conglomerate, pebbly to cobbly			Medium and large Conglomerate symbols using the average of the spacings for pebbly Conglomerate and cobbly Conglomerate.
CGPU	Conglomerate, pebbly to bouldery			Same pattern as used for Conglomerate, pebbly to cobbly.
CGOO	Conglomerate, cobbly			Large Conglomerate symbols with large spacing between symbols.
CGOU	Conglomerate, cobbly to bouldery			Same pattern as used for Conglomerate, cobbly.

Code	Description	Pattern	Proportional	Source / Explanation
CGUU	Conglomerate, bouldery			Same pattern as used for Conglomerate, cobbly.
M1GG	Conglomerate (>65% matrix), granular			Conglomerate (>65% matrix) pattern with small symbols for clasts.
M1GP	Conglomerate (>65% matrix), granular to pebbly			Conglomerate (>65% matrix) pattern with small and medium symbols for clasts.
M1GO	Conglomerate (>65% matrix), granular to cobbly			Conglomerate (>65% matrix) pattern with small and large symbols for clasts.
M1GU	Conglomerate (>65% matrix), granular to bouldery			Same pattern as used for Conglomerate (>65% matrix), granular to cobbly.
M1PP	Conglomerate (>65% matrix), pebbly			Conglomerate (>65% matrix) pattern with medium symbols for clasts.
M1PO	Conglomerate (>65% matrix), pebbly to cobbly			Conglomerate (>65% matrix) pattern with medium and large symbols for clasts.
M1PU	Conglomerate (>65% matrix), pebbly to bouldery			Same pattern as used for Conglomerate (>65% matrix), pebbly to cobbly.
M1OO	Conglomerate (>65% matrix), cobbly			Conglomerate (>65% matrix) pattern with large symbols for clasts.
M1OU	Conglomerate (>65% matrix), cobbly to bouldery			Same pattern as used for Conglomerate (>65% matrix), cobbly.
M1UU	Conglomerate (>65% matrix), bouldery			Same pattern as used for Conglomerate (>65% matrix), cobbly.
M2GG	Conglomerate (35-65% matrix), granular			Conglomerate (35-65% matrix) pattern with small symbols for clasts.

Code	Description	Pattern	Proportional	Source / Explanation
M2GP	Conglomerate (35-65% matrix), granular to pebbly			Conglomerate (35-65% matrix) pattern with small and medium symbols for clasts.
M2GO	Conglomerate (35-65% matrix), granular to cobbly			Conglomerate (35-65% matrix) pattern with small and large symbols for clasts.
M2GU	Conglomerate (35-65% matrix), granular to bouldery			Same pattern as used for Conglomerate (35-65% matrix), granular to cobbly.
M2PP	Conglomerate (35-65% matrix), pebbly			Conglomerate (35-65% matrix) pattern with medium symbols for clasts.
M2PO	Conglomerate (35-65% matrix), pebbly to cobbly			Conglomerate (35-65% matrix) pattern with medium and large symbols for clasts.
M2PU	Conglomerate (35-65% matrix), pebbly to bouldery			Same pattern as used for Conglomerate (35-65% matrix), pebbly to cobbly.
M2OO	Conglomerate (35-65% matrix), cobbly			Conglomerate (35-65% matrix) pattern with large symbols for clasts.
M2OU	Conglomerate (35-65% matrix), cobbly to bouldery			Same pattern as used for Conglomerate (35-65% matrix), cobbly.
M2UU	Conglomerate (35-65% matrix), bouldery			Same pattern as used for Conglomerate (35-65% matrix), cobbly.
M3GG	Conglomerate (<35% matrix), granular			Conglomerate (<35% matrix) pattern with small symbols for clasts.
M3GP	Conglomerate (<35% matrix), granular to pebbly			Conglomerate (<35% matrix) pattern with small and medium symbols for clasts.
M3GO	Conglomerate (<35% matrix), granular to cobbly			Conglomerate (<35% matrix) pattern with small and large symbols for clasts.

Code	Description	Pattern	Proportional	Source / Explanation
M3GU	Conglomerate (<35% matrix), granular to bouldery			Same pattern as used for Conglomerate (<35% matrix), granular to cobbly.
M3PP	Conglomerate (<35% matrix), pebbly			Conglomerate (<35% matrix) pattern with medium symbols for clasts.
M3PO	Conglomerate (<35% matrix), pebbly to cobbly			Conglomerate (<35% matrix) pattern with medium and large symbols for clasts.
M3PU	Conglomerate (<35% matrix), pebbly to bouldery			Same pattern as used for Conglomerate (<35% matrix), pebbly to cobbly.
M3OO	Conglomerate (<35% matrix), cobbly			Conglomerate (<35% matrix) pattern with large symbols for clasts.
M3OU	Conglomerate (<35% matrix), cobbly to bouldery			Same pattern as used for Conglomerate (<35% matrix), cobbly.
M3UU	Conglomerate (<35% matrix), bouldery			Same pattern as used for Conglomerate (<35% matrix), cobbly.
		Tuffs		
TFCS	Tuff, clay sized			Tuff pattern with small symbols and spacing.
TFMS	Tuff, mud sized			Tuff pattern using the average of the spacings for Tuff, clay sized and Tuff, sand sized.
TFTS	Tuff, silt sized			Tuff pattern with medium symbols and spacing.
TFSS	Tuff, sand sized			Tuff pattern with large symbols and spacing.
TTCS	Tuffite, clay sized			Tuffite pattern with small symbols and spacing.

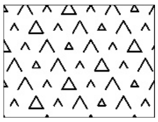
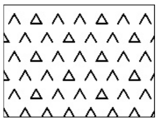
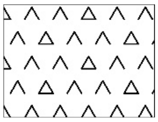
Code	Description	Pattern	Proportional	Source / Explanation
TTMS	Tuffite, mud sized			Tuffite pattern using the average of the spacings for Tuffite, clay sized and Tuffite, sand sized.
TTTS	Tuffite, silt sized			Tuffite pattern with medium symbols and spacing.
TTSS	Tuffite, sand sized			Tuffite pattern with large symbols and spacing.

Table 9.3: Recommended LithoType Background Plotting Colours

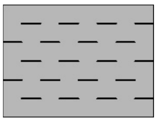
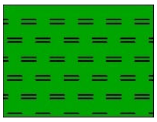
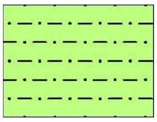
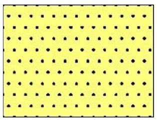
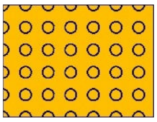
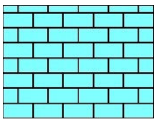
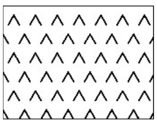
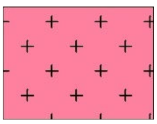
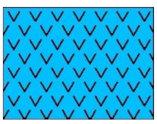
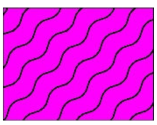
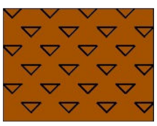
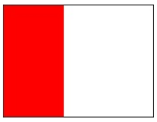
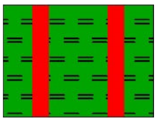
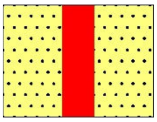
Example Background Colour	Lithotypes	AutoCAD Colour Number	Red	Green	Blue
	Clay, Claystone, Pellet Claystone, Kaolinite	254	190	190	190
	Mud, Mudstone, Shale, Loam, Soil, Oil Shale, Diamictite, Tillite, Undifferentiated Sedimentary Rock	92	0	189	0
	Silt, Siltstone	71	212	255	170
	Sand, Sandstone, Alluvium, Fill/Spoil, Tar Sand	51	255	255	170
	Gravel, Cobbles, Boulders, Conglomerate, Breccia, Colluvium, Fault	40	255	191	0
	Limestone, Calcrete, Carbonate, Chalk, Dolomite, Calcite	131	170	255	255
	Coal, Lignite, Brown Coal, Peat, Tuff, Tuffite, Core Loss, Not Logged, Void etc	NULL	255	255	255
	Plutonic Rocks	241	255	170	191
	Volcanic Rocks	140	0	191	255
	Metamorphic Rocks	6	255	0	255
	Chert, Ferricrete, Fossil Wood, Ironstone, Laterite, Limonite, Silcrete, Tonstein, Pyrite, Quartz, Siderite	32	189	94	0

Table 9.4: Recommended LithoType Fill Plotting Colours

Example Fill Colour	Lithotypes	AutoCAD Colour Number	Red	Green	Blue
	Coal, Lignite, Brown Coal	1	255	0	0
	Carbonaceous Bars	1	255	0	0
	Coaly Bar	1	255	0	0

10 Future Developments

Whilst the CoalLog standard is fixed and users should be adopting it without any modifications, it will not be static. It is likely that with usage, further modifications will become apparent. A committee of industry representatives (CoalLog Review Committee) meets once or twice a year to review, revise, and reissue the CoalLog standard. Any modifications that users would like the committee to consider should be sent by email to coallog@ausimm.com.au.

Addition of Further Codes to CoalLog Dictionaries

Before any new or updated codes are accepted the following checks are required:

- Does the proposed item already exist in another field?
- Is the proposed item consistent with a relevant Standard (which should be referenced)
- Does the proposed mnemonic code already exist in the field?
- Is the proposed code consistent with the use of the item in other fields?

As outlined in Item 13 of Chapter 3 Design Principles, CoalLog includes a Reference Dictionary for the following dictionary categories:

- **Survey_Company**, **Geolog_Organiz**, and **Geophys_Company** on the Header sheet
- **Drill_Company** and **Rig_Type** on the Drilling sheet
- **Seam** and **Horizon** on the Lithology sheet
- **Lab_Name** on the Sample Dispatch sheet

Requests sent to coallog@ausimm.com.au for additions of new items in these categories and the issuing of appropriate codes will not need ratification by the review committee but will be undertaken by the committee chairman upon receiving any requests.

Data submission to the Geological Surveys of New South Wales and Queensland

Coal exploration data that must be submitted to the Geological Surveys of New South Wales and Queensland can now be submitted to the Geological Surveys as CoalLog Data Transfer files. If submitted in this format the user does not need supply them with English language logs and plots thus saving considerable amount of time and effort.

Both the New South Wales and Queensland Geological Surveys intend in the near future to make it mandatory for all coal exploration data submitted to them to be in CoalLog format.

Training

CoalLog has sanitised the dictionaries used by many companies and removed invalid descriptions and duplications. Consequently, it now provides a resource for training in correct logging procedures and consistent logging practices across the industry. It can be incorporated into individual companies training packages or used in association with the CoalLog Geological and Geotechnical Training Manual available for download from the CoalLog web page.

Acknowledgements

The authors would like to thank the Australian Coal Association Research Program (ACARP) for providing the funds for the development and documentation of CoalLog. They would also like to thank the Australasian Institute of Mining and Metallurgy (AusIMM) for hosting the CoalLog webpage from where the CoalLog files can be downloaded.

The creation of CoalLog has benefited from the vast wealth of experience provided by those who have contributed. The authors would like to thank all the contributors but in particular:

- John Simmons who contributed significantly to the geotechnical section
- Graeme Hewitt and Renate Sliwa for compiling the seam/strat code for Queensland
- Kaydy Pinetown for compiling the seam/strat codes for New South Wales
- Susan Alagic who contributed significantly to the Coal Quality section.

Contributors to CoalLog Development

Susan ALAGIC	Peter HANDLEY	Nick MOORE
Emma ANDREWS	Pat HANNA	Chris MURRAY
Rob ANDREWS	Graeme HEWITT	Paul MURTAGH
Jared ARMSTRONG	John HOELLE	Mark MUSK
David ARNOTT	Bernie HOEY	Mary NOWLAND
Gary BALLANTINE	Paul HOUYKAAS	Ken O'REILLY
Mark BIGGS	Cameron HUDDLESTONE-HOLMES	Dan PAYNE
Mal BLAIK	John IRVINE	Kaydy PINETOWN
Tim BROWNE	Malcolm IVES	David PLACE
Glenys COOK	Mambwe KASANGULA	Andries PRETORIUS
Jo COPPARD	Jason KEYS	Daniel RIGG
Paul DAMEN	Mark LAYCOCK	Adrian REIFENSTEIN
Grenville DAVIES	Lynne LEWIS	Christine ROBERTSON
Mark DAWSON	Grahame LINDSAY	John ROGIS
Robert EPPS	Charles LORD	Gordon SAUL
Steve FILMER	Paul MACONOCHIE	John SIMMONS
Nicole FOLEY	Ibo MANGO	Renate SLIWA
Chris GLOVER	Charl MARAIS	Johann van WIJK
Joe GOUGH	Stella MARTINEZ	Kate WALKER
Steve GRAHAM	Chris McMAHON	Samantha WALSH
Glen GUY		Stuart WHYTE

The authors would also like to thank the members of the current review committee for their efforts:

Susan ALAGIC (NSW Geological Survey)
Mark BIGGS (ROM Resources)
Lewis CARTER (Glencore)
Mark DAWSON (Countrywide Mining & Exploration Services)
Thomas DUBOS (Centennial Coal)
Erin HOLMES (NSW Geological Survey)
Ken O’REILLY (Kore Consultants)
Britta PHELPS (Measured Group)
John SIMMONS (Sherwood Geotechnical & Research Services)
Ben THOMPSON (Whitehaven Coal)

Appendix A: Useful Web Links

Australian Coal Association Research Program (ACARP) acarp.com.au

American Geosciences Institute (AGI) Glossary of Geology americangeosciences.org/pubs/glossary

Australian Institute if Geoscientists (AIG) aig.org.au

Australasian Institute of Mining and Metallurgy (AusIMM) ausimm.com

Bowen Basin Geologists Group (BBGG)
gsa.org.au/Public/Specialist/Coal_Geology_Group_CGG/Bowen-Basin-Geologists-Group/Public/Specialist_Groups/CGG_Pages/Bowen_Basin_Geologists_Group.aspx?hkey=dea58186-e1fd-4503-b248-e2b501852c82

CoalLog
https://www.ausimm.com/insights-and-resources/resources/codes-and-standards/coallog/

Geological Society of Australia (GSA) gsa.org.au

Geoscience Australia ga.gov.au

Geoscience Portal geoscience.gov.au

Geological Survey of New South Wales (GSNSW)
resourcesandgeoscience.nsw.gov.au/miners-and-explorers/geoscience-information/geological-survey-of-nsw

Geological Survey of Queensland (GSQ)
business.qld.gov.au/industries/mining-energy-water/resources/geoscience-information/gsq

Global Standards saiglobal.com/online

Intergovernmental Committee on Surveying and Mapping (IGSM) icsm.gov.au

Queensland Dept of Natural Resources, Mines and Energy dnrme.qld.gov.au

Webref – Geology Dictionary webref.org/geology/geology.htm

Appendix B: CoalLog Training Manual

The file *CoalLog Training Manual v2.0.pdf* can be downloaded from the CoalLog webpage (https://www.ausimm.com/insights-and-resources/resources/codes-and-standards/coallog/). This is a comprehensive manual of over 140 pages for reference and training of borehole logging geologists in all the procedures for recording the geology and geotechnical aspects of coal boreholes. It includes chapters on each of the following topics:

- Role and Functions of a Rig Geologist
- Planning and Preparation
- Best Practice
- Survey
- Calculating Borehole Depths
- Introduction to Logging
- Open Borehole (Chip) Logging
- Core Logging
- Geotechnical Logging
- Oxidation (Subcrop / LOX) Drilling
- Other Sampling
- Geophysical Logging
- Borehole Completion

It also includes the handy appendices covering:

- General Drilling Information
- Common Drilling Problem
- Grainsize Chart
- V-Notch Weir Chart
- Visual Percentage Estimation Chart
- Sandstone Classification Chart
- Carbonate Classification Chart
- Coal Brightness
- Roundness Chart

Appendix C: CoalLog Modifications

The file *CoalLog Modifications v1.1 to v3.1.pdf* can be downloaded from the CoalLog webpage (https://www.ausimm.com/insights-and-resources/resources/codes-and-standards/coallog/). This lists all the modifications made to CoalLog since the initial version 1.0 was released in 2012. For those users who have adopted an earlier version, this lists all the changes that you need to make to your logging sheets, dictionaries and data tables to make them compliant to the current version. It has the following sections:

- CoalLog Modifications v3.1 (September 2021)
- CoalLog Modifications v3.0 (April 2020)
- CoalLog Modifications v2.1 (October 2018)
- CoalLog Modifications v2.0 (March 2015)
- CoalLog Modifications v1.2 (November 2013)
- CoalLog Modifications v1.1 (September 2012)

Appendix D: CoalLog Logging Sheets

The file *CoalLog v3.1 Logging Sheets.zip* can be downloaded from the CoalLog webpage (https://www.ausimm.com/insights-and-resources/resources/codes-and-standards/coallog/). This zip file contains the following files:

CoalLog v3.1 Data Table Specifications.xlsx

File containing data table specifications for each of the CoalLog data types. There is a worksheet in the file for each data type and then on each worksheet a row for each valid CoalLog field for the particular data type. The columns in this file are described in Table D.1 and an example of one of its worksheets is shown in Figure D.1.

	A	B	C	D	E	F	G	H	I	J
1	Primary Key	Compulsory Field	Field Name	Field Description	Field Type	Recommended Field Length	Maximum Field Length	Units	Dictionary Category	Notes
2	Yes		Project_Name	Project	C	8	16			
3	Yes	Yes	Borehole_Name	Borehole Name	C	8	16			
4	Yes	Yes	From_Depth	Lithology From Depth	N	7.2	8.3	m		
5	Yes	Yes	To_Depth	Lithology To Depth	N	7.2	8.3	m		
6	Yes	Yes	Record_Seq_Flag	Record Sequence Flag	C	1	1			
7			Recovered_Thick	Recovered Thickness	N	7.2	8.3	m		Most users omit this field and instead denoting Core Loss as a separate unit
8			Seam	Seam	C	4	16		Seam	
9			Ply	Ply	C	4	16		Ply	
10			Horizon	Horizon	C	4	16		Horizon	
11			Sample_Purpose	Sample Purpose	C	2	2		Sample_Purpose	
12			Sample_No	Lithology Sample Number	C	8	16			
13			Interval_Status	Interval Status	C	1	1		Interval_Status	
14		Yes	Litho_Perc	Lithology Percentage	N	3	3	%		Not required where only one lithology in a unit
15		Yes	Litho_Type	Lithology	C	2	2		Litho_Type	Not required on continuation lines
16			Litho_Qual	Lithology Qualifier	C	2	2		Litho_Qual	
17			Shade	Shade	C	1	1		Shade	
18			Hue	Hue	C	1	1		Hue	
19			Colour	Colour	C	1	1		Colour	
20			Adjective_1	Adjective 1	C	2	2		Adjective	

Figure D.1 First 20 Lines of the Lithology Table Specification

CoalLog v3.1 Logging Sheets - Recommended.pdf

File containing ready to print and use logging sheets for all CoalLog data types except Coal Quality.

CoalLog v3.1 Logging Sheets - Maximum.xlsx

File containing logging sheets with all CoalLog fields and all set to the maximum size for each of these fields. These are too large to print as A4 coding sheets, however, they are supplied so that the user can modify them to design their own sheets remembering that they can move fields on the sheet and decrease the size of fields but they must not increase the size of any fields beyond that used in this file.

Table D.1 Field Characteristics shown for each field in the Data Table Specifications file

Field Characteristic	Description of Field Characteristic
Viewing Group	Only in the Quality - Results specification. There are almost 250 possible fields in Quality - Results and this provides groupings of these.
Primary Key	Yes indicates that the field is a primary key for a database. Each record in a database must have a unique set of primary key values.
Compulsory Field	Yes indicates that this fields must exist in the database. Except where noted in the Notes column of the specifications, this field must not be blank.
Field Name	CoalLog name for the field. These names have a maximum length of 20 characters, do not contain any blanks and are not case sensitive. When setting up a database, there is no requirement to use these names internally but they are required for the header of csv file used for data transfer.
Field Description	A description of the field.
Field Type	The data type for the field: • C for character data • N for numeric data • D for date data which in the data transfer file needs to be in DD/MM/YYYY format. • L for logical data which in the data transfer file needs to be a True or False. These can be in upper case, lower case or a mixture of the two.
Recommended Field Length	The length recommended for the field. This length is obligatory for fields with a Dictionary Category. For fields without a Dictionary Category, the field length may be more or less than the recommended length but it must not exceed the Maximum Field Length. Numeric field lengths are shown in the format *n.d* where *n* is the total length of the field including the decimal point and *d* is the number of digits after the decimal point.
Maximum Field Length	Maximum allowable size for the field. Maximum lengths shown in red indicate that they are greater than the recommended length.
Units	The units to be used for data in this field
Dictionary Category	The name of the category in the dictionary listing the valid codes for the field. These have a maximum length of 16 characters, do not contain any blanks and are not case sensitive. Where the same category name appears in more than one data type, for example Est_Strength in both the Lithology and Defect data, the same set of codes are valid for both data types.
Basis	Only in the Quality - Results specification. The basis (such as Air Dried, As Received etc) to be used for each result.
MinVal	Only in the Quality - Results specification. The minimum acceptable value for the field.
MaxVal	Only in the Quality - Results specification. The maximum acceptable value for the field.
Calculated Field	Only in the Drilling and Quality - Results specifications. A Yes indicates that the field is calculated from other fields in the table.
Formula	Only in the Drilling and Quality - Results specifications. The formula for calculating calculated fields.
Notes	Further information regarding the field

Appendix E: CoalLog Dictionaries

The CoalLog dictionary has been split into two dictionaries, one referred to as the Reference Items dictionary and one referred to as the Standard Items dictionary. The Reference Items dictionary includes items for the following categories:

- **Basin**, **Survey_Company**, **Geolog_Organiz** and **Geophys_Company** for the Header data
- **Drill_Company** and **Rig_Type** for the Drilling data
- **Seam/Strat** and **Horizon** for the Geology data
- **Lab_Name** for Sample Dispatch and Coal Quality data
- **Quality_Variable** for Quality – Test Specifications

with all other categories being in the Standard Items dictionary. It is expected that users will only require a very limited number of items from the Reference Items dictionary for their own personal dictionaries. The Seam/Strat category is subdivided into Basins and even though all the codes within a single Basin have a unique description, the same code may have different descriptions for different basins. For example, the code BEN stands for the Ben Seam in the Gunnedah/Surat Basin and in the Collie Basin, the Bengalla Seam in the Hunter Coalfield and the Benley Seam in the Clarence-Morton Basin.

It is possible that users will have data items for Reference Items categories that do not currently exist in the CoalLog Reference Items dictionary, for example a new **Drill_Company** or **Geophys_Company**. In this case, they should email coalLog@ausimm.com to obtain a code for the items. These new codes will then be included in the next CoalLog version. With **Seam/Strat** and **Horizon**, users may instead create their own codes for items currently not in the dictionary, however, if they do create their own codes then any Lithology data transfer file containing these codes needs to also have an accompanying Seam/Strat and Horizon dictionary containing their created codes.

The file *CoalLog Dictionaries v3.1.zip* can be downloaded from the CoalLog webpage (https://www.ausimm.com/insights-and-resources/resources/codes-and-standards/coallog/). This zip file contains the following files:

CoalLog v3.1 Dictionary Categories.xlsx

File containing a list of all valid CoalLog dictionary categories. For each category. It includes:

- Category Name
- Flag indicating if it is a Reference Items Category as opposed to a Standard Items Category
- Description of Category
- List of all Data Types which refer to the Category

	A	B	C	D	E
1	Category Name	Reference Items Category	Description of Category	Data Type 1	Data Type 2
2	Adjective		Lithological Adjective	Lithology	
3	Alteration		RMU Alteration	RMU & Defects	
4	Basal_Contact		Basal Contact for Lithological Unit	Lithology	
5	Basin	Yes	Sedimentary Basin	Header	
6	Bed_Spacing		Bed Spacing within unit	Lithology	RMU & Defects
7	Bit_Type		Drilling Bit Type	Drilling	
8	Borehole_Purpose		Borehole Purpose	Header	
9	Borehole_Status		Borehole Status	Header	
10	Borehole_Type		Borehole Type	Header	

Figure E.1 First ten Lines of the Dictionary Category File

CoalLog v3.1 Standard Items Dictionaries.pdf

File containing ready to print and use lists of descriptions and codes for all the items in the Standard Items Dictionary.

CoalLog v3.1 Standard Items Dictionaries.docx

File containing formatted lists of descriptions and codes for all the items in the Standard Items Dictionary from which the above .pdf was derived. This file is provided so users can if they desire remove items from their copy of the Standard Items Dictionary or add Reference Items such as their **Basins** to create their own personal dictionary.

CoalLog v3.1 Standard Items Dictionaries Work File.xlsx

File containing for each Standard Item Category a number of lists of all items for the category: one sorted by code, one sorted by description and if relevant a third sorted by meaning.

	A	B	C	D	E	F
1	Sorted on Code		Sorted on Description		Sorted on Meaning	
2	Code	Bed Spacing	Bed Spacing	Code	Bed Spacing	Code
3	CB	thickly bedded (600-2000mm)	irregular spaced bedding	IR	massive/absent bedding	MA
4	IR	irregular spaced bedding	massive/absent bedding	MA	very thickly bedded (>2m)	VB
5	LL	thinly laminated (<6mm)	medium bedded (200-600mm)	MB	thickly bedded (600-2000mm)	CB
6	LM	thickly laminated (6-20mm)	thickly bedded (600-2000mm)	CB	medium bedded (200-600mm)	MB
7	MA	massive/absent bedding	thickly laminated (6-20mm)	LM	thinly bedded (60-200mm)	TB
8	MB	medium bedded (200-600mm)	thinly bedded (60-200mm)	TB	very thinly bedded (20-60mm)	UB
9	TB	thinly bedded (60-200mm)	thinly laminated (<6mm)	LL	thickly laminated (6-20mm)	LM
10	UB	very thinly bedded (20-60mm)	very thickly bedded (>2m)	VB	thinly laminated (<6mm)	LL
11	VB	very thickly bedded (>2m)	very thinly bedded (20-60mm)	UB	irregular spaced bedding	IR

... Weathering | Est_Strength | Bed_Spacing | Defect_Type | Defect_Intact | D ...

Figure E.2 List of Bed Spacing Items in Standard Items Dictionary Work File

There is also one additional worksheet in the file listing all items in all categories sorted by description. This has been used to ensure that where a similar description occurs in multiple categories that the same code has been used in each. For example, Figure E.3 displays 10 lines from this worksheet. These lines show that the same code QZ has been used for quartz as a **Litho_Type**, as a **Min_Fos_Type** and **Infill_Type** and in addition for quartzose as an **Adjective**.

	A	B	C
1	Code	Description	Category
764	ZW	Quality Standard - washability composite	Sample_Purpose
765	QZ	Quartz	Litho_Type
766	QZ	quartz	Min_Fos_Type
767	QZ	quartz	Infill_Type
768	QT	Quartzite	Litho_Type
769	QZ	quartzose	Adjective
770	FL	radial filaments	Min_Fos_Assoc
771	GR	ranging well	Borehole_Purpose
772	RA	rare (<1%)	Adjective
773	R	rare (<1%)	Min_Fos_Abund

All Entries Sorted on Desc | Borehole_Type | Data_Status | E ...

Figure E.13 Ten Lines from the All Entries Sorted on Desc Worksheet

CoalLog v3.1 Standard Items Dictionary.csv

File containing Category, Code and Description, sorted on Category then Code for all items in the Standard Items Dictionary.

CoalLog v3.1 Reference Items Dictionaries.pdf

File containing ready to print and use lists of descriptions and codes for all the items in the Reference Items Dictionary.

CoalLog v3.1 Reference Items Dictionaries.docx

File containing formatted lists of descriptions and codes for all the items in the Reference Items Dictionary from which the above .pdf was derived. Users can copy items from this file to include in their own personal dictionary.

CoalLog v3.1 Reference Items Dictionaries Work File.xlsx

File containing for each Reference Item Category a number of lists of all items for the category: one sorted by code, one sorted by description and if relevant a third sorted by meaning.

There is also one additional worksheet in the file which lists all items for the categories **Survey_Company**, **Geolog_Organiz**, **Geophys_Company** and **Drill_Company** sorted by description. This has been used to ensure that where a similar description occurs in multiple categories that the same code has been used in each.

CoalLog v3.1 Reference Items Dictionary.csv

File containing Category, Code and Description, sorted on Category then Code for all items in the Reference Items Dictionary.

Appendix F: Lithology Patterns Software Development Tools

The file *CoalLog v3.0 Lithology Patterns Software Development Tools.zip* can be downloaded from the CoalLog webpage (https://www.ausimm.com/insights-and-resources/resources/codes-and-standards/coallog/). This file contains the following files to assist software developers setup the standard CoalLog patterns in their software:

CoalLog v3.1 Lithology Pattern Repeat Sizes.xlsx

The files *CoalLog v3.1 Lithology Patterns – xxx Format.zip* as described below provide images in various formats of the fixed scale component of each CoalLog Pattern. The image for each lithology has a specific width and height such that when the particular image is repeated across the screen the repeats will join without any artefacts. The file *CoalLog v3.1 Lithology Pattern Repeat Sizes.xlsx* lists in mm's the width and height for each pattern image.

	A	B	C	D	E
1	Category	Code	Desc	Width	Height
2	Litho_Type	AI	Acid/Felsic Intrusive	13	13
3	Litho_Type	AL	Alluvium	10	10
4	Litho_Type	AN	Andesite	8.66	7.5
5	Litho_Type	AV	Acid/Felsic Volcanic	14.434	12.5
6	Litho_Type	BI	Basic/Mafic Intrusive	6	6
7	Litho_Type	BO	Boulders	13	13
8	Litho_Type	BR	Breccia	5.773	10

Figure F.1 First Seven Entries fromCoalLog v3.1 Lithology Pattern Repeat Sizes.xlsx

CoalLog v3.1 Lithology Patterns - DXF Format.zip

This contains a DXF file (AutoCAD Drawing Interchange File) for each of the patterns listed in *CoalLog v3.1 Lithology Repeat Sizes.xlsx.*

CoalLog v3.1 Lithology Patterns - SVG Format.zip

This contains a SVG file (Standard Vector Graphic) for each of the patterns listed in *CoalLog v3.1 Lithology Repeat Sizes.xlsx.*

BMP

CoalLog v3.1 Lithology Patterns - BMP Format.zip

This contains a BMP file for each of the patterns listed in *CoalLog v3.1 Lithology Repeat Sizes.xlsx.*

CoalLog v3.1 Proportional Patterns Specifications.xlsx

Tables F.1 and F.2 above show a number of the patterns as having components whose size is proportional to the width of the column in which they are displayed rather than a specific size. The file *Proportional Patterns Specifications v3.1.xlsx* lists each unique proportional pattern, its specifications, whether it is striped and the **Litho_Type** and **Litho_Type** / **Litho_Qual** combinations for which it is used. Figure F.1 shows three entries from this file:

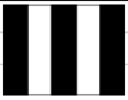
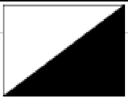
	A	B	C	D	E	F	G	H
1	Image	Bottom Left	Bottom Right	Top Left	Top Right	Striped	Litho_Type + Litho_Qual Codes	Descriptions
29		0	0.2	0	0.2	TRUE	COSP	Coal, sapropelic
30		0.2	0.2	0.2	0.2			
31		0	0.2	0	0.2		COSY	Coal, stony
32		0.4	0.6	0.4	0.6			
33		0.8	1	0.8	1			
34		0	1	1	1		LG	Lignite
35							BC	Brown Coal

Figure F.2 Three Entries from file *CoalLog v3.1 Proportional Patterns Specifications.xlsx*

The first entry in Figure F.2 shows the proportional pattern specifications for the **Litho_Type** + **Litho_Qual** combination COSP meaning Coal, sapropelic. It shows that the shaded area at the bottom of the unit column is from 0.0 to 0.2 of the width of the column and at the top it is also from 0.0 to 0.2 of the width of the column. It also shows that the shaded area is striped. Where shaded areas are striped rather than solid, the stripes are at -45° and have a width of 3mm perpendicular to the stripe direction. It also has a line to close off the stripes going from the bottom at 0.2 of the width of the column to the top also at 0.2 the width of the column.

The second entry in Figure F.2 shows the specifications COSY meaning Coal, stony. It has three bars. The first between 0 to 0.2 at both the top and bottom. The second between 0.4 and 0.6 and the third between 0.8 and 1.0. The actual Pattern for Coal, stony also has a non-proportional component that must be plotted underneath the proportional component.

The third entry in Figure F.2 shows the specifications used for two **Litho_Type**’s: LG meaning Lignite and BC meaning Brown Coal. It consists of a single triangle going from 0 to 1 of the width of the column at the bottom to 1 at the top, that is the top right corner.

Appendix G: Data Transfer Format Test Data

The file *CoalLog v3.1 Data Transfer Format Test Data.zip* can be downloaded from the CoalLog webpage (https://www.ausimm.com/insights-and-resources/resources/codes-and-standards/coallog/). This file contains example CoalLog data in CoalLog data transfer format for each of the CoalLog data types. It includes the following files:

- *CoalLog v3.1 Example Casing.csv*
- *CoalLog v3.1 Example CCCDefinitions.csv*
- *CoalLog v3.1 Example Cementing.csv*
- *CoalLog v3.1 Example Composites.csv*
- *CoalLog v3.1 Example Defects.csv*
- *CoalLog v3.1 Example Drilling.csv*
- *CoalLog v3.1 Example Geologists.csv*
- *CoalLog v3.1 Example Headers.csv*
- *CoalLog v3.1 Example Litho.csv*
- *CoalLog v3.1 Example PointLoads.csv*
- *CoalLog v3.1 Example Quality.csv*
- *CoalLog v3.1 Example Reflectance.csv*
- *CoalLog v3.1 Example SampleDispatch.csv*
- *CoalLog v3.1 Example WaterObservations.csv*
- *CoalLog v3.1 Example TestSpecifications.csv*