The Coal Authority

Resolving the impacts of mining

Morlais Mine Water Treatment Scheme - New licence application for a previously exempt abstraction-Additional information

1. Introduction

The Morlais Mine Water Treatment Scheme (MWTS) is on the site of the Morlais and Brynlliw Collieries which last operated in 1983. The cessation of deep mining and associated mine de-watering has caused the water table to rebound, which resulted in the discharge of iron-rich mine water to the Afon Morlais. Prior to the treatment scheme being built, the impact of the discharge was assessed by the Environment Agency (now NRW) and was ranked as the worst in Wales.

The site lies to the southwest of junction 48 of the M4, approximately 7km east of Llanelli, 2km southwest of Pontarddulais and 1km northeast of the village of Llangennech.

The mine water upwells from a mine shaft located inside the palisade fencing to the left of the site entrance. The flow from the shaft is rainfall dependent and is variable from ~ 70l/s to over 300l/s. Figure 1 shows the location of Morlais MWTS.

Figure 1: Location of Morlais Mine Water Treatment Scheme

2. Pollution Remediation

The raw mine water currently has an iron concentration of ~14mg/l.

Although not toxic in itself, iron within the mine water oxidises and precipitates out of solution within the water course and can result in the smothering of river beds.

In order to treat the discharging mine water, the Morlais MWTS was constructed in 2003 and consists of a raised shaft collar, aeration cascade, settlement lagoons (2 no.) and reed beds (3 no.). It is a "passive" treatment scheme which means it harnesses only natural processes, and no power or chemical additions are used. Passive schemes need only infrequent monitoring, and maintenance.

A raised shaft collar was constructed to lift the mine water by gravity above the aeration cascade where it flows down becoming oxygenated. The oxygenation of the mine water encourages iron oxidation and subsequent precipitation. The lagoons then provide the retention time needed for most of the precipitated particles to settle out of the resulting suspension. The reed beds then act as a final "polishing" filter.

The mine water discharges from the scheme with an average iron concentration of 0.6mg/l.

3. Answers to Specified Sections of Form WRH

The following are responses to the application form sections, in cases where the referenced document is this one, i.e. "Morlais Additional information".

2.4 Abstraction Invoices and Records

	Main Contact	Address	Phone Number	Email
Site Operation	Chris Crowe	Chris Crowe The Coal Authority 200 Lichfield Lane Mansfield NG18 4RG	07917174577, 01623637363	ChrisCrowe@coal.gov.uk; EnvironmentMail@coal.gov.uk
Invoice Abstractions	Accounts Payable	Accounts Payable The Coal Authority 200 Lichfield Lane Mansfield NG18 4RG	01623637000	FinanceDepartment@coal.gov.uk EnvironmentMail@coal.gov.uk
Abstraction Records	Jack Cropper	Jack Cropper The Coal Authority 200 Lichfield Lane Mansfield NG18 4RG	07917093506	EnvironmentMail@coal.gov.uk JackCropper@coal.gov.uk

4.2 What is your connection to the land where the abstraction takes place?

The Coal Authority has ownership of the land where the water upwells and where the treatment scheme currently sits. Please see Appendix A, Figures A2 and A3 for maps outlining land ownership/ abstraction and discharge points.

4.3 Do you have a legal right of access to the land where the abstraction takes place?

The Coal Authority has legal rights of access to the land where the abstraction takes place. Please see Appendix A, Figures A3 for maps outlining land ownership.

7 Abstraction details

Mine water treatment schemes are associated with abandoned and disused mines in which mine water rebound has occurred. During the operation of the mines, water levels are artificially lowered via pumps and drainage adits. When operations in the mine ceases the pumps are turned off and the water levels rebound, flooding the mines. As a result, mine water discharges at the surface from former adits or shafts of these abandoned and disused mine workings. Transfer of the mine water for the purpose of pollution remediation, usually occurs at the surface and is a passive process, facilitated by gravity. We have therefore considered the transfer to be for surface water.

7.1 Site Map

Please see Appendix A for maps outlining the site.

8.1 Abstraction history and evidence

Abstraction has taken place continuously throughout the full duration of the seven year qualifying period.

Since the MWTS is passive, visits are infrequent to avoid excessive management cost. As there is no power supply, only simple manual readings of flow are taken during visits.

The scheme is non-consumptive and so the discharge flow rate is used as a proxy for the abstraction rate, as inlet and outlet flows are assumed to be equal.

Flow is measured at a 0.6m rectangular weir. This weir – see Appendix B, Figure B3 - is located at the end of the final reed bed, a few meters before the consented discharge point.

As part of ongoing site improvement works, the Coal Authority has been undertaking internal assessments of weir accuracy. This work has included a check of the approach channel, weir installation, crest condition and downstream conditions. Using this information, a weir accuracy level has been given to the monitoring points that reflects the level of error that may be associated with the monitoring structure.

The weir at Morlais is considered to be of medium accuracy with ± 15-25% error of flow rate measurements.

The records of weir measurements and flow rates are provided as evidence with this application but the potential weir error of ± 15-25% should be taken into account when looking at the flow rates provided.

As the flow rate of mine water at the site is rainfall related, and infrequently monitored, an estimation of the quantities abstracted are given on form WRH, in Table 8.1, using the largest measured flow rate recorded for the year (peak instantaneous flow rate in l/s). Consequently,

these values are anticipated to be the maximum volumes of water that may have been abstracted during the year, but, in practice, volumes abstracted would have been less than the volumes stated. For ease of visualisation of the amount of data, and the variability of flow rate measurements for the flow data is provided in Figure 2.

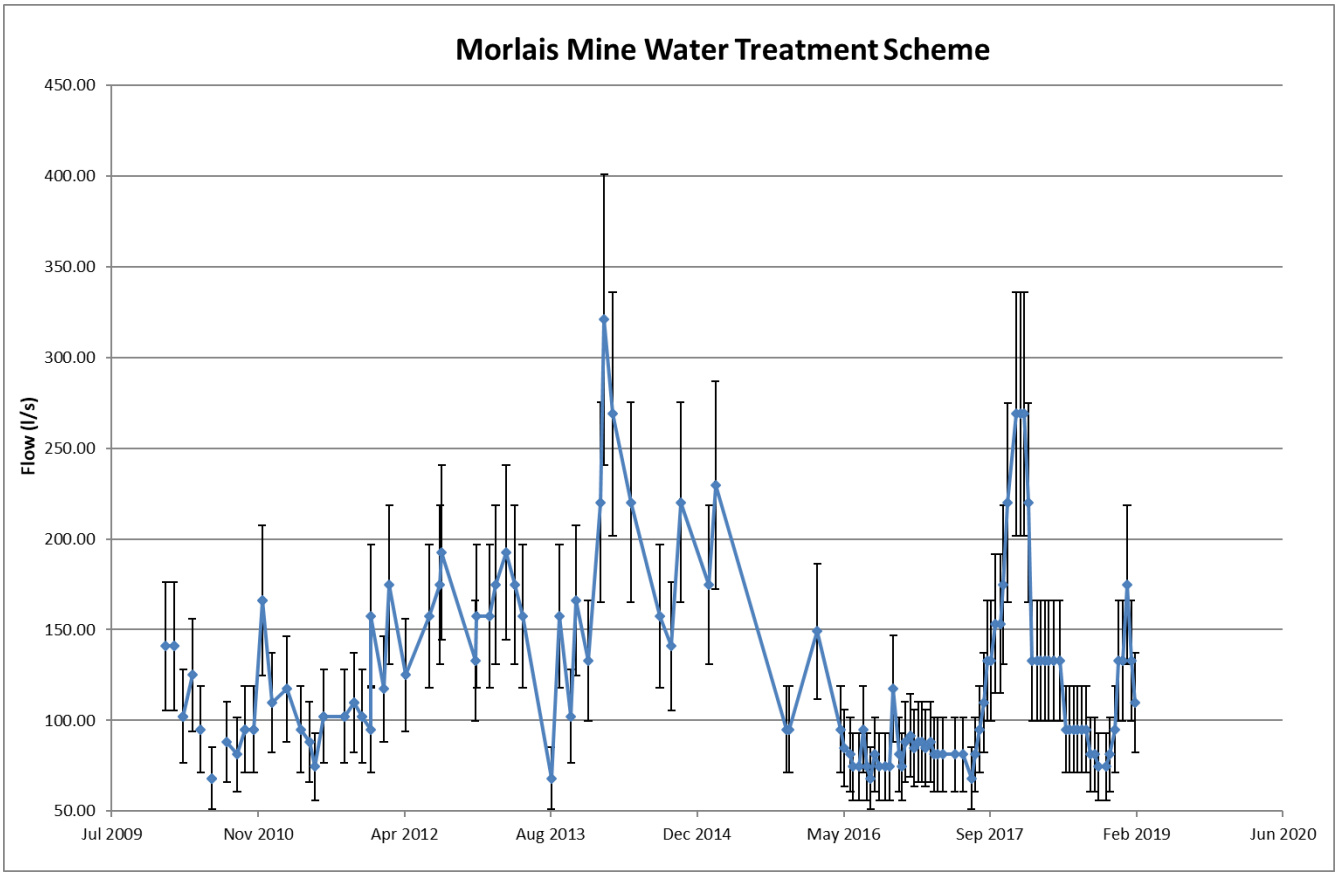

Figure 2: A graph to show the Morlais mine water flow rates (l/s) from 2009 to 2019.

8.4 Detailed description of how the abstraction has taken place

None of the mine water treatment schemes in operation by the Coal Authority are associated with current, or future mine workings – they are all draining abandoned coal workings which have historically flooded, and discharged to surface. The Coal Authority schemes do not dewater workings in the sense that water levels are not actively drawn down using pumps. The treated water emerges at the surface as a result of water levels having fully recovered within the abandoned mines so that it naturally drains from the adits/ shafts. The drainage of the old workings may be considered to be passive dewatering (by gravity), as against active dewatering (with pumps). The main purpose of transferring the mine water is for pollution treatment. On the other hand, the passive dewatering is an integral first step in order to feed water into each treatment scheme.

The source for the abstraction is a filled mine shaft of the former Brynlliw Colliery, within the Coal Measures. The shaft has Coal Authority mine entry reference 257202-013. The original shaft (pre-filling) has a recorded depth of 20.7m, and a diameter of 3.7m.

At the top of the former shaft, a raised collar has been installed. Groundwater from the mine workings connected to the shaft (in other words “mine water”) upwells in the shaft and the raised

collar **entirely passively**. From the top of the raised shaft collar, the mine water flows by gravity over the aeration cascade, and on into the rest of the MWTS.

Please see Appendix B, Figure B1 and Appendix C, Figure C1 for photos and as-built drawings of the abstraction point.

Under normal operating conditions, all of the flow from the shaft collar passes into the MWTS. This is to allow all of the mine water to be treated prior to its discharge into Afon Morlais.

The abstraction volume is **entirely rainfall dependent** and flows depend on the mine water volumes within the workings.

There is **no physical upper limit** to the volume abstracted into the MWTS from the raised shaft collar. This means that extreme rainfall events across the coalfield area could result in abstracted flows being higher than the maximum value recorded to date. In a similar way, if there are fundamental changes to flow paths in the abandoned coal mines (through roof falls etc.) then higher flows could occur.

The abstraction into the MWTS has run continuously since the MWTS construction.

Flows typically range from 75l/s up to >300l/s in extreme weather events (see Figure 2). Due to the flows being dependent on rainfall we ask that this be the basis for our abstraction licence volumes. If this is not possible, we ask that the maximum recorded flow reading of 320l/s be used.

The abstraction is **non-consumptive**, and following treatment, all the abstracted water is returned to Afon Morlais.

It is possible for the abstraction into the MWTS to be stopped. This is by means of opening a valve at the base of the raised shaft collar. If this valve were to be opened, the mine water would flow down the original shaft discharge channel. This channel runs in a southwest direction until it meets the Afon Morlais.

8.5 Please list the evidence you are providing to support your application

An excel spreadsheet entitled ‘Morlais Abstraction Data’ has been included with this application. The excel spreadsheet shows the flow volumes measured at the outlet weir.

Photos of the abstraction, treatment scheme and scheme discharge are also included in the appendices of this document.

9 Discharge Details

The site operates under discharge permit, BP0302601, which states that ‘the volume of the Discharge shall be dependent on rainfall’. The scheme is non-consumptive and 100% of the water abstracted is discharged into the Afon Morlais.

16 Licence Duration

The mine water will require treatment until water quality is significantly improved. Abstraction and treatment of the water is therefore likely to continue for >25 years. Due to this we ask that the licence be granted for the maximum permitted period of 18 years. However, we are also content if NRW choose to apply the common end date for the catchment.

As indicated above (response to 8.4) the abstraction into the MWTS can physically be stopped. However, this would result in the continuing gravity-driven discharge from the filled mine shaft flowing down the channel into Afon Morlais.

Appendix A: Morlais Mine Water Treatment Scheme

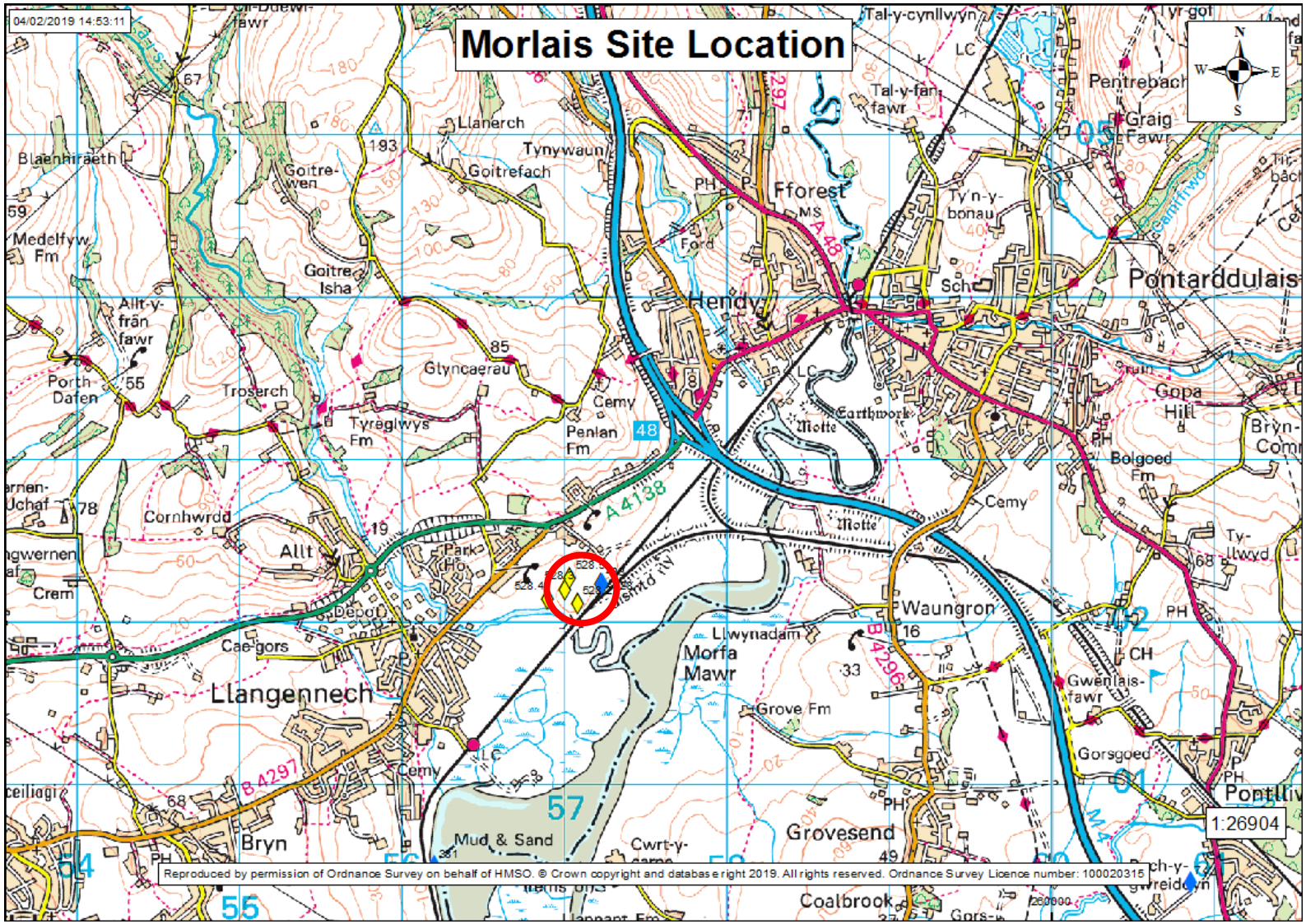

Figure A1: Morlais Site Location Map; site circled in red

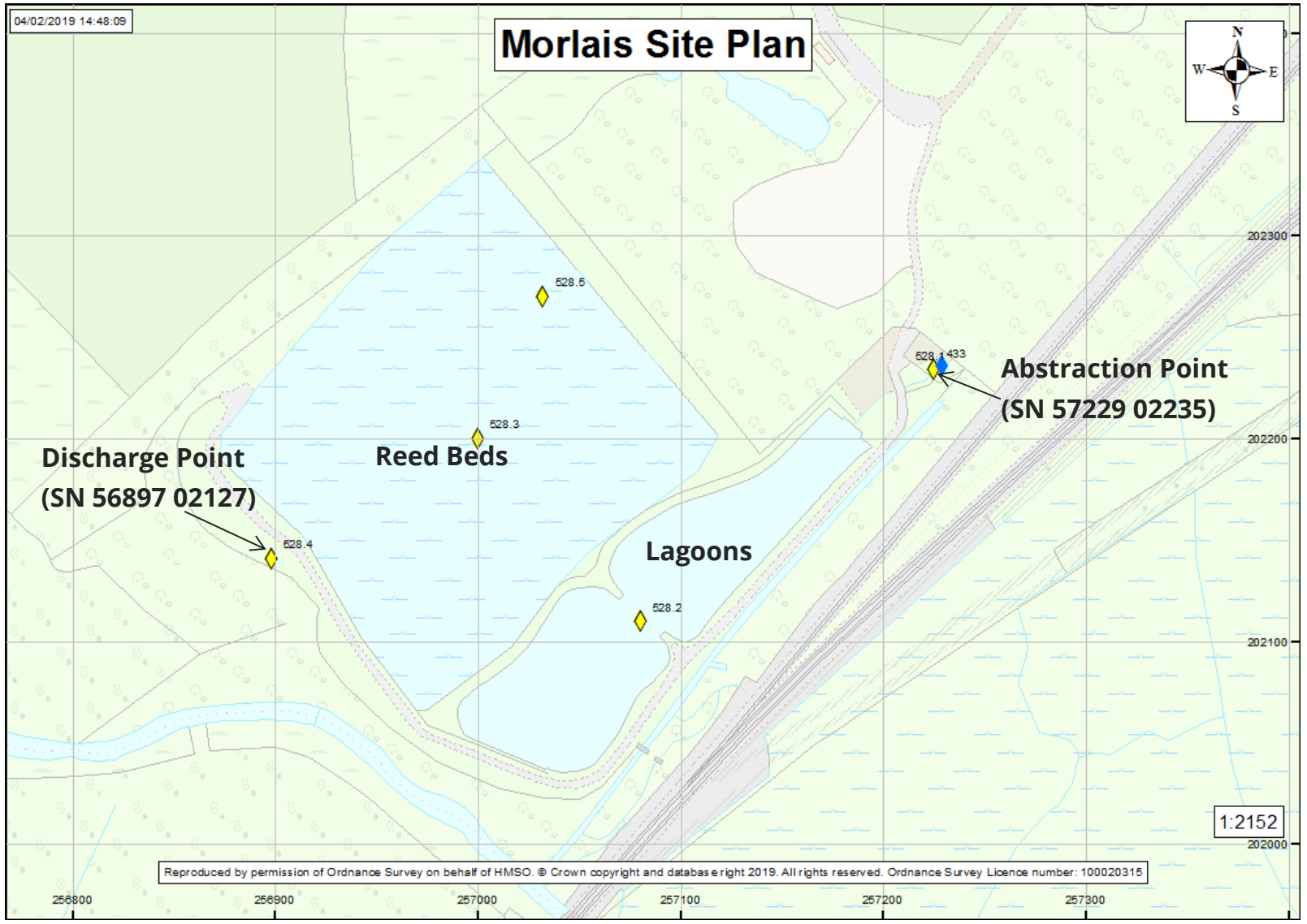

Figure A2: Site plan of Morlais; Yellow diamonds indicate scheme monitoring points.

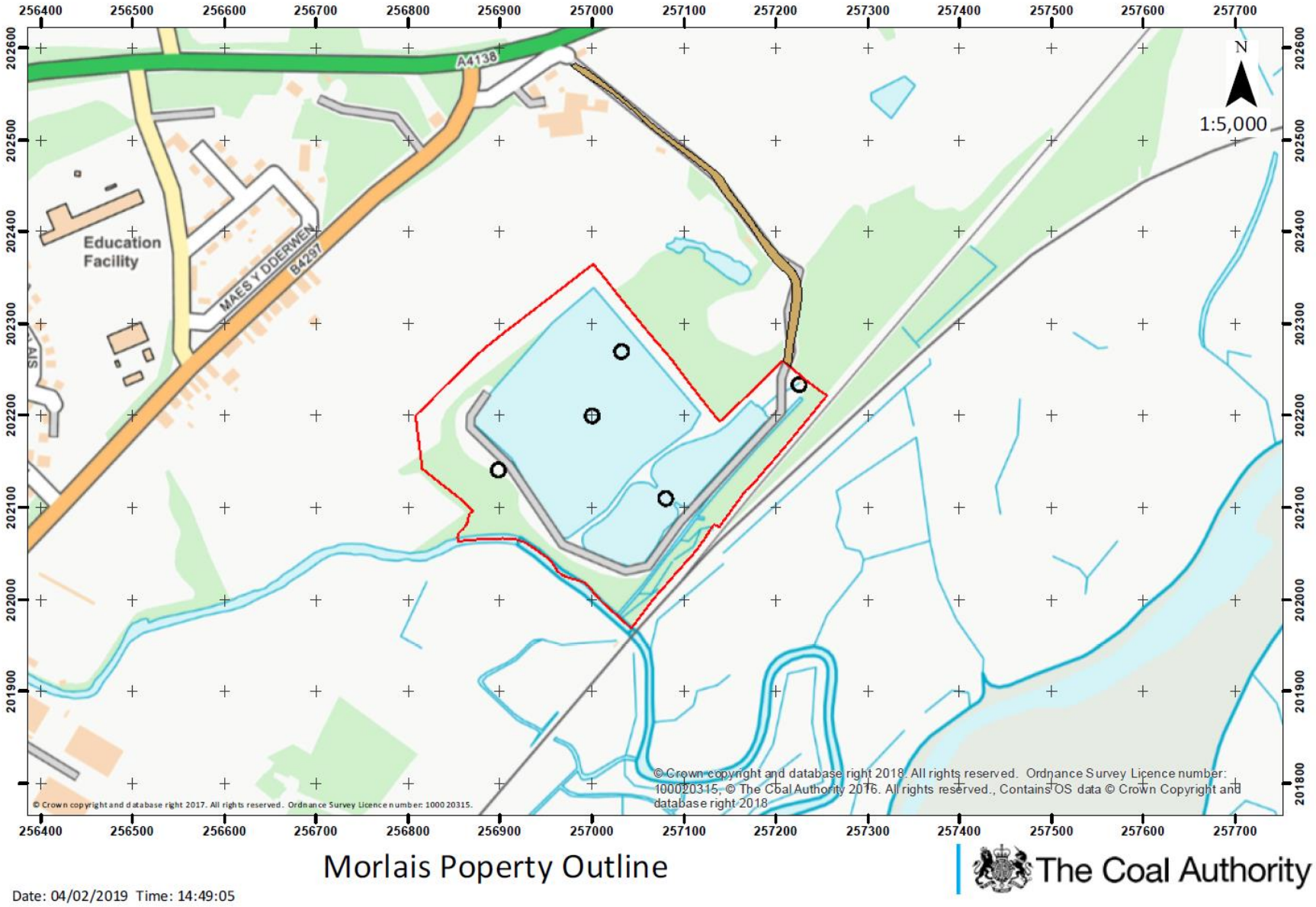

Figure A3: Property outline for Morlais; area ringed in red indicates owned property, brown areas indicate permitted access.

Appendix B: Morlais Site Photos

Figure B1: Photos above show the raised shaft collar (or "mine water head lifting shaft") and cascade at the front of the structure. The raised shaft collar is designed to increase the level of the mine water to enable it to flow, by gravity, down the cascade into the settlement lagoons and thus the treatment system.
Top photo taken 14/06/2006, lower photo taken more recently- 28/06/2017.

Figure B2: Photos showing water entering the settlement lagoons where the oxidised iron settles from suspension. Top photo taken 05/12/2017, lower photo taken 28/06/2017.

Figure B3: Photos showing two of the reed-beds at the site and the treated mine water discharging from the scheme. The right photo shows the flow monitoring weir. Both photos were taken on the 5th December 2017.

Figure B4: Aerial image of Morlais Mine Water Treatment Scheme (MWTS)

Appendix C: Scheme as built drawings

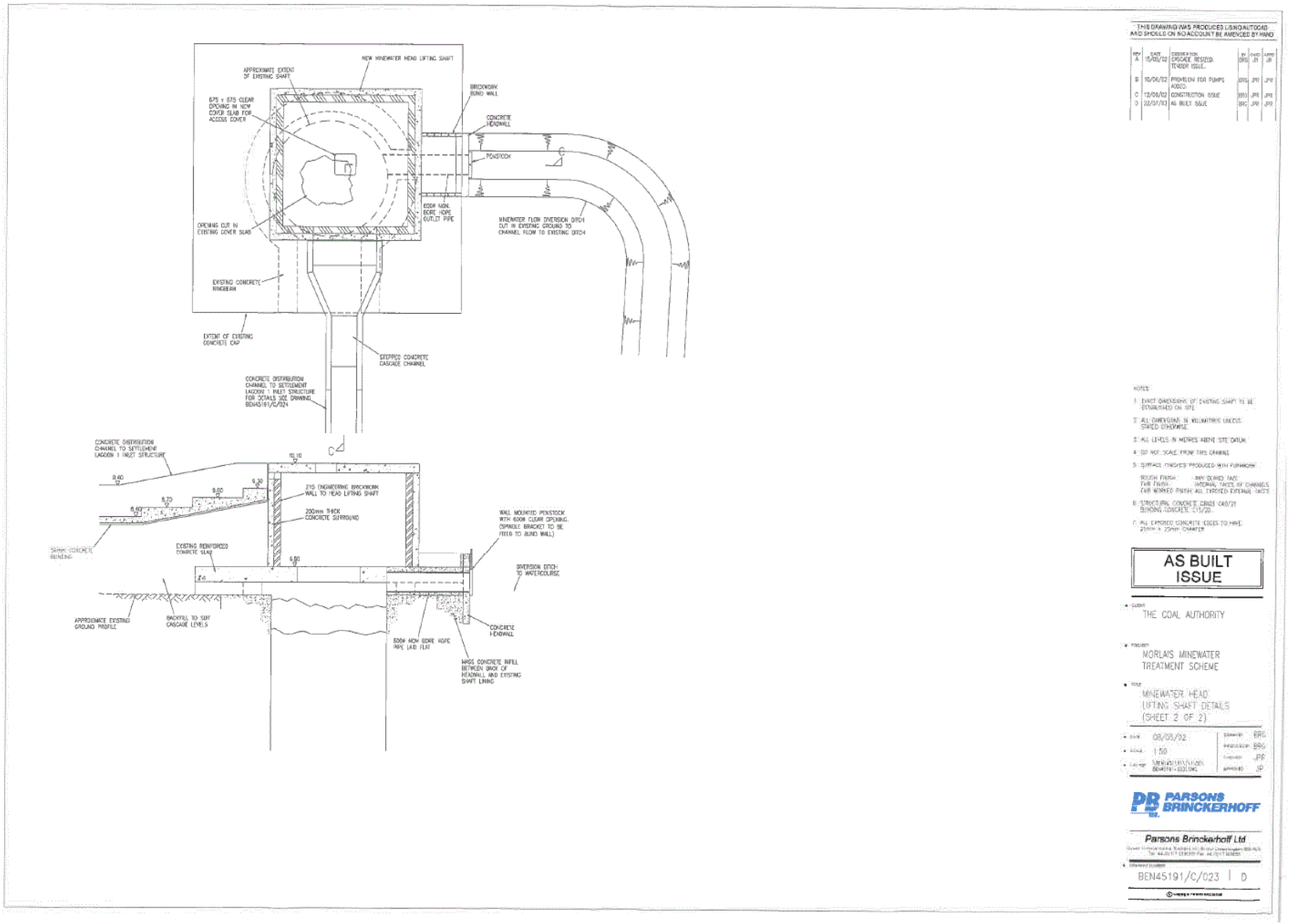

Figure C1: Drawings of the raised shaft collar at the Abstraction point.