Date (Map Scale)	Within the Site boundary	Surrounding Site
1892 - 1914 (25 Inch)	Railway tracks are mapped, from the centre of Site to the eastern boundary, on the extents of the expanded Dowlais Great Tip. Further earthworks are shown towards the northwestern extent of Site, likely associated with mining but do not appear to form part of the Dowlais Great Tip. The reservoir and filter beds previously labelled towards the northwestern side of Site are no longer shown. Earthworks are shown north of the reservoir towards the southern tip of Site, which are not shown on the 1888 – 1915 map.	Most mining features previously discussed are no longer labelled. The remaining features include No.1, No.2, No.4, No.6 and No.7 Pits (all disused), old ironstone levels and ironstone shaft, an old air shaft and railway infrastructure.
1919 – 1930 (One Inch)	No obvious or significant changes.	The Brick Works are no longer labelled northeast of Site.
1937 – 1961 (1:25,000)	Dowlais Great Tip is no longer labelled although an earthwork is present in its location. Railway tracks are no longer mapped, from the centre of Site to the eastern boundary, in the extents of the Dowlais Great Tip. Dowlais Railway is no longer present across the southwestern side of the Site boundary, however, the associated earthworks are still present. A triangular station is shown towards the northwest of Site.	Several disused pits, shafts and reservoirs are labelled. Incline Top Level is present west of Site. Dowlais Iron Works is no longer present though there are several industrial premises shown.
1944 – 1973 (1:1,250/1:2,500)	Several ponds and a Sink are shown onsite. There are 'Ruin' buildings labelled in the northwestern part of the Site and towards the eastern extent. One of the two Old Air Shafts is no longer shown.	An unlabelled road, what is now known as Goat Mill Road and the A4102 is present in the location of the old railways west of Site. Industrial premises labelled as Works, Depot, Factory or Bakery are present north of Site in the area formerly occupied by Dowlais Iron Works. Near the Depot are circular tanks, which could represent Gas holder Stations. The A4060 road has been built east of Site.
Outline: 1945 – 1965 (1:25,000)	No obvious or significant changes.	No obvious or significant changes.
Air Photos: 1945 – 1950 (1:10,560)	No obvious significant changes. The Site is occupied by a large spoil tip in the central and northern part of the Site, with the railway present in the southern part.	No obvious or significant changes.
1948 – 1973 (1:2,500)	No obvious or significant changes.	A slag heap is labelled approximately 100m towards the southeast from Site.
Google Earth Aerial Imagery (2001)	Site appears to be flat with open sparsely grassed gravel. A wooded margin is present along the western and eastern edges of the Site. The Dowlais Great Tip is no longer present [(1)].	Residential development at Incline Top, immediately west of Goat Mill Road. Potential Gas holder Stations are no longer present north of Site.
Google Earth Aerial Imagery (2004)	No obvious or significant changes.	No obvious or significant changes.
Google Earth Aerial Imagery (2006)	No obvious or significant changes.	Residential development at Incline Top and between the A4102 and Pantyffyn Road, west of Site. Evidence of potential industrial activity, approximately 200m, southeast of Site, beyond the A4060.

Date (Map Scale)	Within the Site boundary	Surrounding Site
Google Earth Aerial Imagery (2008)	No obvious significant changes.	Further evidence of industrial activity is present beyond the A4060, which appears to be associated with the Ffos-y-Ffran Opencast Mine which opened in 2008[11]. Further residential development at Incline Top.
Google Earth Aerial Imagery (2009)	No obvious or significant changes.	No obvious or significant changes.
Google Earth Aerial Imagery (2010)	No obvious or significant changes.	Further earthworks and pits present at Ffos-y-Fran Opencast Mine.
Google Earth Aerial Imagery (2016)	No obvious or significant changes.	Workings of Fros-y-Fran Opencast mine appear to have moved towards the east direction. The ground cover in the formerly mined area appears to be grass.
Google Earth Aerial Imagery (2018)	No obvious or significant changes.	No obvious or significant changes.
Google Earth Aerial Imagery (2019)	No obvious or significant changes.	No obvious or significant changes.
Google Earth Aerial Imagery (2021)	No obvious or significant changes.	No obvious or significant changes.
Google Earth Aerial Imagery (2023)	No obvious or significant changes.	No obvious or significant changes. *Note: According to BBC News[11], the Fros-y-Fran Opencast mine closed in November 2023.*

(1) Images of the Dowlais Great Tip, also known as the Great White Tip: The Dowlais Great White Tip[12].

The undated website indicates that the tip, referred to on the website as the 'White Tip', was removed during the 1970s.

There is also a scan of a undated newspaper article, titled; '*The Old Grey Man, he aint what he used to be*' written by Gerard Kiley for the Merthyr Express. The quality of the scan is poor; however, the article indicates that: '*Underneath the White Tip as we know it is another layer of white deposits'*. This could indicate historic mining to the Site, prior to 1840.

[11] BBC News, "Coal: UK's last opencast mine shuts after legal row," BBC, 30 November 2023. [Online]. Available: https://www.bbc.co.uk/news/uk-wales-67564413 [Accessed July 2024].
[12] alangeorge.co.uk, "The Dowlais Great White Tip (alangeorge.co.uk)," [Online]. Available: www.alangeorge.co.uk [Accessed July 2024].

2.5. ARCHAELOGICAL & HISTORICAL INVESTIGATIONS

WSP are aware of historic investigations to the Site, as listed below:

- Sirius Geotechnical LTD, 2022, Report c8341 rev b Preliminary Appraisal (Desk Study) of land off Goat Mill Road, Merthyr Tydfil[1]. The following report is referenced as part of the Sirius Geotechnical LTD desk study.
    - Robert West Consulting Ltd. 1997. East Merthyr Reclamation Scheme Phase II – Assessment of Ground Conditions Report.

WSP are not aware of any previous archaeological investigations to Site.

2.6. UNEXPLODED ORDINANCE

The Zetica UXO Risk Map indicates that Site is located within an area of Low Bomb Risk[13].

2.7. DESIGNATED SITES & SENSITIVE LAND USES

According to Data Map Wales[14], no designations exist near the Site. A review of the Lidar data did not reveal any obvious features that could be related to coal mining or are indicative of ground movements. The interactive map does show a disused shaft towards the centre of the Site as shown in Figure 2-2 below.

Note, the figure provides an indication of the shaft's location onsite.

Figure 2-2 - Location of the disused shaft shown by Data Map Wales



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[13] "Zetica, Risk Maps," [Online]. Available: https://zeticauxo.com/downloads-and- [Accessed July 2024].
[14] Welsh Government / LLywodraeth Cymru, "Data Map Wales," [Online]. Available: https://datamap.gov.wales/maps/lidar-viewer/view#/ [Accessed July 2024].

2.8. COAL MINING RELATED REVIEW OF PREVIOUS STUDIES

WSP have been supplied a fragmented previous desk study, undertaken by Sirius Geotechnical Ltd in February 2022[1], on behalf of J&A Young (Leicester) Ltd, pertaining to the Site. It should be noted that most of the report's appendices are absent, and the Client was unable to provide WSP with a full copy of this report. Section 4 of the Sirius Geotechnical Ltd report summarises a previous study undertaken by Robert West Consulting in 1997, of which the Client also does not have a copy. The Robert West Consulting report would appear to contain useful information regarding historical coal and ironstone mining, ground conditions pre/post opencast mining and mine entries identified during opencast mining. The information in the Sirius Geotechnical Report cannot be verified or relied upon by WSP. The findings of the Sirius Geotechnical Ltd report relative to coal mining is summarised below:

- In 1996 the Site was subject to opencast coal mining, which subsequently removed the Great White Tip and probably most former mining features. The opencast was backfilled upon completion, with the Site restored to its current condition.
    - Note that this timeline contradicts the website; The Dowlais Great White Tip[12], which suggests the Great White Tip was removed in the 1970s.
- Within the footprint of opencast coal mining, historical underground mine workings and the remnants of Coal Authority (CA) recorded mine shafts may remain at depths below the base of the opencast which could lead to future collapse.
- There are potentially shallow mine workings within several ironstone and coal seams in the western and northern parts of the Site. Dependent on the depth, thickness and position in relation to the proposed development, historical underground mine workings and mine entries may require stabilisation/treatment to allow subsequent construction.
- It is possible that there are additional unrecorded mine entries within the Site. Any identified mine entries with potential to affect the proposed development should be investigated and stabilised, e.g., by filling, grouting and capping.
- The Site is likely to be underlain by deep Made Ground in parts, as well as being potentially underlain by shallow abandoned coal and ironstone mine workings, with mine entries also possibly present. These could act as a source / pathway of hazardous ground gases, e.g., methane and carbon dioxide.

3. COAL AUTHORITY RECORDS AND REPORTS

3.1. COAL AUTHORITY ONLINE DATABASE

With reference to the Coal Authority (CA) online interactive viewer[8], the Site falls within *'Development High Risk Areas'*. This classification relates to the presence of known coal mining features. In addition to being situated in a development high risk area, the Site is also in an area of:

- Surface Coal Resource.
- Probable Shallow Coal Mine Workings.
- Surface Mining (past and current).
- Unlicenced Opencast Mining.
- Several mine entries including shafts and adits.

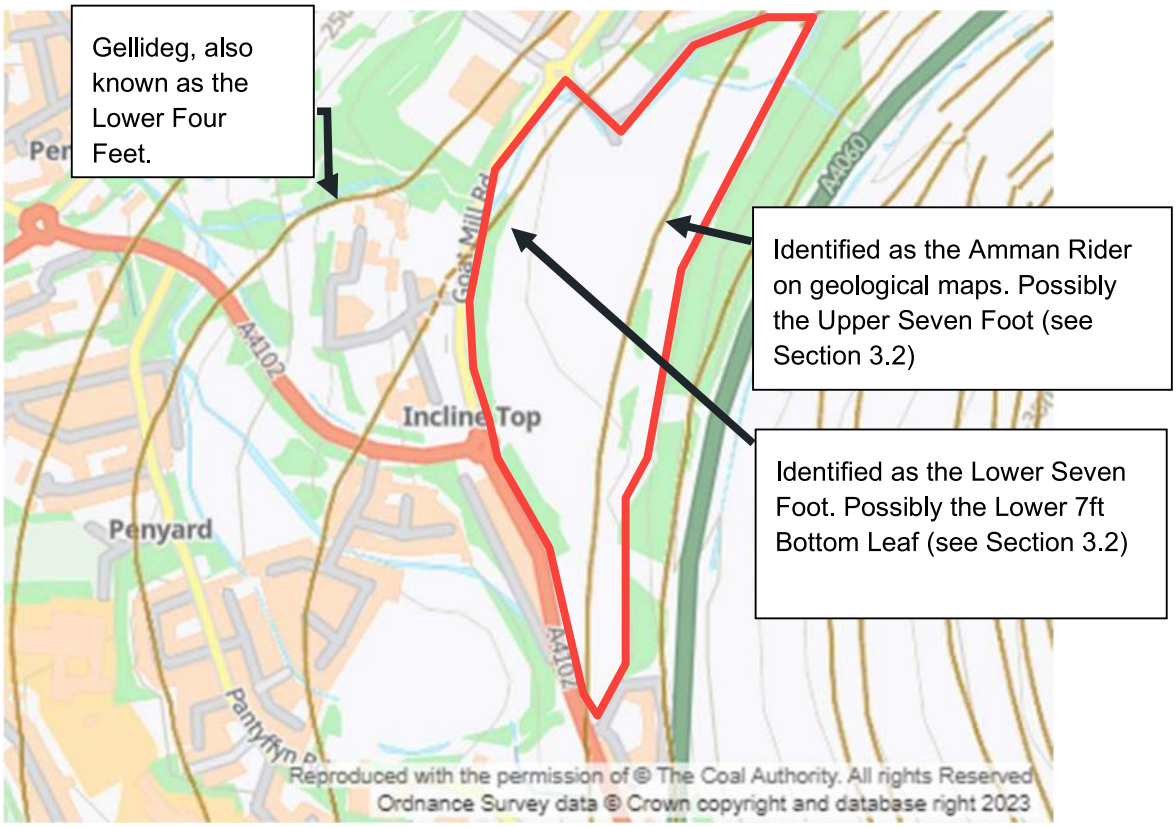
Note: 'shallow coal mine workings' are defined to mean *'within 30m of ground level'*

The CA interactive map viewer suggests two non-inferred outcrops, are located within the Site boundary, a summary of which is included in Figure 3-1. Based on information obtained from BGS records, the eastern outcrop (CA ref. SW021I), crossing the northeastern extent of Site through to the south is the Amman Rider coal seam.

Another outcrop is shown to cross through the northwestern corner of Site. Not shown on the geological maps, the outcrop with a CA reference of SW018I is shown in Figure 3-1. It is shown to be inferred in the area of Incline Top, immediately west of Goat Mill Road. The Lower Seven Feet crop is shown approximately 400m southwest of Site on the 1:10,560 geological map[5] and shares a similar profile to SW018I on the CA interactive viewer, striking towards the south. With this considered, it is likely that the SW018I outcrop is the Lower Seven Feet.

The Gellideg, a non-inferred outcrop is shown west of the inferred Lower Seven Feet seam outcrop.

Figure 3-1 - Extract of the CA interactive map viewer showing outcropping seams anticipated to be subject to potential previous mining below Site (Site is defined by the red boundary)



3.2. COAL AUTHORITY CONSULTANTS COAL MINING REPORT

A Consultants Coal Mining Report and Summary of Findings Plan, both referenced 71009804598001 and included in Appendix C, have been obtained for the Site and record the mining activity onsite. In summary:

- Probable unrecorded shallow workings are expected.
- A spine roadway at shallow depth is recorded within Site. No direction to the spine roadway is provided. The date of the spine roadway is not provided.
- Two outcropping seams, named the '*Lower 7FT Bottom Leaf' and 'Upper Seven Foot'*, both of which outcrop twice within the Site and are identified as being of a workable thickness. The bearing of the Lower 7FT Bottom Leaf is recorded as 216° and 224°, whereas the bearing of the Upper Seven Foot is recorded as 180° and 210°. Based on the bearings described, it is considered that the outcrop previously identified as the Amman Rider is the Upper Seven Foot seam, contradicting the geological maps. Outcrop ref. SW018I is likely to be the Lower 7FT Bottom Leaf, which is possibly shown as conjectured within the Site Boundary, towards the northwest of the Site.
- The Site forms part of an unlicenced opencast Site labelled the Great White Tip (ref. OP/95/0067/C). Another unnamed, unlicenced opencast Site is shown immediately west of the Site boundary.

- An Opencast mine license area labelled Ffos-y-Fran is present beyond the eastern boundary of Site, and is referenced 95/0084/C. The CA suggest coal workings can be expected in this area.

- A Site Investigation of a plot of land immediately northeast of the Site boundary is recorded. Upon requesting further information, the CA referred WSP to Earth Science Partnership Ltd.
- A total of twenty mine entries recorded on or near to Site, including twelve adits and eight shafts. A summary is provided in Table 3-1.

Other points of note within the Coal Mining Report for this Site are listed below:

- No past underground mining recorded.
- No faults, fissures or break lines are recorded.
- No recorded Coal Authority managed tips within 500m of the enquiry boundary.
- No remediated Sites recorded within 50m of the enquiry boundary.
- No record of subsidence on or within 50m of the Site since October 1994.
- No records of mine gas within 500m of the enquiry boundary.
- No records of mine water treatment scheme within 500m of the enquiry boundary.
- No recorded future underground mining, coal mining licenses within 200m of the Site boundary, court orders or Section 46 notices of the Coal Mining Subsidence Act 1991.
- The Site is not in an area where a notice to withdraw support has been given under Section 41 of the Coal Industry Act 1994.
- The Site is not in an area where a relevant notice has been published under the Coal Industry Act 1975 or Coal Industry Act 1994.

Table 3-1 - Summary of Mine Entry Records

Type	CA Reference	Coordinates	Location
Adit	305206-022	305997E 206711N	Located offsite, west of the Site boundary, heading southeast towards Site.
Adit	306206-004	306092E 206525N	Located offsite, west of the Site boundary, heading northeast towards Site.
Adit	306206-005	306106E 206776N	Located onsite, heading southeast, passing beneath Site. It is possible this entry is from the identified Old Level, from the 1840s - 1890s historical maps.
Adit	306206-006	306120E 206856N	Located onsite, heading southeast, passing beneath Site. This mine entry is considered to be associated with the Ton-y-Ffald level.
Shaft	306206-007	306201E 206346N	Located offsite, south of the Site boundary.
Shaft	306206-008	306192E 206741N	Located onsite and considered to be one of the old air shafts based on its location.
Shaft	306206-009	306224E 206819N	Located onsite and considered to be one of the old air shafts based on its location. This also appears to be the disused shaft shown in Figure 2-2.

Type	CA Reference	Coordinates	Location
Adit	306206-010	306285E 206523N	Located offsite, southeast of the Site boundary, heading east away from Site.
Shaft	306206-014	306389E 206875N	Located offsite, east of the Site boundary.
Adit	306206-030	306145E 206464N	Located offsite, west of the Site boundary, heading northeast towards Site.
Shaft	306206-067	306264E 206810N	Located onsite. This shaft could possibly be related to the Ton-y-ffald building identified in the historical review.
Adit	306206-074	306328E 206593N	Located offsite, east of the Site boundary, heading southeast away from Site.
Adit	306206-083	306311E 206990N	Located on the western extent of Site, heading southeast passing the eastern extent of the Site boundary.
Shaft	306206-087	306311E 206501N	Located offsite, southeast of the Site boundary.
Shaft	306206-088	306309E 206441N	Located offsite, southeast of the Site boundary.
Adit	306207-018	306199E 207280N	Located offsite, north of the Site boundary, heading east.
Adit	306207-019	306116E 207186N	Located offsite, northwest of the Site boundary, heading southeast towards Site.
Shaft	306207-032	306431E 207003N	Located offsite, east of the Site boundary.
Adit	306207-077	306329E 207301N	Located offsite, north of the Site boundary, heading northeast.
Adit	306207-078	306089E 207148N	Located offsite, northwest of the Site boundary, heading southeast towards Site.

3.3. ABANDONMENT PLANS

Seven opencast abandonment plans with relevance to Site were obtained following a CA consultation and are included in Appendix C. Five abandonment plans are associated with the ref.17930, which is for the *Great White Tip* open cast mine. One is a master plan, shown to cross the Site boundary and the remaining four are seam plans. Two other abandonment plans are associated with the CA ref.16532 for the *Incline* Top open cast, with records comprising one master plan which shows workings west of Site and a seam plan.

It should be noted that the nomenclature of the seams and the sequence mapped in the abandonment plans does not correlate with the published geology. WSP has provided interpretation to help clarify these points.

3.3.1. ABANDONMENT PLANS REF. 17930

3.3.1.1. Abandonment Plans 17930/1

This is an abandonment plan for the *Great White Tip* opencast coal mine, produced by Celtic Energy Ltd, dated July 1996. The plan states that coaling was completed in March 1996 but does not state when coaling commenced.

The boundary of this opencast corresponds to the Unlicensed Opencast Mine Licence Area Ref. OP/95/0067/C, shown on the '*Summary of Findings'* plan obtained from the CA, for the *Great White Tip* opencast. The extent of actual opencast mining is smaller and covers the central and eastern areas of Site. The plan does not show workings to the northern, the extreme southern margin, and a significant part of the western parts of the Site. The lowest point of excavation is shown to be at a level of 255.45m AOD, approximately 100m east of Site.

There is a vertical section detailing the coal seams extracted, taken at point circa of 250m east of the Site boundary with a NGR of 306560E, 207000N, with a recorded ground level of 322.3m AOD. The coal seams, listed in descending order with their thicknesses, depth and levels are summarised in Table 3-2. The total thickness of this vertical section was 65m, comprising 24.9m of overburden, which likely includes former tipped material and a total extracted coal thickness of 8.72m.

Table 3-2 - Summary of the vertical section on plan 17930/1, with a grid reference of 306560E, 207000N

Seam name	Depth to top of seam (m bgl)	Level of top of seam (m AOD)	Thickness (m)
Rhaslas Lower Leaf	24.96	297.34	0.84
Bute	26.88	295.42	0.82
Three Coals Rider	35.76	286.54	0.44
Three Coals Upper	37.17	285.13	0.83
Three Coals Lower	38.06	284.24	0.34
Little Rider	42.91	279.39	0.49
Little Vein Upper Leaf	58.58	263.72	0.72
Little Vein Lower Leaf	59.51	262.79	0.79
Little Vein Lower Leaf 2	60.45	261.85	0.35
Lower Four Feet Upper Leaf *	60.85	261.45	0.75
Lower Four Feet Middle Leaf *	61.66	260.64	0.94
Lower Four Feet Lower Leaf *	63.59	258.71	1.41
*Also known as the Gellideg seam.			

3.3.1.2. Abandonment Plans 17930/2, 17930/3, 17930/4, & 17930/5

The subsequent plans to 17930/1 are seam extraction contour plans of the coal seams listed in Table 3-2. Similarly to 17930/1, the abandonment plans are for the *Great White Tip* opencast mine, produced by Celtic Energy Ltd, dated July 1996. The plans also suggest that coaling was completed in March 1996 but do not state when coaling commenced.

A summary of each plan is shown in Table 3-3, with the seams listed in descending order. Typically, the plans show the seams to dip towards the southeast direction. Unless stated otherwise, the plans typically cover the central and eastern areas of Site.

Table 3-3 - Summary of Abandonment Plans 17930/2 - 17930/5

Seam	Plan	Location	Approx. Recorded Ground Levels within the Site Boundary (m AOD)	Approx. Range of Bottom of Coal Levels within the Site Boundary (m AOD)	Other features within the Site Boundary
Rhaslas Lower Leaf	17930/5	Offsite, east of the Site boundary.	Not onsite	Not onsite	Not onsite
Bute	17930/5	Offsite, east of the Site boundary.	Not onsite	Not onsite	Not onsite
Three Coals Rider	17930/5	Offsite, east of the Site boundary.	Not onsite	Not onsite	Not onsite
Three Coals Upper	17930/5	Offsite, east of the Site boundary.	Not onsite	Not onsite	Not onsite
Three Coals Lower	17930/5	Offsite, east of the Site boundary.	Not onsite	Not onsite	Not onsite
Little Seam Rider	17930/5	Offsite, east of the Site boundary.	Not onsite	Not onsite	Not onsite
Little Seam Upper Leaf	17930/3	Onsite	294.88 – 282.18	288 - 273	Workings of a potential/suspected adit, possibly associated with 306206-006 is shown extending in a roughly NW/SE orientation in the southwestern part of the Site.

Seam	Plan	Location	Approx. Recorded Ground Levels within the Site Boundary (m AOD)	Approx. Range of Bottom of Coal Levels within the Site Boundary (m AOD)	Other features within the Site Boundary
					Zones of washout is shown towards the southeastern side of Site.
Little Seam Lower Leaf 1	17930/3	Onsite	293.85 – 285.22	287 - 268	Workings of a potential/suspected adit, possibly associated with 306206-006 is shown extending in a roughly NW/SE orientation in the southwestern part of the Site. A zone of washout is shown towards the southeastern side of Site.
Little Seam Lower Leaf 2	17930/3	Onsite	295.20 – 269.00m	286 - 268	Workings of a potential/suspected adit, possibly associated with 306206-006 is shown extending in a roughly NW/SE orientation in the southwestern part of the Site. No coal is shown towards the southeastern side of Site.
Lower Four Feet Upper Leaf *	17930/2	Onsite	291.98 – 287.77	286 - 266	Workings of a potential/suspected adit, possibly associated with 306206-006 is shown extending in a roughly NW/SE orientation in the southwestern part of the Site. A zone of washout is shown towards the southeastern side of Site.
Lower Four Feet Middle Leaf *	17930/2	Onsite	292.16 – 282.70	285 – 265	Workings of a potential/suspected adit, possibly associated with 306206-006 is shown extending in a roughly NW/SE orientation in the southwestern part of the Site. A zone of washout is shown towards the southeastern side of Site.
Lower Four Feet Middle Leaf 2 *	17930/4	Onsite	288.20 – 269.50	277 – 265	This seam is shown towards the southeastern extent of Site, hence the lower upper bound approximate bottom of coal level compared to the other seams.

Seam	Plan	Location	Approx. Recorded Ground Levels within the Site Boundary (m AOD)	Approx. Range of Bottom of Coal Levels within the Site Boundary (m AOD)	Other features within the Site Boundary
Lower Four Feet Lower Leaf *	17930/4	Onsite	289.72 – 280.46	285 - 263	Workings of a potential/suspected adit, possibly associated with 306206-006 is shown extending in a roughly NW/SE orientation in the southwestern part of the Site. The seam plan also indicates another potential/suspected adit, however, this trends across the seam and is fragmentally shown. It is possible that this could be a drivage from the adit workings of the associated mine entry ref.306206-006.

*Also known as the Gellideg seam.

3.3.2. ABANDONMENT PLANS 16532/1 & 16532/2

3.3.2.1. Abandonment Plan 16532/1

This opencast completion plan, produced by British Coal Opencast, titled *Incline Top* was issued in 1994, and indicates coaling works commenced in January 1992 and was completed in September 1993. The opencast shares the same boundary as the unnamed, unlicenced opencast Site, shown on the '*Summary of Findings'* map.

The boundary shown on the abandonment plan is west of Site. No opencast excavations are indicated in this area close to the Site boundary. The batter perimeter of the opencast is shown to be from approximately 75m west of Site, with opencast workings shown from approximately 100m from Site. The lowest point of excavation is shown to be at a level of 226.3m AOD. The possible relevance of this abandonment plan to the Site is the seam records and levels. However, given the dip of strata observed on plan series ref.17930, it could be irrelevant.

A vertical section taken at grid reference 305900E, 206700N; approximately 190m west of Site is shown, taken at a level of 267.1m AOD. This is close to where the 1:10,560 SO00NE geological map[5], shows where the Gellideg seam was encountered at 231.6m AOD. The location of this vertical section is understood to be close to the location outcrop SW018l, understood to be the Lower Seven Feet Bottom Leaf, shown west of Site on the CA interactive map[8] (see Figure 3-1). Table 3-4 summarises the vertical section.

Table 3-4 - Summary of the vertical section on plan 16532/1, with a grid reference of 305900E, 206700N

Seam name	Depth to top of seam (m bgl)	Elevation of top of seam (m AOD)	Thickness (m)
Little Seam Rider	12.85	254.25	0.55
Little Seam Upper	30.13	236.97	0.77
Little Seam Lower	30.93	236.17	0.77
Lower Four Feet Upper *	32.20	234.90	0.80
Lower Four Feet Middle *	33.05	234.05	0.85
Lower Four Feet Lower *	34.00	233.10	1.40
Lower Four Feet Lower Leaf 2 *	35.45	231.65	0.15

*Also known as the Gellideg seam.

3.3.2.2. Historical Review Of The Site And Surrounding Area Based On Abandonment Plan 16532/1

This subsection is an extension to the historical review in Section 2.4, based on plan ref.16532/1, due to the large gap historical development between 1973 and 2001 due to the availability of publicly available information.

The northern half is labelled the *Dowlais Great Tip Slag Heap*. Several ponds, unlabelled buildings and paths are shown onsite. Though not overly clear due to the quality of the scan, there appears to

be a railway siding which runs adjacent to or marginally beyond the southwestern boundary of Site. A feature which appears to be labelled as a disused shaft is shown onsite with an approximate NGR of 306225E, 206815N, which is very close to the CA provided location of shaft ref.306206-009 which is likely to be a historic air shaft.

Regarding the remaining surrounding area to Site, there is no obvious significant changes to the information provided in the historical review i.e. from 1973, beyond the north and south boundary. East of Site, several disused tips are shown.

3.3.2.3. Abandonment Plan 16532/2

The seam plans provided on this abandonment plan supplement plan ref.16532/1, which shares the same drawing details. This plan suggests that the seams have been subject to old workings. Given seam plans are not within the Site boundary, Table 3-5 focusses on the approximate bottom of coal depths for each sequence and the percentage of area of old workings per seam shown on the plan.

Table 3-5 - Summary of Abandonment Plan 16532/2

Seam Name	Approx. Range of Bottom of Coal Levels within the offsite opencast (m AOD)	Seam coverage by old workings area (%) [incl. leaf 2]
Little Seam Rider	255 - 254	6.3
Little Seam Upper	250 - 231	31.7
Little Seam Lower	240 - 231	35.3
Lower Four Feet Upper	240 - 230	43.7
Lower Four Feet Middle [incl. Leaf 2]	237 - 239	43.5 [not stated]
Lower Four Feet Lower [incl. Leaf 2]	235 - 227	65.4 [49.1]

3.3.3. ABANDONMENT PLAN SWR2510

This is a plan titled ‘Plan of Penydarran Minery’ and dated 1860. There are few surface features shown in which to orientate the plan accurately, but the general Site area can be inferred from the position of the Dowlais Railway, what is now Goat Mill Road and the A4102 Road, *Pwll yr Hwyaid Pond*, the position of the *Branch Incline* and some mine entries. The plan shows several mine roadways related to ironstone mining. Based on published geology these workings will be below the Lower Four Feet/Gellideg coal seam. There are no depths or levels given on the plan. Observations of features should be considered as approximate given the difficulty in referencing the plan accurately.

Table 3-6 summarises the name and location of the following spine roads shown below the anticipated location of Site. The legend corresponding to ironstone veins is not clear, making it difficult to differentiate what veins the roadways are from. Due to the typical lower thicknesses of the ironstone veins compared to the coal seams, individual roadways may have been used to exploit more than one vein. It is likely that workings extend from these roadways, areas of which are not shown on the abandonment plan.

Table 3-6 - Summary of Roadways shown to underly Site

Name	Location relative to Site
Dip Level Horseway to No.4 pit	Shown to underly the northern part of Site, trending northwest to southeast. It connects to a pit suspected to be mine entry ref. 306207-032.
Pond Level	Shown to underly the central area of Site, trending northwest to southeast. Towards the eastern extent of Site or beyond the eastern boundary, this road elbows and heads north to a pit suspected to be mine entry ref. 306207-032. At the elbow, workings of another spine road in a different vein are shown.
Wain Rhaf Level	West of Site, a short record of a northwest to southeast spine road is shown. It is possible this continues beneath Site.
Horse Way from No.2 Pit.	Shown to underly towards the southern side of Site, trending northwest to southeast and merges with a roadway which originates from Railway Pit, anticipated to be south of Site.

The Penydarran Fault is typically shown west of the Dowlais Railway. However, the railway is shown to cross the strike of this northwest to southeast trending fault. This is anticipated to be towards southern extent of Site, i.e. suggesting that the fault underlies the southwestern/southern area of Site. The plan suggests the faults raises to the east, suggesting the western side of the fault is downthrown by 15.5m. The BGS published sources do not map the Penydarran Fault through the Site[5,6].

The plan also shows that the 'Pingaw & Coal' outcrop underlies the northwestern corner of Site, with the line of crop shown to head to the northeast away from Site. There is an additional unlabelled, faint linear line feature shown on Site. It shown from the offsite feature labelled Williams Field and heads northwest to the northwestern corner of Site. This is not believed to be geologically related.

3.3.4. SUMMARY OF INFORMATION FROM ABANDONMENT PLANS AND CONCLUSIONS DRAWN

The nomenclature of the seams recorded on both opencast abandonment plans, i.e. plan series ref.16532 & ref.17930, is consistent. Plan series ref.16532 may only be relevant to the Site with respect to the potential depths of the seams. Assuming these plans are correct and given that they have been produced relatively recently, there are anomalies between both regarding the depth of seams. With reference to the Lower Four Feet seam, which is interpreted to be the Gellideg, and the lowest seam recorded on both abandonment plan series, the information provided is converse to what is expected based on a review of the published geology. It would be expected that the Gellideg/Lower Four Feet seam would be at similar levels, showing the strata dip towards the southeast direction.

Abandonment plan series ref.16532 indicates that base of the offsite opencast is between the approximate levels of 235 – 227m AOD. Abandonment plan series ref.17930 suggests that the base of the opencast mining beneath the centre and eastern extents of Site was approximately between 285 – 263m AOD, with the base of the opencast decreasing in level towards the southeast direction. The level difference between the closest points of both seam plans is approximately 32m. This is based on the contours towards the southwestern side of the onsite seam plan and southeastern side of the offsite seam plan.

The Penydarren Fault, shown on plan ref. SWR2510 would be a logical explanation for the conflicting information between both opencast mine abandonment plans. As indicated above the Penydarren Fault, based on publish geology, is shown 750m southeast of Site. Without intrusive investigation, the location of this fault should be taken as approximate.

Given the suggested 15.5m downthrow, there is still some inconsistencies between recorded seam levels. Other possible reasons that may explain the deficit could be due to errors in surveying and incorrect description of the seams beneath Site. The level of the Gellideg seam, shown on the 1:10,560 Geological Map[5], local to the southwestern extent of the offsite Opencast is approximately 231.6m AOD. This would indicate the levels shown on the abandonment plan series ref.16532 is correct.

However, the levels of the Gellideg/Lower Four Feet indicated on BGS borehole ref.SO00NE53 located southeast of Site, supports the levels indicated on abandonment plan series ref.17930. This borehole was undertaken in 1975 and along with the published BGS information, pre-date the latest information held by the Coal Authority which suggests the Lower Seven Feet seam outcrop passes beneath the northwestern corner of Site. There is possibility that the encountered seams have been miss identified.

It has been interpreted that plan ref.SWR2510 does show workings beneath the Gellideg seam and could possibly contradict the CA Consultants Mining Report which indicated no record of underground mining beneath the Site.

From the current approximate ground levels described in Section 1.3, abandonment plan series ref.17930 indicates that the depth of opencast backfills beneath the Site ranges between 0m to approximately 16m towards the southeastern extents of the Site.

The abandonment plans also encountered a suspected adit, which typically trends in a Northwest/Southeast orientation in the southern part of the Site. This demonstrates historical underground coal mining did occur on the Site, but that this was partially excavated by the subsequent open cast mine. It is not clear from the abandonment plans whether there are underground workings beneath the parts of the Site not subject to opencast workings, but it is considered feasible.

4. COAL MINING RISK ASSESSMENT

4.1. RECORDED COAL MINING AT SHALLOW DEPTH (<30M)

The Coal Consultants Mining Report suggests a shallow spine roadway exists within the Site boundary. The location of the spine road is unknown, and no further details are given. Abandonment Plan ref. SWR2510 also suggests that spine roads exist beneath Site. It is unknown whether these and any associated workings exist within 30m or influencing depth of ground level.

Based on open cast abandonment plan series ref.17930, coal mining at shallow depth has taken place towards the centre and eastern extent of Site. According to the abandonment plans this was to the base of the Lower Four Feet Lower Leaf, i.e. the Gellideg seam. However historical unrecorded mining cannot be discounted.

Opencast coal extraction activity has taken place onsite and will have excavated any workings within the extraction zone, although remnants would remain within the side slopes. Recorded mining at shallow depth is a risk in those areas that were not subject to open cast mining and should be investigated to confirm the presence, or otherwise of workings and roadways, depth, extraction thickness of workings, location of the opencast highwall and opencast backfill properties to inform the risk to redevelopment.

4.2. UNRECORDED COAL MINING AT SHALLOW DEPTH

The CA interactive map viewer indicates that the Site lies within a surface coal resource area. The CA also suggest on the interactive map viewer and mining report that there are probable unrecorded shallow workings. The whole Site is also subject to unlicensed opencast mining, with the historical review of the Site indicating past mining to the southern, western and northern extents of Site. Shallow workings from the area of bell pits, not subject to opencast mining could be present towards the west of Site.

4.3. RECORDED COAL MINING AT GREATER DEPTH (>30M)

The CA have no record to suggest coal mining at greater depth. The Gellideg or Lower Four Feet is generally the lowest seam worked in the Merthyr District. Ironstone veins are known to have been worked below the Gellideg, particularly to the north of the district.

The historical maps identify several ironstone mines and small pit features on and surrounding the Site.

Furthermore, abandonment plan SWR2510 indicates ironstone roadways beneath Site, suggesting workings beneath the Gellideg seam. BGS borehole ref.SO00NE72 shows the lowest ironstone vein i.e. the Rosser Veins to be up to approximately 38m below the Gellideg. The CA do not hold records of recorded mining at greater depth beneath the Site, however, this abandonment plan could potentially suggest workings beyond 30m below ground level.

4.4. SURFACE MINING (OPENCAST WORKINGS)

The CA has record of past opencast coal mining activities within the enquiry boundary and 500m of the Site. This comprises the *Great White Tip* opencast onsite, with the *Incline Top* opencast immediately to the west.

4.5. MINE ENTRIES

The CA has records of twenty mine entries within and close to the Site boundary (see Table 3-1). Other than location, mineral type and potential treatment, the CA have no further information regarding the mine entries.

Six mine entries are shown onsite, comprising of three shafts (ref. 306206-008, 306206-009 and 306206-067) and three adits (ref. 306206-005, 306206-006 and 306206-083). The CA believe that five of these mine entries excluding entry Ref.306206-005 have been subject to potential treatment in the form of partial or full excavation during past opencast mining. Possible remnants of the recorded shafts may remain below the base of the backfilled opencast mine. It is considered that the disused shaft shown in Figure 2-2 is of shaft Ref. 306206-009. The abandonment plans only indicate workings of one suspected/possible adit, thought to be workings of adit ref.306206-006. The CA suggest mine entry ref. 306206-083 was for the extraction of Ironstone.

There are seven adits located beyond the western and northern boundary of Site. Along the western boundary five adits (ref. 306206-004, 306206-022, 306206-030, 306207-019 and 306207-078) are shown to head towards Site, indicating the potential for worked seams beneath Site in areas not subject to opencast working. The remaining two adits north of Site (ref. 306207-018 and 306207-077), are shown to head eastwards. It is possible that these adits lead to workings beneath Site. The CA only have records of workings to the central and eastern extent of Site, suggesting that workings from these adits may pre-date the legal requirement to lodge abandonment plans. Additionally, the CA suggest adit ref. 306206-004 and 306207-018, were for the mining of ironstone, the working of which are likely to be below the Gellideg seam.

The remaining shafts and adits are either located too far from the Site boundary to pose a risk to it or, in the case of the adits, appear to be aligned away from the Site and do not pass beneath it. Of these, based on the mapped locations shown by the '*Summary of Findings'* plan in conjunction with the published geology, the following mine entries are considered to not pose a risk to the Site:

- 306207-032
- 306206-014
- 306206-074
- 306206-010
- 306206-087
- 306206-088
- 306206-007

4.6. GROUND MOVEMENTS DUE TO COAL MINING

The CA has no records of any damage due to geological faults, ground subsidence or other lines of weakness that have been caused by coal mining. The CA has not received a damage notice or claim for subsidence within 50 meters of the enquiry boundary since October 1994.

However, abandonment plan ref. SWR2510 indicates that the Penydarran Fault underlies the southern/southwestern part of Site.

As noted above this abandonment plan is difficult to orientate and scale accurately to Site. Therefore, the evaluation of this location is an approximation and should not be taken as exact.

4.7. MINE GAS EMISSIONS

The CA has no record of past mine gas emissions requiring action and no mine gas has been recorded within 500m of the Site. However, due to the presence of probable shallow workings beneath the Site, there is potential for mine gases to migrate to the surface through fissures within the rock and opencast backfill, which will have a higher permeability and any superficial strata, if present.

It is noted that groundwater or ground gas monitoring boreholes are present on the Site. No records have been made available for these locations.

4.8. MINE WATER TREATMENT SCHEMES

There are no recorded mine water treatment locations within 500m of the Site boundary.

4.9. RECORDED COAL MINING SURFACE HAZARD

The Site has been subject to opencast mining. The mining report contains no records of remediated Sites or subsidence. There are no recorded CA managed tips within 500m of the Site boundary.

4.10. SUMMARISED COAL MINING RISK

Given the data obtained from the CA and published geology, the redevelopment to Site is considered High risk. The assessed coal mining risk is summarised in Table 4-1. Appendix B shows a summary mining risk plan identifying the risk to Site redevelopment due to anticipated and known historical mining activity.

Given the historical coal and ironstone mining activity, the understanding relating to the presence, nature, and location of unknown/known workings within the Site may change as the project develops. As such, mining risk should be updated as and when further information becomes available throughout planning, design, and construction stages.

Table 4-1 - Coal Mining Risk Assessment Summary

Coal Mining Issue	Comment
Recorded coal Mining	**HIGH RISK** – A spine road at shallow depth is recorded within the Site at an unknown location. Abandonment plan series ref.17930 indicates recorded opencast workings to the central and eastern extent of Site. The CA hold no records of past underground mining at greater depths. However, as suggested above it is believed that the ironstone viens beneath the Gellideg have been worked based on abandonment plan ref. SWR2510. Depending on the extent of the Ironstone workings, the base of these workings, which is anticipated to be the Rosser Veins based on published geology, could be more than 55m below current ground level.
Unrecorded coal mining	**HIGH RISK** - The CA believe that the Site has probably been subject to shallow coal mining. The Site is also subject to unlicensed opencast mining. The historical review revealed areas of likely opencast activity onsite, particularly towards the north, south and western areas of Site, where CA do not withhold recorded opencast workings. The 1:10,560 SO00NE geological map[5] also shows an area labelled '*Many Bell Pits'* to the central/southern part of Site. The majority of these mine entries will have been

Coal Mining Issue	Comment
	removed during the recorded opencast works in the 1990s, but remnants could remain particularly towards the western extent of Site.
Surface mining (opencast workings)	**HIGH RISK** – The majority of the Site has been subject to opencast coal mining based on recorded information from the CA and the historical review of Site. No information has been obtained to determine the nature of the backfilling.
Mine entries (shafts/ adits)	**HIGH RISK** – There are six CA recorded mine entries within the Site. Although it is likely that the opencast mining removed these, there is no confirmation that these mine entries have been completely removed. The CA state for five of the six mine entries that they may have been partially or wholly removed during past opencast mining. There is no treatment record to adit ref. 306206-006. Mine entry ref. 306206-009 is shown on modern mapping (see Figure 2-2). Some adits offsite are shown to be aligned towards the Site boundary indicating the potential for mine workings beneath Site. Some have records of possible treatment through being partially or wholly removed during past opencast mining. Given the complex mining history within the area, the presence of unrecorded mine entries cannot be fully discounted.
Ground movement due to coal mining	**LOW RISK -** The CA has no record of damage due to geological faults or other lines of weakness. The opencast extraction will reduce the risks from subsidence as any workings will have been removed although there remains a risk of settlement from the open cast backfill.
Gas emissions	**MODERATE RISK -** The CA has no records of past mine gas emissions affecting the Site. Due to the potential for unrecorded shallow workings, there is a potential for mine gases migrating upwards to the surface and affecting enclosed structures within future development. This should be treated as suspect and investigated further.
Coal mining surface hazard	**HIGH RISK** – There is no confirmed record of treatment to mine workings and entries within the Site. No record of CA managed tips within 500m of the Site boundary. No further information has been published in the mining report.

5. MITIGATION STRATEGY PROPOSED

5.1. RISK FROM MINE WORKINGS

Records indicate that shallow, abandoned mine workings may be present beneath parts of the Site, particularly in those areas not open casted. The presence of unrecorded shallow workings across Site cannot be discounted due to lack of comprehensive data coverage. The historical review revealed likely opencast activity towards the north, south and western areas of Site, where CA do not hold records. Records within the opencast abandonment plan series ref.17930 show coal workings towards the central and eastern extent of Site.

The CA indicate a spine road at shallow depth beneath the Site. There is no indication where this is located. The CA also suggest the Site is within an area of surface mining and probable unrecorded shallow workings. As discussed, it is known ironstone veins have been worked below the Gellideg in the Merthyr District, and abandonment plan ref. SWR2510 supports this.

It is recommended that an intrusive investigation by means of boreholes is undertaken to investigate unrecorded shallow mine workings and any other voids associated with underground workings in these areas. It is considered that 30m deep boreholes should be sufficient in providing geotechnical information on the opencast backfill material and underlying Coal Measures. It would be recommended that at least one borehole should be extended to the Rosser Veins, which is anticipated to be approximately up to 60m bgl, to help inform decisions with respect to any potential risks to redevelopment posed by workings within the Ironstone Veins.

Geophysical techniques, such as micro-gravity, resistivity or seismic may provide a relative low cost, wide area investigation technique to determine the position of roadways, voids and the opencast highwall. Any features identified would still require ground proving with boreholes or similar.

If encountered, shallow mine workings/voids with insufficient ground cover would likely require remediation as part of Site development enabling works. This may comprise local excavation and backfilling with engineered fill where the voids are very shallow, stabilisation by grout injection or, the use of high strength geogrids as tension membranes to manage the impacts of any ground movement below less sensitive areas such as green spaces.

5.2. RISK FROM MINE ENTRIES

The CA are aware of twenty mine entries within influencing distance to the Site boundary. Of these six are shown onsite, with up to seven further mine entries considered to potentially relate to workings beneath Site. The location of these mine entries, including spine roadways that pass beneath the Site, should be confirmed and their condition investigated. Some if not all may have been partially or wholly excavated during past opencast mining. Given the complex mining history within the area, the presence of unrecorded mine entries cannot be fully discounted.

Therefore, it is recommended that a watching brief is kept during a ground surface strip and general Site enabling earthworks. If any unusual ground conditions or features are exposed, which may represent an unrecorded mine entry, additional assessment and investigation shall be undertaken.

If any mine entries are present, these may require stabilisation to the satisfaction of the CA prior to Site redevelopment. Depending on their location, a ‘no build zone’ for structures may be required

around the zone of influence of a mine entry if remediation or confirmation of presence is not possible. It should be noted that an exclusion zone is likely to be required around treated openings.

5.3. RISK FROM MINE GAS EMISSIONS

There is a risk of mine gas emissions due to the presence of mine workings beneath the Site. A ground gas monitoring programme should be undertaken to monitor the presence and concentration of hazardous ground gases on the Site and to enable a gas risk assessment to be undertaken for the Site. The presence of hazardous ground gases on the Site may require the implementation of gas protection measures for proposed enclosed and occupied spaces.

5.4. RISK TO REDEVELOPMENT AND FOUNDATIONS

Due to its variable strength, coal is generally not an appropriate bearing stratum for foundations and, if found at foundation formation level, it should be removed locally such that foundations bear on competent strata below. It should be noted that coal may not be excavated with agreement with the CA and a royalty may be payable.

It is anticipated that the majority of Site is underlain by opencast mine backfill, which infill is likely to not to have been compacted in accordance with an engineering specification. It is unlikely that this has been treated. This material is likely to increase the risk of mine gas migration and potentially lead to settlement of future structures. Future redevelopment must take in account the nature and depth of the backfill, as well as a remaining open voids, and pre-treatment may be required before developing proceeds. The use of soakaway drainage may induce collapse settlement, and this must be considered during the detailed design phase.

Appendix A

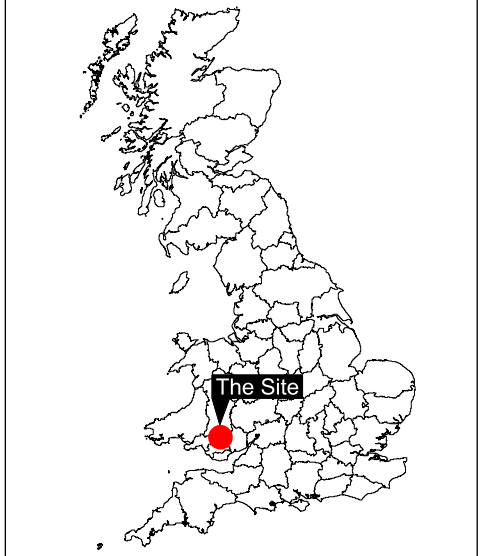
SITE BOUNDARY

Public



SITE LOCATION
SCALE 1:5,000

SITE LOCATION
SCALE 1:50,000



SITE LOCATION
SCALE 1:50,000

LEGEND

SITE BOUNDARY

CLIENT
MERTHYR TYDFIL COUNTY BOROUGH COUNCIL

PROJECT
GOAT MILL ROAD

TITLE
SITE LOCATION PLAN

CONSULTANT
wsp

YYYY-MM-DD	2024-08-28
DESIGNED	CB
PREPARED	ECS
REVIEWED	OEG
APPROVED	KDP

PROJECT NO.	CONTROL	REV.	DRAWING
UK-70116992	1001-ME-0001	A	1

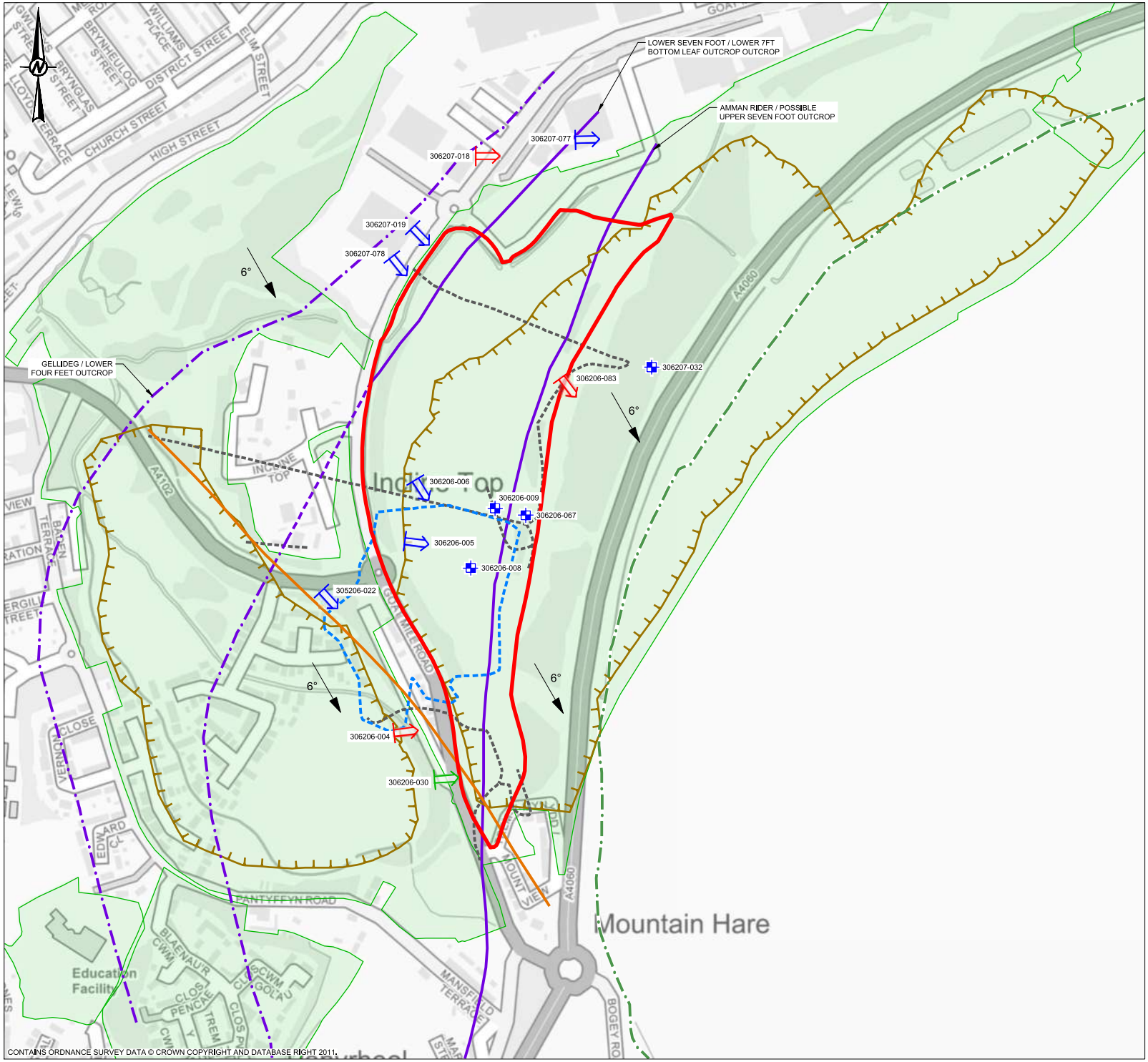
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Appendix B

MINING RISK PLANS

Public



LEGEND

- SITE BOUNDARY
- OPENCAST MINE LICENSE AREA
- UNLICENSED OPENCAST MINE
- OUTCROP (PROVEN)
- OUTCROP (CONJECTURED)
- APPROXIMATE TRACE OF OUTCROP
- APPROXIMATE TRACE OF THE BATTERED PERIMETER OF THE OPENCAST MINES SHOWN ON ABANDONMENT PLANS REF. 17930/1 & 16532/1
- APPROXIMATE TRACE OF THE PENYDARRAN FAULT BASED ON ABANDONMENT PLAN REF. SWR2510
- APPROXIMATE TRACE OF IRONSTONE ROADWAYS SHOWN ON ABANDONMENT PLAN REF. SWR2510
- APPROXIMATE TRACE OF AREA OF MANY BELL PITS
- DIRECTION AND DIP OF THE SOLID GEOLOGY
- SHAFT - COAL
- ADIT - COAL
- ADIT - IRONSTONE
- ADIT - LIMESTONE

0 100 200
1:5,000 METRES

CLIENT
MERTHYR TYDFIL COUNTY BOROUGH COUNCIL

PROJECT
GOAT MILL ROAD

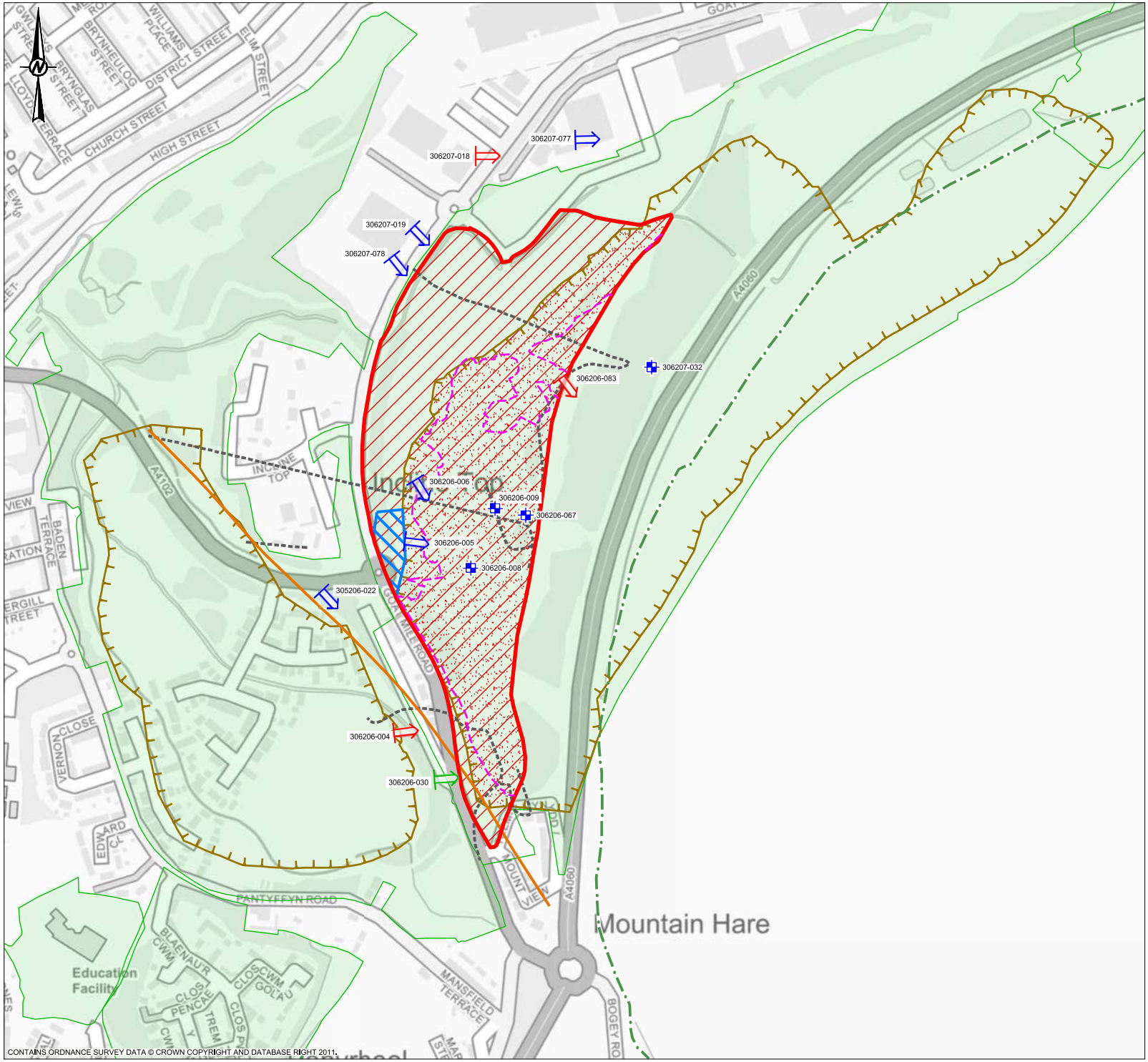
TITLE
GENERAL GEOLOGICAL AND MINING FEATURES ANTICIPATED TO BE RELEVANT TO SITE

CONSULTANT
wsp

YYYY-MM-DD	2024-09-03
DESIGNED	CB
PREPARED	ECS
REVIEWED	OEG
APPROVED	KDP

PROJECT NO.	CONTROL	REV.	DRAWING
UK-70116992	1001-ME-0001	A	2

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LEGEND

- SITE BOUNDARY
- OPENCAST MINE LICENSE AREA
- UNLICENSED OPENCAST MINE
- EXTENTS OF RECORDED OPENCAST MINING ACTIVITY ON SITE
- HIGH RISK: SITE IS SUBJECT TO PROBABLE SHALLOW MINING AND UNLICENSED OPENCAST MINING. MINE ENTRIES MAY STILL BE PRESENT. THE COAL AUTHORITY BELIEVE A SPINE ROAD IS LOCATED BENEATH THE SITE AT AN UNKNOWN LOCATION. THE HISTORICAL REVIEW IDENTIFIED HISTORIC MINING ACTIVITY ACROSS MOST OF THE SITE. IT IS KNOWN THAT IRONSTONE VEINS WITHIN THE MERTHYR DISTRICT BELOW THE GELLIDEG HAVE BEEN MINED IN AREAS.THIS IS SUPPORTED BENEATH SITE BY THE IRONSTONE ROADWAYS SHOWN ON ABANDONMENT PLAN REF.SWR2510
- APPROXIMATE TRACE OF THE BATTERED PERIMETER OF THE OPENCAST MINES SHOWN ON ABANDONMENT PLANS REF. 17930/1 & 16532/1
- APPROXIMATE TRACE OF THE PENYDARRAN FAULT BASED ON ABANDONMENT PLAN REF. SWR2510
- APPROXIMATE TRACE OF IRONSTONE ROADWAYS SHOWN ON ABANDONMENT PLAN REF. SWR2510
- POSSIBLE TOE OF THE OPENCAST SIDE SLOPE BENEATH SITE, I.E. THE LOWER FOUR FEET LOWER LEAF (GELLIEG)
- APPROXIMATE TRACE OF AREA OF MANY BELL PITS WHICH MAY NOT HAVE BEEN REMOVED DURING OPENCAST WORKS
- SHAFT - COAL
- ADIT - COAL
- ADIT - IRONSTONE
- ADIT - LIMESTONE

0 100 200
1:5,000 METRES

CLIENT
MERTHYR TYDFIL COUNTY BOROUGH COUNCIL

PROJECT
GOAT MILL ROAD

TITLE
MINING HAZARD PLAN

CONSULTANT
wsp

YYYY-MM-DD	2024-08-28
DESIGNED	CB
PREPARED	ECS
REVIEWED	OEG
APPROVED	KDP

PROJECT NO.	CONTROL	REV.	DRAWING
UK-70116992	1001-ME-0001	A	3

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Appendix C

COAL AUTHORITY SOURCES

Public

Appendix C.1

SUMMARY OF FINDINGS PLAN

Public

The Coal Authority

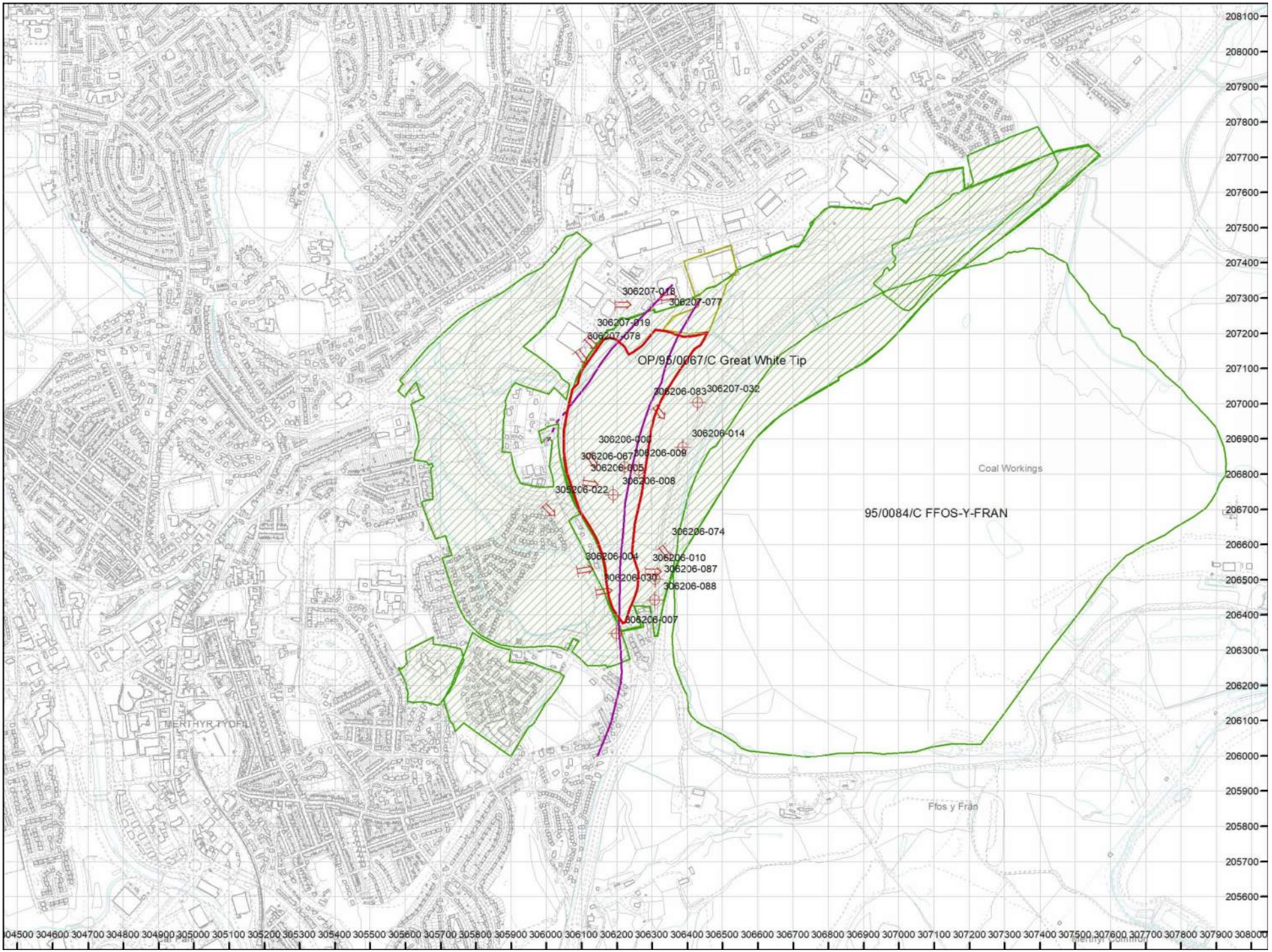
Summary of findings

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

Key

- Approximate position of the enquiry boundary shown
- Disused mine shaft
- Disused adit
- Outcrop (Proven)
- Outcrop (Conjectured)
- Opencast mine licence area
- Unlicensed opencast site
- Site investigations



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Appendix C.2

CONSULTANTS COAL MINING REPORT

Public

The Coal Authority

Consultants

Coal Mining Report

Goat Mill Road
Merthyr Tydfil



Date of enquiry:	**5 July 2024**
Date enquiry received:	**5 July 2024**
Issue date:	**16 July 2024**
Our reference:	**71009804598001**
Your reference:	