



The Coal  
Authority

# Caerphilly County Borough Council: Mine Water Heat Opportunities

July 2024



Making a **better future** for people  
and the environment **in mining areas**

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Version	Produced by	Reviewed by	Approved by	Date
Final	Keith Parker Matthew Fox	Lee Wyatt	Gareth Farr	24/6/2023

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## Executive summary

Coal mining has taken place in the Caerphilly County Borough Council (CBC) area since at least the 17th Century with the last mine to close being Penallta in 1991. Much of the borough is underlain by coal mine workings, with multiple seams being worked in many localities. The presence of mine workings combined with knowledge (where available) of recovered mine water levels are used to provide a very high level assessment of the potential for exploring the development of open loop mine water heat projects in the borough. In addition to borehole opportunities, gravity-fed discharges (including mine water treatment schemes) have also been assessed for heat potential. Some discharges do not have sufficient data for assessment, hence are not included in this report.

The workings vary considerably in depth, being relatively shallow (<75 mBGL) at the northern part of the borough in the vicinity of the A465 "Heads of the Valleys" road. The strata and associated coal seams and workings dip to the south-southeast with the deepest workings reaching over 700 mBGL in the Pontllanfraith locality. The presence of numerous 'gravity discharges' in the Caerphilly CBC administrative area together with the long period since the mines closed suggests that mine water has recovered.

The potential for accessing the mine workings by **drilling new boreholes** and extracting the 'warm' mine water is assessed by reference to criteria set out in the overarching report and classified as having 'good', 'possible' or 'challenging' potential. 'Good' or 'possible' potential exists in a small number of populated areas as listed as 1-5 in the table below where a combination of viable drilling depths and mine water recovery together with the presence of surface development suggests that further detailed assessment would be beneficial.

While there are no Coal Authority mine water treatment schemes in Caerphilly, there are many **gravity-fed discharges**, where mine water is emitting at surface. This mine water may offer potential for mine water heat without the cost and risk of drilling and pumping. A selection of the larger discharges having a heat potential of over 0.5MWth are listed as 6 to 10 in the table below.

It is recommended that the opportunities listed are considered against surface heat demands to highlight those which may be served by mine water heat technologies. A subsequent, more detailed study of the mining and hydrogeology would add further information to firm up the case to take a number of mine water heat projects forward.

**Summary of selected mine heat opportunity locations**

No./ Area	Opportunity name	Opportunity type	Opportunity Category	Estimated Heat Potential MW <sub>th</sub>
1	Rhymney south area of town	Borehole scheme	Good	Subject to further testing
2	Bargoed/Gilfach	Borehole scheme	Good	Subject to further testing
3	Blackwood/Penllwyn	Borehole scheme	Good	Subject to further testing
4	Oakdale	Borehole scheme	Good	Subject to further testing
5	NE Caerphilly	Borehole scheme	Possible	Subject to further testing
6	Pontllotyn (Bute Level)	Gravity discharge	Possible	1.6 to 2.2
7	Cefn Hengoed (Tir-y-Berth) Discharges	Multiple gravity discharges	Possible	2.2 to 4.5*
8	Sunningdale Old Rock	Gravity discharge	Possible	0.6
9	Tram Road, Pontllanfraith	Gravity discharge	Possible	1.2
10	Graig Fawr (Celyn North)	Gravity discharge	Possible	1 to 1.3

**\*includes the discharge at Glanddu Level**

# 1 Introduction

The area covered in this section is the whole of the Caerphilly CBC administrative boundary within which the presence of mine workings combined with knowledge (where available) of recovered mine water levels are used to provide a high level assessment of the potential for exploring the development of open loop mine water heat projects in the borough.

## 1.1 Geographic area

Caerphilly CBC covers an area of approximately 277 km<sup>2</sup>, and runs roughly north-south from just north of the A465 road, to just north of the M4. Urban areas within Caerphilly CBC include: Caerphilly; Ystrad Mynach; Pontllanfraith; Blackwood; Bargoed; and Rhymney. Urban areas are also located along the Rhymney, Sirhowy and Ebbw valleys. All but the south-eastern part of Caerphilly is within the South Wales Coalfield. Elevation in Caerphilly varies between 70mAOD in the south parts of the coalfield, up to >440m above Rhymney.



## 2 Geological Summary

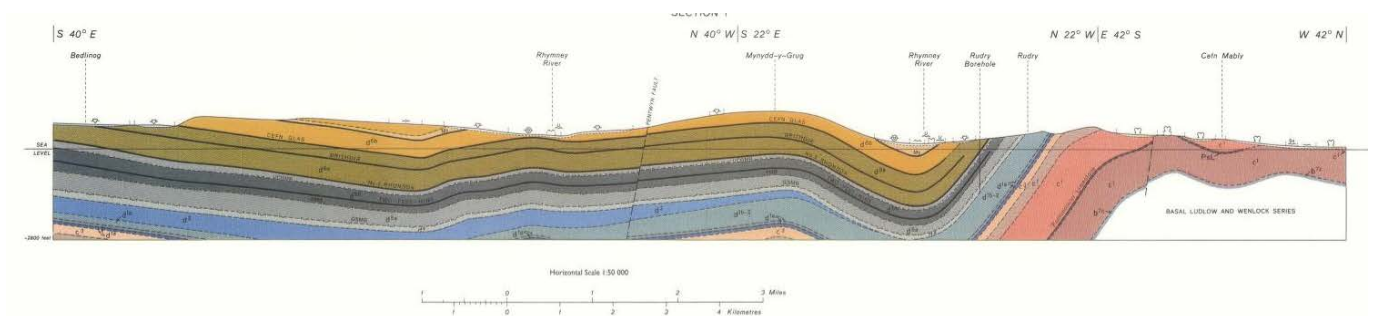
The solid and superficial geology along with seam information has been ascertained by consultation of the available British Geological Survey records including:

- Online GeoIndex viewer ;
- Online geological memoirs;
- Online geology maps (Sheet 232 and Sheet 249 for Caerphilly area); and
- Borehole and mine shaft scans across the area of interest.

### 2.1 Solid geology

The Caerphilly CBC administrative area is almost entirely underlain by South Wales Upper, Middle and Lower Coal Measures. This comprises cyclic sequences of interbedded mudstones, siltstones, sandstones interspersed with coal seams, a generalised section of which is illustrated in **Figure 2.3**.

The base of the South Wales Lower Coal outcrop is located immediately adjacent to the A465 'Heads of the Valleys' road. From the A465, the South Wales Coal Measures dips to the south-south east reaching depths of around 750m (**Figure 2.1**). In the area around Pontllanfraith the Glyn Fault is a major geological disturbance, which displaces the strata upwards by around 100m to the southeast. Heading further south, the Coal Measures again dip in a southerly direction to the southeast of Pontllanfraith where the Llantwit-Caerphilly Syncline is present before eventually rising steeply to the south east with the Coal Measures once more outcropping on a west-southwest to east-northeast trending line between Caerphilly and Risca (**Figure 2.1**).



**Figure 2.1. Regional geological cross section approximately north to south for Caerphilly** [Source Geological Sheet 249 Newport](#)

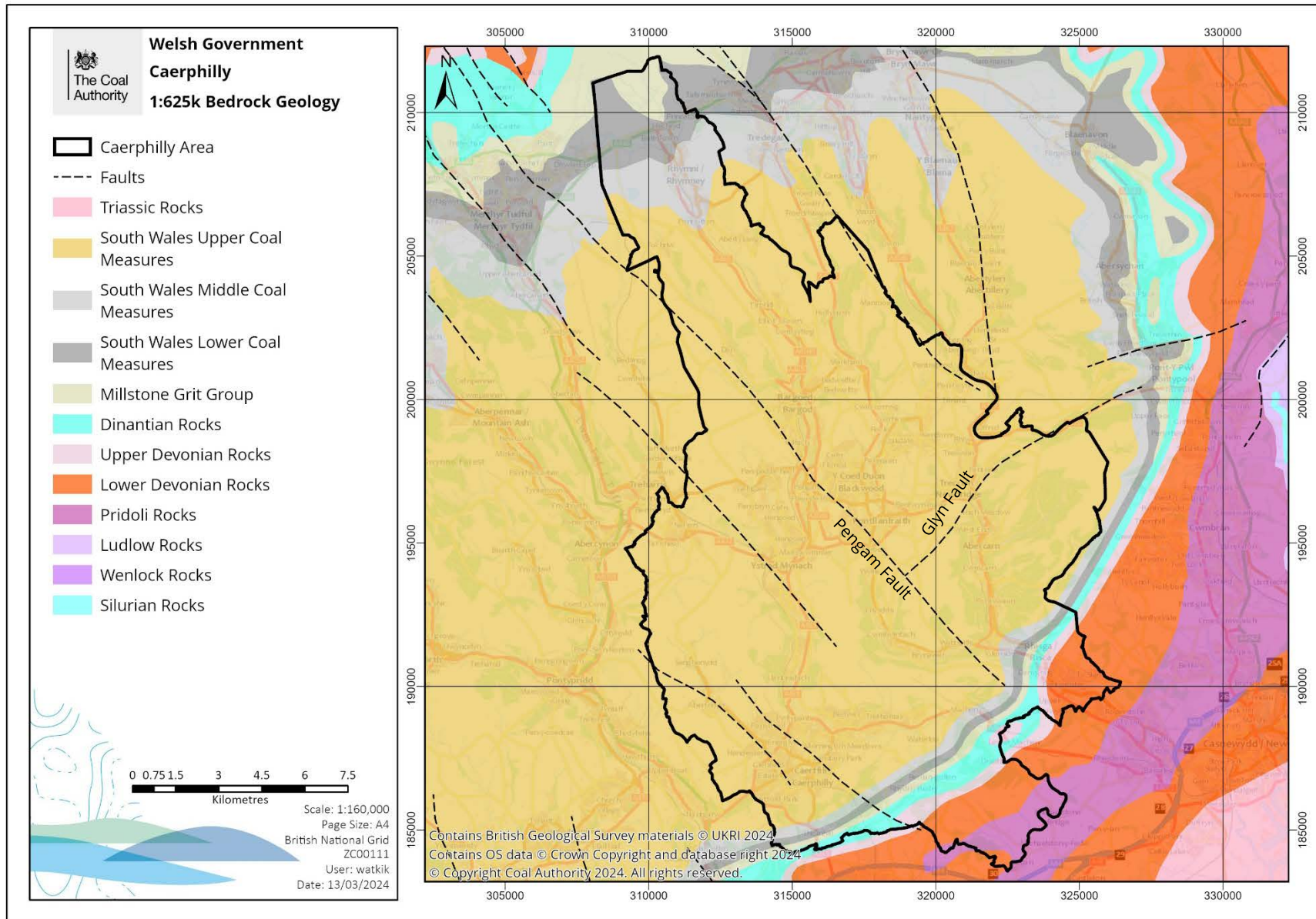
Contains British Geological Survey materials © UKRI 2024

Regional solid geology and selected structural geology is shown in **Figure 2.2**. The stratigraphic sequence, approximate depths and noted shaft sections are shown in **Figure 2.3**.

## 2.2 Structural geology

The Coal Measures across Caerphilly form a large syncline / basin that also extends outside of Caerphilly, this results in the South Wales Lower Coal Measures reaching surface in the north and south parts of the area.

Main faults trends roughly northwest – southeast, with a southwest-northeast trend of faults and ‘disturbances’. The Glyn Fault around Pontllanfraith being a major geological disturbance, and throw the rocks up by approximately 100m.



**Figure 2.2. Bedrock geology in the Caerphilly locality**

Contains British Geological Survey materials © UKRI [2024]

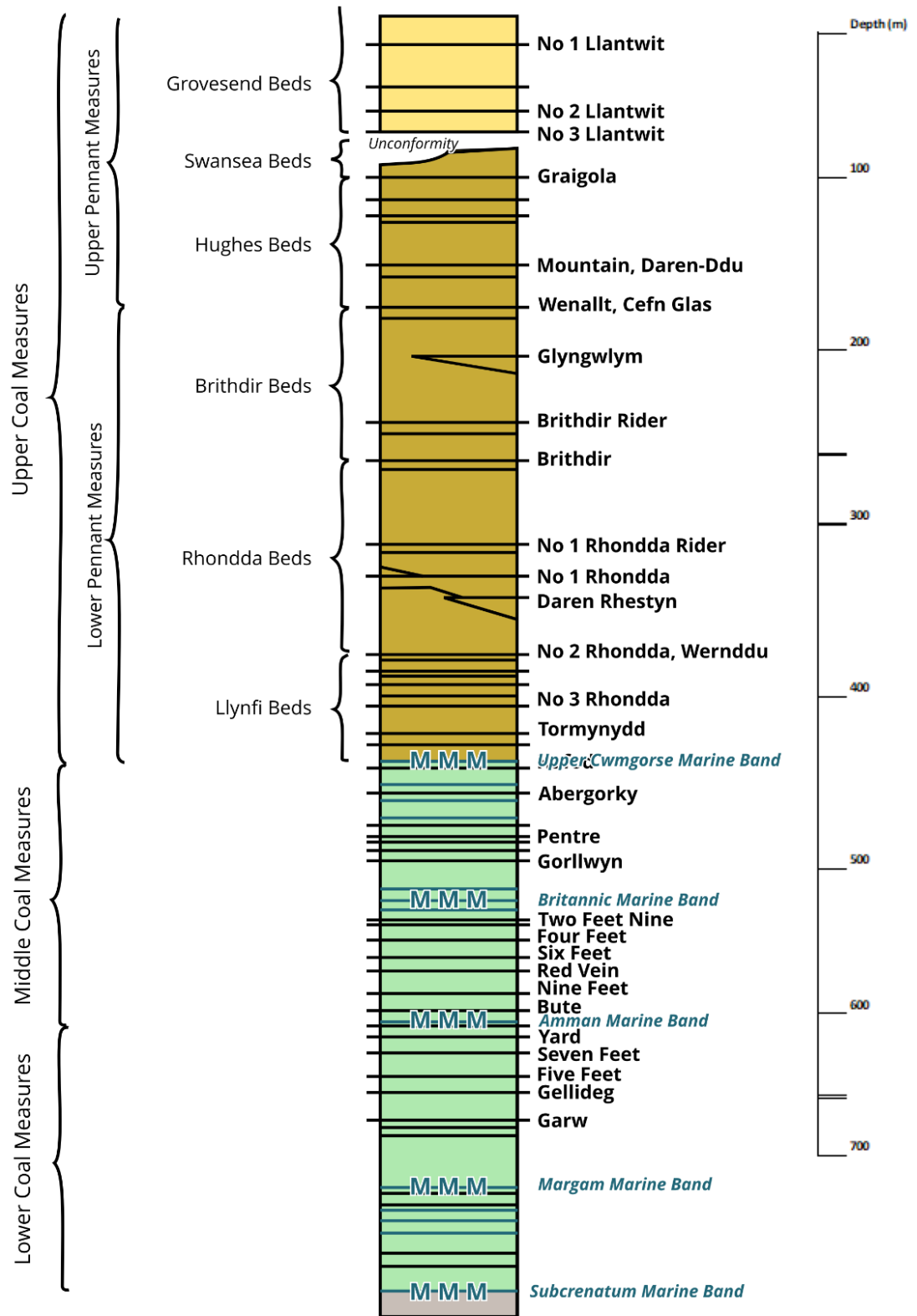


Figure 2.3 - Summary stratigraphy and geological sequence for the study area

(based on Woodland and Evan, 1964)

### 3 Mining situation

Coal mining has taken place in South Wales for several centuries with shallow seams being worked near to outcrop by means of roadways driven from the surface. These workings were often gravity drained by means of water levels, drainage adit or drainage soughs.

From the mid 1800's, the industrial revolution and concomitant increase in demand for coal led to the sinking of many collieries into the deeper seams. The mine workings in the South Wales Upper Coal Measures and those in the South Wales Middle Coal Measures and South Wales Lower Coal Measures were often not connected during mining.

Caerphilly was an area where a number of large scale collieries were developed across much of the borough, to feed the demand for coal. In the 1970's and 1980's collieries were often connected together underground to form 'complexes' to improve efficiency by making use of common surface facilities such as coal preparation. These underground mining connections have a great bearing on the underground mine water regime by interconnecting considerable areas of mine workings.

Following colliery closures and end of mines in the 1980/90s, several mines were lost due to flooding. The final collieries to close, some of which had merged to become 'complexes' are set out in **Table 3.1** below:

**Table 3.1: List of most recent colliery closures**

Colliery	Closure date	Connected underground to
Bedwas	1985	Close proximity to Risca/Celynyn South
Celynyn North	1990	Markham, Oakdale, Crumlin
Celynyn South	1985	Celynyn North, Oakdale, Britannia
Markham	1985	Oakdale, Bargoed
Oakdale	1989	Britannia, Markham, Celynyn North
Penallta	1991	Britannia, Oakdale, Bargoed

Note: a detailed assessment of underground mining connections is required to confirm the mining hydrogeological conceptual model(s)

Following these closures pumping ceased and the mines started to fill with mine water.

Up to 27 individual coal seams have been worked in the area with the northernmost extremity of working being those in the South Wales Lower Coal Measures, which outcrops approximately along the line of the A465 'Heads of the Valleys' road.

The uppermost extensively worked seam in the stratigraphic sequence is the Mynnyddyslwyn Seam. This lies towards the top of the South Wales Upper Coal Measures sequence with the outcrop broadly following the topography of the valley sides. Below the Mynnyddyslwyn Seam, the next extensively worked seam is the (Tillery) Brithdir Seam. Between these two seams, a number of other seams are present, which have been subject to smaller areas of isolated working.

Below the South Wales Upper Coal Measures, mine workings exist in up to 18 seams in the South Wales Middle Coal Measures and South Wales Lower Coal Measures, with the lowermost extensively worked seam in the stratigraphic sequence being the Five Foot Gellideg Seam. Some of the mine workings were often localised with some seams only worked in specific areas. The extreme south of the area (to the south of the A468 Road) is largely devoid of recorded mine workings.

## 4 Mine water regime

### 4.1 Description of mine water blocks

Large parts of the South Wales mine water blocks 11, 12 and 12A are present within and beyond the Caerphilly CBC boundary as illustrated in **Figure 4.1**. The exact boundaries of these blocks will need confirmation by further investigation of mining connections and hydrogeological data. The mine water levels and status of these blocks, along with the interconnectivity between blocks needs confirming by further study. Information from the very limited number of monitoring points, and known gravity discharges suggests mine water recovery is complete, or largely complete.

### 4.2 Monitoring data

#### 4.2.1 Mine water levels

Mine water level monitoring data are available at only nine points for the Caerphilly area with information shown in **Table 4.1** and locations on **Figure 4.2**. Though limited, the monitoring data suggests mine water is largely recovered at those locations. The hydrogeological nature of the coalfield, the time elapsed (>30 years) since colliery closures also suggests that mine water recovery is likely to be complete or at least well advanced.

**Table 4.1: Mine water level monitoring points**

Monitoring point name	Mine Water Block	Mine water level (mAOD)	Comments
Abernant Sirhowy	12	170	[2023] <75 mBGL, recovered
Britannia South	12	162.81	[2016] <75 mBGL, recovered, close to surface
Celynfen South BH	12a	90	[2023] <75 mBGL, recovered, discharging
Nant Llesg	12	253	[2023] <75 mBGL, recovered
Glanravan	11	128	[2023] <75 mBGL, recovered
Llanover	12	182	[2023] <75 mBGL, recovered
Tram Road	12	132-136	[2008, 2023] <75 mBGL, discharging
Rhos Air Shaft	11	229	<75 mBGL
Cross Keys Black Vein	12a	65	[2023] <75 mBGL, recovered, close to surface

The presence of numerous gravity discharges, from workings in the South Wales Upper Coal Measures or from shafts into the South Wales Middle Coal Measures / South Wales Lower Coal Measures adds further to this view. The degree of connection between workings South

Wales Middle Coal Measures / South Wales Lower Coal Measures and the South Wales Upper Coal Measures seams is unclear and will require further more detailed studies to confirm.

### 4.2.2 Mine water temperature

A study into mine water temperatures at various depths around the UK coalfields was published in 2020 ([Farr et al, 2020](#)). This study used historic underground water and strata temperatures along with data from mine water temperature data where available.

Temperature typically increases with depth and data published in the study suggests the following may be anticipated for the Caerphilly area:

**Table 4.2: Anticipated mine water temperatures north of Pontllanfraith (block 12)**

Depth (m BGL)	Mean(°C)	Max. (°C)	Min. (°C)
100	11.7	12.9	11
200	14.3	16.2	12.9
300	17	19.6	14.9
400	18.9	22.5	16.4
500	22.3	26.3	18.9
600	24.7	29.6	20.8
700	27.4	33.2	22.8
800	30	36.8	24.8

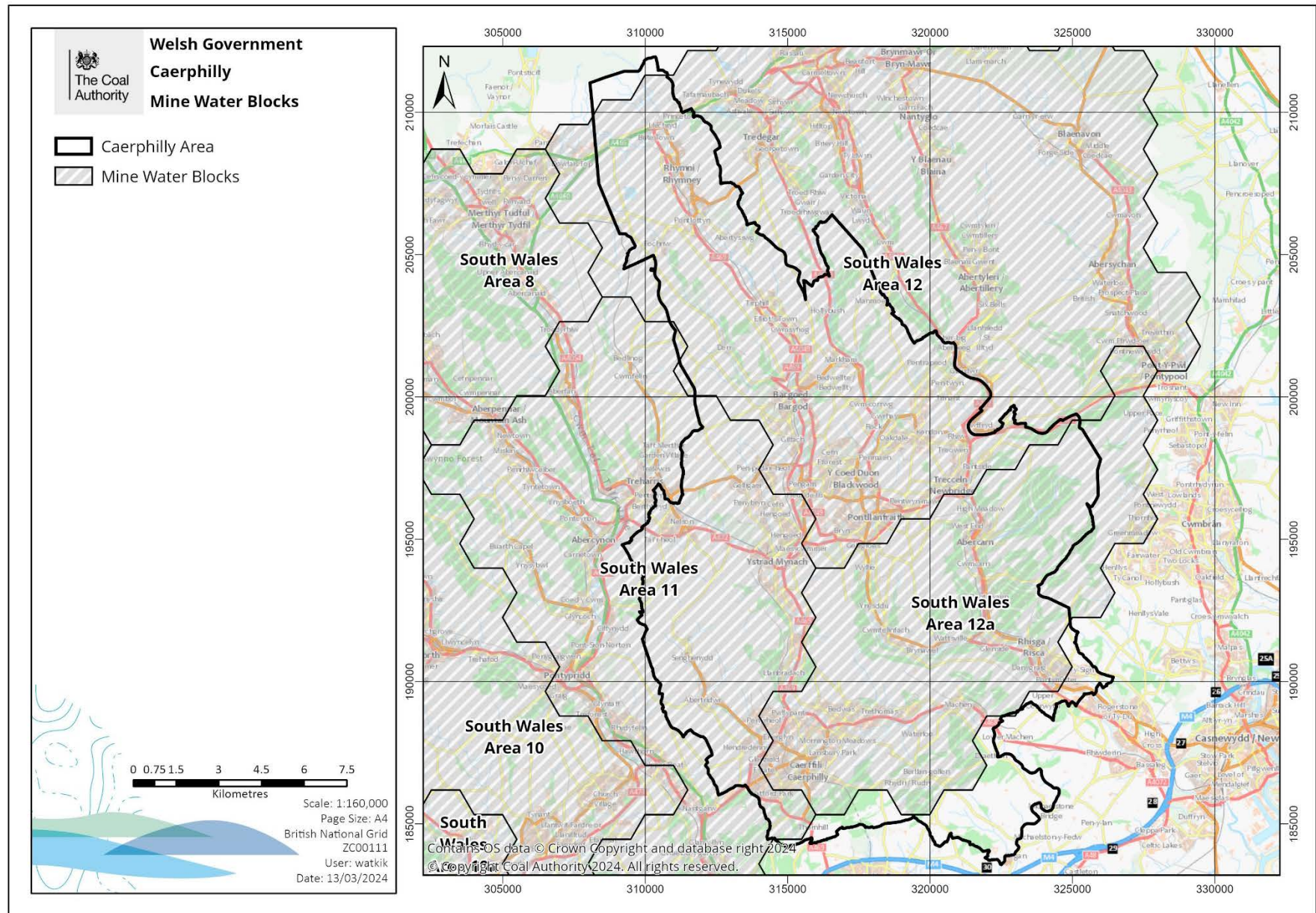
**Table 4.3: Anticipated mine water temperatures south of Pontllanfraith (block 12a)**

Depth (m BGL)	Mean (°C)	Max. (°C)	Min. (°C)
100	11.0	11.1	10.9
200	13.0	13.2	12.9
300	15.1	15.3	15.0
400	17.2	17.4	17.0
500	19.3	19.4	19.1
600	21.3	21.5	21.1
700	23.4	23.6	23.2
800	25.5	25.7	25.2

### 4.2.3 Mine water chemistry

Mine water chemistry can be highly variable depending on specific location and would not normally form part of any initial high level opportunity scoping considerations guided by this study. Mine water chemistry assessment would be included in any more detailed, site specific studies, which may be commissioned in future.





**Figure 4.1: Mine water blocks in Caerphilly**

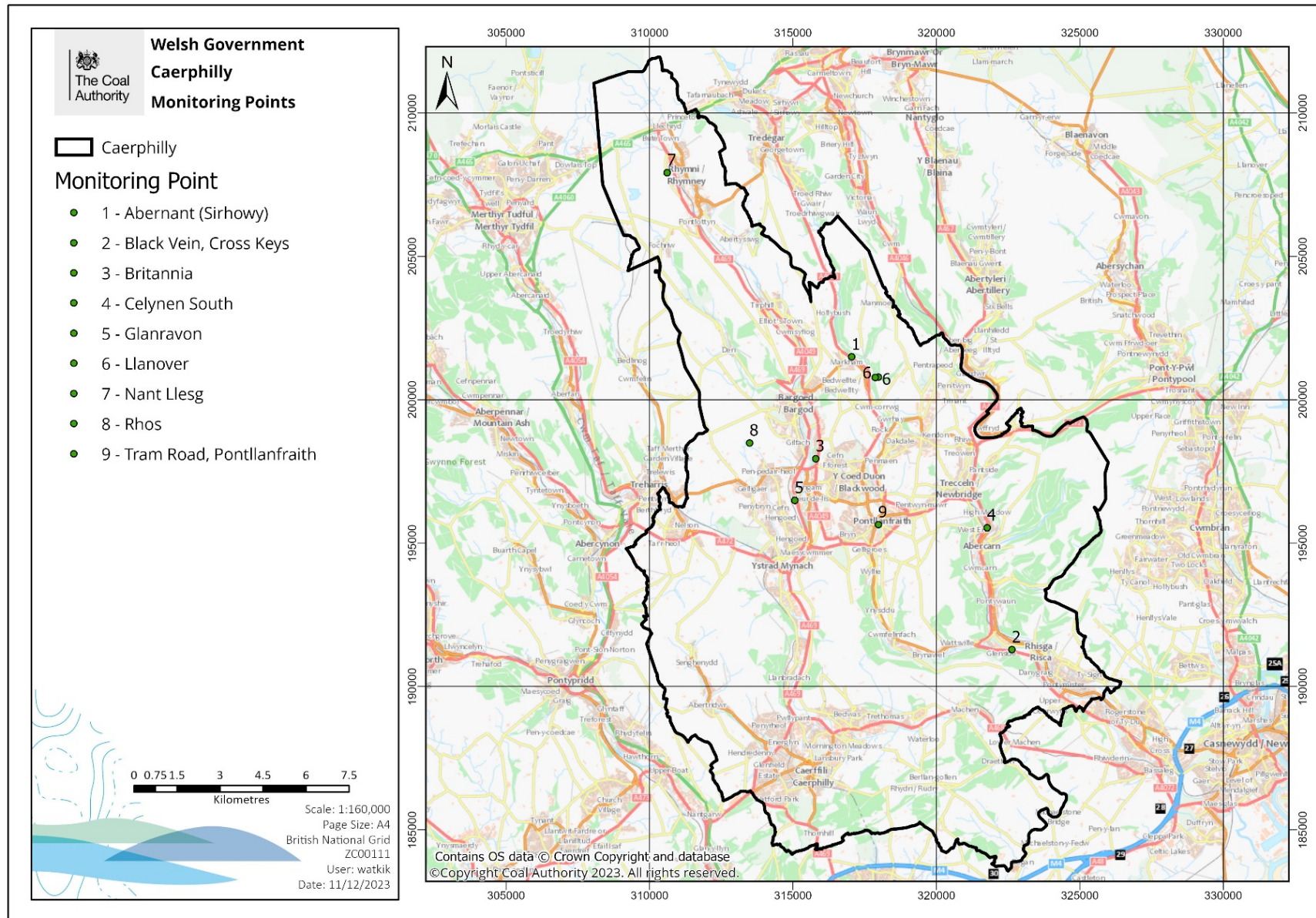


Figure 4.2: Mine water level monitoring points in Caerphilly

## 5 Mine water heat opportunities

### 5.1 Borehole schemes

The prospects for progressing a mine water heat scheme based on drilling boreholes to abstract and re-inject the mine water are assessed on a 'tier' basis. Three tiers have been adopted for the purposes of this study, the methodology and assessment criteria being set out in the over-arching report for Welsh Government

The classification of borehole based opportunities are:

**Good opportunities** – shown coloured **dark orange**

**Possible opportunities** – shown coloured **medium orange**

**Challenging opportunities** – shown coloured **light orange**

The opportunity areas within Caerphilly CBC boundary are outlined below and are illustrated on the maps at **Figure 5.1**.

Any areas where no opportunity exists, mainly due to absence of mine work are shown uncoloured/un-hatched.

#### 5.1.1 Good borehole scheme opportunities

Generally, the area to the north of Bargoed / Aberbargoed reaching almost to the A465 'Heads of the Valleys' road offer "Good opportunities" and the most favourable for developing a mine water heat borehole based scheme. In this area mine workings in multiple seams at depths of less than 300m are present over wide areas, these workings being shallower than elsewhere in the south of the borough, thus likely to incur less expense and difficulties with drilling.

The largest settlement area in this area is the town of Rhymney, however the topography and geometry of the mining is such that coal mine workings are not recorded to be present under the northern part of the town and only the southern part is considered to have "Good opportunities". It is noted that non-coal mine workings (for example ironstone) and unrecorded coal mine workings may be present under the northern part of Rhymney. However this area includes some significant industrial sites, which may present significant heat loads.

#### 5.1.2 Possible borehole scheme opportunities

To the south of New Tredegar the workings shallower than 300m are largely in a single seam, the Tillery Brithdir resulting in a 'possible opportunity' rating. Workings in other seams are present in some of the area but are much deeper (over 500m). This area extends south to the A472 road and includes the main settlement areas of **Aberbargoed, Bargoed, Blackwood, Cefn Hengoed** and **Pontllanfraith**.

Immediately to the south of the A472 opportunities in Caerphilly become much less attractive (“Challenging opportunity”) due to the deepening workings. The shallowest workings here are at depths of over 500m at the base of the syncline in the South Wales Coal Measures.

However, the strata begins to rise again in the southern half of the syncline, with large areas of “Possible opportunity” being present within a 3 km wide band across Caerphilly CBC district. The northern extremity of this band is to the south of Newbridge and it extends in a south-westerly direction reaching almost as far as Caerphilly.

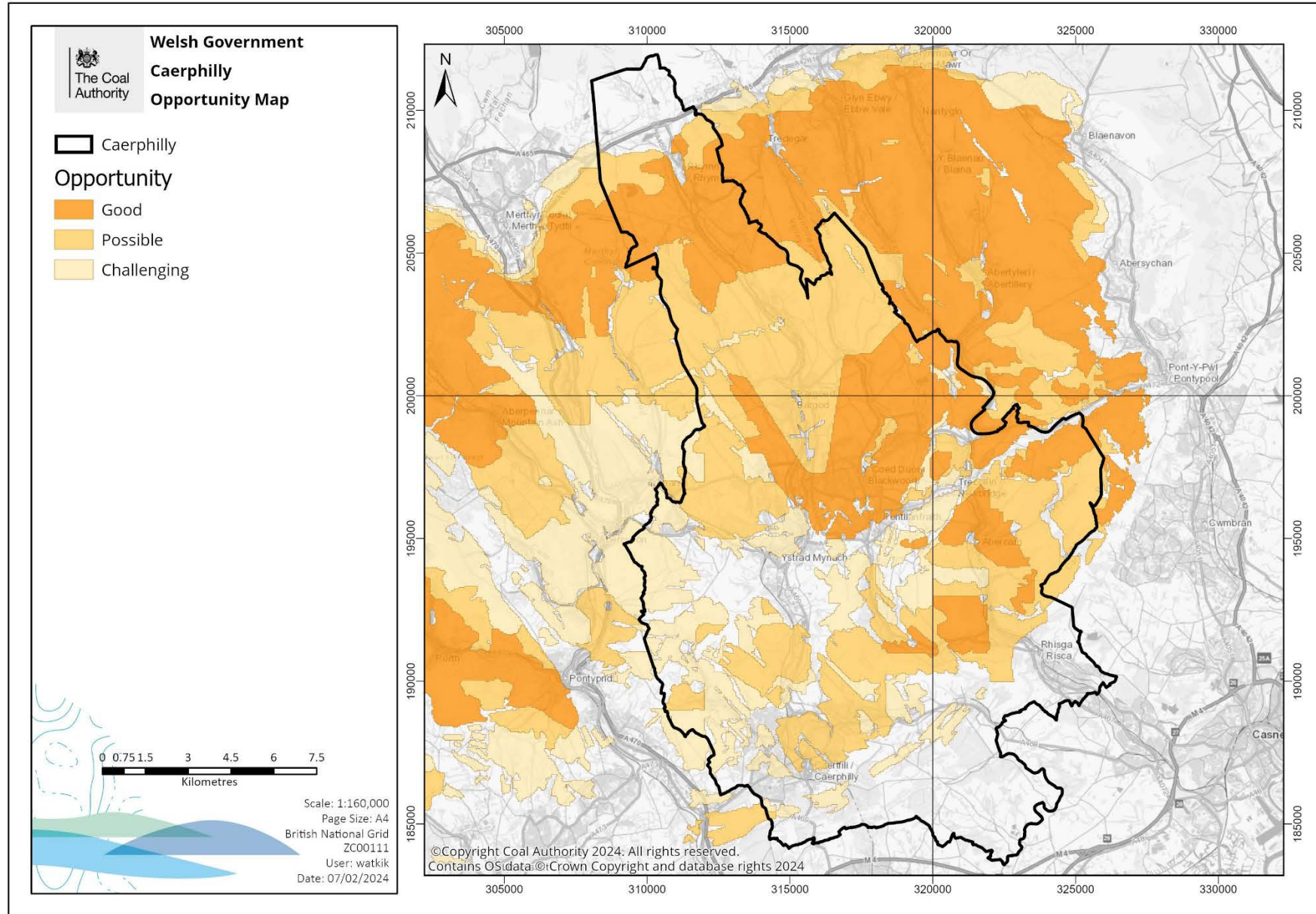
Significant settlement areas in this band where possible opportunities may exist include **Abercarn, Crosskeys, Cwmfelinfach, Trethomas** and **Bedwas**.

A “Possible opportunity” area also exists in the north eastern quarter of **Caerphilly town** bounded by the A468 and A469 ring road which includes major industrial and retail concerns.

### 5.1.3 Challenging borehole scheme opportunities

The south-western extremity of the borough includes a number of areas which, while offering potential for mine water heat, are in a single seam and over 500 m deep. Drilling costs (e.g. due to depth of workings) along with the single seam workings are potentially prohibitive with **Ystrad Mynach** town presenting a ‘challenging opportunity’.

At the southern extremity of the coalfield syncline the strata and workings rise to near surface with a band of workings being present from **Machen to Caerphilly Mountain**. These areas are marked as “challenging opportunities”, due to restrictive extents of workings, and workings largely being in a single seam. However, their shallow depth (<300m) may offer better opportunities for small-scale schemes, although it is noted there is currently little surface development in this area.



**Figure 5.1: Mine water heat opportunities – borehole schemes**

## 5.2 Mine water treatment schemes

Existing Coal Authority mine water treatment schemes, where mine water is already either pumped or flowing, may in some circumstances potentially offer a lower risk approach to developing mine water heat projects as new drilling and testing of boreholes would not be required.

However, there are currently no mine water treatment schemes in the Caerphilly CBC area.

## 5.3 Gravity-fed discharge schemes

Numerous gravity-fed mine water discharges exist in the Caerphilly CBC area. Many are not monitored for flow rate, water quality or temperature. Some of these may offer heat potential not presented in this report. These discharges generally occur when mine workings connect with the surface, typically via mine entries and boreholes.

The nature of gravity-fed discharges (flow, temperature and quality) will be dependent upon a number of factors including mining type and geometry, the hydrogeological system of the mine workings and rainfall.

Some discharges are likely to be more variable in flow rate and temperature than others but as many of the discharges are not currently monitored for flow rate, water quality or temperature and so it is difficult to evaluate with any degree of confidence.

Those discharges that do have some monitoring data (albeit in some cases relatively limited) and are likely to have a heat potential of  $>0.5\text{MW}_{\text{th}}$  are described in the sections below supported by data in **Table 5.1** and illustrated on the plans at **Figure 5.10** and **Figure 5.11**.

**Table 5.1: Summary of selected gravity-fed discharges for mine water heat potential**

Name	Flow average (L/s)	Flow range (L/s)	Typical temperature (°C)	Estimated potential heat (MW <sub>th</sub> )
Bensons Level	18	3 to 40	10.1	0.3 to 0.5
Cefn Hengoed No1	103	50 to >150	11.4	2.1 to 2.9
Cefn Hengoed No5	19	<5 to 50	11.3	0.4 to 0.5
Glanddu Level	50	1 spot reading	11 (est)	1 to 1.4
Glyntillery	47	1 spot reading	11 (est)	1 to 1.4
Graig Fawr (Celynen North)	47	20 to >100	12.5	1 to 1.3
Pontlloftyn (Bute Level)	77	40 to >150	12.0	1.6 to 2.2
Sunningdale (Blackwood)	25	10 to >75	11.1	0.5 to 0.7
Tram Road Pontllanfraith	45	20 to >100	10.9	0.9 to 1.3

Note: Potential heat is based on spot readings and / or average flow rate. Potential heat will vary with flow rate, which varies with rainfall. Potential heat at a site may be above or below the estimated value at different stages of the year.

Should a potential heat demand be identified close to one of these discharges (shown in **Table 5.1**) or any other discharge in the area, then a more detailed study would be required. Additional investigation and data gathering will likely be required to establish its potential.

### 5.3.1 Bensons Level

The discharge is between the Sirhowy River and A467 road at **Crosskeys**. On the north side of the river there is Newtown Industrial Estate and Tredegar Court (Housing Care) run by Caerphilly CBC. Within Crosskeys there are also further residential properties, of which some may be Caerphilly CBC owned, along with schools and college. Capturing the flow from the discharge could be difficult, but there are also other small discharges in the local area that could also be incorporated.

An initial broad estimate suggests a potential of around  $0.5\text{MW}_{\text{th}}$  may be available but a more detailed site specific study will be needed to assess flow rate and temperature with more certainty and confirm feasibility for a heat scheme(s).

### 5.3.2 Cefn Hengoed (Tir-yr-Berth) discharges

There are a total of five mine water discharges at **Cefn Hengoed** within a small area to the west bank of the River Rhymney, with the two main discharges shown in **Figure 5.2** and **Figure 5.3**. The discharges are on a steep slope and mine water capture may be difficult.

An initial broad estimate suggests a potential of over  $3\text{MW}_{\text{th}}$  may be available from the combined discharges but a more detailed site specific study will be needed to assess flow rate and temperature with more certainty and confirm feasibility for a heat scheme(s).

Above the site and on the west side of the river there is Norgine (Pharmaceutical company) and other manufacturing industry may have significant heat demand. Caerphilly Council owned properties and other potential users may also be present but this will need confirming. Glanddu Level (see below) is nearer to Tir-y-Berth, and this could be combined with the Cefn Hengoed discharge to provide an estimated  $4.5\text{MW}_{\text{th}}$ .



**Figure 5.2: Cefn Hengoed No1 (main) Discharge**



**Figure 5.3: Cefn Hengoed No5 Discharge**



### 5.3.3 Glanddu Level

The discharge is adjacent to the railway (possibly west side) to the southwest of **Tir-y-Berth**. The discharge flows in to an open ditch that runs to New Road. To the south there is manufacturing industrial buildings (see Cefn Hengoed), and to the north are residential properties and retail. There is also a Caerphilly CBC depot at Tir-yr-Berth. The flow rate and temperature data will need further investigations and monitoring. The discharge could be combined with Cefn Hengoed.

### 5.3.4 Glyntillery

The discharge is alongside the A472 next to **Hafodyrynys Washery**. The nearest residential properties are at Hafodyrynys, which is 2km to the west, with Pontypool being >3 km to the east. Monitoring data is limited to one spot reading and estimated temperature data. Flow rate and temperature data will need further investigations and monitoring. Due to there being no surface development in the locality of the discharge and distances to potential heat users a heat scheme may not be feasible at present. If there are any future developments close to the discharge, then a feasibility study should be undertaken.

### 5.3.5 Graig Fawr (Celyn North)

There are two discharges at Graig Fawr (Celyn North) illustrated at **Figure 5.4** and **Figure 5.5** which are thought to be shaft drains to the Ebbw River, the vast majority of the flow being from the northern drain. In terms of potential heat loads the discharges are adjacent to and below Axiom (manufacturing company). There are also the built-up areas of Pantside and Newbridge in the local area. There is the Caerphilly Council owned Newbridge Leisure Centre <1 km south of the discharge.

An initial broad estimate suggests a potential of 1.2 MW<sub>th</sub> may be available from the combined discharges but a more detailed site specific study will be needed to assess flow rate and temperature with more certainty and confirm feasibility for a heat scheme(s).



**Figure 5.4: Graig Fawr (Celynen North) (main) discharge**



**Figure 5.5: Graig Fawr (Celynen North) 2nd Discharge**

### 5.3.6 Pontllotyn

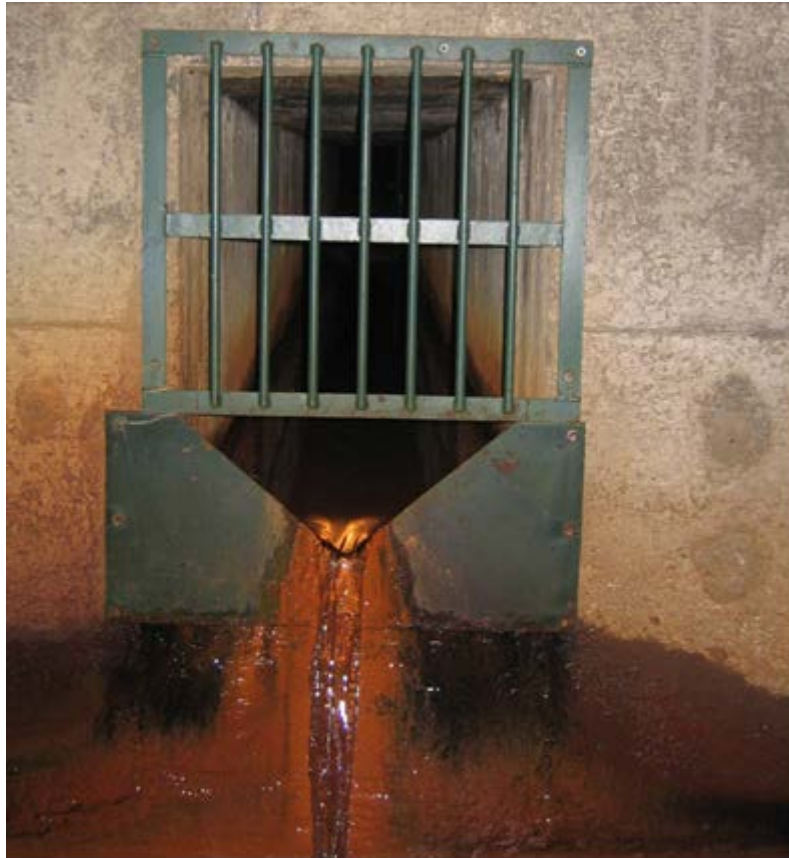
The discharge at **Pontllotyn** is comprised of one main discharge (Bute Level illustrated at **Figure 5.6**) and other smaller discharges (one of which illustrated at **Figure 5.7**) into a culverted section of the River Rhymney. Monitoring of flow rate for the main discharge has been undertaken although technical difficulties in monitoring means the data may have errors. Capturing this discharge could be technically challenging.

An initial broad estimate suggests a potential of 2 MW<sub>th</sub> may be available from the Bute Level discharge but a more detailed site specific study will be needed to assess flow rate and temperature with more certainty and confirm feasibility for a heat scheme(s).

There are Caerphilly Council owned buildings nearby that could be served by a heat scheme at this location. A more detailed site specific study would be required to determine feasibility.



**Figure 5.6: Pontlloctyn Bute Level discharge to river culvert**



**Figure 5.7: Discharge to Pontlottyn culvert at 37m inbye**

### 5.3.7 Sunningdale (Blackwood) Old Rock

The discharge at **Sunningdale** is from a culvert that is thought to be from Old Rock Colliery mine shafts (potentially owned by Caerphilly CBC). The discharge, illustrated at **Figure 5.8**, is to the west bank of the Sirhowy River below the retail park at Blackwood. An initial broad estimate suggests a potential of 0.6 MW<sub>th</sub> may be available from the discharge but a more detailed site specific study will be needed to assess flow rate and temperature with more certainty and confirm feasibility for a heat scheme(s).



**Figure 5.8: Sunningdale (Blackwood) Old Rock discharge**

### 5.3.8 Tram Road, Pontllanfraith

The discharge is alongside Tram Road Industrial Estate in **Pontllanfraith** and is illustrated in **Figure 5.9**. The mine water is artesian in nearby boreholes. An initial broad estimate suggests a potential of 1.2 MW<sub>th</sub> may be available from the discharge but a more detailed site specific study will be needed to assess flow rate and temperature with more certainty and confirm feasibility for a heat scheme(s).



**Figure 5.9: Tram Road Discharge**

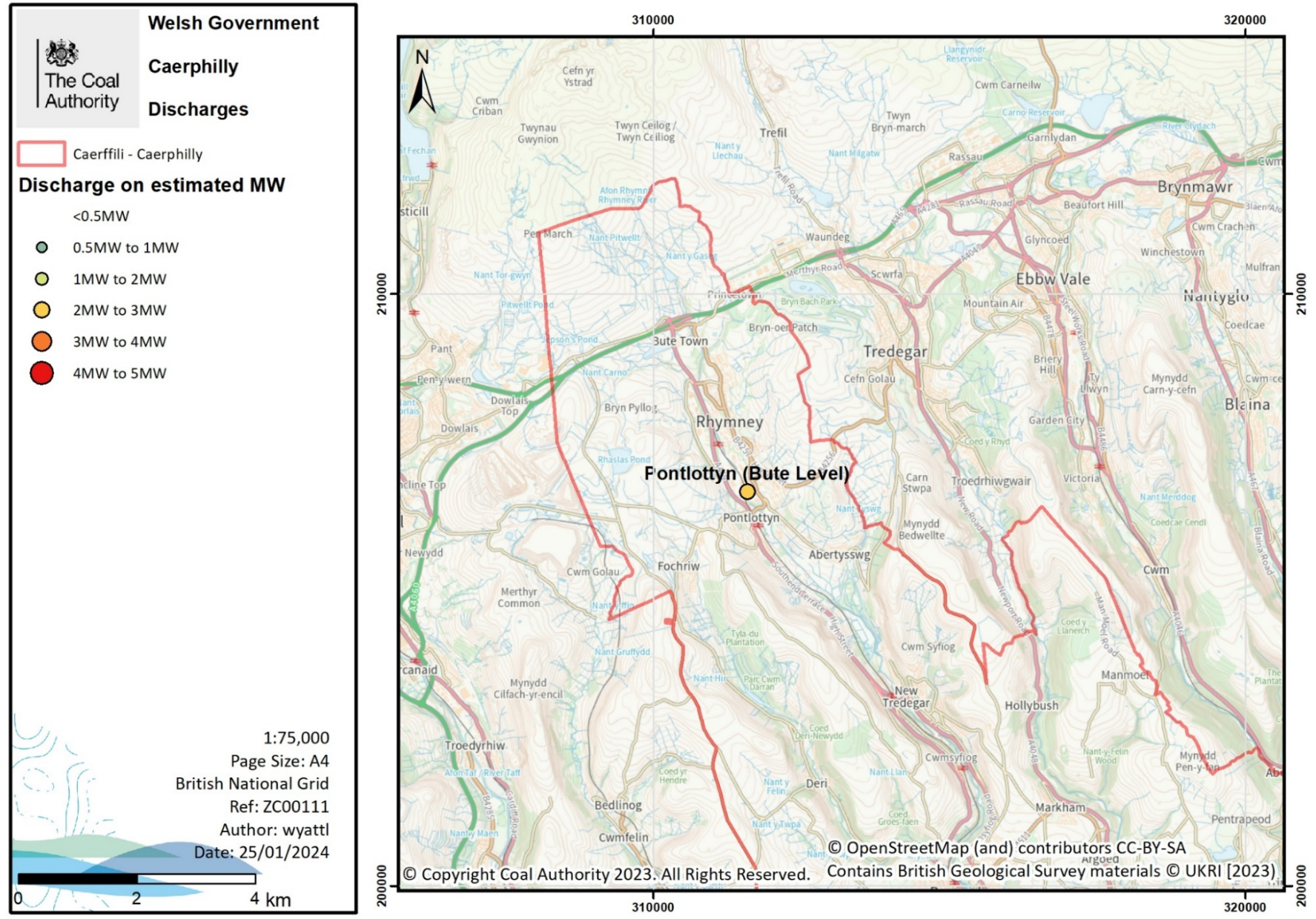


Figure 5.10: Gravity-fed coal water discharges in Caerphilly North

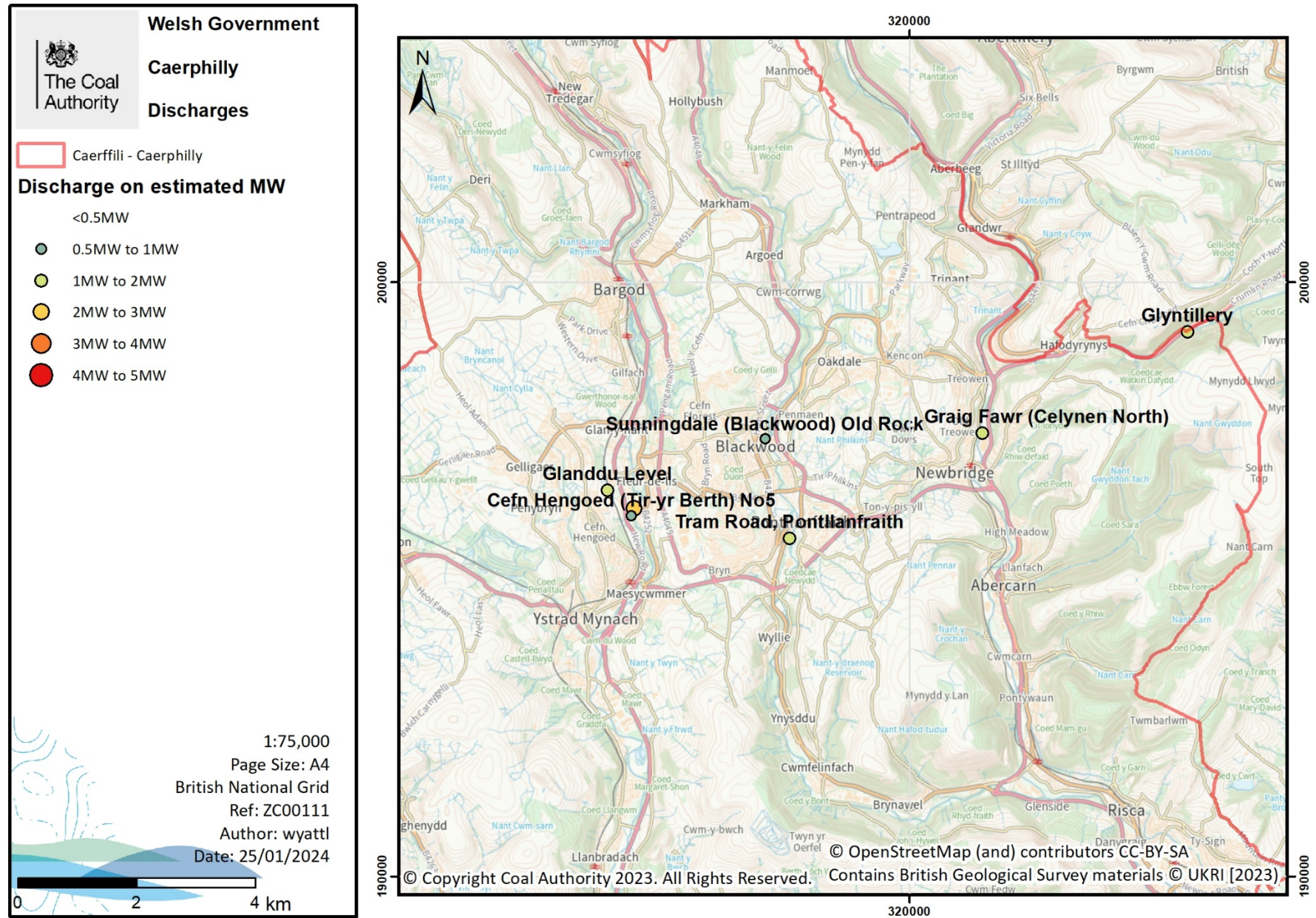


Figure 5.11: Gravity-fed coal water discharges in Caerphilly South

## 6 Summary

Considerable areas of the Caerphilly CBC administrative area are underlain by abandoned coal mine workings. The earlier sections of this report consider the mining and mine water parameters across the whole borough to rank areas by reference to an opportunity classification system. This summary section overlays the opportunities (**Figure 6.1**) on populated settlement areas to provide a steer on localities where mining aspects and surface development may present the most likely places to further investigate and potentially deploy mine water heat.

The opportunity areas are set out in **Table 6.1** and their locations illustrated in **Figure 6.2**.

**Table 6.1: Mine water heat opportunities within Caerphilly**

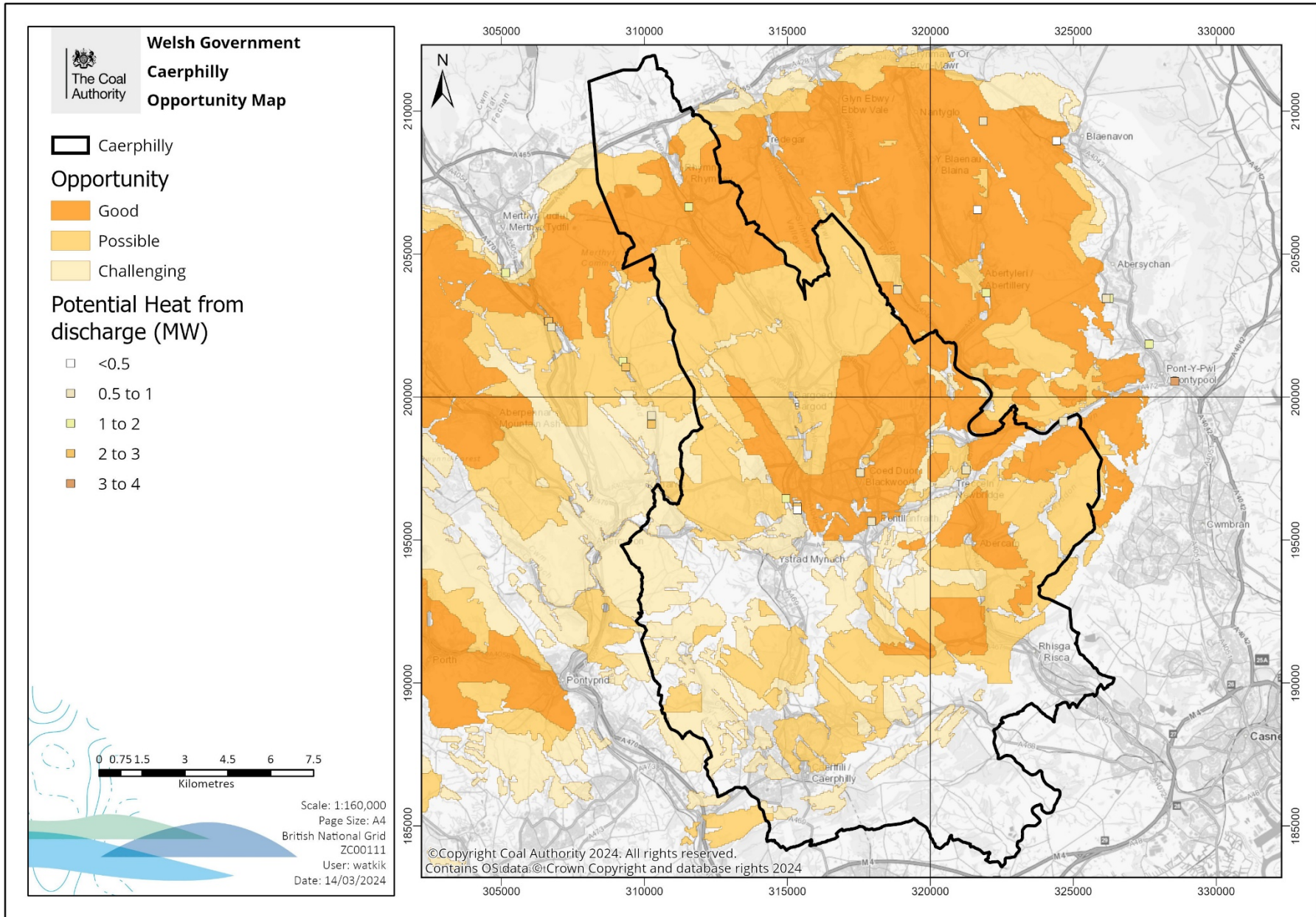
No./ Area	Opportunity name	Opportunity type	Category	Potential MW <sub>th</sub>
1	Rhymney South	Borehole scheme	Good	Subject to further testing
2	Bargoed/Gilfach	Borehole scheme	Good	Subject to further testing
3	Blackwood/Penllwyn	Borehole scheme	Good	Subject to further testing
4	Oakdale	Borehole scheme	Good	Subject to further testing
5	NE Caerphilly	Borehole scheme	Possible	Subject to further testing
6	Pontllotyn	Gravity Discharge	Possible*	2.0
7	Tir-y-Birth Discharges	Multiple gravity discharges	Possible*	3.2 TO 4.5**
8	Sunningdale Old Rock	Gravity Discharge	Possible*	0.64
9	Tram Road	Gravity Discharge	Possible*	1.2
10	Craig Fawr (Celyn N)	Gravity Discharge	Possible*	1.2

\*Gravity discharge categories

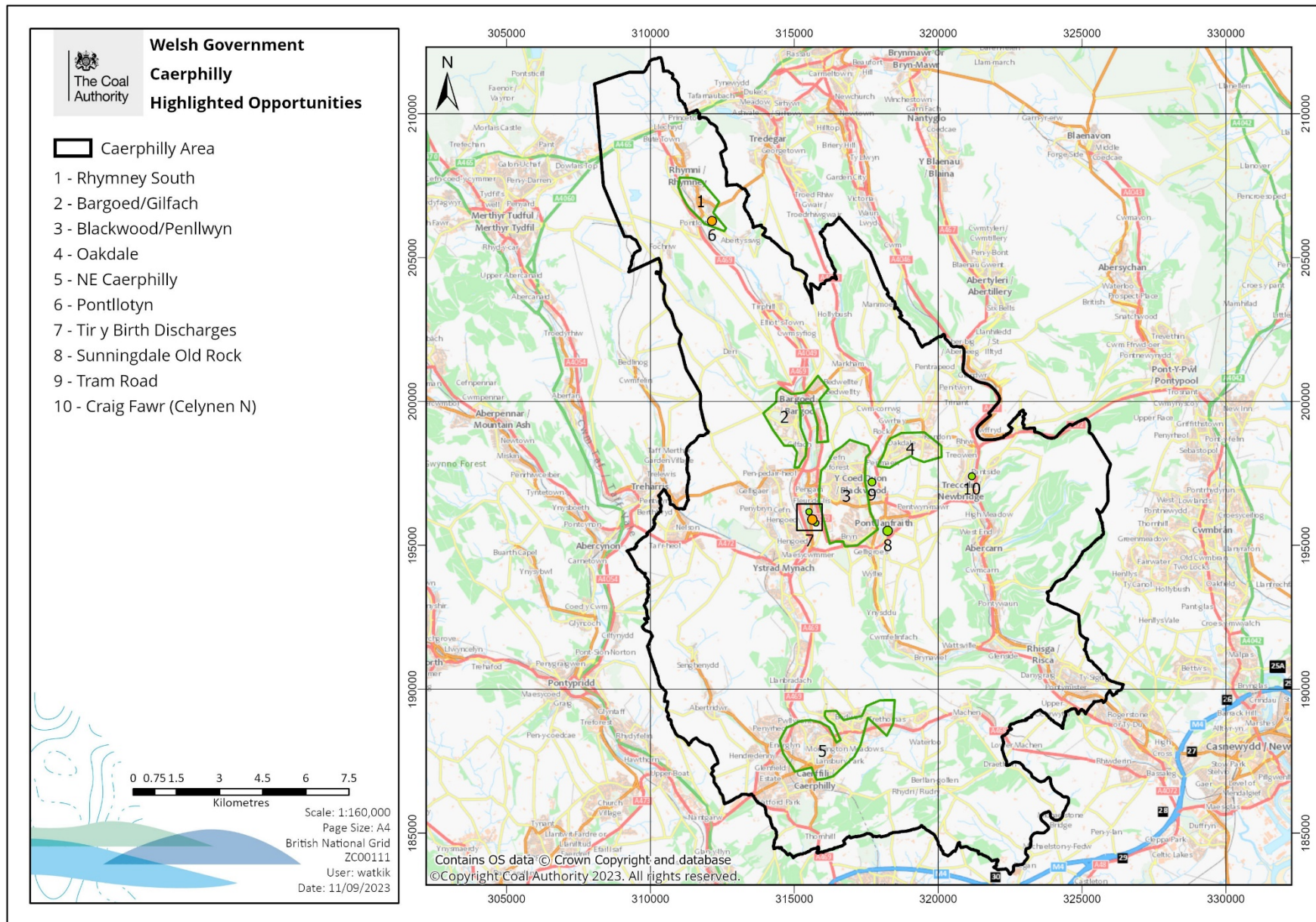
- Good means heat potential over 0.5MW uncomplicated capture and uncomplicated heat transfer.
- Possible means heat potential over 0.5MW complicated capture or complicated heat transfer.
- Challenging means heat potential over 0.5MW complicated capture and complicated heat transfer.

\*\* 4.5 MWth includes 1.3 MWth from nearby Glanddu discharge





**Figure 6.1: Combined mine water opportunities map**



**Figure 6.2: Highlighted good opportunities within Caerphilly**

## 6.1 Borehole schemes

### 6.1.1 Good opportunities

In broad terms good opportunities are expected to exist in the northern half of the borough extending from the A465 'Heads of the Valleys' road southwards to Blackwood and Pontllanfraith.

In the extreme north of the borough good opportunities exist at **Rhymney**. While the northern half of the town is devoid of coal workings, the southern half (south of High Street/Tre-York Street) is underlain by workings in several seams at depths ranging from c. 30 m to 170 m. This area includes a number of significant commercial/industrial buildings on the **Maerdy Industrial Estate** and the **Garden City residential estate** and extends through **Pontllotyn** where a major (c. 2 MW<sub>th</sub>) gravity discharge exists (see **section 5.3.6.**). This area is shown as **area 1** on **Figure 6.2**. Caerphilly CBC have previously suggested that at the site of the proposed Upper Rhymney primary school there may be an option for borehole location for a potential scheme. Workings are present in two seams beneath the site.

**Bargoed** and **Aberbargoed** are also considered to be in good opportunity areas. While workings here are only in a single seam (some very deep workings are also present at Bargoed) they are extensive in nature and may support larger schemes if carefully designed. The area is shown as **area 2**.

A Phase I mine water heat study was produced for CCBC on the land at **Aberbargoed Plateau** in July 2023. The recommendations for the report were that a scheme using the upper seam in conjunction with local industrial waste heat would be a good option. However, this requires input from industrial stakeholders but would provide an innovative solution to both decarbonisation and reduced energy costs. It would be advisable to integrate the proposed schemes at the Upper Rhymney primary school and development at the Aberbargoed Plateau and drill from the primary school site in order to reduce drilling costs.

Further south, much of **Blackwood** represents a good opportunity area with workings present in more than one seam at depths from c. 50m to c.300m and is shown as **area 3**.

Much of the settlement area of **Oakdale** (shown as **area 4**) is also considered to be in a good opportunity area.

### 6.1.2 Possible opportunities

A 3 km wide band offering possible opportunities exists bounded by the southern outcrop of the coal measures. The area is to the south of the A472 Road with the southern boundary following a line from Risca to the south of Caerphilly town. Interspersed in this area are smaller areas with both good and challenging opportunities but most of this band tends to be under relatively uninhabited areas.

The **north eastern quarter of Caerphilly town**, shown as **area 5**, is underlain by workings at less than 300m depth but as this is only single seam working this is considered a possible opportunity area rather than good.

Caerphilly CBC has previously indicated the possibility of developing the site of the former Bedwas Colliery. Here it was suggested that 500-600 new homes could be built along with a primary school. The workings are relatively deep at 550-720m but the size of the development may be enough to support the increased drilling costs.

### 6.1.3 Challenging opportunities

Workings do exist under large parts of **Ystrad Mynach** at a depth of over 500m. While a mine water heat scheme(s) may be technically possible it is unlikely to be commercially viable due to the high drilling costs/risk.

A narrow band of disparate areas of workings exist in a single seam at the southern extremity of the coalfield. This band stretches from **Machen** in the north east to **Caerphilly Common** in the south west. The limited area of each set of workings has resulted in a challenging opportunity ranking overall. However, the relatively shallow depth of some of the workings may present possible opportunities for smaller schemes.

## 6.2 Mine water treatment schemes

There are currently no Coal Authority mine water treatment schemes within the Caerphilly CBC area.

## 6.3 Mine water discharges

Many mine water discharges are known to exist in the area, currently eight of these have been considered as offering mine water heat potential of between 0.5 MW<sub>th</sub> to 2.9 MW<sub>th</sub> without the need for boreholes and associated deep pumping. While the heat potential is good, many of these discharges do present some challenges in collecting the mine water which results in them being ranked as "possible opportunities" as opposed to "good opportunities". The exception is Glyntillery discharge, which is discounted in this opportunity summary as it is located in an area devoid of current surface development and at a considerable (>2 km) distance from any significant potential heat loads. The discharges are set out in **Table 6.1** and their locations illustrated in **Figure 6.2**.

## 6.4 Next steps

A number of good, possible and challenging mine water heat opportunity areas have been identified across the Caerphilly CBC region as illustrated in **Figure 5.1**. However, much of the Caerphilly CBC area is rural with little or no surface development, and potential users in those areas will be limited compared to urban areas. The opportunity areas have been considered against the major developed areas (which may have a significant heat demand) in the borough to seek to identify places where good heat supply opportunities may coincide with significant heat demand. It is suggested that the opportunities covered in this section

and listed in **Table 6.1** and shown in **Figure 6.2** are further considered for more detailed study.

The heat potential of the borehole schemes cannot be estimated to any degree of certainty until more detailed and localised study is undertaken. Localised studies or more in-depth studies for boreholes are required to confirm available flow rates and other factors that are used to determine heat potential. This may involve exploratory drilling. However, within this report, there are borehole opportunity areas marked as good on the basis that it is considered the workings in these areas are substantial and likely to have significant heat potential  $>3\text{MW}_{\text{th}}$ .

It is recommended that a survey of the main heat loads, particularly potential large 'anchor' loads such as hospitals or larger public buildings is undertaken in the opportunity areas in **Table 6.1** to establish synergies between potential heat supply and heat demand. Potential cooling demands should also be considered. This may identify good opportunities to further investigate pilot mine water heat projects through more detailed feasibility work, initially involving desktop studies and subsequent investigative drilling should the potential be attractive.

## 7 References

Farr, G., Busby, J., Wyatt, L., Crooks, J., Schofield, D.I., Holden, A. 2020. The temperature of Britain's coalfields. *Quarterly Journal of Engineering Geology and Hydrogeology* (2021); **54**(3). pp.1-14. <http://dx.doi.org/10.1144/qjegh2020-109>