



Regener8 Power

Rhigos Road Solar Farm Scheme

Preliminary Coal Mining Risk Assessment

315223 R02 (03)



This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

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1 INTRODUCTION

1.1 Commissioning

RSK Environment Limited (RSK) were commissioned by Regener8 Power (the client) to prepare a desk-based coal mining risk assessment (CMRA) for the site of the proposed solar farm located off Rhigos Road, Hirwaun, CF44 9AZ.

RSK's service constraints are presented in Appendix A.

The land, which currently comprises undeveloped grassland and is utilised for agricultural grazing (of sheep), is being considered for green energy development with a solar farm.

Following the conclusions and recommendations outlined within the RSK Phase 1 Desk Study (Ref. 315223 R01(01), August 2022) for the site, a CMRA is required to further understand the risks to the proposed development from coal measures strata underlying the site. In addition, it is understood that a CMRA will be required to be submitted to Rhondda Cynon Taf County Borough Council (RCTCBC) as part of any planning application pertaining to the proposed development.

1.2 Scope of coal mining risk assessment

The assessment provided in this report is required due to the site being within an area defined by the Coal Authority as a Coal Mining Reporting Area and a Development High Risk Area.

The Coal Authority, in common with other statutory consultees, utilises a risk-based approach for the advice that they offer on proposed developments in relation to coal mining legacy issues. It is generally a requirement in High Risk areas for a desk based CMRA to be completed to support any planning applications. Coal Authority guidance suggests that development comprising solar arrays, even in 'development high risk areas', may not require a Coal Mining Risk Assessment (CMRA), however, a CMRA is required for more heavily loaded structures such as power/sub stations.

A CMRA needs to consider a number of sources of information to determine coal mining issues relevant to a site. It then needs to identify and assess the site-specific coal mining risks and propose an appropriate mitigation strategy relevant for the proposed site end-use. This approach has been followed in the current assessment.

Guidance from the Coal Authority outlines the assessment stages required for a CMRA, which are included in the following sections of this report:

Stage 1 - Sources of information

- Sections 1 and 2 of this report provide background information.
- Section 3 presents available desk-based information.

Stage 2 - Assessment of site-specific coal mining risks

- Section 4 presents an assessment of the site-specific coal mining risks.

Stage 3 - Mitigation strategy proposed

- Section 5 presents the required mitigation measures to address the identified risks.

The proposed scope of site assessment works for the Rhigos Road site is to be carried out in two phases: the initial phase being the production of a desktop study and site appraisal (this report). If required, the second phase of works will involve an intrusive site investigation works. The site investigation will include an assessment of the coal mining risks identified in this report as set out in Section 4.

1.3 Sources of information

The scope of this preliminary coal mining condition report will include:

- Review of all relevant data sources and available reports on previous investigations conducted on the site;
- Procurement of a Consultants Coal Mining Report and any relevant Abandoned Mine Catalogue drawings from the Coal Authority;
- Site walkover to identify any potential areas of concern; and
- Production of a factual report, including if required, recommendations for intrusive site investigation works to fully assess coal mining risks.

1.3.1 Previous reports

The following report detailing previous works at the site were made available for review:

- RSK, Preliminary Risk Assessment: Rhigos Road, Merthyr Tydfil Solar Farm Scheme, Ref. 315223 R01(04), April 2023.

The above report should be read in conjunction with this report.

1.4 Proposed development

RSK understands that the site is being considered for development as a solar farm. The current planned layout of the site is shown in Appendix B.

The development will include two main elements; the solar arrays and the on-site power and customer stations and substations, which are surrounded by perimeter fencing. The two main elements of the development are outlined below.

Solar arrays – These are a series of sectional, approx. 4.8m long, photo voltaic (PV) solar panels which are typically supported on an array of pins on an approx. 6.0m spacing, driven into the ground to shallow depth (typically to 0.7m but less than 1.0m). The panels are supported at an approx. elevation of between approx. 0.8m and 2.8m above ground level and are tilted above horizontal by approx. 25°.

Transformer stations and enclosures – The four proposed transformer stations comprise a cabinet (2.6 m x 1.1 m in plan) and a fenced compound (4.5 m x 4.0 m in plan) to contain electrical equipment. In addition, two enclosures will be located in the eastern extent of the site; one will contain a cabinet (3.1 m x 2.8 m in plan) for customer switchgear; and the second will contain a cabinet (3.6 m x 2.5 m in plan) for the Distributer Network Operator (DNO). Foundation requirements for these structures are not known. Both the transformer stations; customer switchgear cabinet; and the DNO cabinet are assumed to

comprise well-ventilated structures and containers typically placed on concrete slabs which are constructed over a layer of compacted sub-grade gravel and are anticipated to be lightly loaded structures.

1.5 Limitations

The comments given in this report and the opinions expressed are based on information gained in the desk study and the sources of which are presented within the report for reference. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account.

This report is subject to the RSK service constraints given in Appendix A and limitations that may be described through this document.

2 SITE DETAILS

2.1 Site location and description

Site location details are presented in Table 1, below, and a site location plan is presented in Figure 1.

Table 1: Site location details

Site name	Land at Rhigos Road
Full site address	Land at Rhigos Road, Hirwaun, Aberdare, CF44 9AZ
National Grid reference (centre of site)	SN9346705760 (E 293476, N 205705)

The site boundary and current layout are presented in Drawing 11201/C01. The site covers an area of approx. 15.8-hectares and is wholly comprising of soft landscaping for the purposes of agricultural uses: sheep grazing. The land is divided into four fields separated by hedges and wooden fencing with typical farm access gates.

There are a number of streams, drainage ditches, and ponds on or adjacent to the site. In general, the site slopes to the north, south, and east, with localised undulation within each of the fields. The lowest points of the site are recorded in the far north and in the east of the site, both at approx. 220m elevation above ordnance datum (AOD).

2.2 Relevant site history

Based on a review of the available historical information undertaken in the RSK Preliminary Risk Assessment (Ref. 315223 R01(01), August 2022), it is considered that the following relevant land use to have been present on-site:

- The site appears to have formed part of an opencast coal mine between the 1962 and 1993 as shown on historical OS maps. Gaps in successive maps entries mean that a full historical picture of the site and its uses could not be compiled. Publicly available aerial imagery shows material stockpiles located across the site in 1969.

Given the nature of the opencast mining operations, it was considered unlikely that significant widespread or gross land contamination would be present on-site. Additionally, it was also considered that adjacent land uses are unlikely to provide potential source-pathway-receptor contaminant linkages affecting the site, largely due to potential sources being located down-gradient distally from the site area.

The review also considered publicly available unexploded ordnance (UXO) risk maps which indicated that the site is located within an area with low potential for wartime bombs to be present (Zetica, 2022).

2.3 Development plan

The proposed development layout of the site, at the time of writing, is presented in Appendix B. This drawing depicts the locations of the solar arrays, perimeter fencing, access track, and the four transformer stations and two enclosures (customer switchgear and DNO).

2.4 Geology

A brief review of the geological data provided by the interactive British Geological Survey (BGS) GeolIndex viewer and available BGS geological maps indicates that site is underlain by the following sequence:

Artificial geology

- Worked Ground (undivided) – void: described by the BGS as “*worked ground is an area where the land surface (natural or artificial) has been lowered as a result of man-made excavations. The purpose of the excavation is unspecified. Void.*” Understood to be present in the southern, central, and western areas of the site, this deposit is interpreted to related to the historical opencast mining and is likely of variable unknown thickness and permeability, both of which characteristics will depend on the material used to backfill the mine workings as well as the extent of the opencast.
- It is likely that Made Ground will be ubiquitous across the site area, with thicker deposits located in the vicinity of the opencast coal mine and thinner deposits spread locally as part of the regeneration works after its abandonment.

Superficial (drift) geology

- Till, Devensian – diamicton: while this unit has not been formally described by the BGS, it is understood to commonly comprise an unsorted, heterogeneous mixture of clay, sand, gravels, and boulders which vary considerably in size and shape. The thickness of this unit is unknown; based on the heterogeneous nature of Till, its permeability is considered to be low but may be high locally. BGS boreholes SN90NW110 to 113, located approx. 250m north-east of the site area, record between 6.0 and 7.6m of Till underlying peat and overlying laminated mudstone from 3.0m below ground level (bgl).

Bedrock (solid) geology

- South Wales Lower Coal Measures Formation: described by the BGS as “*grey, (productive) coal-bearing mudstones/siltstones, with seatearths and minor sandstones.*” Lower Coal Measures (LCM) bedrock is understood to be present underlying the entirety of the site and to outcrop in all but the southernmost reaches of the site area, where it is depicted in BGS mapping to be overlain by the South Wales Middle Coal Measures. While the local thickness is not known, BGS records state that the LCM is between 80 and 300m thick. Permeability is understood to be low to moderate and facilitated by fractures within the rock.
- South Wales Middle Coal Measures Formation: described by the BGS as “*grey, (productive) coal-bearing mudstones/siltstones, with seatearths and minor sandstones.*” Middle Coal Measures (MCM) bedrock is present to the south of the site only and will likely be thin on-site and thicken southwards. Permeability is understood to be low to moderate and facilitated by fractures within the rock.

While not recorded on BGS geological maps, BGS borehole records suggest that superficial peat deposits may also be present within the site area; this will most likely be limited to the regions outwith the extent of the opencast mine workings.

BGS mapping also includes records of at least five coal seams outcropping within the site area, including the Nine-Feet, Bute, No. 2 Yard, Seven-Feet, and Five-Feet coals.

Additionally, the Amman Marine Band is stratigraphically located between the Bute and the No. 2 Yard seams and is understood to represent the boundary between the LCM and the MCM.

A geological fault is depicted to outcrop adjacent but outwith the south-west of the site area on available BGS geological maps. Based on the map, it is understood that the downthrown block is to the west of the fault, suggesting that the fault should not underlie the site at any depth.

2.5 Existing reports

In August 2022 RSK prepared a PRA for the proposed development at Rhigos Road (Ref. 315223 R01(01), August 2022). Relevant key findings of this report include:

- Coal seam outcrops – 19no. coal outcrops are noted within the site boundary of which 8 No. are workable;
- Opencast mining – The site is within the boundary of the Ffyndaff opencast site from which coal has been removed by opencast methods. Additionally, the site is located approximately 200 metres to the west of the boundary of the former Tower Colliery Opencast site which is currently in the process of being restored;
- Past (shallow) underground mining – there are 3no. recorded ironstone and 1no. fireclay workings recorded beneath the site, the last working of which was reported as ceased in 1856. These workings range from approx. 1.10 to 1.20m in thickness at depths of approx. 16 to 27m bgl;
- Past (deep) underground mining – the site lies in an area that could be affected by underground mining in 2no. seams of coal at shallow to 140m depth, and last worked in 1966; and
- Mine entries – Shaft Ref: 293205-019, located at Grid (NGR 293502, 205776) in the centre of the site. This mine entry may have been partially or wholly excavated during past opencast mining.

3 COAL MINING DESK STUDY

3.1 Introduction

A review of available information has been undertaken to establish the historical development of the site in relation to coal mining activities and to ascertain their influence on current and proposed future site development. The following sources of information have been used within the review:

- RSK, Preliminary Risk Assessment: Rhigos Road, Merthyr Tydfil Solar Farm Scheme, Ref. 315223 R01(01), August 2022;
- Coal Authority Consultants Mining Report, The Coal Authority, reference 51003193792001, dated 20 June 2022 (Appendix C);
- Coal Authority Interactive Viewer (www.mapapps2.bgs.ac.uk/coalauthority/home) accessed on the 23 August 2022;
- Coal Authority abandoned mine catalogue plans (Appendix D);
- BGS, Geological Survey of England and Wales 1:63,360/1:50,000 geological map series, Sheet 231 Merthyr Tydfil, solid geology, 1979; and
- BGS, Geological Survey of England and Wales 1:63,360/1:50,000 geological map series, Sheet 231 Merthyr Tydfil, drift geology, 1979; and
- BGS historical borehole records (Appendix E).

Composite drawing, Drawing 32404/C01, combines selected information from the Coal Authority including the Ffyndaff opencast and historical underground mineworkings with the proposed development layout.

3.2 Coal Authority information

A Consultants Coal Mining Report (CCMR), Ref. 51003193792001, dated 20 June 2022 is included in Appendix C. Mine abandonment plans obtained from the Coal Authority's abandoned mine catalogue are included in Appendix D. These sources of information have been reviewed in conjunction in order to assess the coal mining risks at the site.

3.2.1 Identified coal mining risks

A summary of the potential risks associated with coal mining that are applicable to the site are shown in Table 2.

Table 2: Identification of site-specific coal mining features

Coal mining feature	Present on site	Comments
Past underground mining (recorded at shallow depths)	Yes	The site is reportedly underlain by shallow mineworkings in the Gellideg Fireclay (extracting fireclay and ironstone), the Little Blue Ironstone, and the Gellideg Ironstone. All four of these workings are reported to be between 1.10 and 1.20m thick and are located between 16 and 27m of ground level.
Probable unrecorded shallow workings	No	The Coal Authority determines the presence of probable unrecorded shallow workings to be <i>"None."</i>
Mine entries	Yes	One mine entry (shaft), Coal Authority Ref. 293205-019, is recorded within the site centre at 293502 205776. The Coal Authority states that <i>"This mine entry may have been partially or wholly excavated during past opencast mining."</i> There may be additional mine entries in the local area which the Coal Authority has no knowledge of.
Outcrops	Yes	The Coal Authority holds records of 19no. coal seam outcrops within the site boundary and a further record of one seam outcropping 27.7m west of the site; of these, nine are recorded as <i>"workable."</i> These 20no. seams pertain to nine named seams: the Five Foot, the Gellideg, the Lower Nine Foot (Top Leaf), the Middle Bute Leaf, the Seven Foot Rider, the Upper Gellideg, the Upper Seven Foot, the Yard, and the Yard (Meadow).
Geological faults, fissures, and breaklines	Yes	Data presented by the Coal Authority indicates they are not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining. A number of faults are recorded within the site area. Two faults, orientated approx. east west, bisect the site, and connect in a 'horsetail' arrangement off-site west; these faults are split by another fault orientated approx. north-west south-east that also passes through the site centre. A fourth fault, also orientated north-west south-east, passes through the south-westernmost corner of the site area only.
Opencast mines	Yes	The site is located wholly within the boundary of an <i>"unlicensed opencast site."</i> Coal Authority data records this site as <i>"95/0065/C Ffyndaff."</i>
Mine gas	No	The Coal Authority holds no records of mine gas <i>"within 500 metres of the enquiry boundary."</i>

Coal mining feature	Present on site	Comments
Coal mining subsidence	No	The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994. There is no current Stop Notice delaying the start of remedial works or repairs to the property. The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

The Coal Authority CCMR also reports a spine roadway at shallow depth within the site area, as well as a previous investigation area located 48.0m west of the site.

Where risks identified in Table 2 require assessment, this is provided in subsequent sections of this report.

3.2.2 Past underground mining

The CCMR states that the proposed development area lies within a surface area that could be affected by underground mining in three non-coal seams. Minerals within these seams have been extracted in four workings, between 16 and 27m depth, the last worked of which ceased in 1856:

- Gellideg Fireclay, extracting fireclay (Ref. 4GMF) – located approx. 16m beneath the site and dipping by approx. 5.1° to the south, the extraction thickness within the working is reported to be approx. 1.20m. The seam was last worked in 1856 as part of an unnamed/unknown colliery operation;
- Gellideg Fireclay, extracting ironstone (Ref. 4GMG) – located approx. 20m beneath the site and dipping by approx. 6.7° to the south, the extraction thickness within the working is reported to be approx. 1.20m. The seam was last worked in 1856 as part of an unnamed/unknown colliery operation;
- Little Blue Ironstone, extracting ironstone (Ref. 4GNS) – located approx. 24m beneath the site and dipping by approx. 7.1° to the south, the extraction thickness within the working is reported to be approx. 1.20m. The seam was last worked in 1848 as part of an unnamed/unknown colliery operation; and
- Gellideg Ironstone, extracting ironstone (Ref. 4GME) – located approx. 27m beneath the site and dipping by approx. 5.8° to the south, the extraction thickness within the working is reported to be approx. 1.10m. The seam was last worked in 1850 as part of an unnamed/unknown colliery operation.

The CCMR indicates that a spine roadway is present within the site area, although it does not provide an indicative location of the roadway.

3.2.3 Coal Authority mine entry data

The Coal Authority Consultants Report identifies a single shaft to be located on-site for the extraction of coal. Details of the recorded shaft is presented in Table 3.

Table 3: Coal Authority recorded mine entries

Entry type	Coal Authority Ref.	Position	Treatment description
Shaft	293502-019	293502 205776	This mine entry may have been partially or wholly excavated during past opencast mining.

The shaft is located in the centre-north of the site, close to the Y-shaped intersection between the northern, eastern, and central fields and within the proximity of one of the proposed east west orientated solar arrays. Further detail of the shaft is presented in Section 4.2.

3.2.4 Abandoned mine plan catalogue numbers

The Coal Authority CCMR identifies the following mine plan catalogues to intersect with some or all of the site boundary.

Table 4: Abandoned mine catalogue plan

16541	SWR2753	16617
SWR2462	SWR2468	16616
SWR2466		

The plans from these catalogues that are relevant to the site were obtained from the Coal Authority and are discussed in Section 3.3. The plans are presented in Appendix D.

3.2.5 Geology

The CCMR indicates that coal outcrops are located primarily within the site centre and north in an approx. east west orientation. A total of 19no. seams are understood to be located within the site area, with a further seam located approx. 27.7m off-site to the west. These 20no. seam outcrops are understood to relate to nine discrete coal seams which have split, whether naturally into leaves or by faulting, details of which are presented in Table 5, below.

Table 5: Coal seam outcrops

Seam name	Workable?	Distance (m)	Direction	Bearing of outcrop (°)
Five Foot	Yes	Within	n/a	103
	Yes	Within	n/a	266
Gellideg	Yes	Within	n/a	263
Lower Nine Foot (Top Leaf)	No	Within	n/a	102
	No	Within	n/a	262
	No	Within	n/a	262
Middle Bute Leaf	Yes	Within	n/a	237
Seven Foot Rider	No	Within	n/a	87

Seam name	Workable?	Distance (m)	Direction	Bearing of outcrop (°)
	No	Within	n/a	107
	Yes	Within	n/a	262
	No	Within	n/a	265
Upper Gellideg	Yes	Within	n/a	257
	Yes	27.7	West	270
Upper Seven Foot	No	Within	n/a	269
	No	Within	n/a	299
Yard	Yes	Within	n/a	267
	Yes	Within	n/a	286
Yard (Meadow)	No	Within	n/a	102
	No	Within	n/a	266
	No	Within	n/a	296

The locations of these seams are presented in the 'Summary of findings' drawings supplied within the CCMR, which is included in Appendix C.

The CCMR indicated that the Coal Authority they are not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining. However, the CCMR does present records of a number of faults within the site area. Two faults, orientated approx. east west, bisect the site, and connect in a 'horsetail' arrangement off-site west; these faults are split by another fault orientated approx. north-west south-east that also passes through the site centre. A fourth fault, also orientated north-west south-east, passes through the south-westernmost corner of the site area only. The larger fault (north-west south-east) is reported to be the Hirwaun No. 2 cross-fault, dipping by approx. 55° south-west, and displacing the south-western block by up to 28m (Gayer *et al.*, 1995).

3.2.6 Investigative or remedial activity

The report confirms that the Coal Authority has not received a damage notice or claim for the site or any property within 50m of the site boundary, since 31 October 1994. Similarly, there is no Stop Notice delaying the start of remedial works or repairs to the site and the Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under Section 33 of the Coal Mining Subsidence Act 1991.

No mine gas issues are recorded within 500m of the site and there are no recorded mine water treatment schemes also within 500m of the site. There are no remediated sites listed within 50m of the site boundary.

The Coal Authority does hold one record of an investigated site, however, which is located approx. 48.0m to the west of the site area. No further information on this feature has been

provided beyond the statement: *“The site is within an area of previous interest. It is close to where the Coal Authority has received information relating to past site investigations. The site requires further investigation and may influence how you approach your risk assessment.”* The location of this investigated site is presented in the ‘Summary of findings’ drawings supplied within the CCMR, which is included in Appendix C.

3.2.7 Licensing and future mining activity

There are no licensed coal mining activities within 200m of the site and no future licensed mining activities are recorded. The Coal Authority confirms the site is not within an area where a notice to withdraw support has been given and no notices stating that the land is at risk of subsidence have been given under Section 46 of the Coal Mining Subsidence Act 1991. The site is not within an area where a notice has been given under section 41 of the Coal Industry Act 1994, or within an area where a relevant notice has been published under the Coal industry Act 1975 / Coal Industry Act 1994.

3.3 Coal Authority mine abandonment plans

A total of three mine abandonment plans held by the Coal Authority were available relating to the coal workings beneath the site. These are for mineworkings in a number of coal seams:

- AMC No. SWR2462: Knobby Vein Ironstone and Blue Vein Ironstone seams, and the Little Blue Veins, Black Vein, Rhyd Vein, and Rosser Vein seams;
- AMC No.16616: Red Vein, Nine Feet, and Bute seams; and
- AMC No.16617: Red & Six Feet (Upper), Six Feet (Lower), Nine Feet, Nine Feet Repeat, Bute, New, Yard (Upper), Yard (Lower), Seven Feet (Upper), Seven Feet (Lower), Five Feet (Upper), and Five Feet (Lower) seams.

The abandonment plans are included within Appendix D. However, it should be noted that the original plans often had few above ground features, and the accuracy of the transposition cannot be guaranteed. It should also be noted that these plans present the extent of workings at specific survey dates and workings beyond these limits may have been carried out at other times. The abandonment plans have been reviewed and the key findings are provided in Table 6 and discussed in further detail below.

Table 6: Coal Authority abandonment plans reviewed

Coal Authority abandoned mine plan reference	Document Title & Date	Comment on extent of workings in relation to the site
SWR2462 (Sheets 1-3 of 4)	Rhygos Mine Level Mine plan dates unclear, most recent recorded date is 1850	Mine plans consist of two large scale plans of the Knobby Vein Ironstone and Blue Vein Ironstone workings, and a larger untitled map consisting of these two workings and a large-scale extension of the mine to the south and south-west. The Knobby and Blue Vein plans are titled Rhygos Mine, while the Knobby Vein plan

Coal Authority abandoned mine plan reference	Document Title & Date	Comment on extent of workings in relation to the site
		also suggests the workings are part of the Hirwaun Iron Works. Level data is given from trial pits and air pits within the Knobby Vein, with the working depth ranging from 11-yards (~10m) in the north and 32.5-yards (~30m) in the south, a feature that is consistent with the dip direction reported by the Coal Authority. The Knobby Vein subcrop is also recorded to the nearby north of the workings with some possible adit features in the centre north. Levels in the Little Blue Veins are less clear, although one level record at a trial pit suggests it is ~18-yards (~16m) in the centre north. A further phase of workings in an unnamed seam extends further south with no record of level or date data. The maps do not contain any above-ground features that can be correlated to any available historical OS maps and, as such, they cannot be accurately positioned beneath the site boundary. Based on the Coal Authority interactive viewer (extract provided in Plate 1), it appears as if the plans pertain to a region stretching from approx. 0.8km west and 0.2km north, progressing south and east to underlie the north-western corner of the site area.
16616 (Sheets 1-2 of 2)	Ffyndaff Mine plans dated "Early 1950's Site" but operational dates are recorded as "Not known"	Mine plans indicate the extent of the mining at Ffyndaff opencast mine as of the early 1950s, where the Red Vein, Nine Feet, and Bute seams had all been extracted. The stratigraphic succession is given as the Red Vein, over the Nine Feet, over the Bute seam. Overburden and backfill data is given as comprising of "opencast backfill, mudstone, and sandstone." Overlay of the current site boundary suggests that workings in all three seams will underlie the site, with opencast excavation taking place in the site south, starting just north of the 205600 northing reference line.

Coal Authority abandoned mine plan reference	Document Title & Date	Comment on extent of workings in relation to the site
		The lowest point of excavation of each seam is the only level recorded, although all of these were measured south of the development site and will, therefore, be lower than those within the site. The recorded excavation depths in the Red Vein is 632.2ft, 692.0ft in the Nine Feet, and 701.2ft in the Bute, loosely corresponding to depths of approx. 67, 37, and 27m below the previous ground level based on the limited plan data. The position of a shaft is given in the notes of the drawing with co-ordinates 292282, 206012 and a length of 217.05m. The shaft is not recorded on the map itself. The co-ordinates plot the location of the shaft approximately 1.3km to the west of the site on the northern outskirts of the village of Rhigos.
16617 (Sheets 1-4 of 4)	Ffyndaff Mine plans record "Coaling commenced July 1981" and "Coaling ceased Sept 1988."	Mine plans indicate the extent of the mining at Ffyndaff opencast mine as of closure in 1988, where 13no. seams have been worked. The stratigraphic succession is given as, in descending order, Red, Six Feet (Upper and Lower), Nine Feet Repeat, Nine Feet, Bute, New, Yard (Upper and Lower), Seven Feet (Upper and Lower), and the Five Feet (Upper and Lower) seams; however, it appears as if only the New, Yard (Upper and Lower), Seven Feet (Upper and Lower), and the Five Feet (Upper and Lower) seams have been worked within the development boundary, with the location of the fault to the off-site west displacing the seam and forcing a pause in the east west progression of workings. Overburden and backfill data is given as comprising of "opencast backfill, mudstone, and sandstone." Overlay of the current site boundary places almost the entirety of the proposed development site as within the confines of the opencast mine as marked by the perimeter of batter. The very northernmost reaches of the site are understood to lie outwith the opencast mine perimeter,

Coal Authority abandoned mine plan reference	Document Title & Date	Comment on extent of workings in relation to the site
		although it is estimated that these will comprise less than 5% of the site area. The lowest point across the entirety of the mine is recorded approx. 475m west of the site south-west. These excavations are recorded to be in the Five Feet (Lower) seam and are at an elevation of 149.9m, a value which is loosely interpreted to be approx. 100m below the previous ground level based on the limited plan data. The lowest point is also recorded around the perimeter of the workings within each seam, but the elevation of or depth from ground level is not provided for comparison. The position of a shaft is given in the notes of the drawing with co-ordinates 292282, 206012 and a length of 217.05m. The shaft is not recorded on the map itself. The co-ordinates plot the location of the shaft approximately 1.3km to the west of the site on the northern outskirts of the village of Rhigos. On the Red and Six Feet (Upper) seam workings plan a shaft is shown approximately between 292200, 204500 and 292800, 205200 which has been labelled as "Gwrangon Air Shaft. 5.6m Dia. Destroyed and Filled March 1981 Clay Sealed at 246.5m" (elevation, at what is understood to be approx. ground level). This shaft is located approx. 800m south-west of the site.

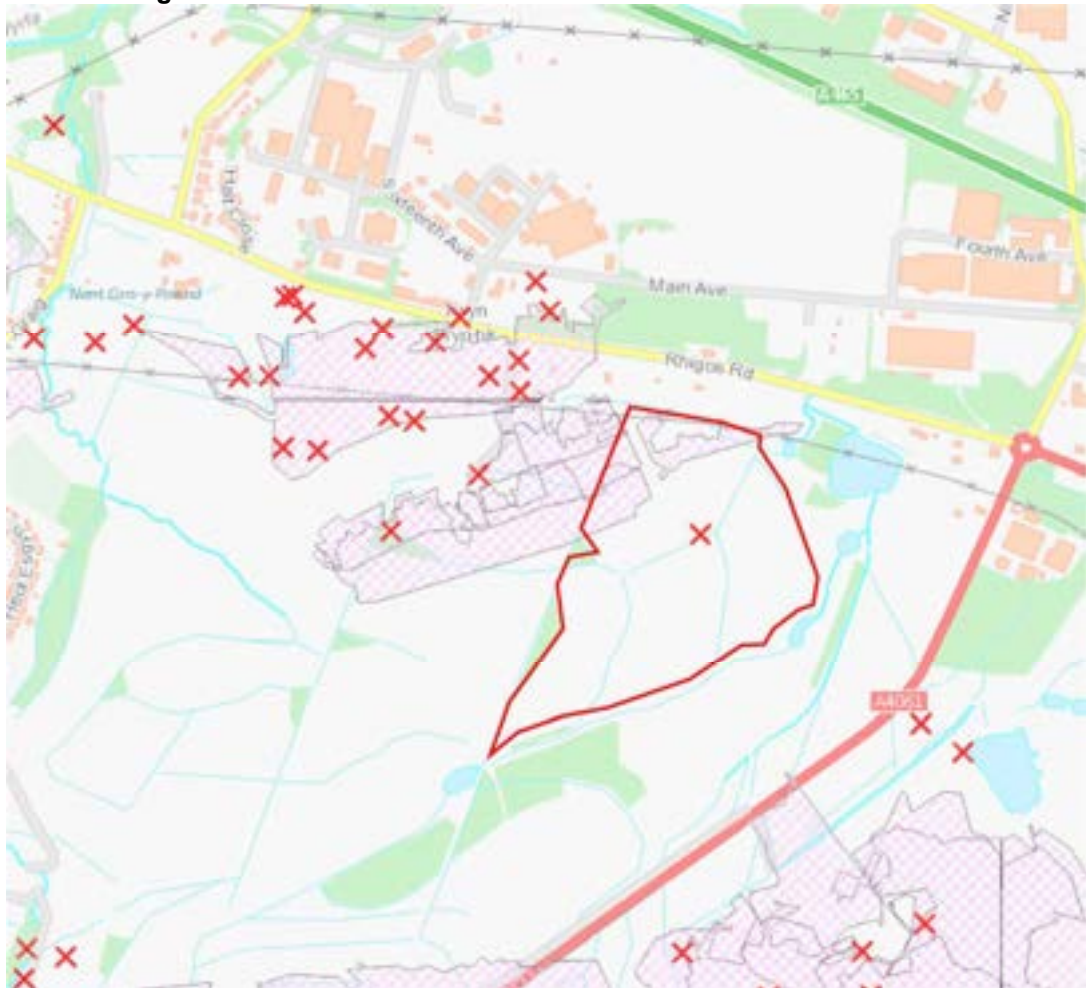
Plate 1, overleaf, contains an extract from the Coal Authority interactive viewer depicting the location and extent of the underground mineworkings c. 1850. The mineworkings, presented in hatched, pink shading, appear to progress from the west-north-west in a south-easterly direction until they underlie the north and north-western reaches of the site area. The arrangement and shape of the overlay appears generally consistent with those provided in the abandonment plan SWR2462 and suggests that the on-site mine entry is not related to the underground mineworkings. Additionally, the mineworking reference codes provided on the interactive viewer correlate to those provided in the CCMR for the non-coal workings discussed in Section 3.2.2, from which an indication of depth to workings has been provided by the Coal Authority.

In total, the Coal Authority has provided three mine abandonment plans relating to the site, all of which indicate mining to have occurred beneath parts of the site. Plan SWR2462 indicates that underground mining of ironstone and fireclay has occurred in the site north and north-west only, while plan 16617 indicates that opencast mining has occurred across

more than 95% of the site area, omitting only the far north of the site; plan 16616 indicates opencast mining within the confines of the 16617 plan and, as such, is considered to have been 'overwritten'.

Comparing the overlay image presented in Plate 1, overleaf, and opencast plan 16617 presented in Appendix D, it is interpreted that the majority of region of the site subject to underground mining will have been excavated during opencast workings. However, a small region in the far north of the site appears to have been undermined and not excavated during opencast workings, indicating that mining voids and ground stability hazards may still be active in this area.

Plate 1: Coal Authority interactive viewer extract showing the extent of underground mineworkings in relation to the site area



Note: Active filters included in the extract comprise: Mine Entry, Parent Phase, and Underground Working.

3.4 British Geological Survey information

3.4.1 Borehole records

The BGS holds records of three boreholes located within 250m of the site boundary. Of these, one is marked confidential, and another has been "transferred to opencast collection," leaving only borehole SN90NW112 as within 250m of the site and accessible as part of this study. Boreholes SN90NW110, 111, and 113 are all located adjacent east

of 112; borehole SN90NW113, the deepest of these, has also been considered for assessment. A copy of these borehole logs are provided in Appendix E.

The geological sequences recorded from the on-site boreholes are as presented in Table 7, below.

Table 7: BGS borehole data

Borehole ID	Length (m bgl)	Location	Geological Succession
SN90NW112	9.0	245m E	0.0 to 1.0m – Dense grey shale and ash FILL 1.0 to 2.0m – Soft dark brown grey clayey PEAT 2.0 to 4.5m – Soft to firm grey brown silty sandy CLAY with sandstone gravel and occasional cobbles 4.5 to 8.0m – Firm to stiff grey laminated CLAY with sandstone gravel and occasional cobbles 8.0 to 9.0 – Weak light grey laminated MUDSTONE
SN90NW113	12.0	330m E	0.0 to 1.0m – Dense grey shale and gravel FILL 1.0 to 2.0m – Soft brown grey clayey PEAT with some fine shaley gravel 2.0 to 3.0m – Soft brown grey to grey clayey PEAT 3.0 to 7.0m – Soft to firm grey brown silty sandy CLAY with limestone and sandstone gravel and occasional cobbles 7.0 to 8.0m – Firm to stiff brown mottled slightly laminated CLAY with gravel and cobbles 8.0 to 9.0m – Stiff brown with some orange laminated CLAY 9.0 to 10.5m – Hard brown clayey SAND with some medium to fine gravel 10.5 to 12.1m – Hard brown orange and grey mottled highly laminated MUDSTONE

In summation, the available BGS borehole records detail a thin Made Ground (fill) layer, over peat, over superficial (drift) deposits appearing to consist solely of Till. Underlying the Till from 8.0 to 10.5m is reported to be laminated mudstone, interpreted to represent Coal Measures Formation deposits. Given this, it is considered that the parts of the site that were not subject to opencast mining (see Table 6) may be underlain by a soft peat layer approx. 1.0 to 2.0m thick over Till. These boreholes are, however, located distally from the site area and are relatively shallow in completion depths and, given the nature of the on-site geology (a backfilled opencast mine), cannot be considered analogous of the current on-site conditions.

3.5 Other workings

Excluding the non-coal mining discussed in Section 3.2.2, no further evidence has been provided by the Coal Authority which indicates that other mineral extraction has taken place beneath the site.

4 ASSESSMENT OF SITE-SPECIFIC COAL MINING RISKS

4.1 Worked seams – underground mining

Available Coal Authority records provided within the CCMR indicate that there are no underground workings of coal beneath the site. However, four workings in three non-coal seams have been identified within the site sub-surface. The Coal Authority indicate that unrecorded shallow workings (within 30m of the surface) are not probable.

The following non-coal seams are reportedly present at shallow depth beneath the site:

- Gellideg Fireclay, extracting fireclay at a depth of 16m, with working thickness of 1.20m, dipping by 5.1° to the south;
- Gellideg Fireclay, extracting ironstone at a depth of 20m, with working thickness of 1.20m, dipping by 6.7° to the south;
- Little Blue Ironstone, extracting ironstone at a depth of 24m, with working thickness of 1.20m, dipping by 7.1° to the south; and
- Gellideg Ironstone, extracting ironstone at a depth of 27m, with working thickness of 1.10m, dipping by 5.8° to the south.

The Coal Authority information on past underground mining includes specific depth information for each seam; although helpful, this can only be used for general guidance as the coal seams dip across the subject site and will be present at a range of depths from up-dip to down-dip. Details taken from Coal Authority records indicates the strata dip to the south between 5.1 and 7.1°. The Coal Authority also provide information on extraction thicknesses for worked seams, which should also be considered indicative.

Abandoned mine catalogue data suggests that the northern reaches of the site have been undermined, although the extent and depths of which are not known as a result of the poor quality of the mine plan and lack of recorded levels. As such, it is pertinent to consider that the 'worst-case' scenario is present, and that the mineworkings undermine the site north at shallow depths and are minerally unstable.

In general, where worked, these seams would require significant cover of rock and superficial soils to be present to ensure that any collapse would not migrate upwards and disturb foundations or the ground surface. It is generally considered that a cover of competent rock strata equivalent to ten times the height of the worked seam provides adequate protection against ground instability. Less rock cover can be adequate in certain circumstances (e.g., if the rock is very strong). Drift deposits give less protection than competent rock, with competent superficial soils considered to provide half the protection as rock; relying on superficial soils to provide competent cover is predicated on at least 80% of the total competent cover is comprised of rock, i.e., a 1m thick working would require at least 8m of competent rock cover to consider any amount of superficial cover sufficient (CIRIA C758: "the Coal Authority adopts the rule of thumb that the rock cover contribution should be in excess of 80 percent").

As no deep borehole logs within relevant distance of the site area were publicly available, it is not possible to interpret the sub-surface structure beyond rockhead. The BGS

boreholes drilled approx. 250m east of the site recorded rockhead between 8.0 and 10.5m, and that the material encountered at rockhead was a weak laminated mudstone. As such, it is interpreted that engineering rockhead is likely found at greater depths and that a reasonable proportion of the bedrock strata at rockhead will be weathered and not deemed 'competent.'

Given the recorded thicknesses of the non-coal seam workings, 12.0m competent cover will be required overlying the Gellideg Fireclay (both workings) and the Little Blue Ironstone, and 11.0m competent cover will be required overlying the Gellideg Ironstone. Factoring in their reported depth, the estimated depth to rockhead, and unknown thickness of the weathered horizon, it is pertinent to consider all of these workings as minerally unstable and a potential ground stability hazard until proven otherwise.

Where seams have been worked at shallow depths, if the workings do collapse the overlying rock and superficial cover will provide some protection. Even in a 'worst-case' scenario where progressive upwards collapse may reach the ground surface, rock and superficial soils will likely 'break off' during collapse and fill the underlying void, bulking-up as they do so and accommodating most of the progressive collapse, resulting in relatively small settlements at the ground surface; such a mechanism is only plausible where the seams are worked at mostly shallow depths (i.e., immediately down-dip of subcrop). Given the Knobbly Vein subcrop is recorded outwith the site north on mine plan SWR2462 and the inferred stratigraphy suggests that the Knobbly Vein is the 'highest' seam mined, it is interpreted that the subcrop of the non-coal seams mined beneath the site area will lie off-site: as such, it is considered unlikely that this scenario is active.

Given the use of the majority of the site for opencast mining of coal in the 1950s and 1980s, discussed further in Section 4.3, it is interpreted that any shallow underground mining features located within the footprint of the opencast workings may have either been excavated as part of the opencast workings, or underly the opencast workings. Based on the estimates of the maximum excavation depth discussed in Section 4.3, it is assumed that the latter scenario would apply: that historical underground mines are located beneath the opencast workings, and that the workings are most likely no longer void. Given the ground loading and removal of competent cover overlying the mineworkings undertaken as part of the opencast coal mining it is considered probable that, should the mines have been void at the time of opencast mining, they would have collapsed as a result of the opencast mining. As such, it is tentatively considered that these mineworkings are minerally stable, but that those located to the far north of the site area and outwith the footprint of the opencast mine are likely a ground stability hazard.

4.2 Mine entries

Records from the Coal Authority CCMR, the interactive viewer, and from the abandoned mine catalogue indicates there is a single mine entry located on-site, positioned approx. in the centre-north of the site. The mine entry is listed as shaft ref. 293502-019, and has an assumed diameter, provided by the Coal Authority, of 2.5m and a departure of 8 m. The departure is the assumed positional accuracy accorded to the shaft by the Coal Authority. The Coal Authority reports that *"this mine entry may have been partially or wholly excavated during past opencast mining."*

It should be noted that this shaft does not appear to be linked to the past non-coal underground mining c. 1850, discussed in Section 4.1. As such, it is interpreted that shaft 293502-019 may have been an exploratory or investigative feature, such as a bell pit, excavated prior to the opencast mining to determine depth to and quality of the underground coal seams. This would appear consistent with the fact that the Coal Authority records the mine entry as *“partially or wholly excavated during past opencast mining,”* and the fact that it is not recorded on mine abandonment plans 16616 or 16617.

The shaft is now buried beneath the backfill used to restore the opencast mine, RSK estimate the depth of cover (restored material) to be the difference between the current topographical level of the shaft location and the depth to the base of the open cast pit at the location of the shaft. The current topographical level of the shaft location is estimated to be 230 m AOD based on drawing provided to RSK ‘Regener8 Power – UAV SURFACE TOPOGRAPHY Rhigos Project in Mid Glamorgan, UK (Rev 1.0 dated 13th May 2022)’. The depth to the base of the open cast pit (rockhead) has been taken from Coal Authority completion drawings referenced 16617/1 to 16617/4 and dated March 1995. The lowest coal seam worked within the pit is the Five feet (Lower). At the approximate position of the shaft the Five feet (Lower), assumed to be the base of the pit, is estimated to be at 198 m AOD. Therefore, it is estimated that there is 32 m of cover (restoration material) above rockhead at the location of the shaft.

4.3 Opencast workings

Data provided within the CCMR indicates that there 19no. coal outcrops (nine seams) beneath parts of the site and one, 27.7m west of the site. In addition, four workings in three non-coal seams have also been identified within the on-site sub-surface. The Coal Authority indicate that unrecorded shallow workings within these seams (within 30m of the surface) is not likely.

The following coal seams are reportedly present beneath the site:

- Five Foot, with three workable seams within the site-area and outcrop bearings of 103, 263, and 266°;
- Gellideg, with one workable seam within the site area and an outcrop bearing of 263°;
- Lower Nine Foot (top leaf), with no workable seams (of three) within the site-area;
- Middle Bute leaf, with one workable seam within the site area and an outcrop bearing of 237°;
- Seven Foot Rider, with one workable seam (of four) within the site-area and outcrop bearings of 87, 107, 262 (workable), and 265°;
- Upper Gellideg, with one workable seam within the site-area and a second located 27.7m outwith, and outcrop bearings of 257 and 270°, respectively;
- Upper Seven Foot, with no workable seams (of two) within the site area;
- Yard, with two workable seams within the site-area and outcrop bearings of 267 and 286°; and
- Yard (Meadow), with no workable seams (of three) within the site-area.

Available abandoned mine catalogue records suggest that a number of seams were worked as part of opencast mining operations, the first phase of which occurred in the 1950s and the second in the 1980s.

Coal seams worked by opencast methods in the 1950s (mine plan 16616), in stratigraphic order, include:

- Red Vein seam (top);
- Nine Feet seam; and
- Bute seam (base).

Coal seams worked by opencast methods in the 1980s (mine plan 16617), in stratigraphic order, include:

- Red & Six Feet (Upper) seam (top);
- Six feet (Lower) seam;
- Nine Feet Repeat seam;
- Nine Feet seam;
- Bute seam;
- New seam;
- Yard (Upper) seam;
- Yard (Lower) seam;
- Seven Feet (Upper) seam;
- Seven Feet (lower) seam;
- Five Feet (Upper) seam; and
- Five Feet (Lower) seam (base).

Based on the footprint of the 16616 and 16617 mine abandonment plans, it appears that 16617 is the second phase of the workings and incorporates the entirety of the footprint of 16616 within it. As such, the data provided in 16617 is considered to be the most complete and representative of the final extent and depth of the opencast mineworkings.

The lowest point of excavation (LPE) in the mine is located within workings in the Five Feet (Lower) seam, approx. 475m off-site west, at 149.9m above Newlyn Datum (AOD); this position is located on the downthrown block of the Hirwaun No. 2 cross-fault and is understood to have been vertically displaced by up to 28m relative to the fault footwall (Gayer *et al.*, 1995). This estimate of the fault displacement is generally consistent with the elevation data provided in mine plan 16617, which shows 20 to 28m of elevation displacement across the fault. A better approximation for the maximum depth of workings within the site area can be obtained from the 'bottom of coal level' for the lowest seam, the Five Feet (Lower), where the minimum elevation is approx. 160m AOD, adjacent off-site south. Referencing this against the historical ground level data recorded on mine plan 16616 in this position (approx. 770 feet AOD) gives a maximum depth of excavation of approx. 74m, a value consistent with the 70m reported by Gayer *et al.* (1995).

In the site north, a similar method of depth estimation cannot be undertaken as historical ground levels are not available across the entirety of the site area. If the ground is considered to be approx. flat lying, then it could be assumed that the depth to workings would be approx. 17m within the site north; however, the site is not flat lying, with historical ground level data suggesting that the ground surface slopes down to the north-east. Given that there is no recorded abnormal change in elevation across the site area, it is considered that the historical elevation of ground level is roughly consistent with that of the present-day; within the vicinity of the shallowest workings in the site north (approx. 217m AOD) ground level is approx. 220m AOD, suggesting that the depth to the base of the workings is approx. 3m bgl in this region, i.e., the opencast mine worked the seam to outcrop/subcrop.

The opencast site has been backfilled since completion, with completion records on mine plans suggesting backfilling materials consisted of: opencast backfill, mudstone, and sandstone. While some volume of material will have been lost from the stratigraphic column through the extraction of coal, the redeposited materials will have bulked up in comparison to the compressed deposits from which they were excavated, as evidenced by the lack of a marked change in elevation between the former opencast mine site and the surrounding land. Given the proposed development plans, it is considered unlikely that any of the on-site structures will contribute significant loading to the ground surface to cause additional compression and settlement within the backfill deposits. However the site might still be subject to long term self-weight settlement within the backfill materials themselves, although the majority of this is likely to have taken place during backfilling works in the past, provided groundwater level rebound rise is not occurring with the backfill causing collapse settlement over the longer term. The exception to this may be the transformer stations, enclosures for customer switchgear and DNO; and any large machinery (cranes or piling rigs) used to traverse and construct the development. Given the potential loads imposed by the transformer stations and equipment within the enclosures on to the ground and the nature of the sub-surface (backfilled materials), it is thought that a spread concrete pad / or reinforced concrete raft may present the best option for foundations for these structures to minimise and evenly spread imposed loads and minimise the impacts of the long term self-weight settlement of back fill materials, however the foundation solution should only be confirmed once an appropriate ground investigation has been undertaken.

Given these facts, the assumed accuracy of the abandonment plans dating from the 1950s (16616) and 1980s (16617), and the nature of the current development proposals, it is thought that the development as currently planned is at low to moderate risk from hazards pertaining to former opencast mining. However, should development plans change and permanent buildings or structures with foundations are to be developed on site, the ground conditions would present a more significant risk and geotechnical assessment work would be required to be completed.

4.4 Coal mining gases

Although underground mineworkings are present beneath parts of the site these pertain to ironstone and fireclay, and not coal. These underground mineworkings are believed to be at least partially interconnected through a series of mine tunnels which are indicated on the abandonment plans. The Coal Measures deposits are a known source of

hazardous ground gases, including carbon dioxide (asphyxiant) and methane (flammable, explosive), and shallow workings may provide preferential migration pathways.

It is understood that current development plans include the construction of solar panel arrays with four associated transformer stations, customer switch gear and DNO enclosures. Based on the current layout, proposed new infrastructure within the footprint of the underground mines is limited to solar arrays. Given the solar panels will likely each be founded on shallow C - section steel piles (1.5 – 3m max depth), it is not anticipated that they will create a gas migration pathway through their emplacement, wherever situated on site. The transformer stations and other equipment are assumed to be sited on spread concrete pad or raft foundations, which will prevent or minimise the possibility for explosive gases to accumulate beneath; however, it is not anticipated that these structures will be in locations with a potentially active migratory pathway and the structure itself is likely to be well ventilated and all penetrations could be sealed if required if a risk was identified.

Based on the above information, and the currently development layout plans, it is considered that the risk from potential mine gas is low. However, should development plans change and permanent buildings or structures with foundations are to be developed on site, the ground conditions may present a more significant gas risk and ground gas assessment work would be required to be completed.

5 MITIGATION STRATEGY

The CMRA completed in the preceding sections of this report has concluded that there may be possible coal mining risks from the past shallow underground mineworkings for ironstone and fireclay associated with long term former opencast site backfill self-weight settlement. However, the actual risk will be dependent on the end use of the site and the sensitivity of the proposed development to possible ground settlement.

The proposed development (see Appendix B) includes a widespread array of solar panels together with a four transformer stations, a customer switch gear enclosure and a DNO enclosure, fencing, and an access track.

The solar arrays are a series of sectional, approx. 4.8m long, photo voltaic (PV) solar panels which are typically supported on an array of shallow (1.5 – 3m long) C section steel piles on an approx. 6.0m spacing. The panels are supported at an approx. elevation of between approx. 0.8m and 2.8m above ground level and are tilted above horizontal by approx. 25°. The above-ground construction requires the solar panels to have some flexibility and they are not particularly sensitive to ground surface settlement and maybe adjusted on the above ground structural frames. Their nature allows easy and open access for adjustment, maintenance and repair.

There are four proposed transformer stations comprise a cabinet (2.6 m x 1.1 m in plan) and a fenced compound (4.5 m x 4.0 m in plan) to contain electrical equipment. In addition, two enclosures will be located in the eastern extent of the site; one will contain a cabinet (3.1 m x 2.8 m in plan) for customer switchgear; and the second will contain a cabinet (3.6 m x 2.5 m in plan) for the DNO. Foundation requirements for these structures are not known. Both the transformer stations; customer switchgear cabinet and the DNO cabinet are assumed to comprise well-ventilated structures and containers, anticipated to be lightly loaded structures. These would typically be placed on concrete slabs or reinforced concrete rafts which are typically constructed over a layer of compacted sub-grade gravel, although these details have yet to be confirmed. These structures would typically impose very low spread loads to the ground and accommodate small to moderate ground settlement before remedial works would be required.

The solar panels are open, and the stations / cabinets are well ventilated spaces and if formed upon solid concrete pads or reinforced concrete rafts with sealed entries will not have any potential pathways into the stations and housings for ground gas, if present. In addition, these are considered to be at very low risk from any hazardous gases derived from underground coal mining as the nature of the open cast backfill is likely to be predominantly cohesive compacted fill and would represent a very thick very low permeability media which is unlikely to provide a pathway for gas migration up to the development area at surface should any former workings at depth be sources of mine gas. Consequently, no further consideration of mine gas risk or mitigation is considered to be required.

Aspects of coal mining discussed in this CMRA, which may pose a risk to the proposed development of the site, are covered in turn below.

5.1 Worked seams – underground mining

There are very limited parts of the site where the ground surface would be considered to be at risk of disturbance (settlement) from collapse and upward void migration of shallow underground mineworkings (ironstone and fireclay). Those areas that appear to underlie the historical opencast mineworkings which, if they were susceptible to collapse, would most likely have done so during the opencast workings when the competent cover was being stripped and machinery loading would have taken place.

The shallowest underground mining to have taken place beneath the site area is located to the far north of the site, outwith the footprint of the opencast mine. Based on the current layout, no development is proposed for this area i.e. outwith the perimeter of batter of the opencast workings. Regardless of this, it would be considered beneficial to undertake ground investigation works within the perimeter of batter in the north and north-western site area to confirm whether or not risks of potential ground instability are present with respect to underground mineworkings if development is planned in or close to these areas. The aim of the investigation would be to determine the depth to rockhead, engineering rockhead, base of opencast workings, and depth to underground mineworkings where within influencing distance of the ground surface.

5.2 Mine entries

A single mine entry is located on-site, positioned approx. in the centre-north of the site. The mine entry has an assumed diameter of 2.5m and a departure (Coal Authority measure of accuracy) of 8m. The Coal Authority reports that “this mine entry may have been partially or wholly excavated during past opencast mining.” There are no records to indicate that the mine entry has been treated (capped).

Coal Authority policy is that building over the top of, or in close proximity to, mine entries should be avoided wherever possible, even after they have been capped. Given the relatively low sensitivity of the proposed structures (solar arrays) with their minimal ground disturbance, development may be possible in close proximity to the shaft. However, this would be subject to appropriate site investigation to confirm the compactness of the backfill and negotiation with the Coal Authority as to what zone of influence (ZOI), if any, is required. More substantial structures such as transformer stations should be located beyond any ZOI of the shaft, as agreed with the Coal Authority.

5.3 Opencast mining

Hazards posed by the former opencast mining are interpreted to be limited to the nature of the mine backfill and its suitability as founding strata for the transformer stations; DNO and customer switch gear enclosures; and anchoring of the solar panels. Expansion of the ground investigation works recommended in Section 5.1 to include the site of the transformer stations; DNO and customer switch gear enclosures; and include a general spread across the site would allow for characterisation of that uncertainty and better inform foundation design.

5.4 Coal mining gases

While considered to be at low risk, it is recommended that a gas monitoring exercise is undertaken at the locations of the transformer stations and potentially in the vicinity of the underground mineworkings in order to confirm the low risk ranking with respect to the proposed development posed by mine gases.

6 CONCLUSIONS AND RECOMMENDATIONS

This document presents the findings of the Preliminary Coal Mining Risk Assessment. This report addresses the potential issues posed to the proposed development (presented in Appendix B) and provides recommendations for further work to quantify risks identified.

The desk-based investigation has identified the possible presence of coal mining risks posed by worked seams at shallow depths in the north of the site, former opencast mining, mine shaft and coal mining gases. Additionally, the nature of the superficial strata will likely result in a weathered rockhead which will increase the depth to competent strata (engineering rockhead), reducing the thickness of competent cover overlying any worked seams, if present.

The coal mining risk assessment indicates that the risks posed by these hazards will require further investigation before the site can be assessed as 'safe' from risks posed by ground instability. It is recommended that a series of intrusive investigations are undertaken at targeted locations in order to confirm the ground conditions present and fully assess the potential risks.

A targeted mine gas monitoring exercise should be undertaken with monitoring completed within the proposed investigation boreholes.

It is likely that a Coal Authority permit will be required to allow intrusive investigations of coal mining features to take place. The requirement for a permit should be confirmed with the Coal Authority. RSK would also recommend that the Coal Authority are contacted with a view to commencing discussions over what, if any, ZOI from the shaft is required.

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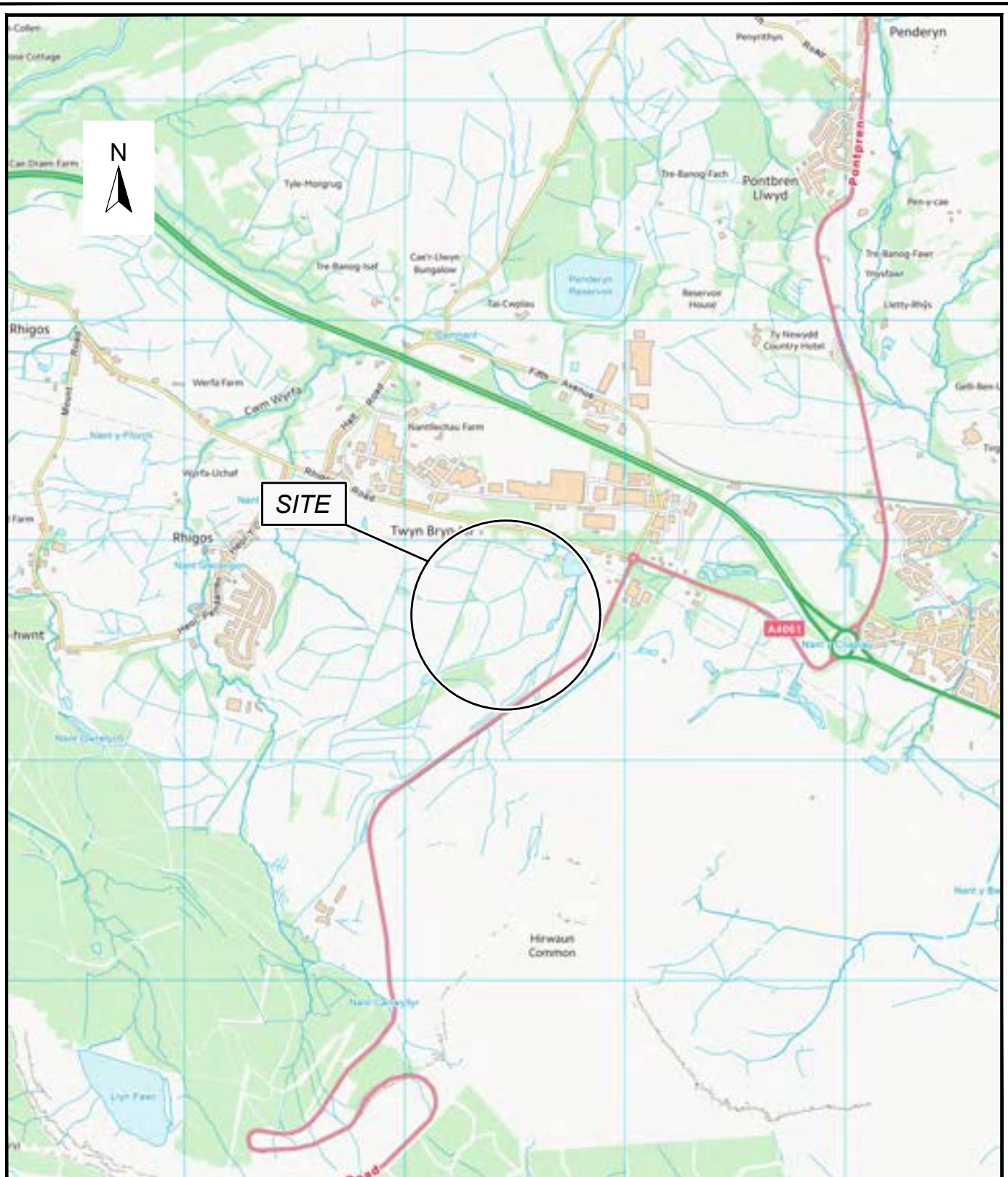
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FIGURES AND DRAWINGS



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Project Title

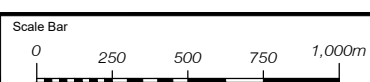
Rhigos road, Merthyr Tydfil Solar Farm Scheme

Drawing Title

SITE LOCATION MAP

Rev	Drawn	Date	Checked	Date	Approved	Date
00	MB	15.07.22	HB	15.07.22	-	-
Dimensions		Scale		Original Size		
m		1:25,000		A4		

Project Number	Grid Ref
315223	SN 934 057



Drawing Number
FIGURE 1



LEGEND

- Site Boundary
- Land Ownership
- Access Track - 5m width
- Historical Trial pit location
- Historical Borehole location
- F Field
- T Trough
- G Field Gate
- H Hedge

Notes:
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C01	13.04.23	First Issue	LS	TM	TM
Rev	Date	Amendment	Drawn	Chkd	Appd



The Old School
Stillhouse Lane
Bristol
BS3 4EB

Tel: +44(0)1414 180471
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client
Regener8 Power

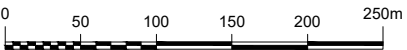
Project Name
Rhigos Road, Merthyr Tydfil Solar Farm Scheme

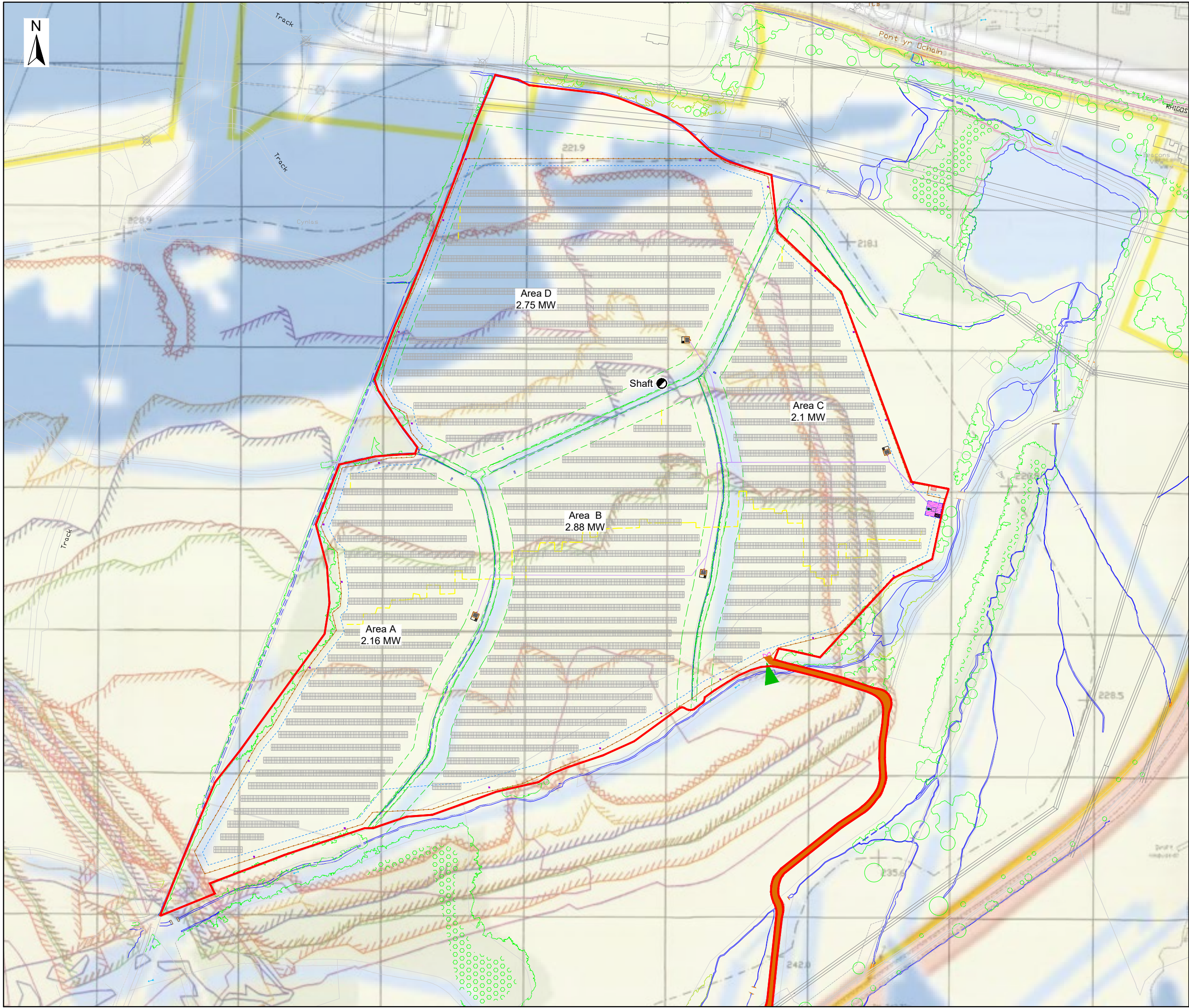
Description
Site Layout Plan

Project ID	Drawing no.	Revision
315223	11201	C01

File name
315223-BL-112-SS-D-C-11201-C01

Dimensions	Scale	Size
m	1:5000	A3





LEGEND

- Extent of underground mineworkings
- Site boundary
- Perimeter fence (1637m)
- Maintenance track
- Customer substation
- DNO
- 20ft. Power Station (3000 kVA)
- 20ft. Power Station (6000 kVA)
- Table of 60 modules (205 pcs)
- Table of 30 modules (59 pcs)
- Gate
- Site boundary (centre of symbol to be taken as boundary of site)
- Perimeter of batter
- Position of known or suspected shaft
- Position of known or suspected adit
- Fault (Throw in metres, seam colour)
- Washout
- Area of no coal
- Old workings (seam colour)
- Bottom coal contour (seam colour)
- Original ground leve (metres) (relative to Newlyn Datum)
- Lowest point of excavation (metres) (relative to Newlyn Datum)
- Area of seam worked (with seam code) in geological descending order
 - Red
 - Six feet (upper)
 - Six feet (lower)
 - Nine feet repeat
 - Nine feet
 - Bute
 - New
 - Yard (upper)
 - Yard (lower)
 - Seven feet (upper)
 - Seven feet (lower)
 - Five feet (upper)
 - Five feet (lower)

Notes:
Past shallow underground mining WMS metadata provided by the Coal Authority.
Base plan provided by the client No.Ref: 16617_999999_10F4 & Figure 3 - Proposed PV layout plan.

C02	13.04.23	First Issue	LS	TM	TM
Rev	Date	Amendment	Drawn	Chkd	Appd



RSK
GEOSCIENCES

65 Sussex Street
Glasgow
G41 1DX

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Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client Regener8 Power		
Project Name Rhigos Road, Merthyr Tydfil Solar Farm Scheme		
Description Combined Ffyndaff (1981-1989) Opencast and Underground Mineworkings over Proposed PV Development Plan		
Project ID 315223	Drawing no. 32404	Revision C02
File name 315223-GL-324-SS-D-C-32404-C02		
Dimensions m	Scale NTS	Size A3

APPENDIX A

SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for Regener8 Power (the "Client") in accordance with the terms of a between RSK and the Client. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.
2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent, or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates, or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the Client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate, or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials, unless specifically identified in the Services.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):

- a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.
- b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.
- c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.
10. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.
11. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.
12. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

APPENDIX B

PROPOSED DEVELOPMENT LAYOUT PLAN



LEGEND

- Site Boundary
- Security Fence
- DNO Enclosure
- Customer Switchgear Enclosure
- LV Transformer Station
- CCTV cameras
- Gate
- Access Road
- MV cable

Notes:

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PV plan provided by Enviromena Project Management UK Ltd
No.Ref: P-Rhigos_01_GeneralLayout

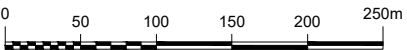
C01	27.03.23	First Issue	LS	TM	TM
Rev	Date	Amendment	Drawn	Chkd	Appd



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Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client		
Regener8 Power		
Project Name		
Rhigos Road, Merthyr Tydfil Solar Farm Scheme		
Description		
Proposed PV Layout		
Project ID	Drawing no.	Revision
315223	32301	C01
File name		
315223-BL-323-SS-D-C-32301-C01		
Dimensions	Scale	Size
m	1:5000	A3



APPENDIX C

COAL AUTHORITY CONSULTANTS COAL MINING REPORT



The Coal
Authority

Consultants

Coal Mining Report

Rhigos Road, Hirwaun, Cf44 9az
Rhondda Cynon Taff

Date of enquiry:	20 June 2022
Date enquiry received:	20 June 2022
Issue date:	20 June 2022

Our reference:	51003193792001
Your reference:	GS-8836476

Consultants

Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

GROUNDSURE LIMITED

Enquiry address

Rhigos Road, Hirwaun, Cf44 9az
Rhondda Cynon Taff

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.groundstability.com

 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	GELLIDEG FIRECLAY	Fireclay	4GMF	16	Beneath Property	5.1	South	120	1856
unnamed	GELLIDEG FIRECLAY	Ironstone	4GMG	20	Beneath Property	6.7	South	120	1856
unnamed	LITTLE BLUE IRONSTONE	Ironstone	4GNS	24	Beneath Property	7.1	South	120	1848
unnamed	GELLIDEG IRONSTONE	Ironstone	4GME	27	Beneath Property	5.8	South	110	1850

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

Distance to spine roadway (m)	Direction to spine roadway
Within	N/A

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	293205-019	293502 205776	This mine entry may have been partially or wholly excavated during past opencast mining	Coal	

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

16541	SWR2753	16617
SWR2462	SWR2468	16616
SWR2466		

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
FIVE FOOT	Coal	Yes	Within	N/A	103
FIVE FOOT	Coal	Yes	Within	N/A	266
GELLIDEG	Coal	Yes	Within	N/A	263
LOWER NINE FOOT (TOP LEAF)	Coal	No	Within	N/A	102
LOWER NINE FOOT (TOP LEAF)	Coal	No	Within	N/A	262
LOWER NINE FOOT TOP LEAF	Coal	No	Within	N/A	262
MIDDLE BUTE LEAF	Coal	Yes	Within	N/A	237
SEVEN FOOT RIDER	Coal	No	Within	N/A	87
SEVEN FOOT RIDER	Coal	No	Within	N/A	107
SEVEN FOOT RIDER	Coal	Yes	Within	N/A	262
SEVEN FOOT RIDER	Coal	No	Within	N/A	265
UPPER GELLIDEG	Coal	Yes	Within	N/A	257
UPPER GELLIDEG	Coal	Yes	27.7	West	270
UPPER SEVEN FOOT	Coal	No	Within	N/A	269
UPPER SEVEN FOOT	Coal	No	Within	N/A	299
YARD	Coal	Yes	Within	N/A	267
YARD	Coal	Yes	Within	N/A	286
YARD (MEADOW)	Coal	No	Within	N/A	102
YARD (MEADOW)	Coal	No	Within	N/A	266
YARD (MEADOW)	Coal	No	Within	N/A	296

Geological faults, fissures and breaklines

Please refer to the 'Summary of findings' map (on separate sheet) for details of any geological faults, fissures or breaklines either within or intersecting the enquiry boundary.

Faults under or close to the property recorded.

Opencast mines

Please refer to the "Summary of findings" map (on separate sheet) for details of any opencast areas within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

Distance to site investigation (m)	Direction
48.0	West

See Section 4 for further information.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

Site investigations

The site is within an area of previous interest. It is close to where the Coal Authority has received information relating to past site investigations.

The site requires further investigation and may influence how you approach your risk assessment.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

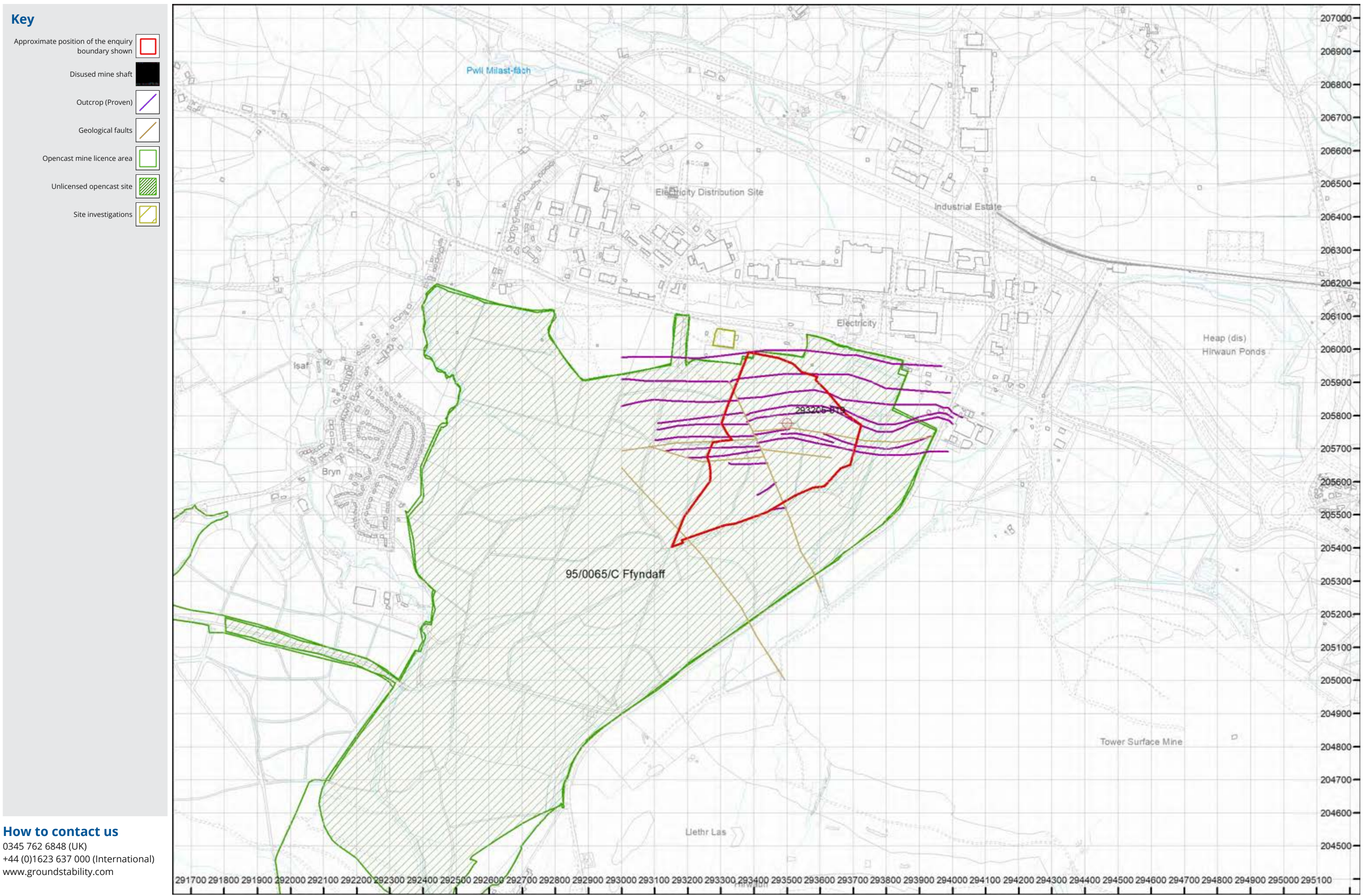
Withdrawal of support notices

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land

Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

The map highlights any specific surface or subsurface features within or near to the boundary of the site.



APPENDIX D

COAL AUTHORITY ABANDONED MINE

CATALOGUE PLANS



Legend

- SITE BOUNDARY (Centre of symbol to be taken as boundary of site)
- PERIMETER OF BATTER (NOT KNOWN)
- POSITION OF KNOWN OR SUSPECTED SHAFT
- POSITION OF KNOWN OR SUSPECTED ADIT
- FAULT (Throw in Metres, Seam Colour)
- WASHOUT
- AREA OF NO COAL
- OLD WORKINGS (Seam Colour)
- ORIGINAL GROUND LEVEL (Feet)
(Relative to Newlyn Datum)
- LOWEST POINT OF EXCAVATION (Feet)
(Relative to Newlyn Datum)

AREA OF SEAM WORKED (with seam code) IN GEOLOGICAL DESCENDING ORDER

- RED VEIN
- NINE FEET
- BUTE
- ...

NOTES

Shafts (S1 etc.) Refer to Shaft Register			
Site Bench Mark	E	N	L
	292282	206012	217.05M

LAND TYPE AND USAGE

- BEFORE OPERATIONS AGRICULTURE & INDUSTRIAL
- AFTER RESTORATION AGRICULTURE & SOME FORESTRY
- DETAILS OF OVERBURDEN OPENCAST BACKFILL MUDSTONE, SANDSTONE
- DETAILS OF BACKFILL AS ABOVE
- NATURE OF COAL SEMI-ANTRACITE

OPERATIONAL DATES

- AUTHORISED NOT KNOWN
- COALING COMMENCED NOT KNOWN
- COALING COMPLETED NOT KNOWN
- PLANS ISSUED 24/04/95

Vertical Sections
NOT AVAILABLE

SITE BOUNDARY,
BENCH MARK AND
O.S. INFORMATION
TAKEN FROM 1981/88
SITE (DRG. No. CP2436)

BRITISH COAL OPENCAST
Headquarters, 200 Lichfield Lane,
Mansfield, Notts. NG18 4RG

SITE NAME		
FFYNDAF (Early 1950's Site)		
TITLE		
COMPLETION PLAN		
COUNTY MID-GLAMORGAN	DISTRICT CYNDY VALLEY	CIVIL PARISH RHIGGS
LOCATION SOUTH WEST OF HERVAUN		
D.S. SHEETS USED	Prefix SN	Based upon Ordnance Survey maps with the sanction of the controller of HM Stationery Office Crown Copyright Reserved. Licence No. HA 273082
9205 9305		Drawn by C.W. Date April 1995
9204 9304		Checked by C.W. Date April 1995
		Scale 1:2500 Sheet 1 of 2
		Drawing No. CP2054a
		Contract Drawing No.



Legend

- SITE BOUNDARY (Centre of symbol to be taken as boundary of site)
- PERIMETER OF BATTER
- POSITION OF KNOWN OR SUSPECTED SHAFT
- POSITION OF KNOWN OR SUSPECTED ADIT
- FAULT (Throw in Metres, Seam Colour)
- WASHOUT
- AREA OF NO COAL
- OLD WORKINGS (Seam Colour)
- BOTTOM COAL CONTOUR (Seam Colour)
- ORIGINAL GROUND LEVEL (Metres) (Relative to Newlyn Datum)
- L.P.E. 149.9 LOWEST POINT OF EXCAVATION (Metres) (Relative to Newlyn Datum)

AREA OF SEAM WORKED (with seam code) IN GEOLOGICAL DESCENDING ORDER

- RED
- SIX FEET (UPPER)
- SIX FEET (LOWER)
- NINE FEET REPEAT
- NINE FEET
- BUTE
- NEW
- YARD (UPPER)
- YARD (LOWER)
- SEVEN FEET (UPPER)
- SEVEN FEET (LOWER)
- FIVE FEET (UPPER)
- FIVE FEET (LOWER)

NOTES

Shafts (S1 etc.) Refer to Shaft Register			
Site Bench Mark	E	N	L
	292282	206012	217.05M

LAND TYPE AND USAGE

BEFORE OPERATIONS AGRICULTURE & INDUSTRIAL

AFTER RESTORATION AGRICULTURE & SOME FORESTRY

DETAILS OF OVERBURDEN OPENCAST BACKFILL, MUDSTONE, SANDSTONE

DETAILS OF BACKFILL AS ABOVE

NATURE OF COAL SEMI-ANTHRACITE

OPERATIONAL DATES

AUTHORISED NOT KNOWN

COALING COMMENCED JULY 1981

COALING COMPLETED SEPT 1988

PLANS ISSUED 24/11/88

Vertical Sections

NOT AVAILABLE

16617/1.

BRITISH COAL OPENCAST
Headquarters, 200 Lichfield Lane,
Mansfield, Notts. NG18 4RG

SITE NAME

FFYNDAFF
(1981-1988)

TITLE

COMPLETION PLAN

COUNTY MID-GLAMORGAN DISTRICT CYNNEN VALLEY CIVIL PARISH RHIGODS

LOCATION
3km WEST OF HIRWAUN

D.S. SHEETS USED

Prefix
CN

9205 9305

9204 9304

9203 9303

9202 9302

9201 9301

9200 9300

9199 9299

9198 9298

9197 9297

9196 9296

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Drawn by C.W. Date March 95

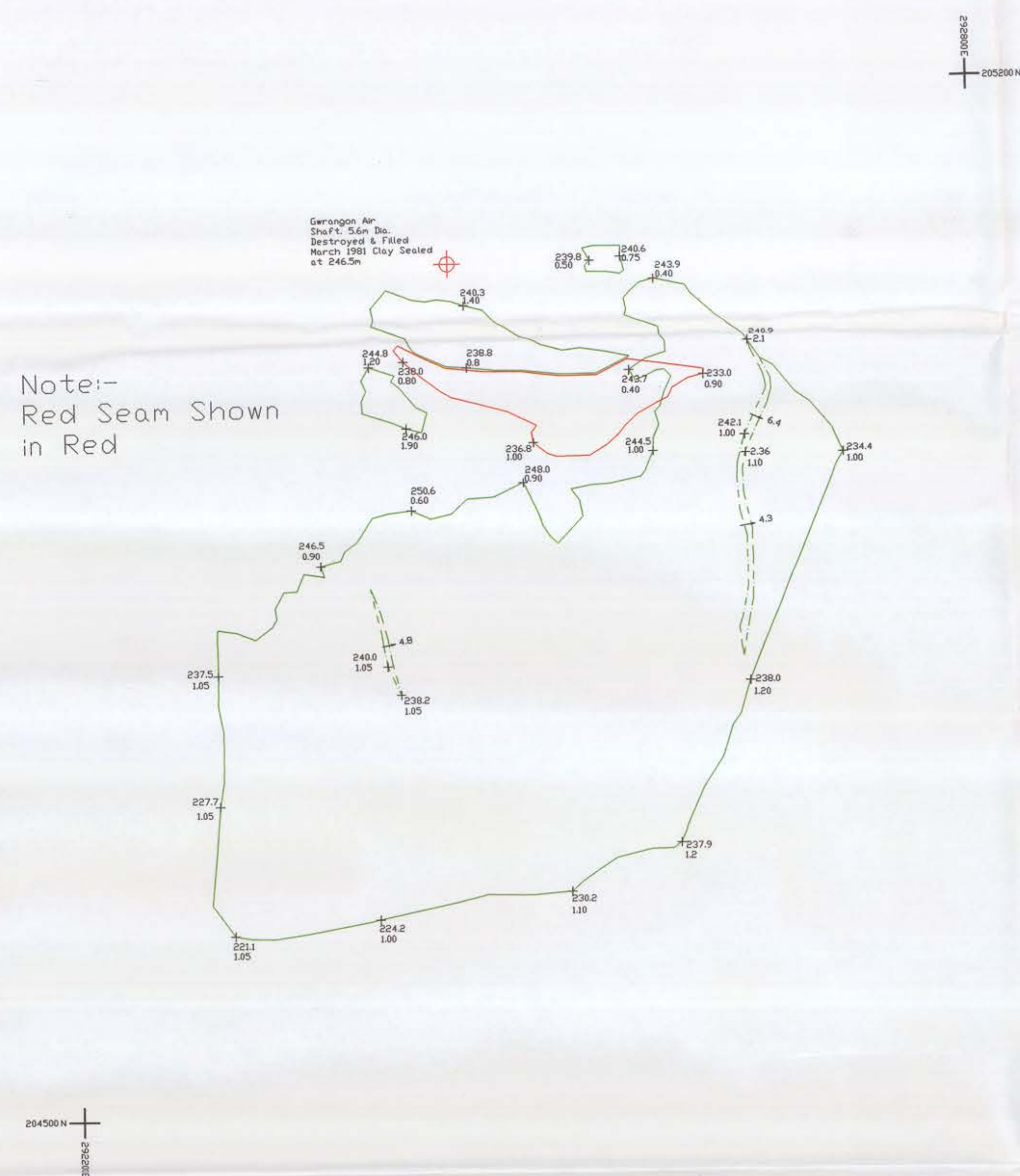
Checked by CJB Date March 1995

Scale 1:2500 Sheet 1 of 4

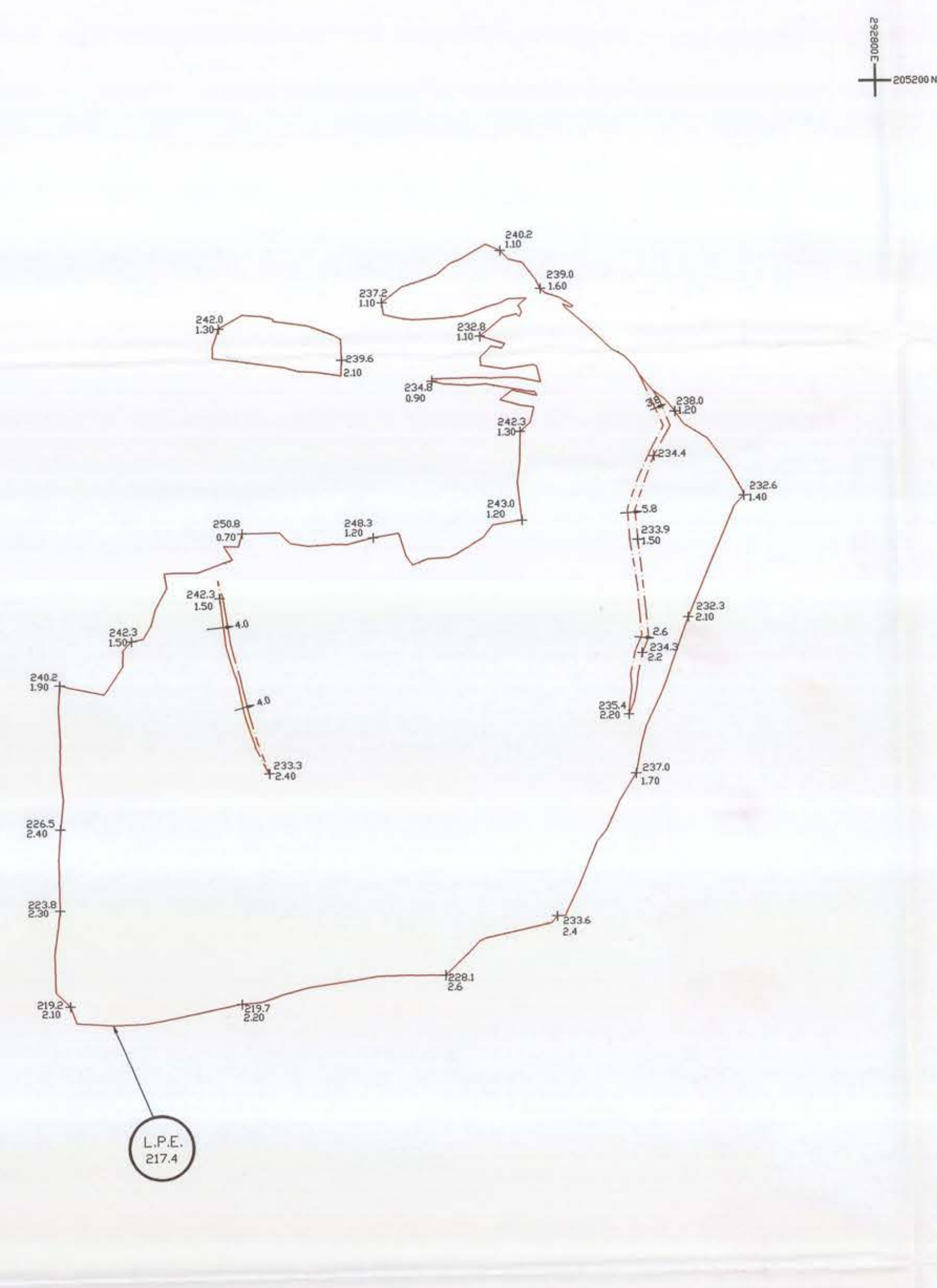
Drawing No. CP2436a Contract Drawing No.

16617/1.

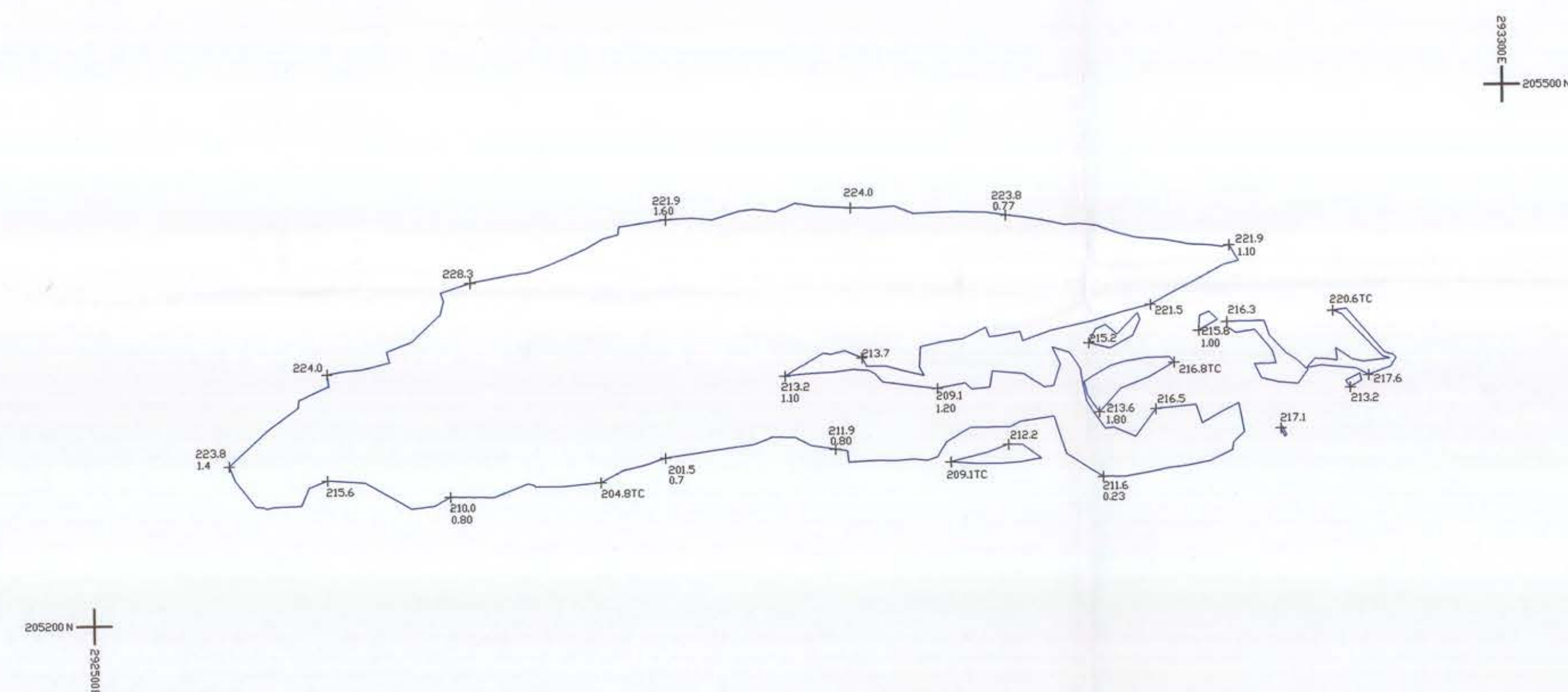
Note:-
Red Seam Shown
in Red



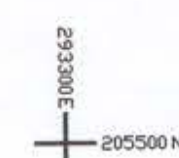
RED + SIX FEET(UPPER) SEAM



SIX FEET(LOWER) SEAM



NINE FEET REPEAT SEAM



Legend

- SITE BOUNDARY (Centre of symbol to be taken as boundary of site)
- PERIMETER OF BATTER
- POSITION OF KNOWN OR SUSPECTED SHAFT
- POSITION OF KNOWN OR SUSPECTED ADIT
- FAULT (Throw in Metres, Seam Colour)
- WASHOUT
- AREA OF NO COAL
- OLD WORKINGS (Seam Colour)
- BOTTOM COAL CONTOUR (Seam Colour)
- BOTTOM OF COAL LEVEL WITH THICKNESS (Metres)
- L.P.E. 217.4
- LOWEST POINT OF EXCAVATION (Metres) (Relative to Newlyn Datum)

AREA OF SEAM WORKED (with seam code) IN GEOLOGICAL DESCENDING ORDER

- RED
- SIX FEET (UPPER)
- SIX FEET (LOWER)
- NINE FEET REPEAT
- NINE FEET
- BUTE
- NEW
- YARD (UPPER)
- YARD (LOWER)
- SEVEN FEET (UPPER)
- SEVEN FEET (LOWER)
- FIVE FEET (UPPER)
- FIVE FEET (LOWER)

NOTES

Shafts (S1 etc.) Refer to Shaft Register	
Site Bench Mark	E N L
	292282 206012 217.05M

LAND TYPE AND USAGE

BEFORE OPERATIONS AGRICULTURE & INDUSTRIAL

AFTER RESTORATION AGRICULTURE & SOME FORESTRY

DETAILS OF OVERBURDEN OPENCAST BACKFILL, MUDSTONE, SANDSTONE

DETAILS OF BACKFILL AS ABOVE

NATURE OF COAL SEMI-ANTHRACITE

OPERATIONAL DATES

AUTHORISED	NOT KNOWN
COALING COMMENCED	JULY 1981
COALING COMPLETED	SEPT 1988
PLANS ISSUED	24/04/95

16617/2.

BRITISH COAL OPENCAST
Headquarters, 200 Lichfield Lane,
Mansfield, Notts. NG18 4RG

SITE NAME

FFYNDAFF
(1981-1988)

TITLE

COMPLETION PLAN

COUNTY MID-GLAMORGAN DISTRICT CYNON VALLEY CIVIL PARISH RHIGOS

LOCATION 3km WEST OF HIRVAUN

D.S. SHEETS USED Prefix SN

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Drawn by C.W. Date March 95

Checked by CJB Date March 95

Scale 1:2500 Sheet 2 of 4

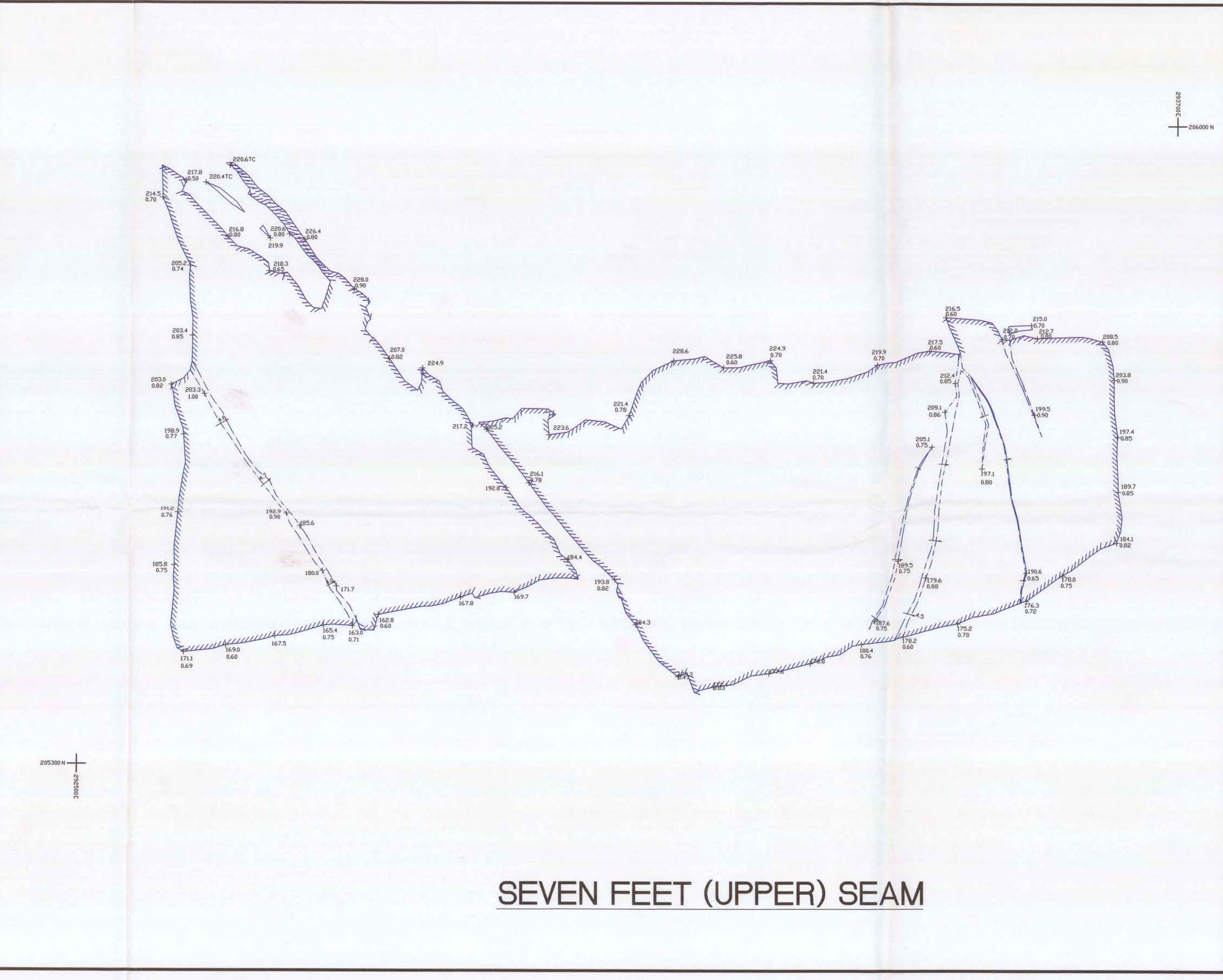
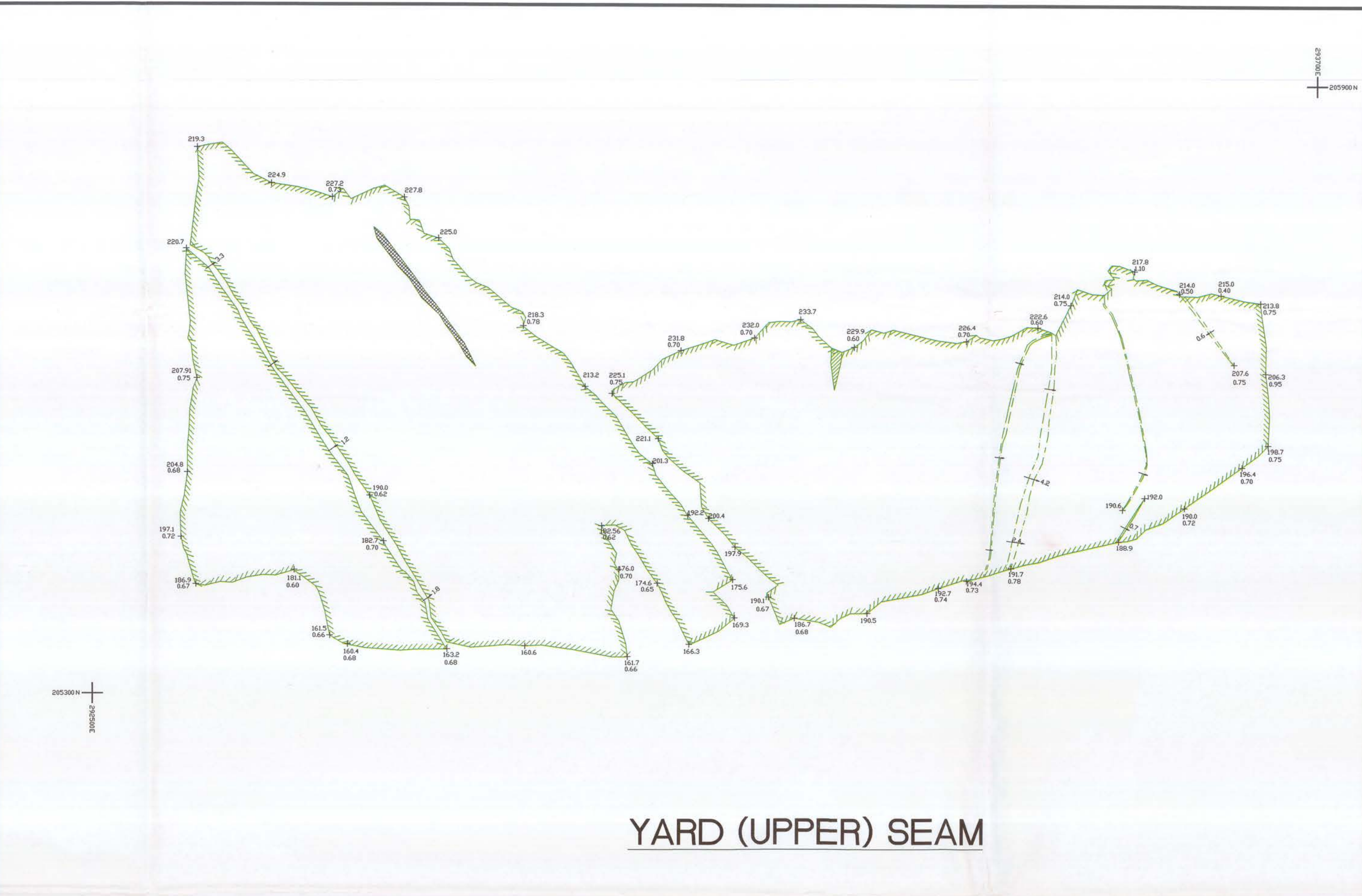
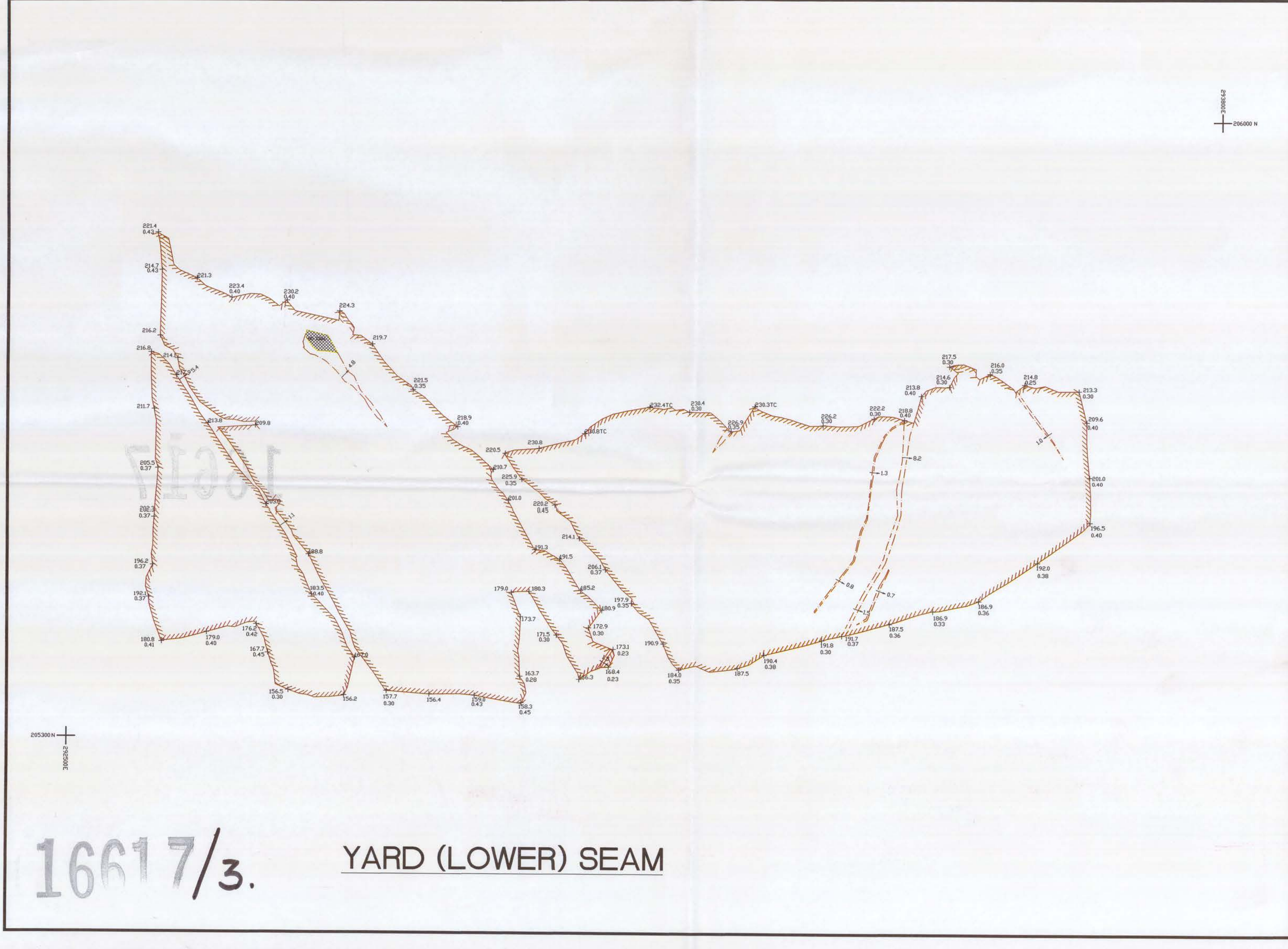
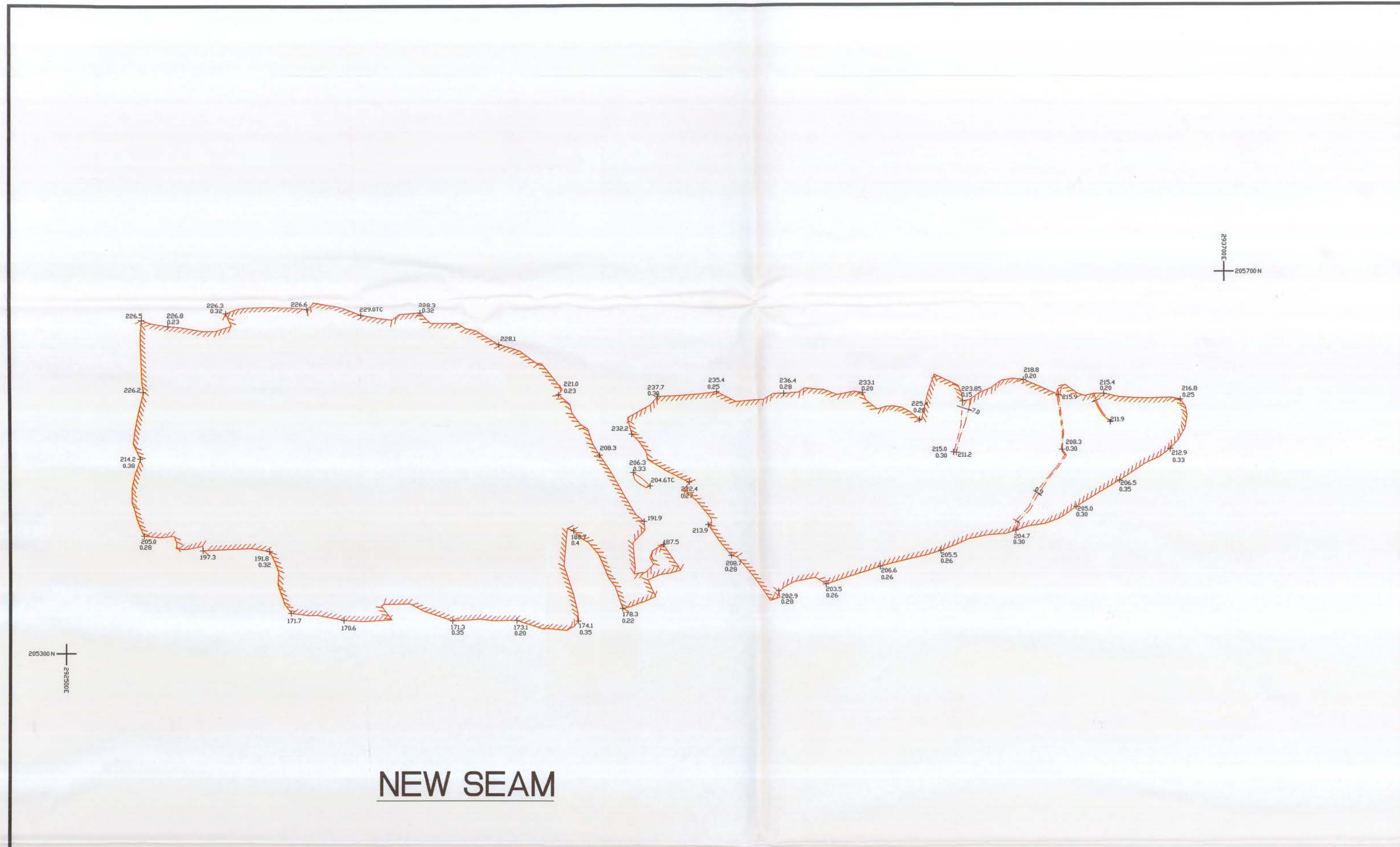
Drawing No. CP2436b Contract Drawing No.



NINE FEET SEAM

BUTE SEAM

16617/2.



Legend

- SITE BOUNDARY (Centre of symbol to be taken as boundary of site)
- PERIMETER OF KNOWN OR SUSPECTED SHAFT
- POSITION OF KNOWN OR SUSPECTED ADIT
- FAULT (Throw in Metres, Seam Colour)
- WASHOUT
- AREA OF NO COAL
- OLD WORKINGS (Seam Colour)
- BOTTOM COAL CONTOUR (Seam Colour)
- BOTTOM OF COAL LEVEL WITH THICKNESS (Metres)
- L.P.E. 140 LOWEST POINT OF EXCAVATION (Metres) (Relative to Newlyn Datum)

AREA OF SEAM WORKED (with seam code) IN GEOLOGICAL DESCENDING ORDER

RED	SIX FEET (UPPER)	SIX FEET (LOWER)	NINE FEET REPEAT	BUTE	NEW	YARD (UPPER)	YARD (LOWER)	SEVEN FEET (UPPER)	SEVEN FEET (LOWER)	FIVE FEET (UPPER)	FIVE FEET (LOWER)
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NOTES

Shafts (S1 etc.) Refer to Shaft Register
Site Bench Mark E N L
292282 206012 217.05M

LAND TYPE AND USAGE

BEFORE OPERATIONS AGRICULTURE & INDUSTRIAL
AFTER RESTORATION AGRICULTURE & SOME FORESTRY

DETAILS OF OVERBURDEN OPENCAST BACKFILL, MUDSTONE, SANDSTONE
DETAILS OF BACKFILL AS ABOVE
NATURE OF COAL SEMI-ANTHRACITE

OPERATIONAL DATES

AUTHORISED NOT KNOWN
COALING COMMENCED JULY 1981
COALING COMPLETED SEPT 1988
PLANS ISSUED 24/10/88

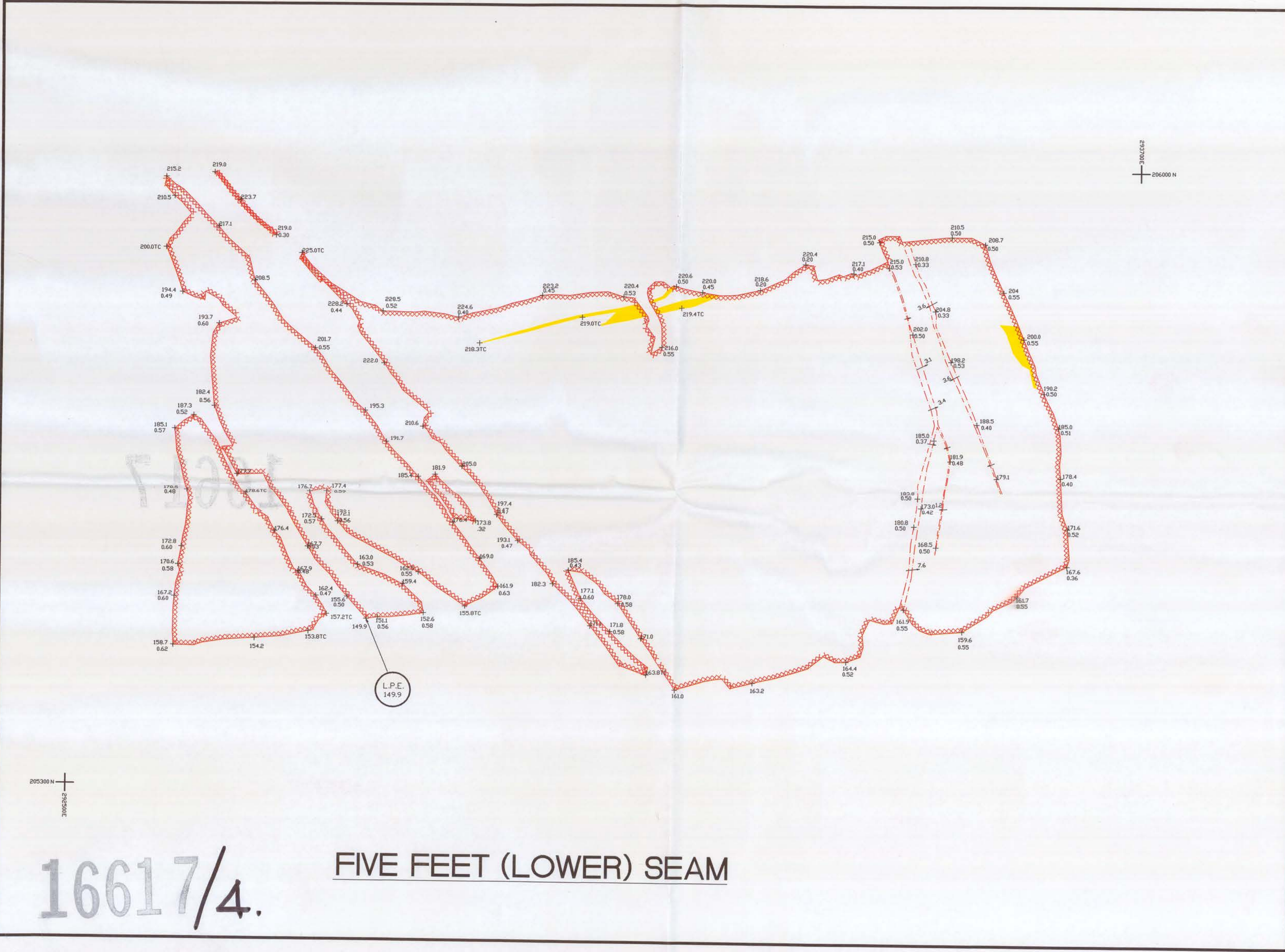
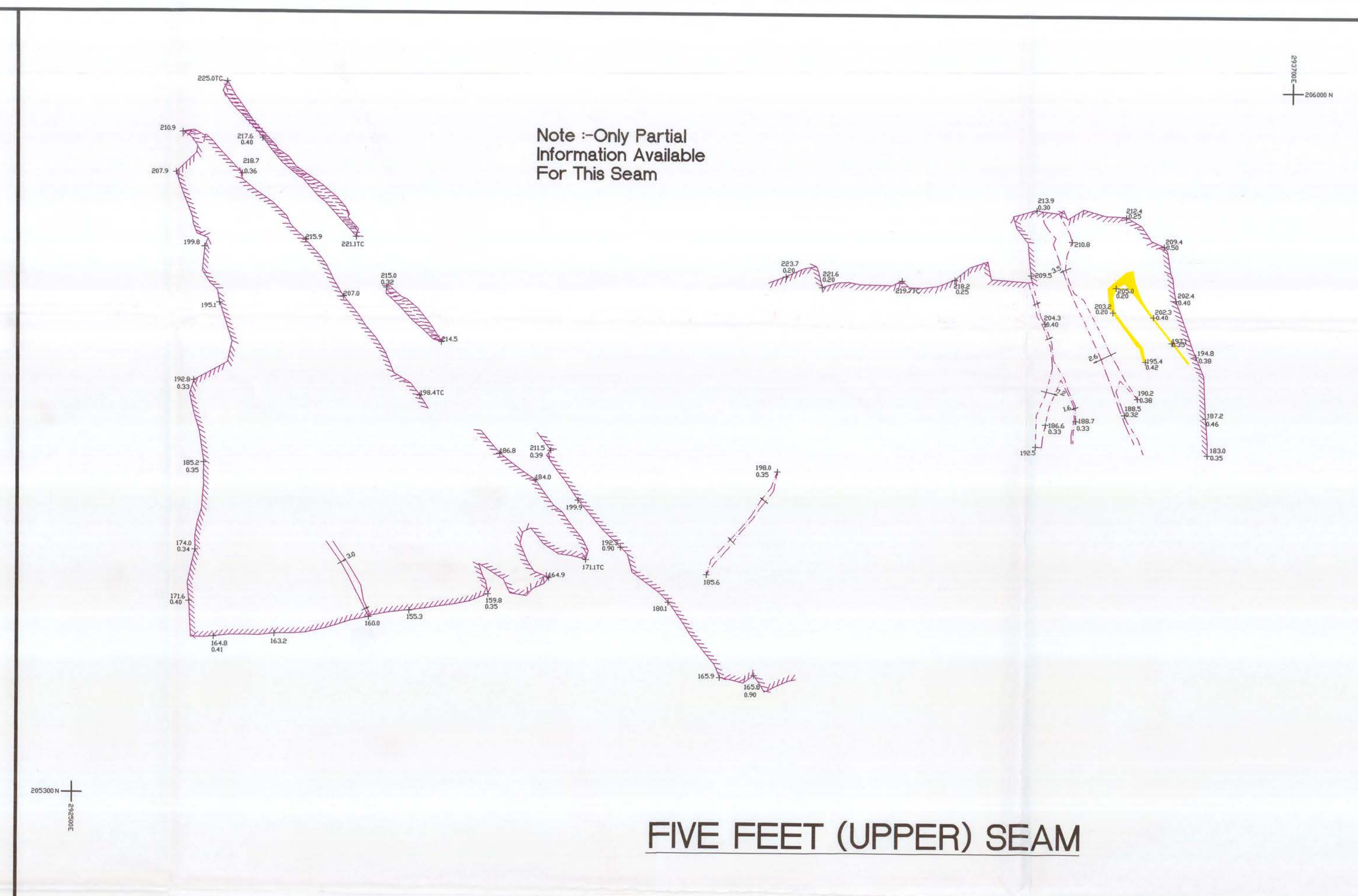
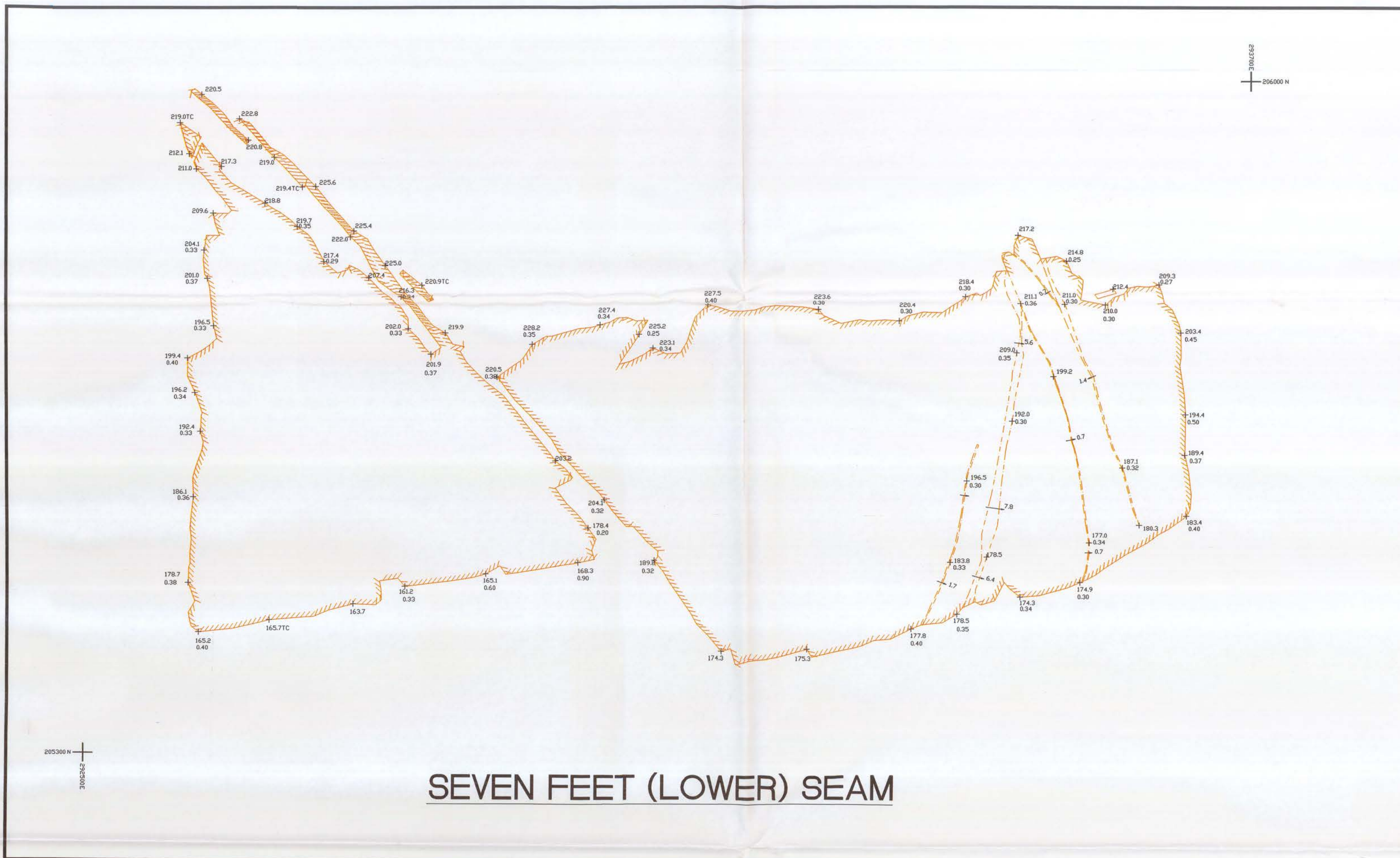
16617/3.

BRITISH COAL OPENCAST
Headquarters, 200 Lichfield Lane,
Mansfield, Notts. NG18 4RG

SITE NAME
FFYNDAFF
(1981-1988)

TITLE
COMPLETION PLAN

COUNTY MID-GLAMORGAN	DISTRICT CYNDY VALLEY	CIVIL PARISH RHIGGS
LOCATION 3km WEST OF HIRVAUN		
D.S. SHEETS USED	Prefix SN	Based upon Ordnance Survey maps with the sanction of the controller of HM Stationery Office. Crown Copyright Reserved. Licence No. NA 273682
		Drawn by C.W. Date March 95
		Checked by CJB Date March 95
		Scale 1:2500 Sheet 3 of 4
		Drawing No. CP2436c Contract Drawing No.



Legend

- SITE BOUNDARY (Centre of symbol to be taken as boundary of site)
- PERIMETER OF BATTER
- POSITION OF KNOWN OR SUSPECTED SHAFT
- POSITION OF KNOWN OR SUSPECTED ADIT
- FAULT (Throw in Metres, Seam Colour)
- WASHOUT
- AREA OF NO COAL
- OLD WORKINGS (Seam Colour)
- BOTTOM COAL CONTOUR (Seam Colour)
- BOTTOM OF COAL LEVEL WITH THICKNESS (Metres)
- LOWEST POINT OF EXCAVATION (Metres) (Relative to Newlyn Datum)

AREA OF SEAM WORKED (with seam code) IN GEOLOGICAL DESCENDING ORDER

RED	SEVEN FEET (UPPER)
SIX FEET (UPPER)	SEVEN FEET (LOWER)
SIX FEET (LOWER)	FIVE FEET (UPPER)
NINE FEET REPEAT	FIVE FEET (LOWER)
NINE FEET	
BUTE	
NEW	
YARD (UPPER)	
YARD (LOWER)	

NOTES

Shafts (S1 etc.) Refer to Shaft Register

Site Bench Mark	E	N	L
	292282	206012	217.05M

LAND TYPE AND USAGE

BEFORE OPERATIONS AGRICULTURE & INDUSTRIAL

AFTER RESTORATION AGRICULTURE & SOME FORESTRY

DETAILS OF OVERBURDEN OPENCAST BACKFILL MUDSTONE, SANDSTONE

DETAILS OF BACKFILL AS ABOVE

NATURE OF COAL SEMI-ANTHRACITE

OPERATIONAL DATES

AUTHORISED NOT KNOWN

COALING COMMENCED JULY 1981

COALING COMPLETED SEPT 1988

PLANS ISSUED 24/04/88

16617/4.

BRITISH COAL OPENCAST
Headquarters, 200 Lichfield Lane,
Mansfield, Notts. NG18 4RG

SITE NAME

FFYNDIAFF (1981-1988)

TITLE

COMPLETION PLAN

COUNTY	MID-GLAMORGAN	DISTRICT	CYNNER VALLEY	CIVIL PARISH	RHIGGS
LOCATION	3km WEST OF HIRVAUN				
D.S. SHEETS USED	Prefix SN				
Based upon Ordnance Survey maps with the sanction of the controller of HM Stationery Office. Crown Copyright Reserved. Licence No. NA 273882					
Drawn by C.W. Date March 95					
Checked by C.J.B. Date March 95					
Scale 1:2500 Sheet 4 of 4					
Drawing No. CP2436d Contract Drawing No.					

RHYGOS MINE LEVEL

Blue Vein Ironstone.

Mouth

Scale  Chains



The Drains and the Mines are colored
The Workings on the Blue Vein Ironstone
The Workings on the Black Vein Ironstone

Red
Blue
Green

Survey from Works of the August 1840

*Check on Glyn 10 NE?
DIE 9 Regon*

WORKING PLAN of RHYGOS MINE LEVEL.

Knobby Vein Ironstone

Explanation.

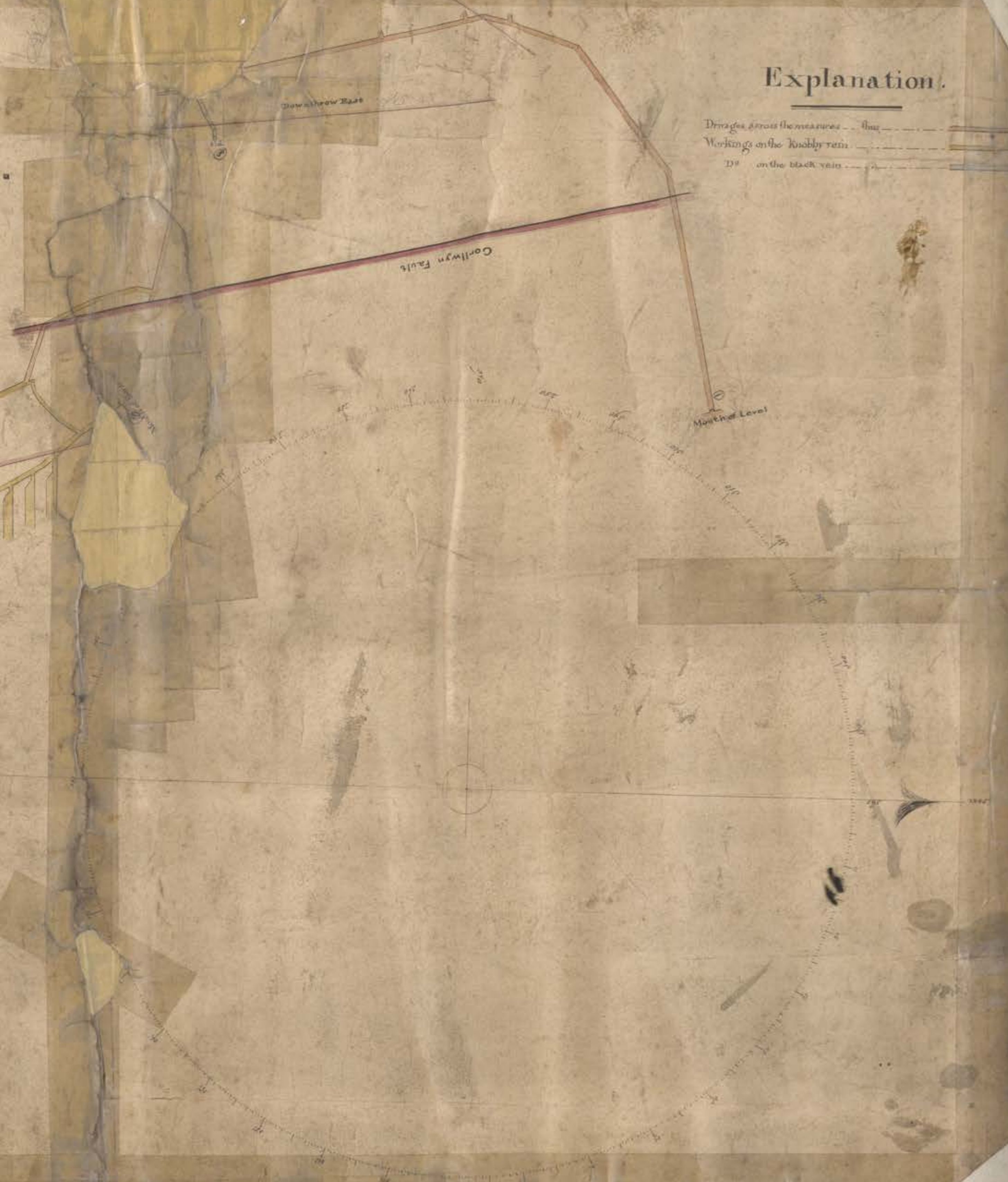
Drifts across the measures — — — — —
Workings on the Knobby vein — — — — —
Do on the black vein — — — — —

Face Sept. 1885

Scale of Chains



David Shawell Esq.
Hirwaun Iron Works
September 23rd 1845.



APPENDIX E

BRITISH GEOLOGICAL SURVEY BOREHOLE RECORDS

STRUCTURAL SOILS LIMITED

Borehole Log

CONTRACT

Mirvaat

GROUND LEVEL

-

GRID REF

-

DATE

27/4/85

BOREHOLE NO

DN 90 NW

SHEET 1 OF 1

112

CLIENT

S.W.E.S.

EQUIPMENT & METHOD

Shell & Rager

ORIENTATION

Vertical

DEPTH OF HOLE

9.0m

Coring depth	Sample type	Penetration	Water	Description of strata	Depth m	Logged
				Dense grey shale and ash FILL	1	
	D			Soft dark brown grey clayey PEAT	2	
	D				3	
	D	2/1/2/2		Soft to firm grey brown silty sandy CLAY with sandstone gravel and occasional cobbles	4	
	D	3/4/5/3			5	
	D	50 blows 40%		Firm to stiff grey laminated CLAY with sandstone gravel and occasional cobbles	6	
	D	10/11/12/12			7	
	D				8	
	D	22/30/-/-		Weak light grey laminated MUDSTONE	9	
	D	50 blows 150mm				
				Borehole terminated at 9.0m		

REMARKS

Water strike at 3.8m

Standing level 1.8m borehole

Depth 9.0m

SAMPLE/TEST KEY

D : Disturbed

B : Battered

S : Soft

W : Water

STRUCTURAL SOILS LIMITED

Borehole Log

CONTRACT HL/1980/1		GROUND LEVEL -		GRID REF -		DATE 28/4/85		BOREHOLE NO SH/1980/1		SHEET 1 of 2		113	
CLIENT S.W.S.B.				EQUIPMENT & METHOD Shell & Auger				ORIENTATION Vertical		DEPTH OF HOLE 12.1m			

Coreing depth	Sample type	Penetration	Water	Description of strata	Depth (m)	Legend
	D			Dense grey shale and gravel FILL	0 - 1	
				Soft brown grey clayey PEAT with some fine shaley gravel	1 - 2	
U100	13 blows 60S			Soft brown grey to grey clayey PEAT	2 - 3	
D					3 - 4	
D					4 - 5	
U100	22 blows 100S			Soft to firm grey brown silty sandy CLAY with limestone and sandstone gravel and occasional cobbles	5 - 6	
D					6 - 7	
SPT	5/6/5/5				7 - 8	
D					8 - 9	
SPT	6/4/4/6				9 - 10	
D					10 - 11	
SPT	4/5/6/6			Firm to stiff brown mottled slightly laminated CLAY with gravel and cobbles	11 - 12	
D					12 - 13	
SPT	9/10/11/14			Stiff brown with some orange laminated CLAY	13 - 14	

REMARKS

Water seepage at 4.0m

SAMPLE/TEST KEY

- D : Disturbed
- S : Disturbed
- B : Bulk
- W : Water

STRUCTURAL SOILS LIMITED

Borehole Log

CONTRACT Hirwaun		GROUND LEVEL -		GRID REF -		DATE 28/4/85		BOREHOLE NO Four		SHEET 2 OF 2	
CLIENT S.W.E.B.				EQUIPMENT & METHOD Shell & Auger			ORIENTATION Vertical		DEPTH OF HOLE 12.1m		

Coring depth	Sample type	Penetration	Water	Description of strata	Depth m	Legend
	D				9	
				Hard brown clayey SAND with some medium to fine gravel	10	
	D				11	
	SPT	12/19/25/34		Hard brown orange and grey mottled highly laminated MUDSTONE	11	
	D				12	
	SPT	40 blows 150 mm		Borehole terminated at 12.1m	12	
					13	

REMARKS	SAMPLE/TEST KEY
	D : Disturbed B : Bedrock S : Soil W : Water