



## Figures

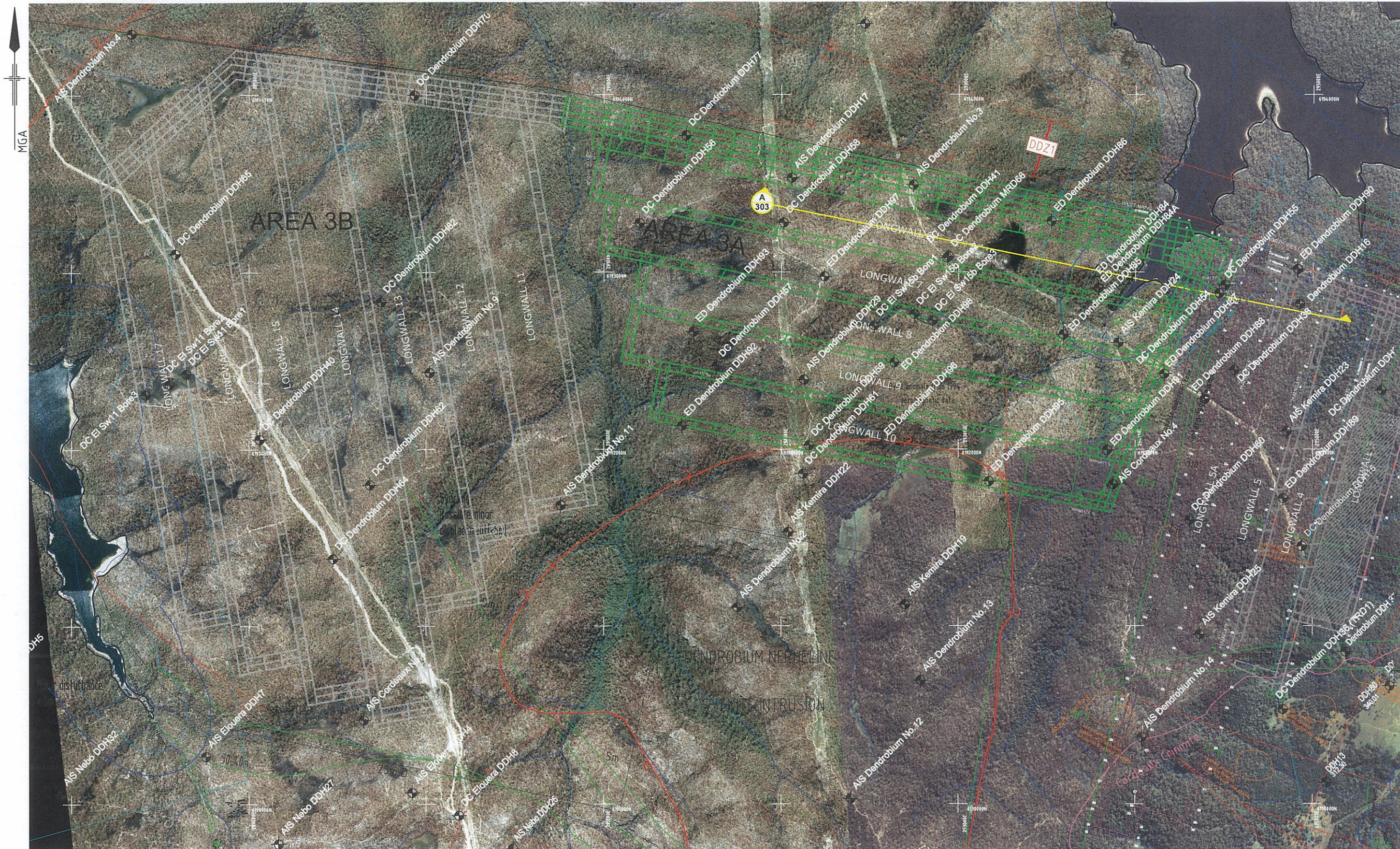
|               |  |
|---------------|--|
| Figure HG 301 | Area 3 site plan   |
| Figure HG 302 | Area 3A with landform contours   |
| Figure HG 303 | Exploration boreholes with downhole packer data  |
| Figure HG 304 | Exploration boreholes with downhole piezometer strings   |
| Figure HG 305 | Inferred stratigraphic piezometric surfaces  |
| Figure HG 306 | Anticipated influences upon hydrogeology by underground Mining   |
| Figure HG 307 | Consequences upon groundwater regime   |
| Figure HG 308 | Consequences of mine subsidence upon hydrogeology  |
| Figure HG 309 | Piezometric profiles – existing and post mining  |
| Figure HG 310 | Illustrative groundwater profile (hydrostatic conditions)  |
| Figure HG 311 | Illustration of hydrostatic conditions   |
| Figure HG 312 | Illustration of non-hydrostatic conditions   |
| Figure HG 313 | Illustration of non-hydrostatic conditions with strata de-pressurisation                                 |
| Figure HG 314 | Post mining adjustment to hydrogeological model  |
| Figure HG 315 | Hydrogeologic impact post mining of Area 2 – anticipated modifications to piezometric pressures          |
| Figure HG 316 | Hydrogeologic impact post mining of Area 2 & Area 3 – anticipated modifications to piezometric pressures |
| Figure HG 317 | Expected groundwater movement prior to mining  |
| Figure HG 318 | Anticipated groundwater movement post mining of Area 2   |
| Figure HG 319 | Anticipated groundwater movement post mining of Area 2 & Area 3  |
| Figure HG 320 | Apparent hydrogeologic controls in Wongawilli Seam   |
| Figure OSD-4  | Off-set distances of reservoir FSL to longwalls  |

### **From GHD-LongMac (2004)**

|           |  |
|-----------|--|
| Figure 5a | Subsidence Model Central Coast (NSW) from Forster (1995) |
| Figure 5d | Proposed extension of subsidence model                   |

### **From SCT (2005)**

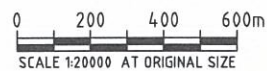
|          |   |
|----------|---|
| Figure 8 | Distribution of zones within overburden strata (Elouera Colliery) |
|----------|---|



REFERENCE: BASE INFORMATION SUPPLIED BY BHP BILLITON MARCH/AUGUST 2007

**LEGEND**

- DDH1 EXPLORATION BOREHOLE
- MINE WORKINGS



**GHD** CLIENTS | PEOPLE | PERFORMANCE  
**GHD GEOTECHNICS**

BHP Billiton  
 Dendrobium Mine Area 3 - Hydrogeology

job no. | 21-11716-03  
 rev no. | A

Area 3 Site Plan  
 scale | 1:20000 for A3 date | October 2007

Figure HG301



REFERENCE: BASE INFORMATION SUPPLIED BY BHP BILLITON MARCH/AUGUST 2007.



**LEGEND**  
 DDHT EXPLORATION BOREHOLE  
 MINE WORKINGS

360 ALS CONTOURS

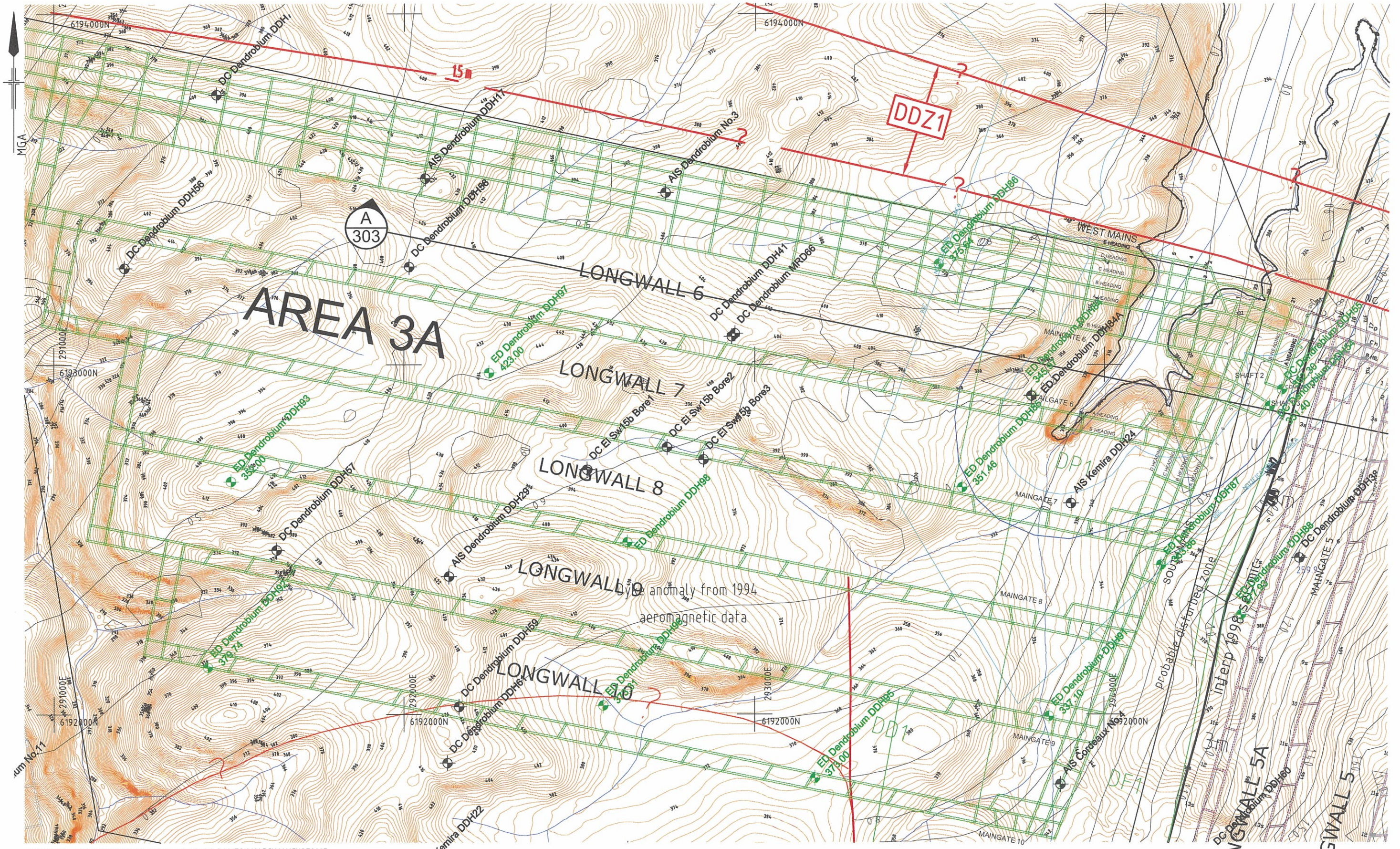


CLIENTS | PEOPLE | PERFORMANCE  
**GHD GEOTECHNICS**

BHP Billiton  
 Dendrobium Mine Area 3 - Hydrogeology  
**Area 3**  
 with Landform Contours  
 scale | 1:10000 for A3 date | October 2007

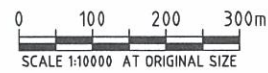
job no. | 21-11716-03  
 rev no. | A

**Figure HG302**



REFERENCE: BASE INFORMATION SUPPLIED BY BHP BILLITON MARCH/AUGUST 2007.

- |  |                            |  |                                  |
|--|----------------------------|--|----------------------------------|
|  | <b>LEGEND</b>              |  | ALS CONTOURS                     |
|  | EXPLORATION BOREHOLE       |  | WONGAWILLI SEAM FLOOR CONTOURS   |
|  | BOREHOLE WITH PACKER TESTS |  | PROPOSED MINE WORKINGS IN AREA 3 |

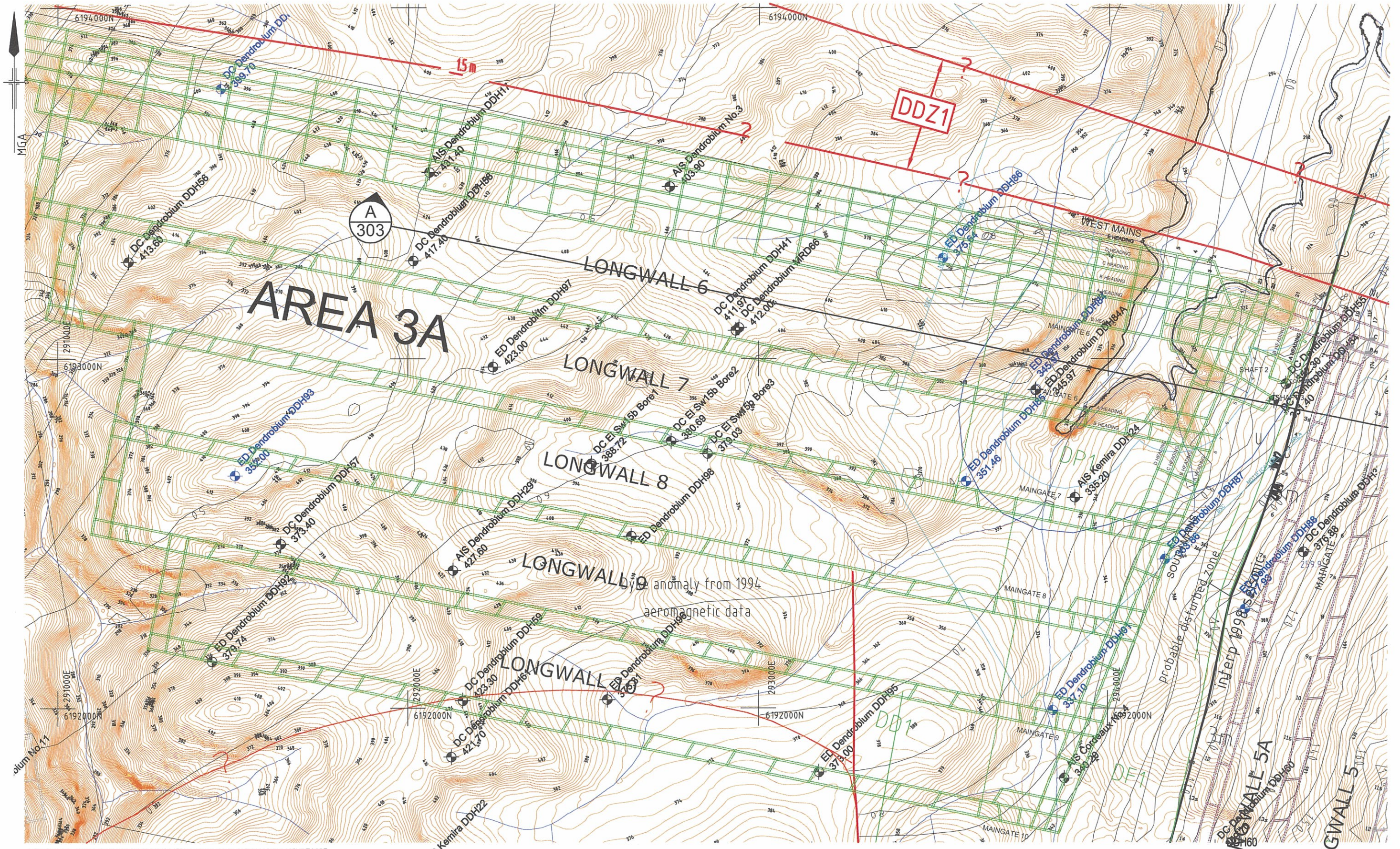


CLIENTS | PEOPLE | PERFORMANCE  
**GHD GEOTECHNICS**

BHP Billiton  
 Dendrobium Mine Area 3 - Hydrogeology  
 Exploration Boreholes  
 with Downhole Packer Data  
 scale | 1:10000 for A3 date | October 2007

job no. | 21-11716-03  
 rev no. | A

**Figure HG303**



REFERENCE: BASE INFORMATION SUPPLIED BY BHP BILLITON MARCH/AUGUST 2007.

**LEGEND**

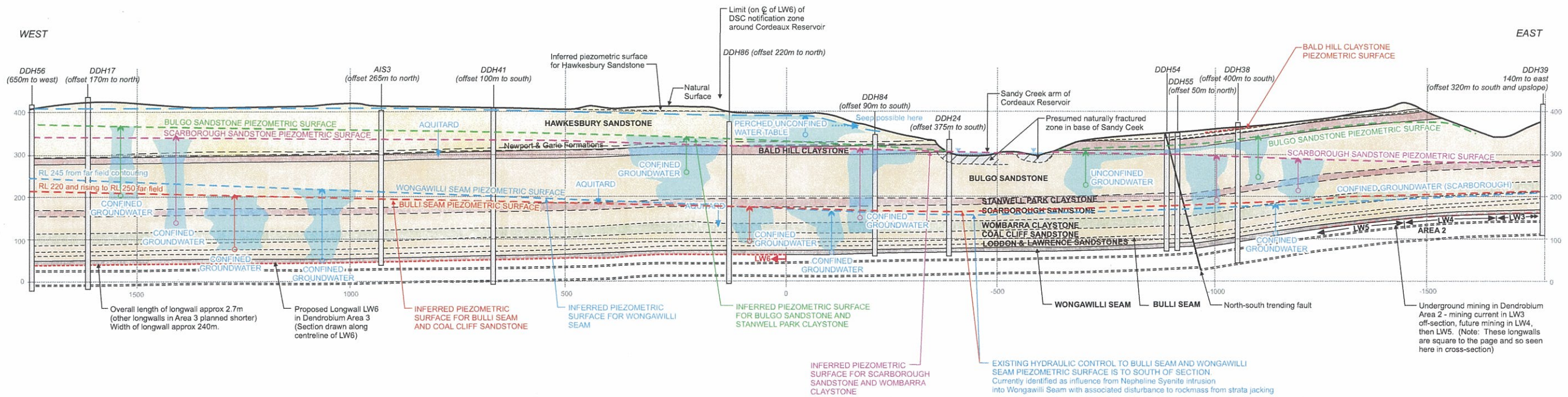
- DDHT EXPLORATION BOREHOLE
- DDH70 BOREHOLE WITH PIEZOMETER STRINGS
- 360 ALS CONTOURS
- 360 WONGAWILLI SEAM FLOOR CONTOURS
- PROPOSED MINE WORKINGS IN AREA 3



**GHD** CLIENTS | PEOPLE | PERFORMANCE  
**GHD GEOTECHNICS**

BHP Billiton  
 Dendrobium Mine Area 3 - Hydrogeology  
 Exploration Boreholes with  
 Downhole Piezometer Strings  
 scale | 1:10000 for A3 date | October 2007

job no. | 21-11716-03  
 rev no. | A  
**Figure HG304**



Note: See Drawing G302 for details



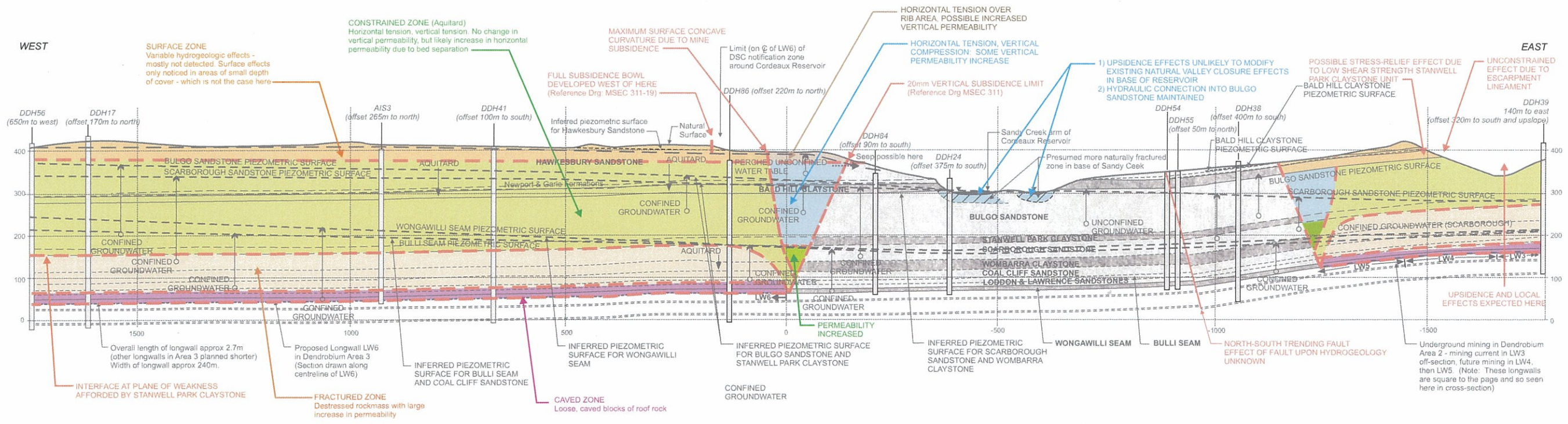
BHP Billiton, Illawarra Coal  
Dendrobium Area 3

### Inferred Stratigraphic Piezometric Surfaces

scale | 1:1000      date | 10 September 2007

job no | 21-11716-03  
file ref | 2111716-03\_LTN\_01.cdr

Figure HG305



Ref: Forster IR (1995) Figs 1 & 5, GHD Longmac (2004) Fig 5d



BHP Billiton, Illawarra Coal  
Dendrobium Area 3

### Anticipated Influences Upon Hydrogeology By Underground Mining

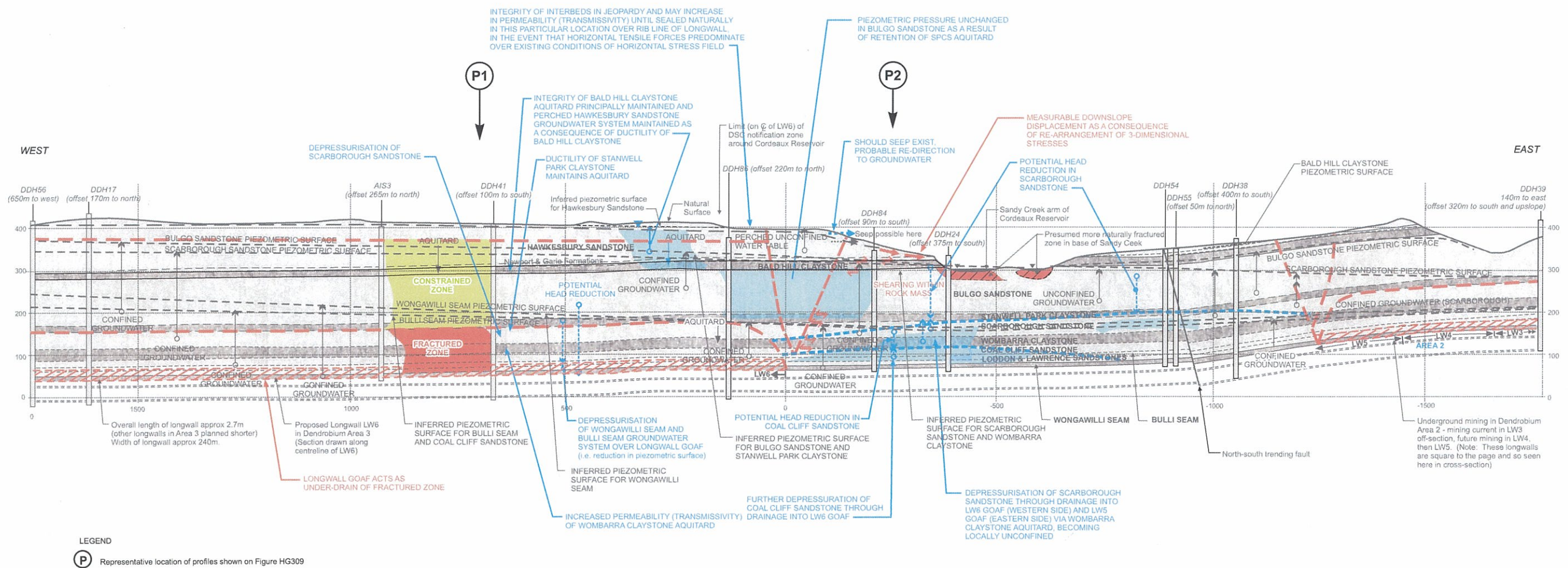
scale | 1:1000      date | 10 September 2007

job no | 21-11716-03  
file ref | 2111716-03\_LTN\_04.cdr

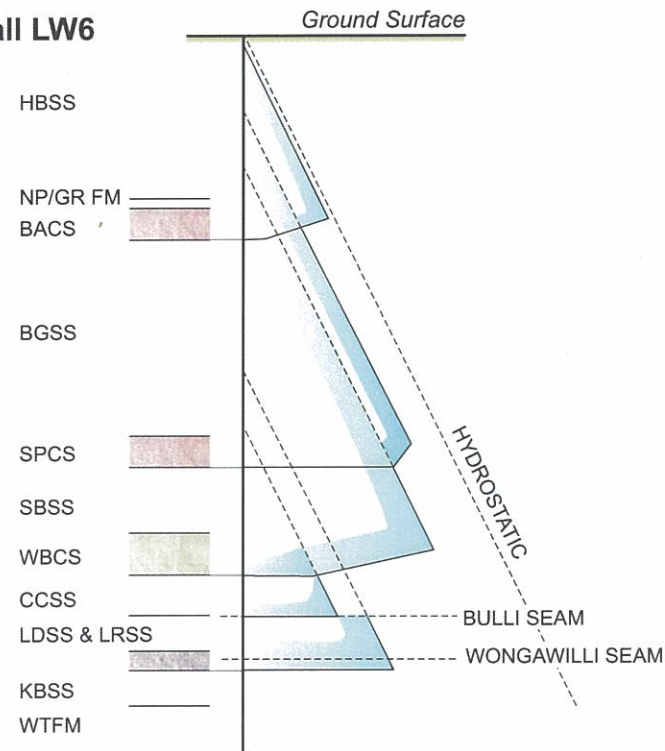
**Figure HG306**



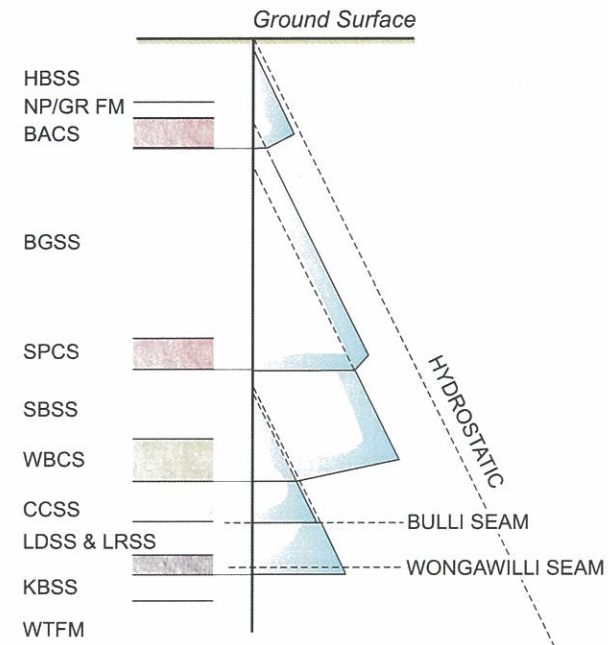




**PIEZOMETRIC PRESSURE  
PROFILE P1  
Over Longwall LW6**



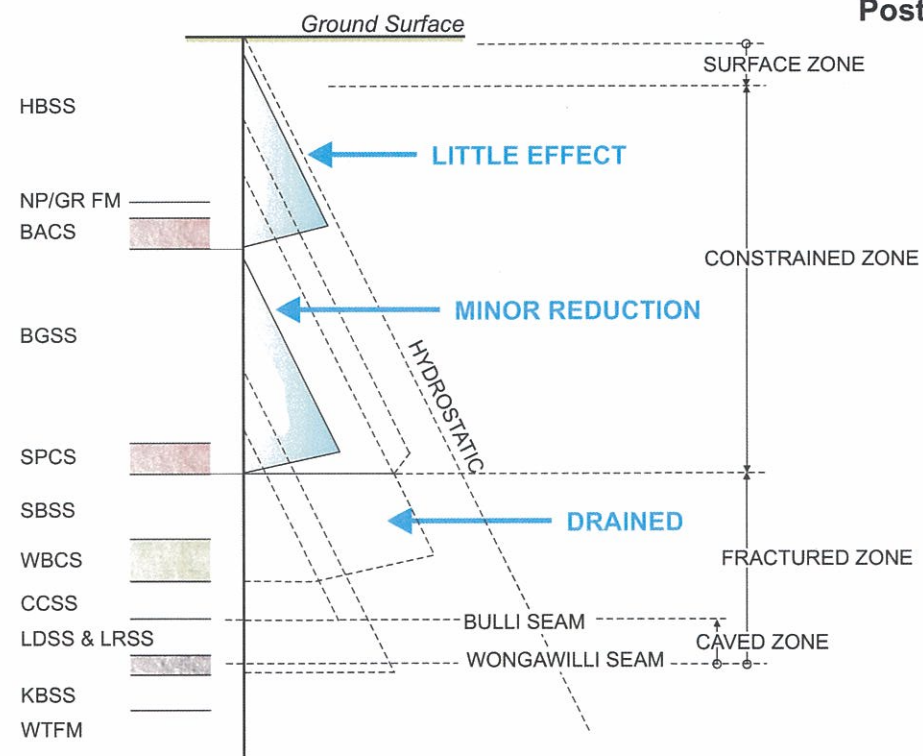
**PIEZOMETRIC PRESSURE  
PROFILE P2  
In rockmass between LW6 and Sandy Creek Arm  
of Cordeaux Reservoir**



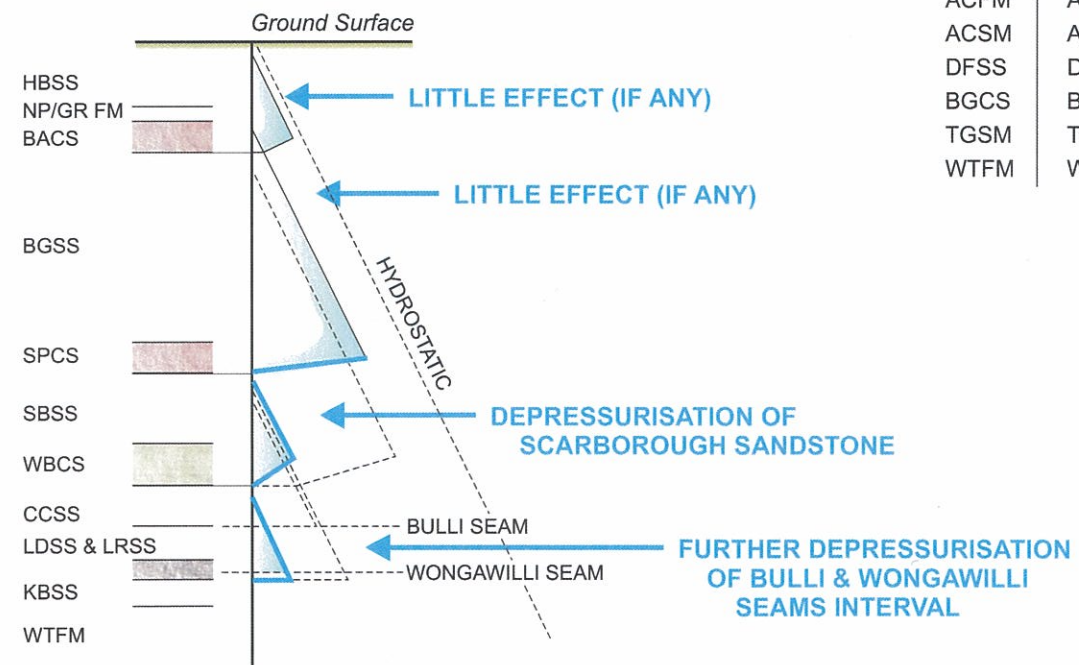
**Legend for Stratigraphic Units**

|          |                         |
|----------|-------------------------|
| HBSS     | Hawkesbury Sandstone    |
| NP/GR FM | Newport Formation       |
| GRFM     | Garie Formation         |
| BACS     | Bald Hill Claystone     |
| BGSS     | Bulgo Sandstone         |
| SPCS     | Stanwell Park Claystone |
| SBSS     | Scarborough Sandstone   |
| WBCS     | Wombarra Claystone      |
| CCSS     | Coal Cliff Sandstone    |
| BUSM     | Bulli Seam              |
| LDSS     | Loddon Sandstone        |
| LRSS     | Lawrence Sandstone      |
| WWSM     | Wongawilli Seam         |
| KBSS     | Kembla Sandstone        |
| ACFM     | Allans Creek Formation  |
| ACSM     | American Creek Seam     |
| DFSS     | Darke Forest Sandstone  |
| BGCS     | Bargo Claystone         |
| TGSM     | Tongarra Coal           |
| WTFM     | Wilton Formation        |

**PIEZOMETRIC PRESSURE  
PROFILE P1  
Over Longwall LW6  
Post-Mining of LW6**

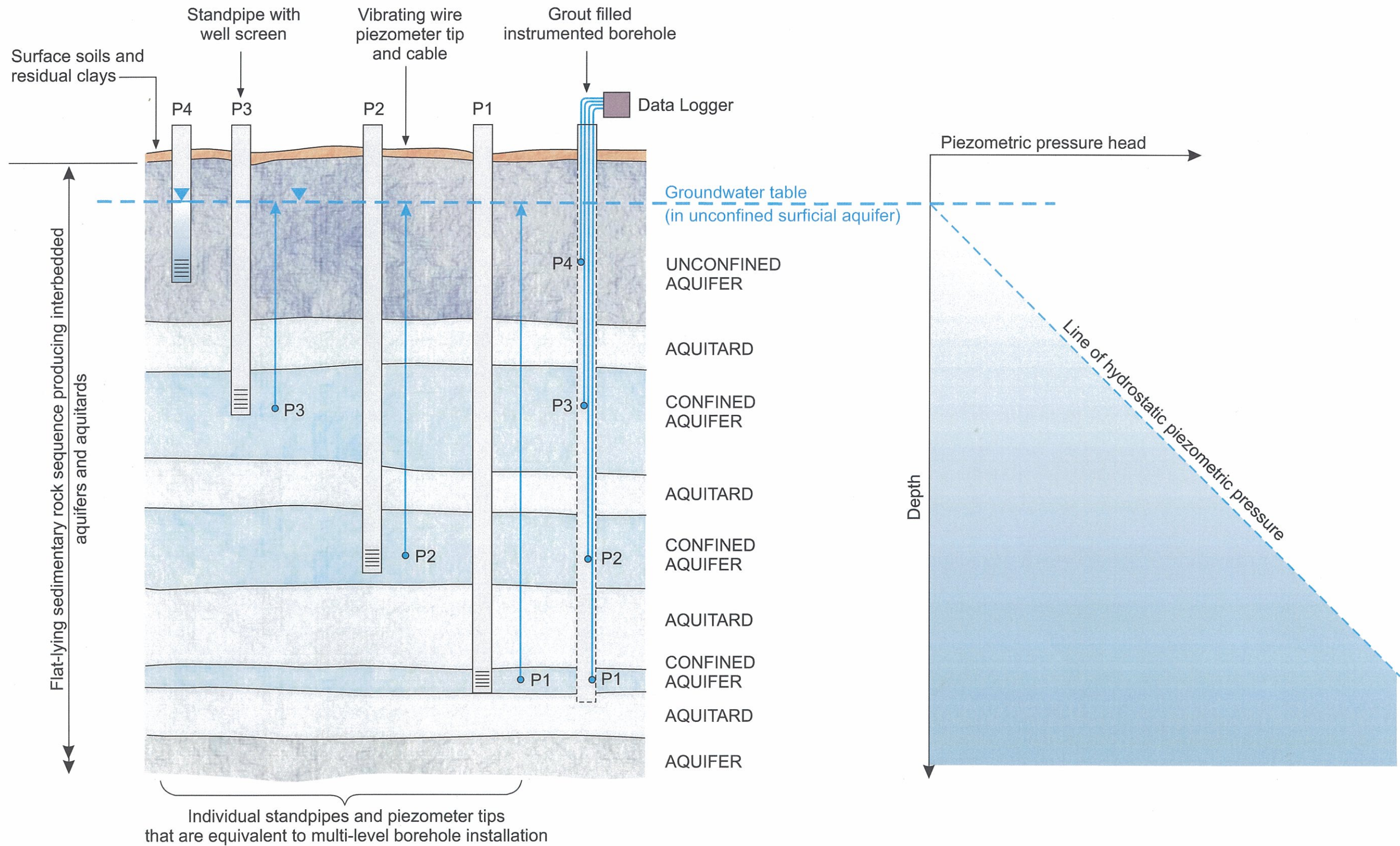


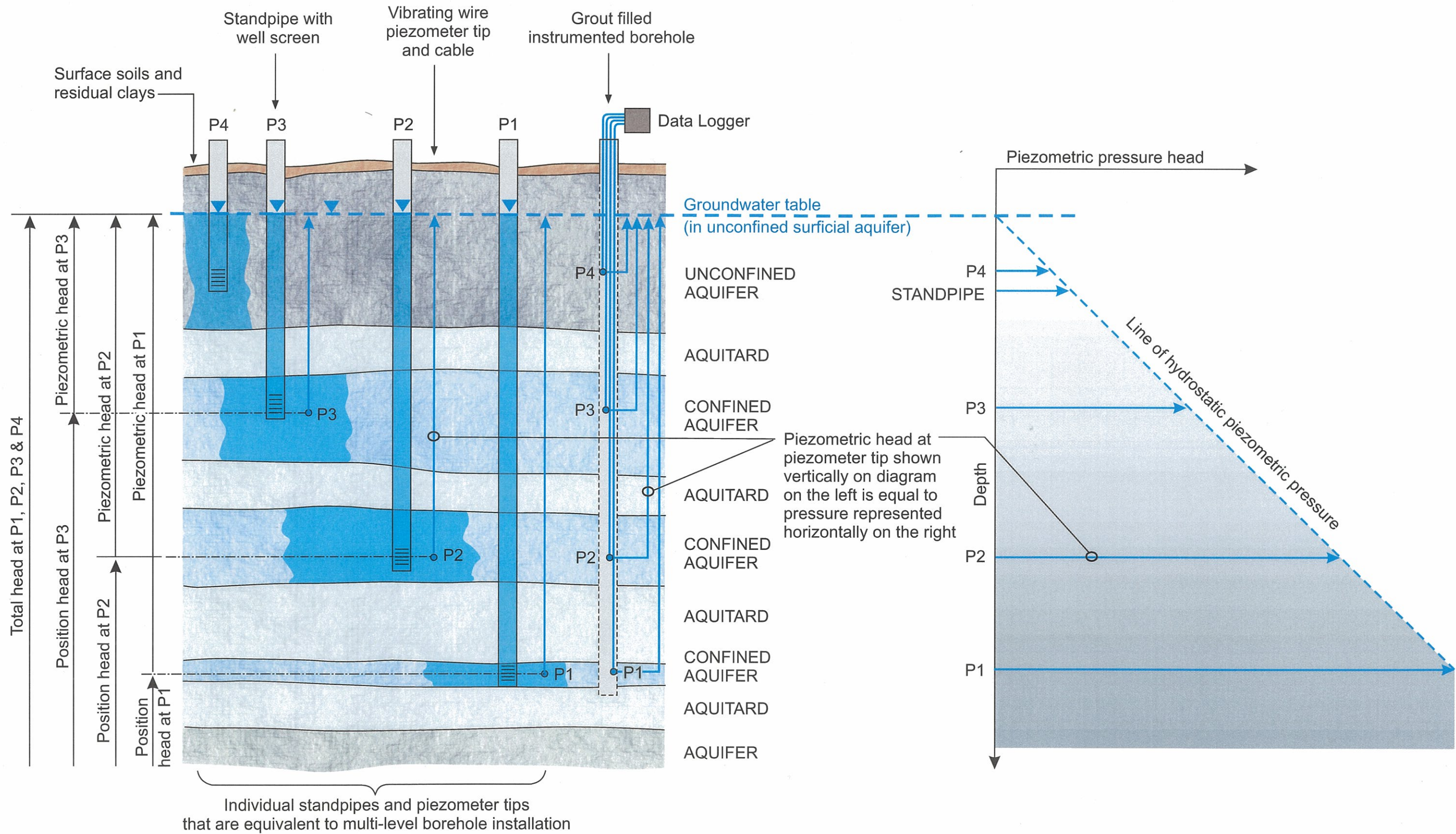
**PIEZOMETRIC PRESSURE  
PROFILE P2  
In rockmass between LW6 and Sandy Creek Arm  
of Cordeaux Reservoir  
Post-Mining of LW6**

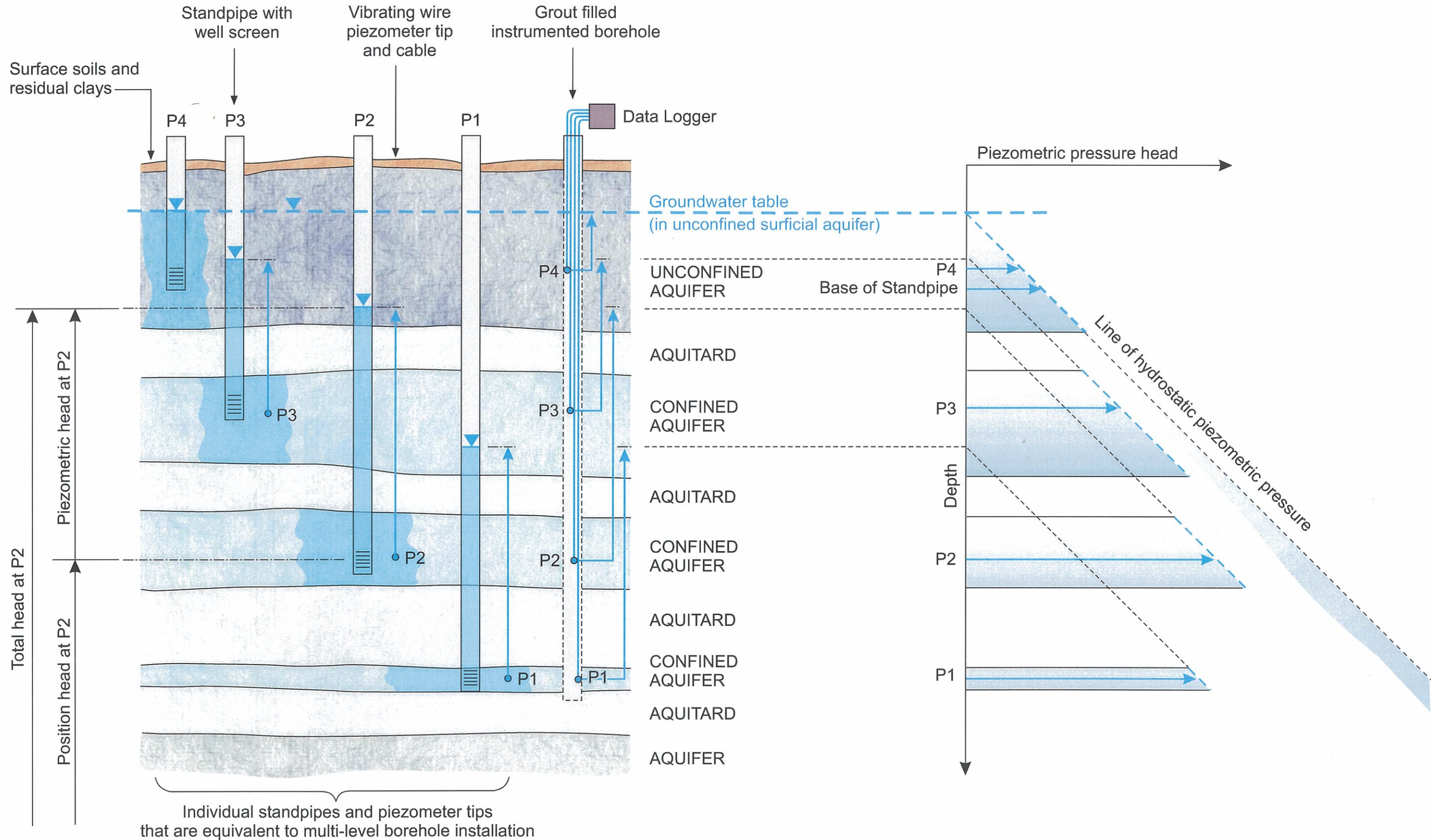


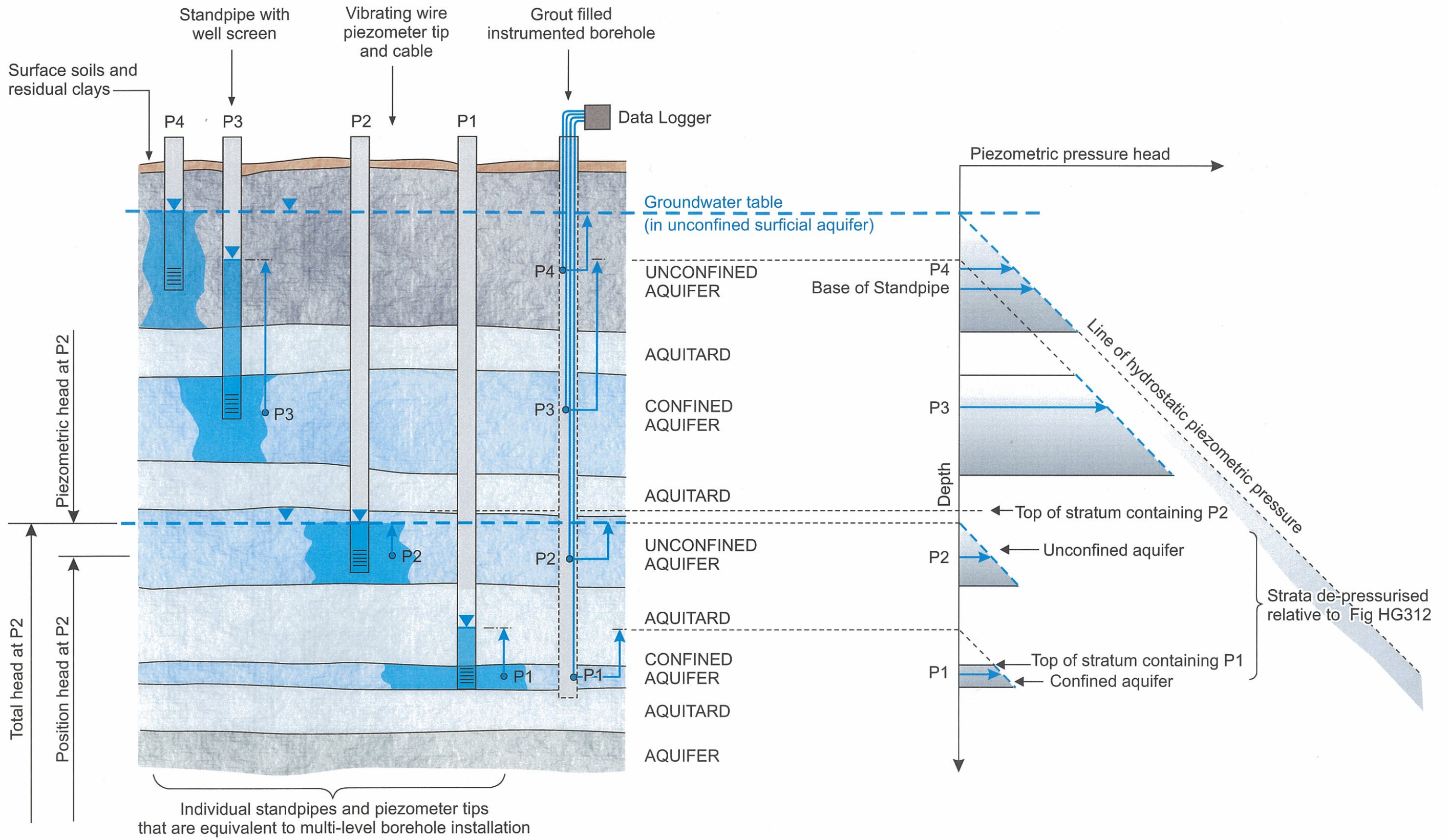
ILLUSTRATIVE PIEZOMETRIC INSTRUMENTATION

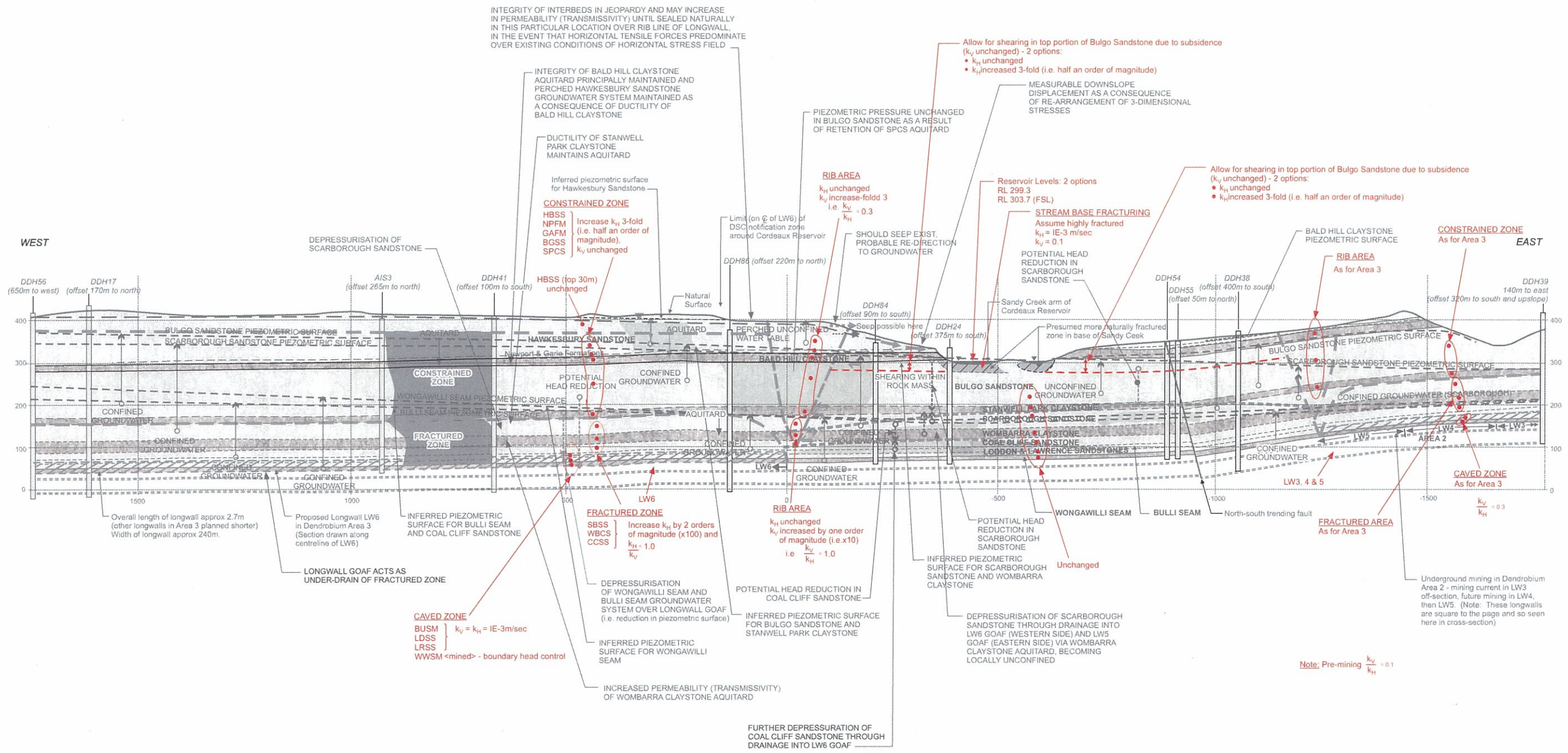
PRESSURE HEAD DISTRIBUTION

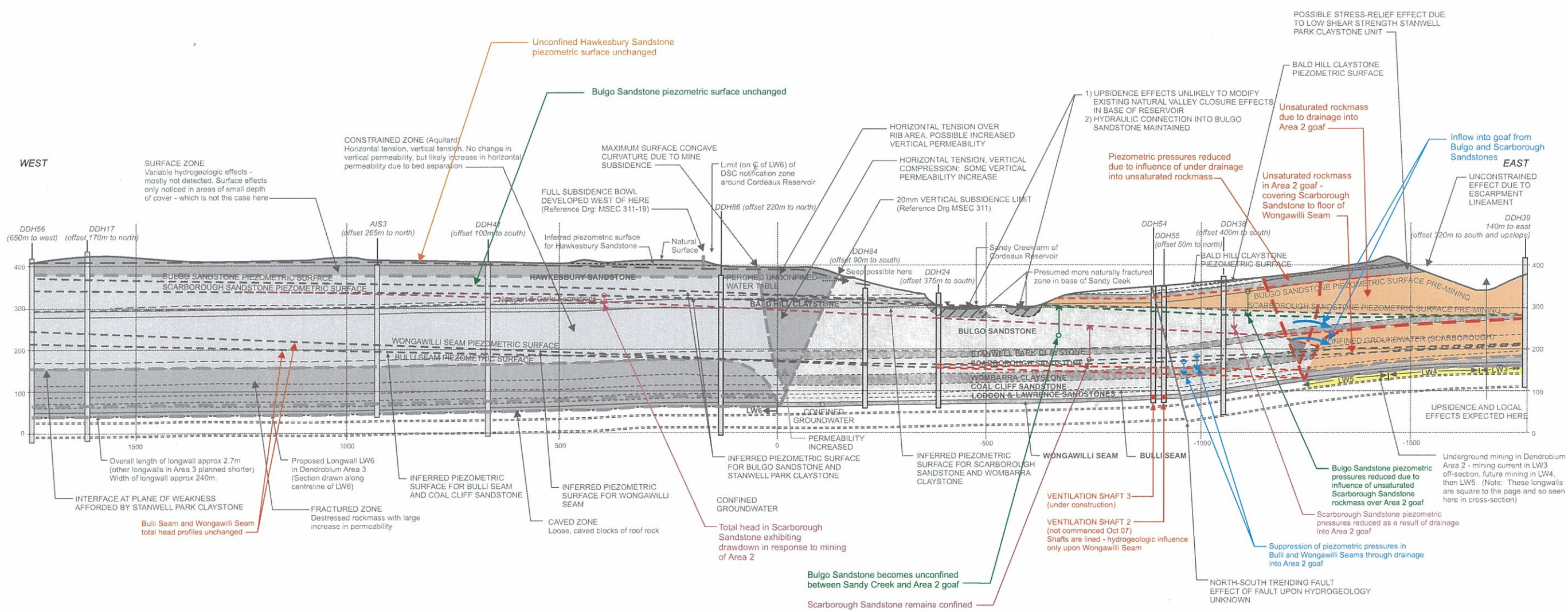












Ref: Forster IR (1995) Figs 1 & 5, GHD Longmac (2004) Fig 5d

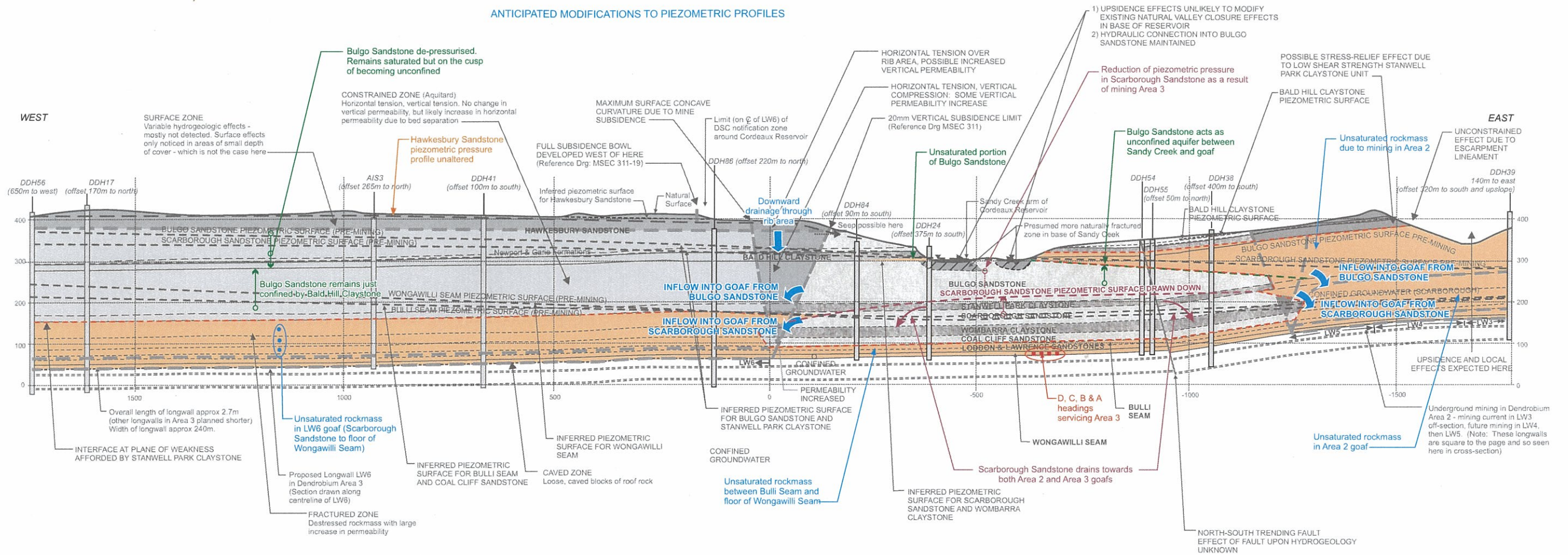


BHP Billiton, Illawarra Coal  
 Dendrobium Area 3  
**Hydrogeologic Impact Post Mining of Area 2 - Anticipated  
 Modifications to Piezometric Pressures**  
 scale 1:1000 date 18 October 2007

job no 21-11716-03  
 file ref 2111716-03\_LTN\_11.cdr

**Figure HG315**





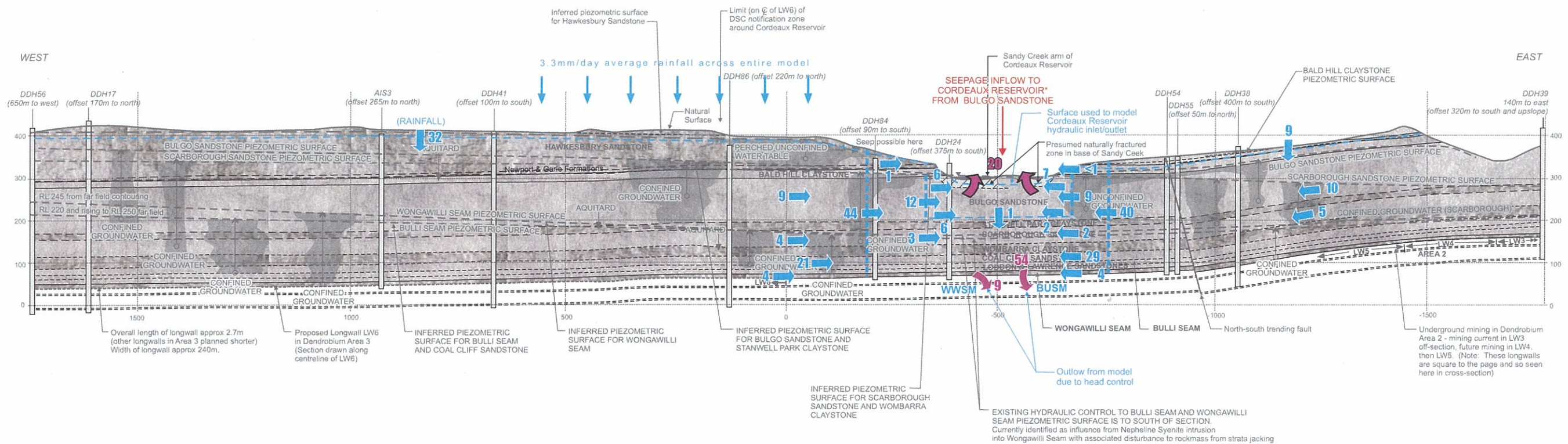
Ref: Forster IR (1995) Figs 1 & 5, GHD Longmac (2004) Fig 5d



BHP Billiton, Illawarra Coal  
 Dendrobium Area 3  
**Hydrogeologic Impact Post Mining of Area 2 & Area 3**  
**Anticipated Modifications to Piezometric Pressures**  
 scale | 1:1000      date | 18 October 2007

job no | 21-11716-03  
 file ref | 2111716-03\_LTN\_12.cdr

**Figure HG316**



**LEGEND**

- Proportional flow within stratigraphic unit (at arrow position)
- Proportional flow across model section
- Proportional flow leaving the model
- Reference seepage inflow to reservoir at FSL

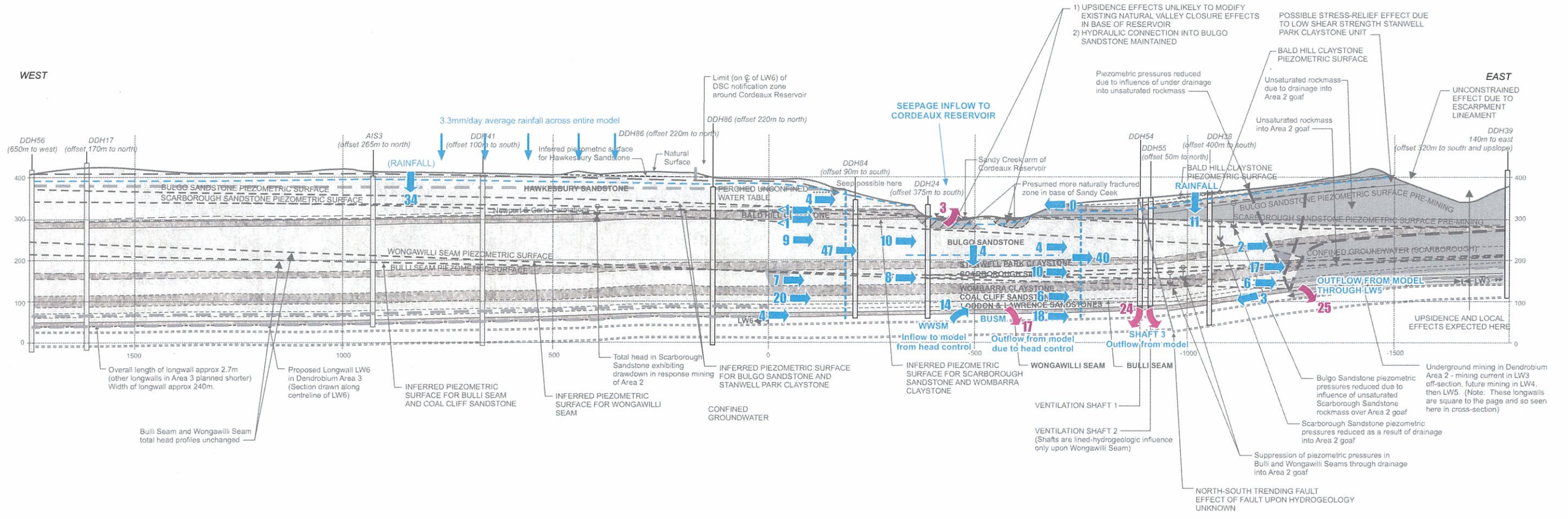
- Note: 1 Groundwater flows are expressed as proportions of reference seepage inflow to Longwall 6 (after mining) with reservoir at FSL - see Figure HG319.
- 2 \* Groundwater flows ignore overland run-off contribution to storage. Reference seepage inflow is from Bulgo Sandstone unit only.
- 3 See Drawing G303 for details.



BHP Billiton, Illawarra Coal  
 Dendrobium Area 3  
**Expected Groundwater Movement Prior to Mining**  
 scale | 1:1000    date | 19 October 2007

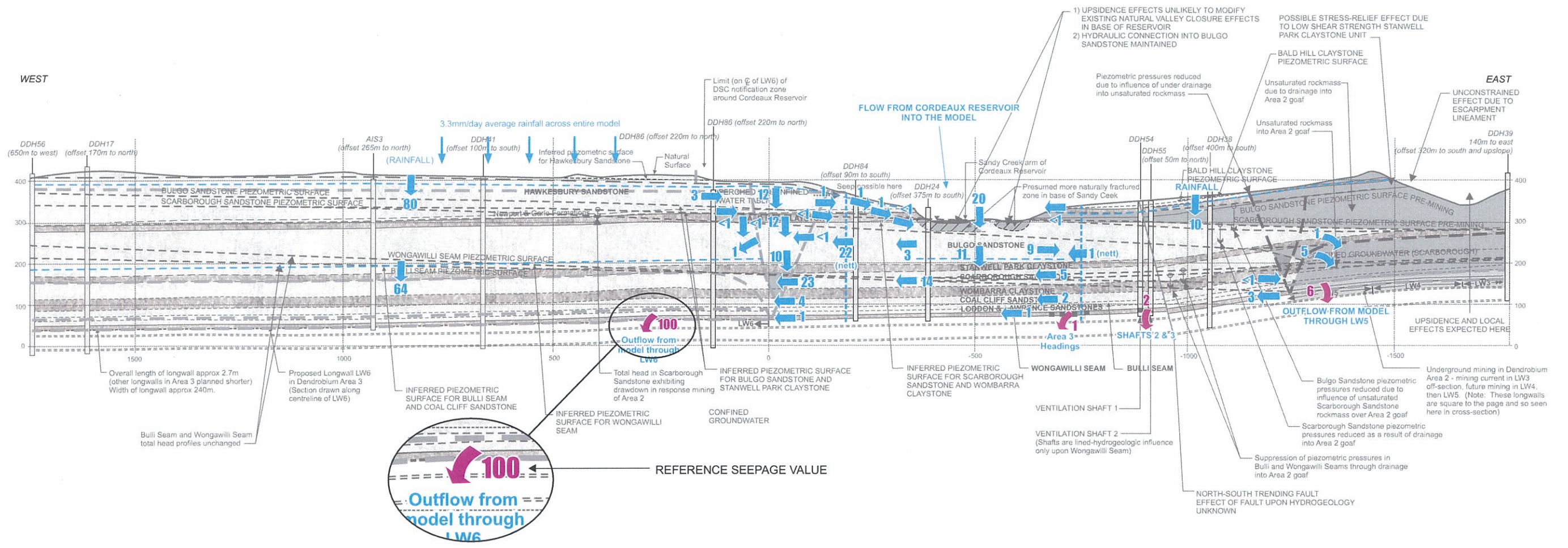
job no | 21-11716-03  
 file ref | 2111716-03\_LTN\_13.cdr

**Figure HG317**



- LEGEND**
- ➔ Proportional flow within stratigraphic unit (at arrow position)
  - ➔ Proportional flow across model section
  - ➔ Proportional flow leaving the model

Note: 1 Groundwater flows are proportions of reference seepage inflow to Longwall 6 (after mining) with reservoir level at FSL - see Figure HG319.  
 2 Groundwater flows ignore overland run-off contribution to storage.



- LEGEND**
- Proportional flow within stratigraphic unit (at arrow position)
  - - - → Proportional flow across model section
  - Proportional flow leaving the model

Note: 1 Groundwater flows are proportions of reference seepage inflow to Longwall 6 (after mining) on this figure.  
 2 Groundwater flows ignore overland run-off contribution to storage



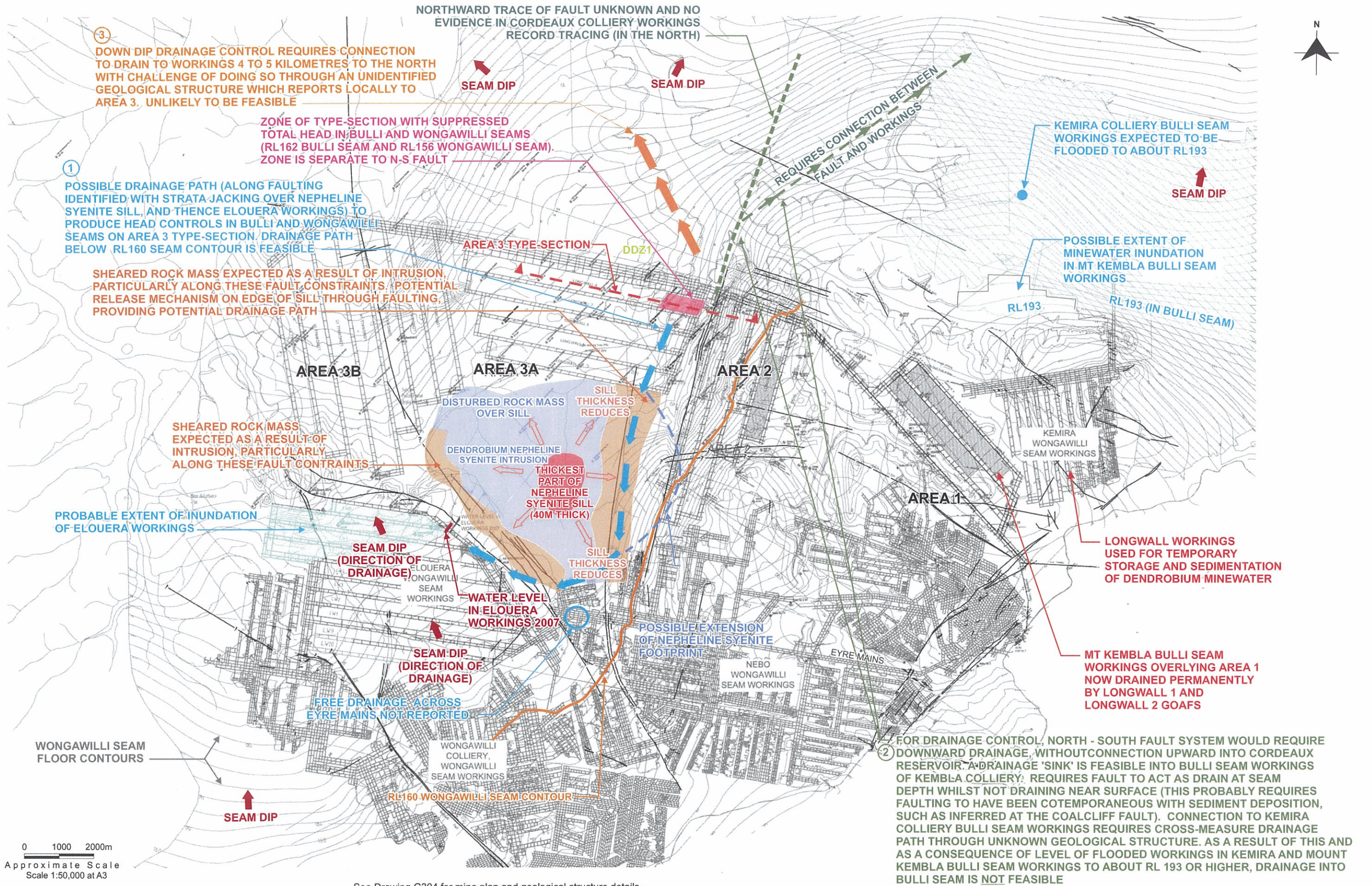
BHP Billiton, Illawarra Coal  
 Dendrobium Area 3

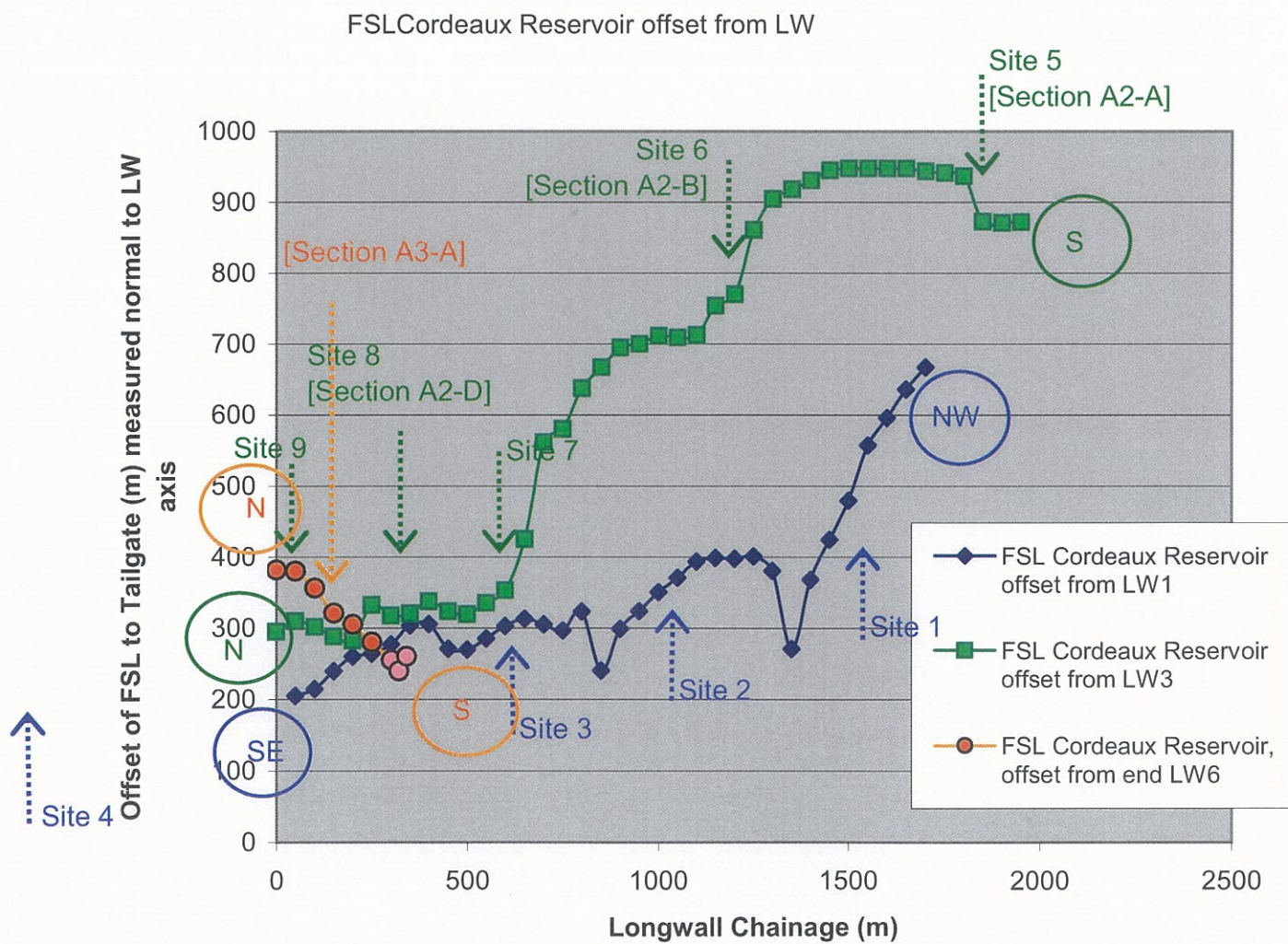
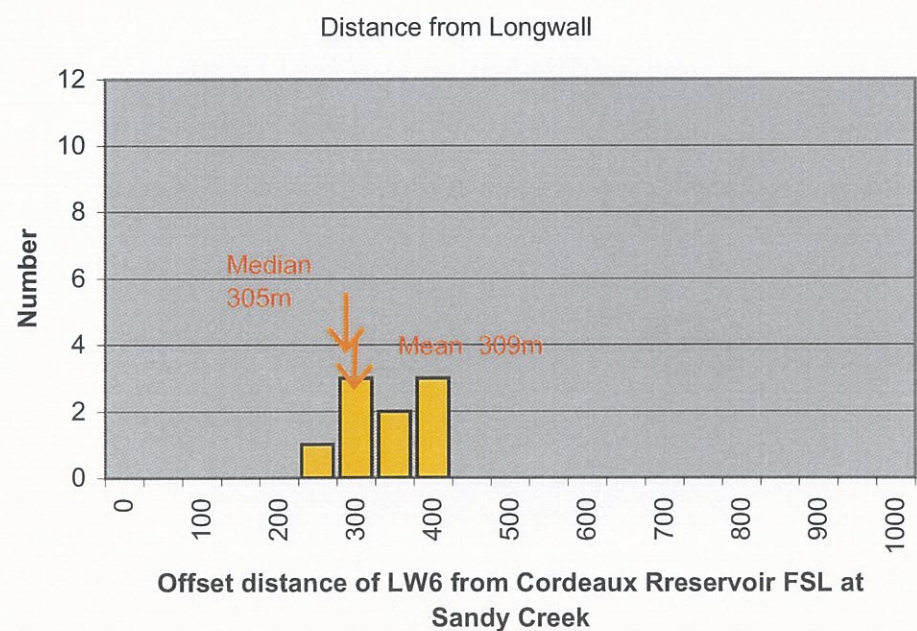
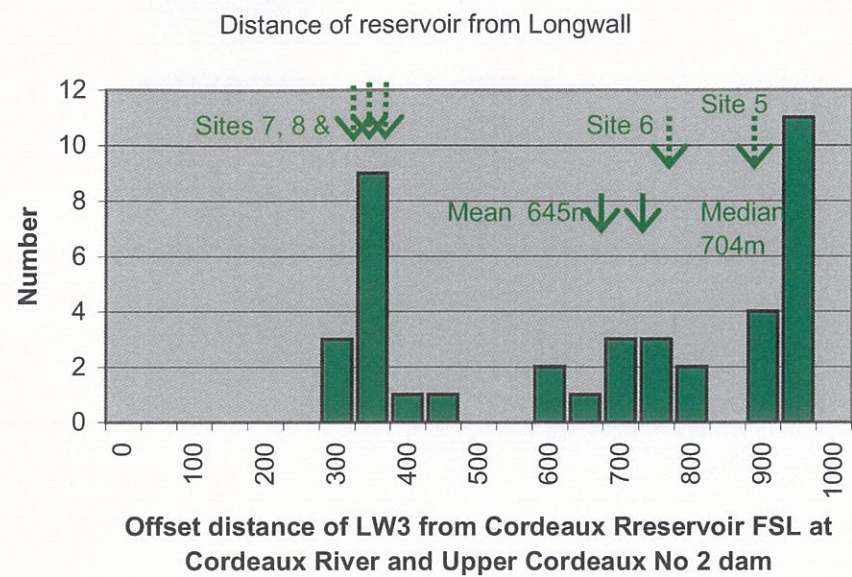
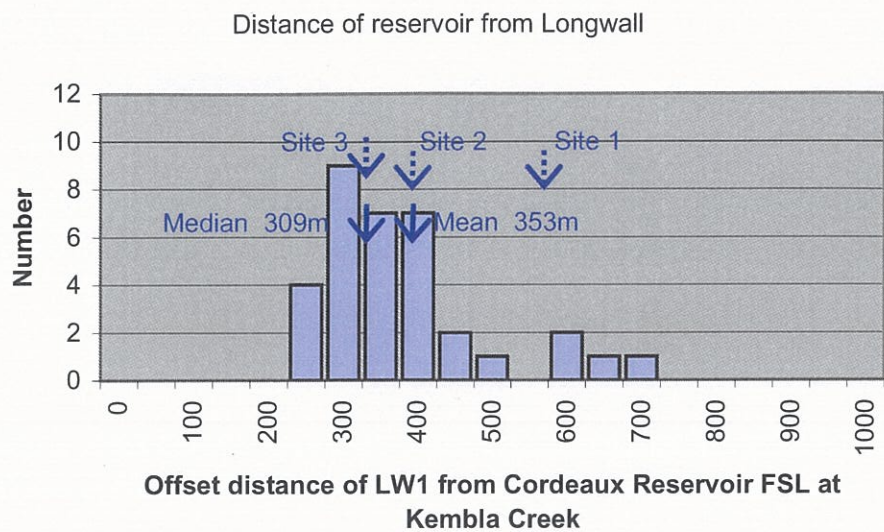
**Anticipated Groundwater Movement Post Mining of Area 2 & Area 3**

scale | 1:1000      date | 18 October 2007

job no | 21-11716-03  
 file ref | 2111716-03\_LTN\_15.cdr

**Figure HG319**





57-63 Herbert Street, ARTARMON, NSW, 2064  
Tel: (02) 9462 4700 Fax: (02) 9462 4710

GHD GEOTECHNICS

DENDROBIUM AREA 3 - MINING ADJACENT TO STORED WATERS  
OFFSET DISTANCES OF RESERVOIR FSL TO LONGWALLS

Designed: ARL  
Drawn: VN / ARL  
Checked: Date: Oct2007  
File name: 2111716 Dendrobium

Figure No: **OSD-4**  
Job No: 21.11716  
Scale: as shown

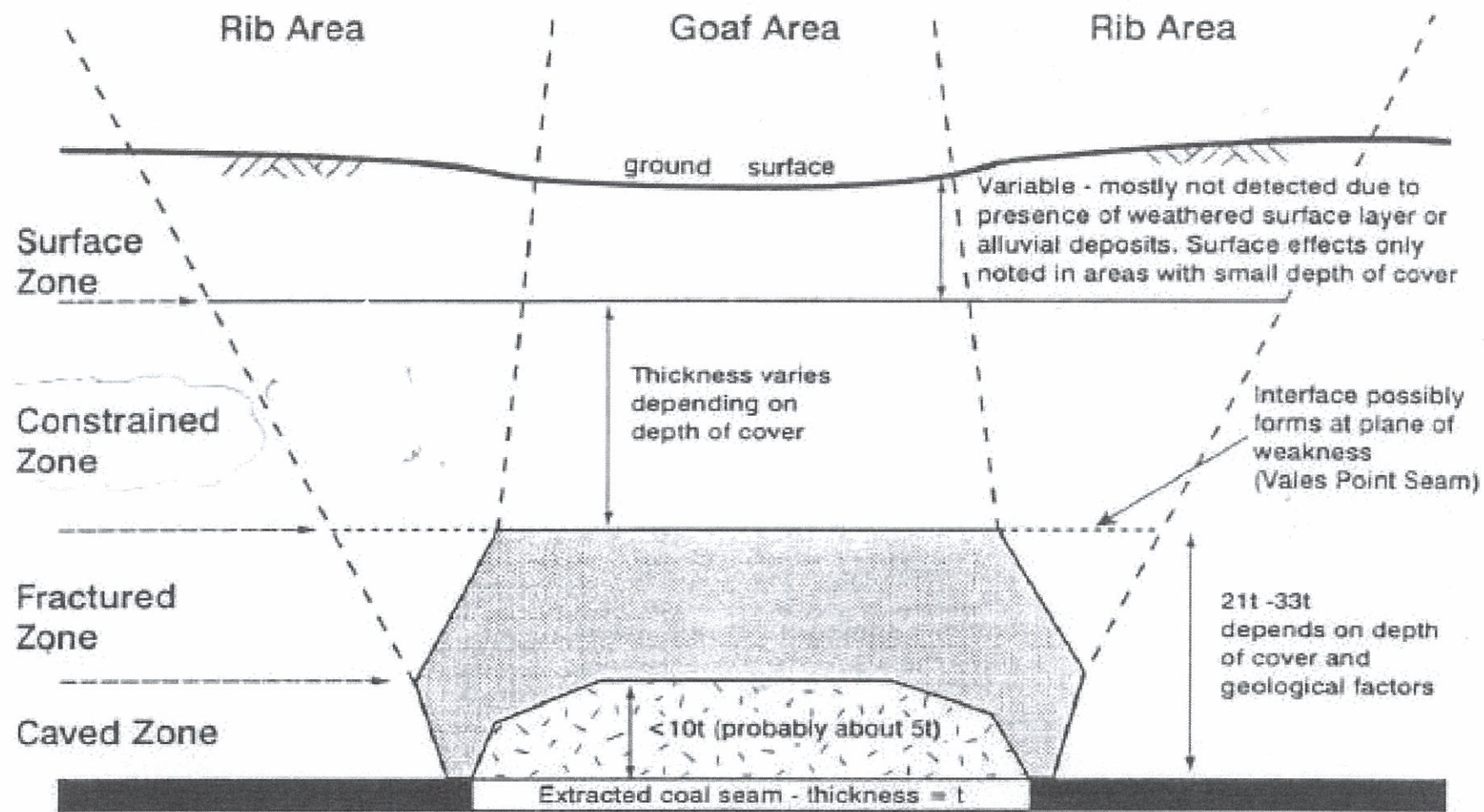


Figure 5. Proposed practical hydrogeological model for mining in the Central Coast area.

Ref: Foster IR (1995) "Impact of underground mining on the hydrogeological regime, Central Coast NSW"  
 Conf on Eng Geol of the Newcastle-Gosford Rgeion, Australian Geomechanics Society, eds Sloan SW & Allman MA



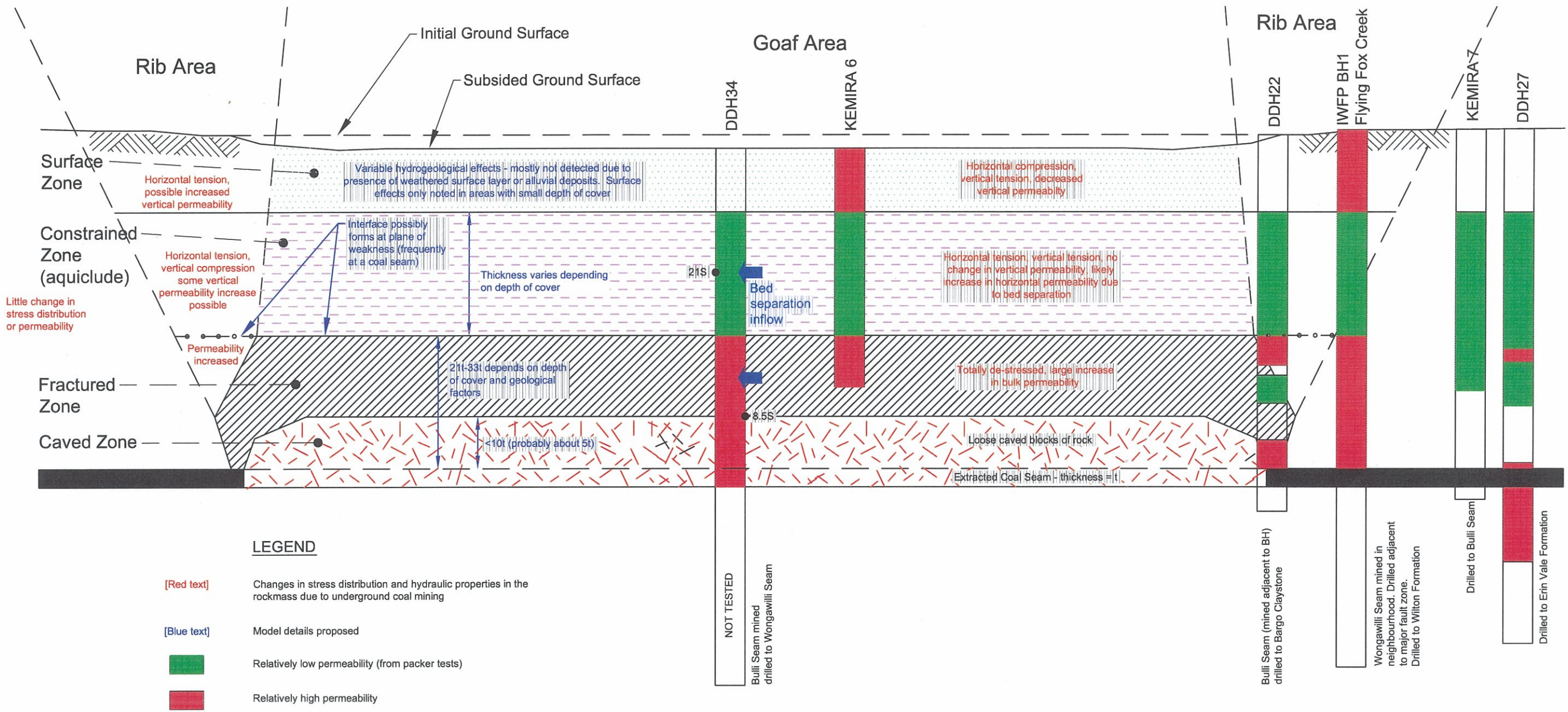
57-63 Herbert Street, ARTARMON, NSW, 2064  
 Tel: (02) 9462 4700 Fax: (02) 9462 4710  
 EM: longmac@ghd.com.au  
**GHD LONGMAC**



**DENDROBIUM AREA 1 - MINING ADAJENT TO STORED WATERS  
 SUBSIDENCE MODEL, CENTRAL COAST, NSW**

|            |                    |
|------------|--------------------|
| Designed:  | ARL                |
| Drawn:     | ARL                |
| Checked:   | Date: Nov 2003     |
| File name: | 2111716 Dendrobium |

|            |           |
|------------|-----------|
| Figure No: | <b>5a</b> |
| Job No:    | 21.11.716 |
| Scale:     | as shown  |



Proposed extension of practical hydrogeological model for underground coal mining from that proposed by Foster (1995)

Ref: Foster IR (1995) "Impact of underground mining on the hydrogeological regime, Central Coast NSW"  
 Conf on Eng Geol of the Newcastle-Gosford Region, Australian Geomechanics Society, eds Sloan SW & Allman MA

57 HERBERT STREET, ARTARMON N.S.W. 2064  
 TEL: (02) 9462 4700 FAX: (02) 9462 4710  
 EMail: longmac@ghd.com.au  
 GHD LONGMAC

**DENDROBIUM AREA 1 - MINING ADJACENT TO STORED WATERS  
 PROPOSED EXTENSION OF SUBSIDENCE MODEL**

|            |                |
|------------|----------------|
| Designed:  | ARL            |
| Drawn:     | HW             |
| Checked:   | Date: 17/2/04  |
| File name: | 2111716_5d.DWG |

|            |           |
|------------|-----------|
| Figure No: | <b>5d</b> |
| Job No:    | 21/11716  |
| Scale:     | AS SHOWN  |



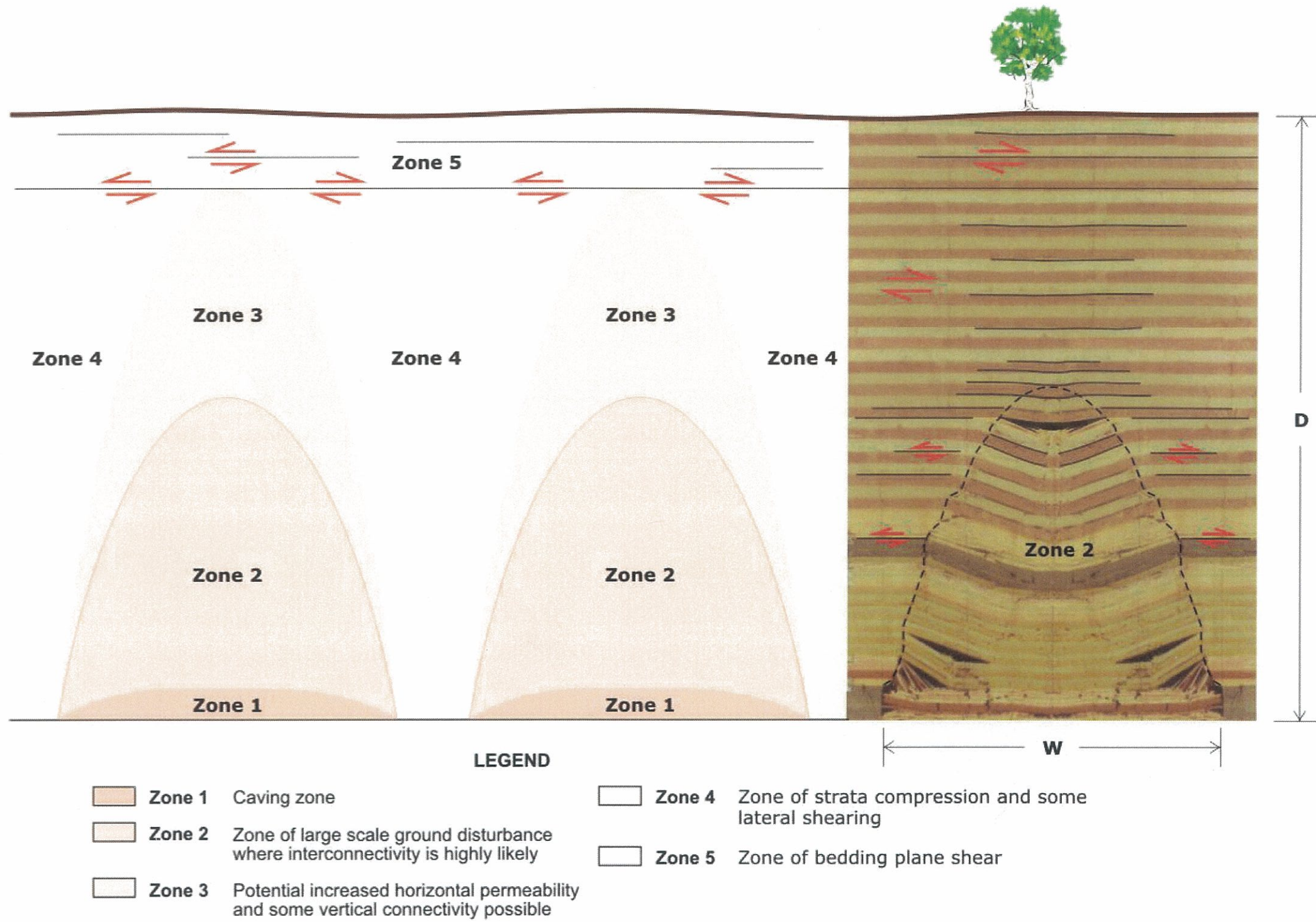


Figure 8 Distribution of zones within the overburden strata.