

Persimmon Homes

Elm Tree Grove, Twynrobyn, Merthyr Tydfil

**Report on Ground Stabilisation of
Old Shallow Mine Workings**

12690/DPD/24/GS

CLIENT: Persimmon Homes

PROJECT: Elm Tree Grove, Twynrobyn

TITLE: Report on Ground Stabilisation of Old Shallow Mine Workings

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Geotechnical Engineers:
Intégral Géotechnique (Wales) Limited
Integral House
7 Beddau Way
Castlegate Business Park
Caerphilly
CF83 2AX

Tel: 029 2080 7991

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1.0 INTRODUCTION

Persimmon Homes are currently developing a site at Elm Tree Grove, Twynrodyn, Merthyr Tydfil for residential housing.

Intégral Géotechnique (Wales) Limited were originally appointed as the Geotechnical Engineers to advise on the ground conditions which included the risk from possible past shallow mine workings, and to make recommendations for any required stabilisation works. Previous studies have been undertaken and reported as follows:

- a) Site Investigation Report by Intégral Géotechnique (Wales) Limited dated August 2008, report reference: 9913/GNS/08
- b) Mine Entries Risk Assessment by Intégral Géotechnique (Wales) Limited dated August 2020, report reference: 12690/JJ;
- c) Site Investigation Report by Intégral Géotechnique (Wales) Limited dated August 2023, report reference: 12690/JJ/23/SI.
- d) High density proof drilling from May to September 2023.

In 2023 Intégral Géotechnique issued a site Investigation report for the site, reference: 12690/JJ/23/SI (Document 'c' above) which included a desk study, machine dug trial pitting, shell and auger boreholes, rotary probeholes, chemical and, water monitoring, together with recommendations.

The purpose of the rotary probeholes was to establish the depth to, and amount of, competent rock cover above any shallow coal seams / ironstone veins, and any associated old mine workings, to assess the level of ground subsidence risk.

Evidence of shallow mine workings was encountered in eight out of 23 No. boreholes (i.e., at R2, R3, R11, R12, R16, R17, BH101 and BH103). Additionally, numerous boreholes encountered shallow coal seams of workable thicknesses.

The encountered mine workings are considered to represent unrecorded mine workings (i.e., workings not shown on the available abandonment plans) targeting the Lower Seven Foot, the Five-Foot Gellideg coal seams and shallow ironstone veins.

When assessing potential ground subsidence risks resulting from void migration above old mine workings, the limiting height of void migration, where no appreciable surface subsidence can result, is termed 'acceptable cover', with its determination based upon a criterion reflecting the worked thickness of the seam and the overlying rock cover.

1.0 INTRODUCTION (CONTINUED)

When assessing acceptable cover thicknesses above old mine workings, the 10:1 rock cover to void height ratio is commonly used throughout the UK.

Based on the maximum thickness of the encountered mine workings at R16, a conservative maximum potential void thickness (t) of 2.7m has been assumed for the purposes of assessing acceptable cover thickness.

When adopting a cover ratio of 10:1, the conservative maximum potential void thickness of 2.7m would equate to a required safe rock cover thickness of 27m. The thickness of the rock cover above the encountered mine workings varied from approximately 0.60m (at R16) to 19.10m (at R3).

The drilling results have demonstrated there to be insufficient rock cover above the encountered mine workings, shallow coal seams and any potentially ironstone veins beneath the site, and the potential ground subsidence risk to the proposed development is considered high.

To mitigate the potential ground subsidence risk, drilling and grouting ground stabilisation works were recommended prior to development. To inform the extent of the required drilling and grouting ground stabilisation works, it was recommended that a programme of high-density plot-specific proof drilling was undertaken across the whole site area.

In addition, several coal adits/mine entries were found along the sites eastern boundary, and adits 305205-053 and 305205-02 would need to be investigated and if required treated, their approximate locations are shown on Figure 2.

Based on the findings of the high-density proof drilling, extensive shallow ironstone mine workings with insufficient rock cover were encountered across the site with some additional pockets of coal working close the site's south east boundary. A stabilisation programme was therefore recommended to backfill any shallow mine workings beneath the site, with insufficient rock cover, and to thereby prevent future significant ground movements occurring because of possible future collapses of these mine workings.

Between May 2023 and March 2024 Apex Drilling Services Limited undertook the ground stabilisation works, which included a programme of drilling and grouting.

The drilling and grouting works, were monitored by Intégral Géotechnique (Wales) Limited.

This report describes the procedure for the ground stabilisation works and gives information about the quantities of drilling and the volumes of injected grout.

1.0 INTRODUCTION (CONTINUED)

Conclusions are also drawn as to the future stability of the site regarding the stabilised shallow mine workings and the mine entries located on the site.

For completeness, this report should be read in conjunction with the previous reports produced by Intégral Géotechnique, which are discussed in Section 4.0 of this report.

For convenience, summaries of the geology and mining data from the previous reports, have been reviewed and are presented in this report.

2.0 THE SITE AND PROPOSED DEVELOPMENT

The site is situated off Elm Tree Grove, Twynrodyn, Merthyr Tydfil. The centre of the site is situated at an approximate National Grid Reference of SO 059 057, see Figure 1.

The site is irregular in shape and occupies an area of approximately 5.6 hectares.

The site boundaries are defined by Elm Tree Grove and Oak Tree Rise to the east, the rear gardens of residential properties along Wallhead Road and Aneurin Crescent to the west, the rear gardens of residential properties along Wallhead Road to the north, and undeveloped land to the south.

The site topography slopes gently towards the south. The topographic elevation of site ranges from approximately 238m AOD at the northern boundary, to approximately 213m AOD at the southern boundary.

The site is generally covered by long grasses with fenced-off sections of semi mature trees and bushes. Invasive plant species including Japanese Knotweed have been identified in the eastern areas of the site.

It is understood that an existing culvert crosses the site in an approximate north-south direction.

Live Welsh Water apparatus, including a foul rising main with an associated easement, cross the eastern edge of the site. An existing pumping station is also present adjacent to the eastern site boundary.

The surrounding land use predominantly comprises residential properties to the north, east and west. Undeveloped land utilised as public open space is situated to the south of the site.

Persimmon Home proposed to construct some 121 two storey residential properties.

The approximate layout of the proposed development, is shown on Figure 2.

3.0 GEOLOGY AND PAST MINING

The 1:10,560 scale geology map of the area (Sheet No. SO 00 NE) indicates that the site is underlain by bedrock strata of the South Wales Lower Coal Measures Formation of the Carboniferous period. These strata typically comprise grey, productive, coal and ironstone bearing mudstones/siltstones, with seatearths and minor sandstones.

The geological map indicates the conjectured outcrop of the 'Lower Seven Feet' coal seam crosses through the eastern half of the site in an approximate north-south direction. The map also indicates the conjectured outcrop of the 'Five-Foot Gellideg' coal seam, orientated north-south, approximately 40m to the west of the site. Both coal seams are of workable thicknesses and are likely to underlie the site at shallow depths.

Based on a review of the Generalised Vertical Section (GVS) as shown on the geological map, the next named coal seam down from the Five-Foot Gellideg is indicated to be the 'Garw' coal seam. A sequence of ironstone veins is indicated between the Five-Foot Gellideg and the Garw coal seams. These ironstone veins would therefore be anticipated beneath the site (potentially at shallow depths).

Superficial deposits comprising Devensian Till of the Quaternary period are indicated to overlie the bedrock strata beneath the site. These deposits are typically poorly sorted and variable in nature, comprising clays, sands, and gravel.

Variable thickness of made ground comprising colliery spoil (associated with historical coal and ironstone mining works and the 'Cwm Blacks Reclamation Scheme') are anticipated beneath the site.

A summary of the anticipated geological succession is given below in Table 1.

Table 1: Summary of Anticipated Site Geology		
Geological unit	Horizon	Description
Recent	Made ground	Various materials but predominantly colliery spoil
Quaternary	Devensian Till	Poorly sorted and variable clays, sands, and gravel
Carboniferous	South Wales Lower Coal Measures	Grey, productive, coal and ironstone bearing mudstones/siltstones, with seatearths and minor sandstones.

3.0 GEOLOGY AND PAST MINING (CONTINUED)

Several data sources have been reviewed to provide a preliminary desk-based assessment of potential mining legacy risks at the site.

The data sources utilised for the purposes the preliminary desk-based assessment include:

- Published geological maps,
- Published historical OS maps,
- A Consultants Coal Mining Report obtained from the Coal Authority,
- Mine abandonment plans obtained from the Coal Authority,
- The Coal Authority Interactive Map Viewer
- Intégral Géotechnique (Wales) Limited Mine Entries Risk Assessment Report, 12690/JJ, dated 05 August 2020 and subsequent Coal Authority correspondence.

A preliminary desk-based assessment of the potential mining legacy risks at the site is presented below.

Past Underground Coal Mining

The Consultants Coal Mining Report records shallow coal mine workings beneath the site.

The depths to these recorded mine workings are indicated to vary between approximately 35m and 50m depth.

In order to determine the extent of the recorded coal workings mine abandonment plans have been obtained from the Coal Authority. Georeferenced extracts of the available mine abandonment plans.

The available mine abandonment plans indicate the recorded coal workings beneath the site encroach upon the upon the eastern site boundary. The workings are indicated to have targeted a coal seam referred to on the plans as the '5'6 vein', which is likely to be a local seam name for the Lower Seven Foot or the Five-Foot Gellideg coal seam.

The possibility of more extensive shallow unrecorded mine workings being present beneath the site cannot be discounted.

Wherever old mine workings underlie the site at shallow depths and are not backfilled or still uncollapsed (or only partially collapsed), there may be an associated risk of ground subsidence occurring and affecting the site surface.

3.0 GEOLOGY AND PAST MINING (CONTINUED)

The level of this potential ground subsidence risk will depend on the height and extent of any remnant voids and whether there is sufficient rock cover above the mine workings to prevent any associated uncollapsed voids migrating up to and affecting the ground surface. Where shallow mineworking with insufficient safe rock cover thicknesses are proven to still be present, appropriate remediation / mitigation measures (such as drilling and grouting ground stabilisation) may be required.

In order to further assess this risk to the proposed development from shallow recorded and unrecorded coal mine workings, a series of rotary boreholes have been drilled across the proposed development area. The findings of the rotary borehole investigation are presented in Section 4.0

Past Underground Ironstone Mining

A sequence of ironstone veins underlies the Lower Seven Feet and Five-Foot Gellideg coal seams beneath the site. The Consultants Coal Mining Report records mine workings targeting the 'Rosser' ironstone vein to the east of the site. The recorded ironstone workings are indicated at a depth of approximately 79m.

Based on a review of the GSV shown on the geological map, there are several other named ironstone veins between the Five-Foot Gellideg coal seam and the Rosser vein beneath the site. These include the 'Spotted', 'Yellow', 'Red', 'Blue', and 'Lumpy' ironstone veins. Several of these ironstone veins may be present at shallow depths beneath the site.

Although there are no shallow recorded mine workings targeting ironstone veins beneath the site, the possibility of shallow unrecorded workings being present cannot be discounted.

It should be noted that ironstone workings are typically more sporadic in nature than coal workings and therefore the locations of workings can be difficult to determine.

Wherever old mine workings underlie the site at shallow depths and are not backfilled or still un-collapsed (or only partially collapsed), there may be an associated risk of ground subsidence occurring and affecting the site surface. The level of this potential ground subsidence risk will depend on the height and extent of any remnant voids and whether there is sufficient rock cover above the mine workings to prevent any associated un-collapsed voids migrating up to and affecting the ground surface. Where shallow mineworking with insufficient safe rock cover thicknesses are proven to still be present, appropriate remediation / mitigation measures (such as drilling and grouting ground stabilisation) may be required.

3.0 GEOLOGY AND PAST MINING (CONTINUED)

In order to further assess this risk to the proposed development from shallow ironstone mine workings, a series of rotary boreholes have been drilled across the proposed development area. The findings of the rotary borehole investigation are presented in Section 4.0

Mine Entries

The Coal Authority indicate there to be four mine entries recorded within the site boundary, and a further three mine entries within 20m of the site.

The mine entries recorded on site are as follows:

- Adit 305205-053
- Adit 305205-021
- Adit 306205-045
- Adit 306205-034

The mine entries recorded off-site (within 20m of the site boundary) are as follows:

- Adit 306205-005
- Adit 306205-035
- Adit 306205-057

A previous desk-based mine entries risk assessment was undertaken by Intégral Géotechnique (Wales) Limited, on behalf of Persimmon Homes East Wales, during 2020. The detailed findings are presented in report ref: Land at Twynyrodyn, Merthyr Tydfil, Mine Entries Risk Assessment Report, 12690/JJ, dated 05 August 2020.

The works undertaken included an extensive data review and a thorough georeferencing exercise using various source plans in order to determine the 'best fit' plotting locations and appropriate development 'no build' zones for the recorded mine entries on site (and within 20m of the site boundary).

A summary of the mine entry data is presented below in Tables 2 and 3.

The recorded locations of the various mine entries in relation to the proposed development layout are shown in Figure 2.

Where mine entries are proven to still be present beneath the site at shallow depth, there will be a potential ground subsidence risk to the proposed development, and appropriate remediation and development no build zones will need to be implemented.

3.0 GEOLOGY AND PAST MINING (CONTINUED)

Table 2: Mine Entry Data – On Site Features

Ref:	Shaft/ Adit?	CA Primary Source Plan	Depth of Shaft (m)	Assumed Diameter (m)	Adit Azimuth	IG Easting, Northing	CA Easting, Northing	CA Assigned Departure Distance
305205-053	Adit	Ab plan	n/a	3m	79°	305960, 205825	305959, 205829	8m
305205-021	Adit	OS Map	n/a	3m	58°	305976, 205799	305973, 205801	5m
306205-045	Adit	Ab plan	n/a	3m	17°	306040, 205624	306039, 205621	8m
306205-034	Adit	Ab plan	n/a	3m	83°	306052, 205605	306051, 205605	8m

Table 3: Mine Entry Data – Off Site Features (within 20m)

Ref:	Shaft/ Adit?	CA Primary Source Plan	Depth of Shaft (m)	Assumed Diameter (m)	Adit Azimuth	IG Easting, Northing	CA Easting, Northing	CA Assigned Departure Distance
306205-005	Adit	OS Map	n/a	3m	60°	306047, 205562	306046, 205565	5m
306205-035	Adit	Ab plan	n/a	3m	131°	306039, 205548	306038, 205547	8m
306205-057	Adit	Ab plan	n/a	3m	57°	306050, 205560	306049, 205560	8m

Targeted intrusive investigation works will be required to locate the recorded mine entries on site. These works will allow for the assessment of the level of risk to the proposed development, the scope of any required remediation / mitigation measures, and the size of development no build zones.

Until the recorded mine entries on site have been accurately located and remediated, a series of preliminary 'worst-case' development no build zones have been determined around each of the Coal Authority listed best-fit plotting locations.

The no build zone radii account for an assumed 3m adit width and the Coal Authority assigned potential lateral departure distances.

The preliminary worst-case development no build zones are shown on Figures 2.

Note the no build zone is outside of the planned Persimmon development area.

4.0 AVAILABLE SITE INVESTIGATION AND PROOF DRILLING DATA

As already, discussed, previous studies have been undertaken and reported as follows:

- a) Site Investigation Report by Intégral Géotechnique (Wales) Limited dated August 2008, report reference: 9913/GNS/08
- b) Mine Entries Risk Assessment by Intégral Géotechnique (Wales) Limited dated August 2020, report reference: 12690/JJ;
- c) Site Investigation Report by Intégral Géotechnique (Wales) Limited dated August 2023, report reference: 12690/JJ/23/SI.
- d) High density proof drilling from May to September 2023.

The probeholes drilled as part of the above site investigations encountered a significant evidence of shallow mine workings at shallow depth beneath the site.

Based on the depths at which the rock head and the ironstone veins/seams/associated workings were encountered, it was considered that there was a potential for the proposed residential development to be affected by ground subsidence, caused by future collapses of past unrecorded shallow mine-workings.

Based on the widely accepted general 'rule of thumb' which requires a rock cover to void ratio of 10:1, (to prevent mining subsidence migrating up to the surface) it was estimated that 25m of rock cover would be required to provide sufficient rock cover above the main underground roadways. Consequently, it was considered that there was an insufficient thickness of rock cover above these workings and its associated mine workings beneath the site.

From the information gathered from the mine abandonment plan, geological data, previous extensive drilling and grouting works and the mining report from the Coal Authority, it is considered that there is a high risk of ground subsidence associated with past shallow mine workings associated with shallow ironstone underneath the site as well as a the Lower Seven-feet coal seam in the south eastern part of the site.

Proof drilling carried out during ground stabilisation works confirmed the findings of the above site investigations and established that Plots 1 to 121 had significant shallow mine-workings with insufficient rockhead due to worked ironstone covering the entire site. In addition, shallow coal workings believed to be the Lower Seven Feet coal seam were found beneath Plots 37 to 63, both of which requiring ground stabilisation by a programme of drilling and grouting.

4.0 AVAILABLE SITE INVESTIGATION AND PROOF DRILLING DATA (CONTINUED)

A stabilisation programme was therefore recommended to infill any un-collapsed underlying shallow mine workings beneath the site and thereby prevent any future significant ground movements occurring because of future collapse of these mine workings. The extent of the stabilisation works is as shown on Figure 2.

Similar stabilisation works (as those undertaken for the adjacent housing development in the east) will therefore be required beneath the southeast part of the site.

The ground stabilisation works were in the form of conventional drilling and grouting techniques. With this method, only voided/ un-collapsed and/or partially collapsed shallow mine-workings beneath the proposed buildings, and roads and the un-collapsed would be infilled with an appropriate grout mix.

5.0 GROUND STABILISATION WORKS

5.1 GENERAL

The extent of the undertaken ground stabilisation works includes Plots 1 to 121, and is shown on Figure 2.

A high-density proof drilling, was undertaken at the beginning of the ground stabilisation works and entailed the drilling of over 300 proof probeholes across the site. These probeholes confirmed there to be extensive ironstone shallow mine workings beneath Plots 1 to 121. Due to the presence of shallow mine workings and the insufficient thickness of overlying rock cover, it was considered that there was a ground subsidence risk from the possible future collapse of these mine workings beneath Plots 1 to 121 inclusive. In addition, shallow coal workings were found beneath Plots 37 to 63, both of which requiring a further programme of drilling and grouting.

The approximate areas within which the old mine workings were subsequently stabilised beneath the proposed dwellings and garages (Plots 1 to 121), are shown on Figure 2.

In addition, the two mine entries adits 305205-21 and 305205-53 at the northeastern site boundary identified during the desk study was investigated/treated by stage grouting though the findings during the drilling and grouting did not find any significant voids, but minor shallow pockets of soft ground requiring only nominal grout takes to infill, the approximate location of which is shown on Figure 2.

Gas monitoring was carried out for the duration of the works, but did not identify any elevated levels of gases associated with mining.

5.2 OBJECTIVES

The main objectives of the ground stabilisation works were to:

- (a) stabilise the encountered shallow mine workings which the site investigation and proof drilling had found beneath the proposed Plots 1 to 121 inclusive, as shown on Figure 2;
- (b) stabilise any associated broken ground above and around the horizons of these shallow workings be it ironstone or coal (associated with past collapses); and
- (c) investigate/ stabilise the mine adits at the north eastern boundary of the site. .

5.3 PROGRAMME AND GENERAL DETAILS

The Contract for the initial high density and subsequent proof drilling and ground stabilisation works was awarded to Apex Drilling Services Limited in March 2023, and the works were completed in March 2024.

The grouting boreholes were set out by Apex Drilling Services Limited to a plan configuration which was provided by Intégral Géotechnique (Wales) Limited. The setting out of plots and roads were carried out by Persimmon Homes.

The probeholes were drilled from these points to intercept the old workings within shallow mine workings ironstone and or occasional coal workings.

In all the probeholes, steel and plastic casings were inserted at least approximately 1.0m into the underlying less weathered rocks, to prevent grout loss into the overlying fill and superficial deposits and highly weathered/fractured rocks.

The following procedure was adopted:

- (i) A 12:1 (PFA to cement) mix was injected in the perimeter holes commencing with the holes 'down dip, gravel was often added to thicken up the mix to reduce grout loss';
- (ii) On completion of the perimeter probeholes and the consequent formation of a grout curtain, the grouting of the infill holes was commenced; and
- (iii) A 12:1 (PFA to cement) mix was also used for the infill holes;

Following the ground treatment of the plots, several test boreholes were sunk in areas of highest grout take to confirm that no significant voids had been left beneath Plots 1 to 121 after the grouting process.

All these test holes revealed solid ground, and that any old cavities and/or broken ground associated with the underlying shallow coal seams had been successfully infilled with grout.

It should be noted that the drilling and grouting operations were only carried out in and around the building plots and roads shown on Figure 2.

5.4 DRILLING

The drilling works were carried out by using Klemm, and Berretta rotary drilling rigs. The hydraulically operated drilling rigs used compressed air as the flushing medium.

All the probeholes were a minimum of 110mm in diameter and were extended to penetrate through the horizons of the ironstone veins, coal seam, or mine workings and into the underlying solid strata. When two sets of workings were encountered additional close centre drilling was undertaken to ensure that all significant workings had been infilled. Stabilisation grouting probeholes were spaced based on a 5.0m grid beneath all plots with the additional supplementary split holes and test holes reducing it to less than 4.0m in areas of high grout takes. The spacing of drilling beneath the spine road was every 6.0m.

The total number of probeholes drilled, together with the total and average depths of the probeholes are presented in Table 1.

TABLE 1: SUMMARY OF DRILLING AND GROUTING WORKS				
Total N° of Probeholes	Total Depth Drilled (m)	Average Depth of Probeholes (m)	Total Grout Intake (tonnes)	Total Gravel Intake (tonnes)
1424	41773	29	6306.4-	520

The extent of the and treated mine workings encountered is shown on Figure 2.

5.5 GROUTING

A 12:1 PFA to cement grout mix was always used during the infilling of any mine workings. The grout was batch mixed on site using a high shear agitating grout pan. sandpiper air diaphragm pumps were then used to inject the grout into the boreholes.

The total grout take is indicated in Table 1.

5.6 TEST DRILLING AND GROUTING

As discussed in Section 5.3, test probeholes were sunk in the areas of highest grout takes, after completing the stabilisation of the old mine-workings. These probeholes were drilled to confirm the effectiveness of the main drilling and grouting operation.

The test boreholes typically revealed solid/broken ground/voids infilled with cementitious grout, thus confirming the effectiveness of the stabilisation programme. All the test holes were grouted up with only nominal grout takes being required to fill the holes.

5.7 MINE WORKINGS

Most of the probeholes penetrated the horizons of the underlying shallow, coal seams and associated workings. A total of 1,424 probeholes were drilled. Most of the voids and/or broken ground were encountered at the horizon ironstone veins or occasional coal seam, or immediately above it.

The mine workings encountered voids/ old workings with a height ranging from approximately 0.5m to 5.0m at the horizon of the ironstone veins, indicating (in the case of the larger voids) the possible presence of some main roadways beneath the site.

The grout volume taken by those probeholes which encountered voids, varied between approximately 0.3 and 150 tonnes per hole.

5.8 MINE ENTRIES

ADITS 305205-21 AND 305205-53

Adits 305205-21 and 305205-53 were thought to be close to the north eastern site boundary based on information received from The Coal Authority information gathered during the desk study and were investigated/ treated by stage grouting. Where a series of close centre probeholes were drilled at 1.5m c/c over an approximate distance of 40m the approximate area of which is shown on Figure 2. The findings during the drilling and grouting did not find any significant voids/workings but minor shallow pockets of soft ground requiring only nominal grout takes to infill, it more likely that both adits are just east of the site boundary and were treated during the drilling and grouting of housing development immediately adjacent to the east.

As a precaution it is recommended that no buildings should be planned or constructed within the preliminary development no build zone as specified in Integral Geotechnique Mine Entries Risk Assessment letter dated August 2020, report reference: 12690/JJ; indicated on Figure 8 within the above report. This no build zone area is repeated in Figure 2 of this report for ease of reference

6.0 STABILITY OF TREATED MINE WORKINGS AND FOUNDATION DESIGN

6.1 STABILITY OF TREATED MINE WORKINGS

Following the completion of the grouting works and the subsequent drilling and grouting of the test holes, any significant voids from the old shallow coal mine workings should be substantially infilled within the stabilised areas. It is therefore concluded that in the treated areas indicated on Figure 2, there is now little risk of significant surface instability occurring because of the possible future collapse of shallow mine workings beneath these areas.

It should be noted that during the ground stabilisation works, only the plots, garages and roads shown on Figure 2, were drilled and grouted. Therefore, if the proposed building locations at the site should alter, then further drilling and grouting works may become necessary to stabilise any hitherto untreated areas.

It should also be noted that the possibility of encountering old unrecorded 'bell pits'; shafts and/or adits within the site cannot be ruled out. Should any such mining features be encountered during the general earthworks, then they should be removed or stabilised prior to continuing with the earthworks. If any such features/anomalies are encountered, they should be brought to the Engineer's attention for further instructions.

6.2 FOUNDATION DESIGN

The drilling and grouting programme has infilled most of the cavities associated with shallow mine workings within the influencing zone of the building foundations. However, in those areas where drilling and grouting works have been carried out, there remains the possibility that remnant small voids associated with shallow mine workings may still be present within an influencing zone of the building foundations.

It is therefore recommended that, as a further contingency, appropriate steel reinforcement should be incorporated within the proposed foundations and floor slabs, capable of spanning a 3.0m soft spot and 1.5m cantilever at the building corners. This is to protect them against potential small-scale ground subsidence, which could still occur as a result of possible future small collapses.

APPENDIX A

COAL AUTHORITY MINING REPORT

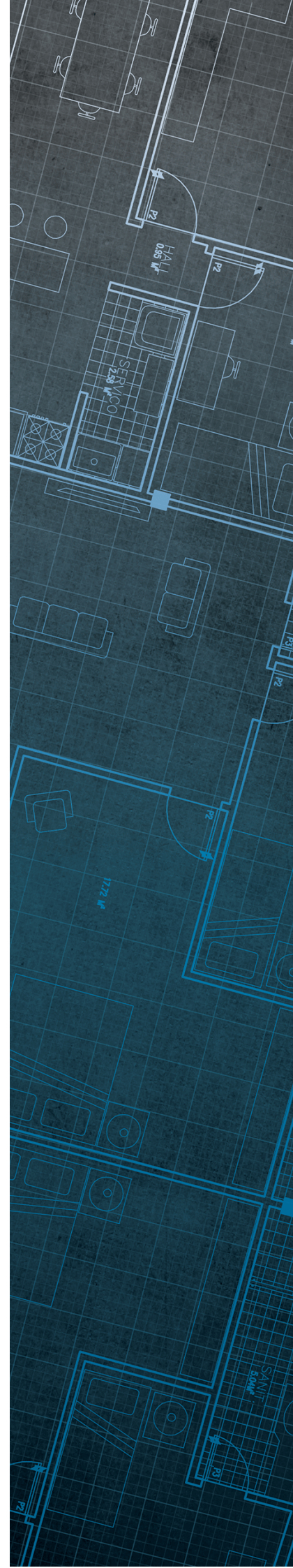


The Coal
Authority

Consultants Coal Mining Report

Land At Elm Tree Grove
Merthyr Tydfil
Merthyr Tydfil

Date of enquiry:	19 October 2023
Date enquiry received:	19 October 2023
Issue date:	19 October 2023
Our reference:	51003384545001
Your reference:	12690/JJ



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

INTEGRAL GEOTECHNIQUE (WALES) LTD.

Enquiry address

Land At Elm Tree Grove
Merthyr Tydfil
Merthyr Tydfil

How to contact us

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

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

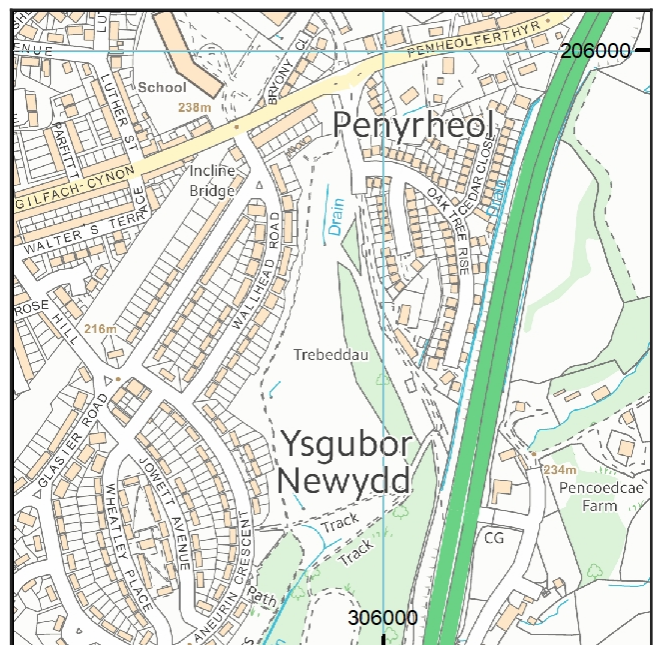
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Approximate position of property



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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	SEVEN FOOT	Coal	4BAU	35	Beneath Property	32.0	South-East	120	1908
unnamed	LOWER 7FT BOTTOM LEAF	Coal	4BB2	50	Beneath Property	3.8	South-East	117	1915
unnamed	ROSSER IRONSTONE	Ironstone	4BBN	79	East	3.7	South	780	1860

Probable unrecorded shallow workings

Yes.

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
Adit	305205-020	305959 205957		Coal	
Adit	305205-021	305973 205801		Coal	
Shaft	305205-030	305974 205442		Coal	
Adit	305205-053	305959 205829		Coal	
Shaft	306205-003	306033 205698	The position of this mine entry was investigated by Rutter Johnson Partnership in January 2000. No evidence of its presence at this location could be found.	Coal	
Adit	306205-005	306046 205565		Coal	
Shaft	306205-027	306123 205609		Coal	
Adit	306205-033	306095 205681	This adit was investigated in January 2000 by Rutter Johnson Partnership. Their investigations revealed that the adit was totally collapsed	Coal	The National Assembly For Wales 17/11/2004
Adit	306205-034	306051 205605		Coal	
Adit	306205-035	306038 205547		Coal	
Adit	306205-045	306039 205621		Coal	
Adit	306205-057	306049 205560		Coal	

Abandoned mine plan catalogue numbers

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

SWR3622	SWR2272	SWR2523
SWR2509	SW221	SWR2500
SWR3192	SW1917	SWT3850

Our records show we have more plans than those shown above which could affect the enquiry boundary.

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 GELLIDEG	Coal	Yes	34.3	West	195
LOWER 7FT BOTTOM LEAF	Coal	Yes	Within	N/A	186

Geological faults, fissures and breaklines

No faults, fissures or breaklines 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
6.1	North-East
Within	N/A
Within	N/A

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.

Future development

If development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply specialist engineering practice required for former mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or coal mines without first obtaining the permission of the Coal Authority.

MINE GAS: Please note, if there are no recorded instances of mine gas within 500m of the enquiry boundary, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded. Developers should be aware that the investigation of coal seams, mine workings or mine entries may have the potential to generate and/or displace underground gases. Associated risks both to the development site and any neighbouring land or properties should be fully considered when undertaking any ground works. The need for effective measures to prevent gases migrating onto any land or into any properties, either during investigation or remediation work, or after development must also be assessed and properly addressed. In these instances, the Coal Authority recommends that a more detailed Gas Risk Assessment is undertaken by a competent assessor.

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. Please note, if there are no recorded instances of mine gas reported, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded.

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.

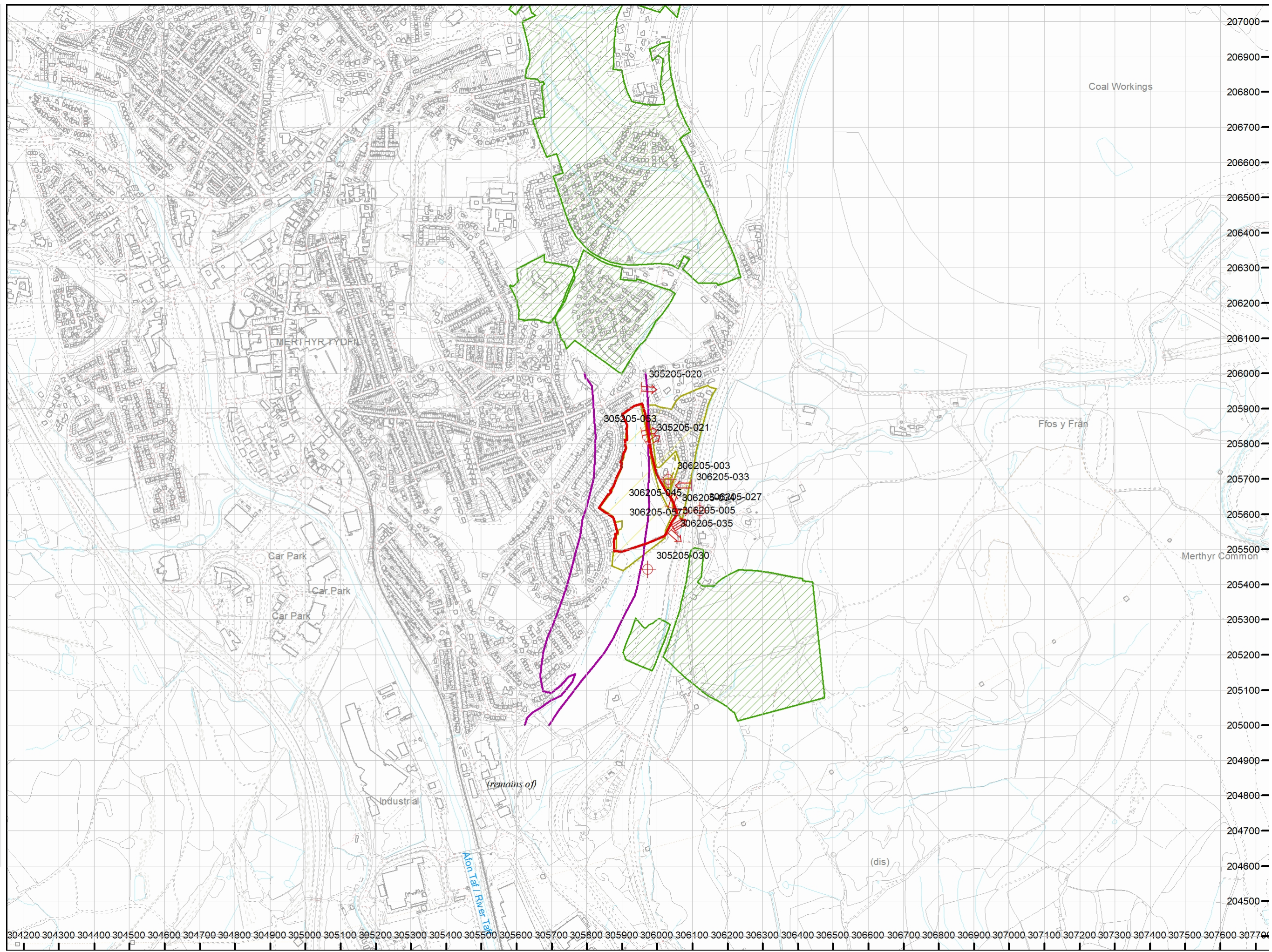
The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

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

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)
www.groundstability.com



APPENDIX B

COAL AUTHORITY PERMISSION



The Coal
Authority

Permit to Enter or Disturb Coal Authority Interests

Permit 26646

Name and Address of Permit Holder:

*Persimmon Homes Wales
Llantrisant Business Park
Llantrisant
CF72 8YR*

Site Location:

*Land off
Twynyrodyn
Merthyr Tydfil*

This certificate hereby grants the above named Permit Holder a Permit to carry out:-
*A proof drilling and grouting exercise to identify and remediate the presence of shallow mine workings and treat those shallow mine workings to the specification provided and as amended by agreement to provide a safe and stable development platform for the proposed housing development all in accordance with CIRIA C758D all within the Authority's interests at the identified site location above as shown on the Grant Permit Boundary (overleaf) for the period of **12 months** from the granted date shown below. The granting of this Permit does not constitute advice given by the Authority in relation to the proposed operations. It is the Permit Holder's responsibility to obtain appropriate health, safety, environmental, technical and legal advice.*

Conditions:

- *Manned entry (i.e.) into mine entries/workings) is strictly prohibited.*
- *Water flush drilling only within 50m of any receptor*
- *Gas Monitoring for CO, CH₄, CO₂, O₂, and H₂S at proof/treatment boreholes and drill rig*
- *Operators undertaking the work must be in possession of this certificate and the Permit boundary plan at the time of works*
- *Appropriate borehole reinstatement and sealing (temporary sealing requirements to be minimised) all permanent solutions to withstand site level changes*

Signed: Leigh Sharpe Granted Date: 15/05/2023

For and on behalf of The Coal Authority

Nominated Representative: Leigh Sharpe, Permitting Manager;

The Coal Authority, Permitting Office, 200 Lichfield Lane, Mansfield, Notts, NG18 4RG

Tel: 01623 637450; E-Mail: permissions@coal.gov.uk

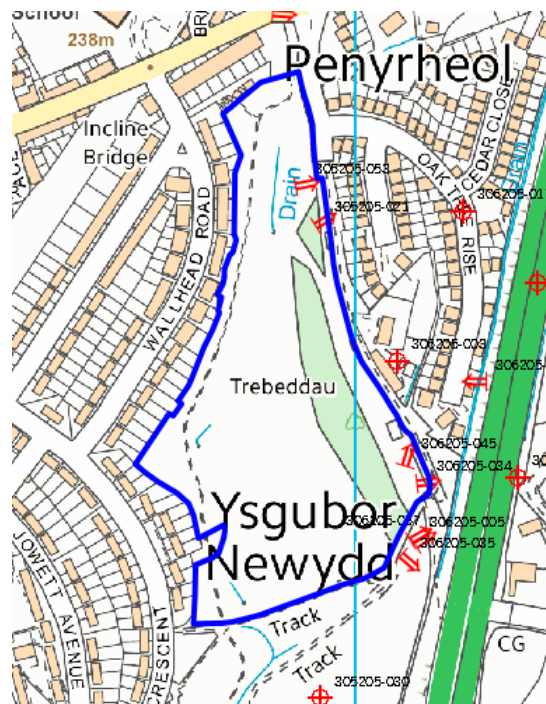


The Coal
Authority

Granted Permit Boundary

Permit Ref: 26646

Permit Boundary:



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FIGURES



SITE LOCATION

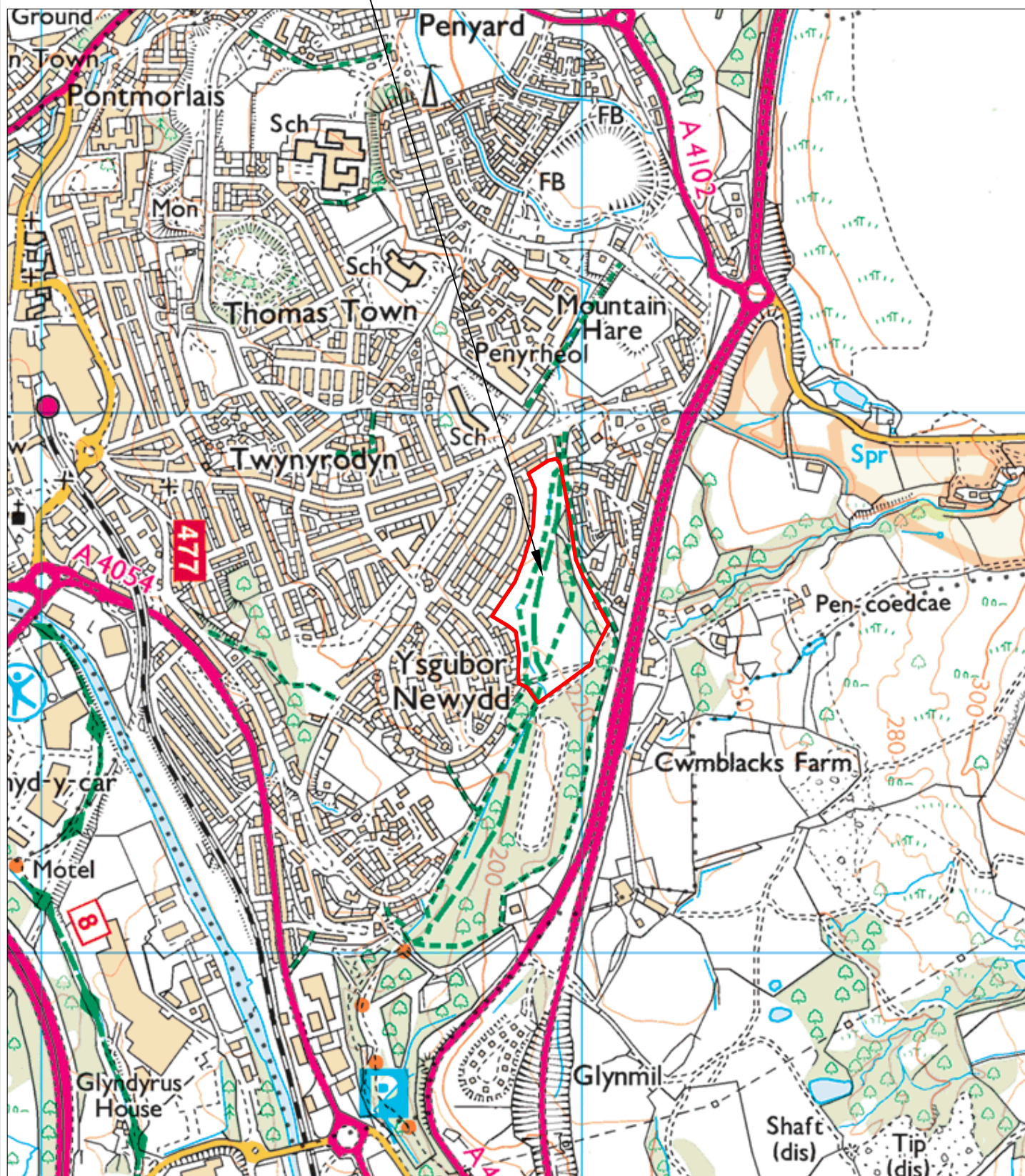


Figure 1: Site Location

Project: Land at Elm Tree Grove, Twynyrôdyn

Job no.: 12690

Client: Persimmon Homes East Wales

Scale: 1:10,000 at A4

Intégral
Géotechnique

Integral House,
7 Beddau Way,
Castlegate Business Park,
Caerphilly,
CF83 2AX.
Tel: 029 2080 7991

