Gold Mines of Wales (Operations) Ltd

Clogau St David's Mine Water Summary

5th April 2023

Author: [redacted]

This report is an abridged summary of information previously submitted to Natural Resources Wales, as part of GMOW permit applications.

Clogau St David’s Mine Water Summary

Introduction

The Clogau St David’s gold mine is located within the southern perimeter of the Snowdonia National Park, just north of the village of Bontddu, on the Mawddach Estuary, in Gwyneth. There has been a long history of commercial mining at the site, commencing in the 1850’s and with the last commercial operation ceasing in 1998. Mining operations started in the Clogau Hill, on the eastern slopes of Cwm Llechen, following outcropping veins into the hillside. The Llechfraith Adit was initially developed as a drainage adit to aid in the dewatering of the initial upper workings but also expanded the mining operations as further mineralised zones were intercepted as the adit advanced. A smaller second drainage adit was subsequently added to aid in the further dewatering of these newer workings, Level 2 or the Llechfraith Drainage Adit. Then in the later part of the 20th Century an internal mine shaft, Llechfraith Shaft, was sunk to access the mineralisation below the river and the groundwater levels. There were 2 further mining levels developed, Levels 3 and 4. These needed to be continually pumped as they were below the natural groundwater level within the valley. However, since the mine was abandoned in 1998 these levels have subsequently flooded, and a constant flow was left to discharge from the mine.

Figure 1 Existing mine water discharge from the Llechfraith Drainage Adit

Gold Mines of Wales (Operations) Ltd, (GMOW) are currently characterising these existing discharges with a view to obtaining a permit/licence to dewater the flooded workings in order to undertake further exploration works.

Mine Layout

All the mine workings of concern are in the hillsides that forms the eastern side of the Cwm Llechen. They stretch from the Afon Cwm Llechen, at the centre of the valley, to the tops of the Clogau Hill. Essentially the workings can be split into 2 sections the older Upper Workings, encompassing all the mining activities from the Llechfraith adit and above, and the newer Lower Workings, that is essentially the Llechfraith Drainage Adit and below. These can be seen in the figure below.

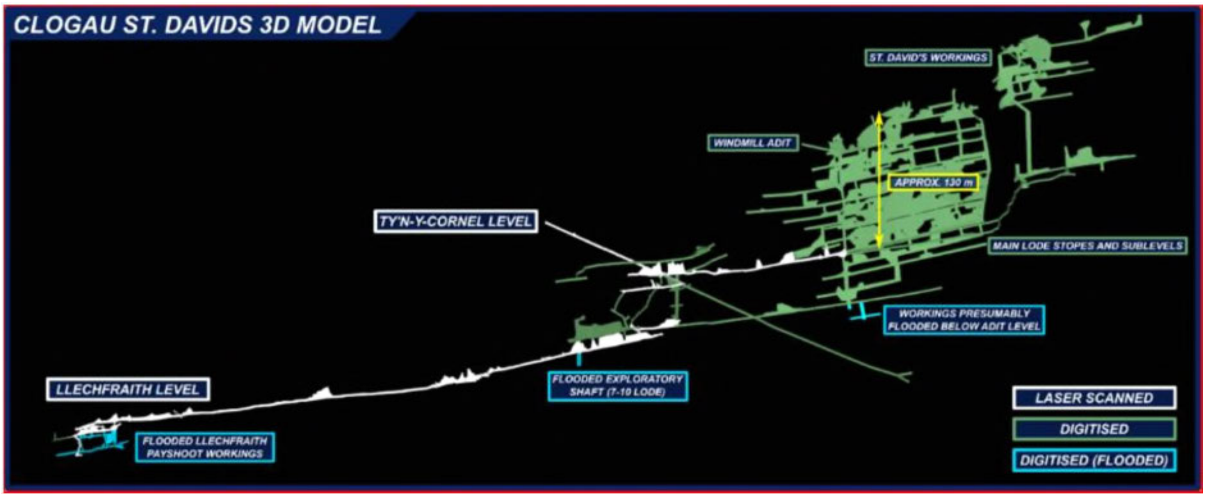

Figure 2 Extent of known mining network in the Clogau St David's mine. The Upper Workings form over 95% of the network, from the Llechfraith Level label on the left and right, the Lower Workings are in the bottom left corner, labelled Flooded Llechfraith Payshoot Workings.

The Llechfraith Shaft, Main Shaft, connects the Lower Workings to the Llechfraith Adit and was the main route of material extraction from the lower sections of the mine.

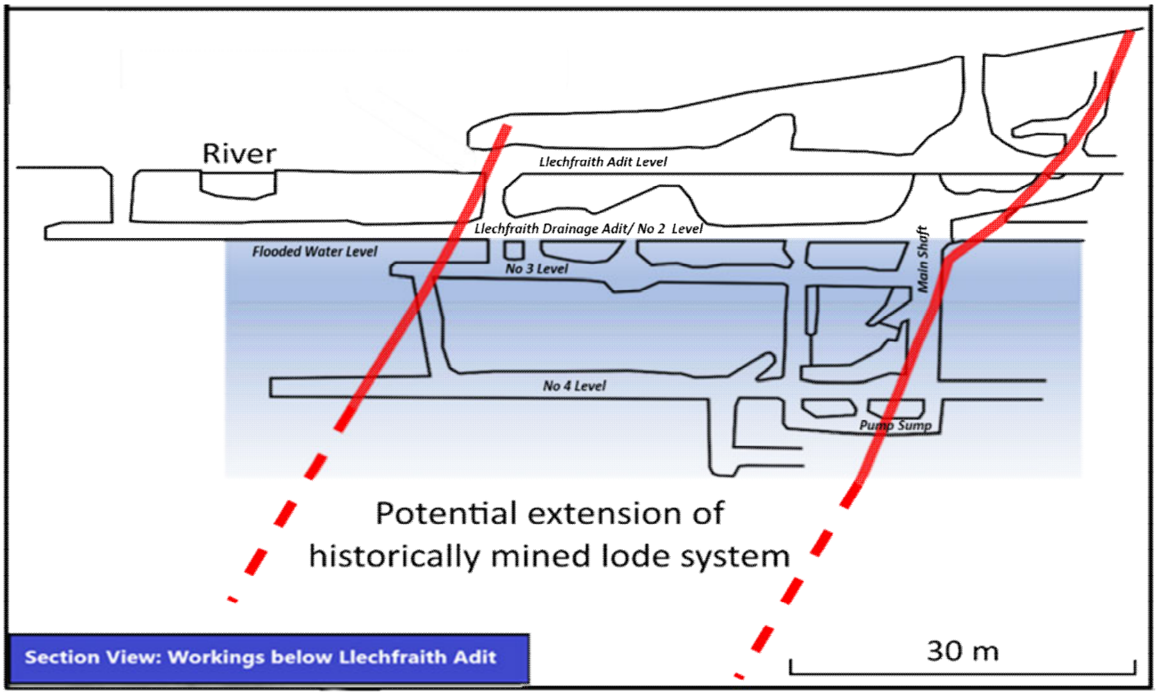

Figure 3 Cross section of the Lower Workings of the mine. Shaded blue area depicts level of flooded workings. Note: Level 2 discharges at river level but downstream of this cross section.

Water Flows

As the Llechfraith Adit was originally created as a drainage adit it has a slightly positive gradient, to promote a natural water flow out of the adit, towards the river, and advances some 600m into the Clogau hillside, where it interconnects to the historic production zones.

In November 2021, Groundwater Science Ltd undertook a walk-through survey of the water inflows into the Llechfraith Adit. They concluded that the majority of the observed inflow was intercepted surface waters travelling through to the groundwater.

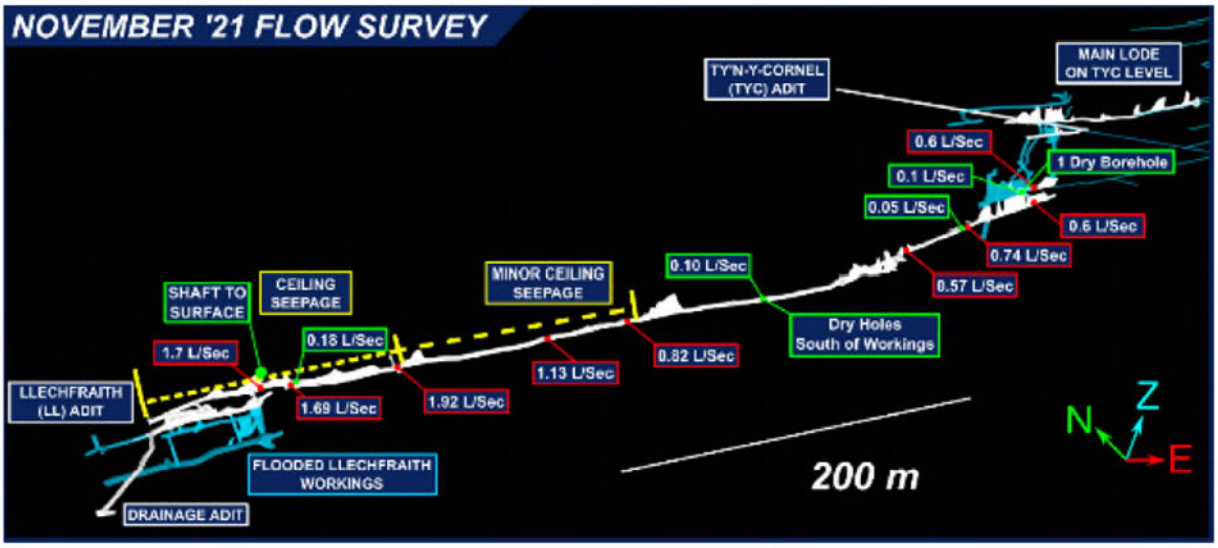

Figure 4 Llechfraith Adit water flow survey summary. Flow on floor (red), discrete borehole flows (green), ceiling seepage (yellow).

The conclusion of the Company's independent consultants, therefore, is that humidity and temperature within the Mine will not be affected by the proposed dewatering of the Lower Workings as the Mine is fed by continuous groundwater sources which are separate and up-gradient from those flooded levels.

In July 2020 a v-notched weir was installed 10m into the Llechfraith Drainage Adit to measure discharging water flow from the adit. A Van Essen CTD diver measuring conductivity, temperature and depth was also deployed here to record water quality, EC, and any change in water depth. This is the methodology employed to measure the discharge flow from the Llechfraith adit (via the drainage adit).

Figure 5 First internal v-notch weir, monitoring the net discharge flow from the mine.

On average, between July 2020 and September 2022, the flow was measured to be 4.7 m^3/hour. Table 1 presents the recorded and calculated flow rates, inclusive of 10th and 90th percentiles:

Table 1 Total Llechfraith Drainage Adit flow values.

DA Flows	L/s	m^3/hr	m^3/day
90%	2.15	7.75	186
Average	1.31	4.72	113
10%	0.58	2.11	51

In July 2021 the Lower Workings were isolated from the normal water flow from the Upper Workings, by a simple internal diversion pipe. A second v-notched weir was installed in the drainage adit, about 30m upstream of the original weir, and this weir was used to determine the flow from the now isolated Lower Workings.

Figure 6 Second weir installed up-gradient of first weir. Note the black pipe on the right of picture carrying the diverted waters from the Upper Workings.

The following table illustrates the variation in the recorded flows, on average 15 m^3/day was observed.

Table 2 Isolated Lower Workings flow values.

Weir 2 Flows	L/s	m^3/hr	m^3/day
90%	0.31	1.11	27
Average	0.18	0.64	15
10%	0.06	0.22	5

This internal water diversion had no impact on the net flow or water chemistry from the mine.

The second weir essentially measures the flow from the flooded workings, plus some occasional excess water from the Llechfraith Adit. Weir 1 effectively measures the net discharge from the Drainage Adit, after the 2 isolated flows from the Upper and Lower workings are recombined. These are plotted in Figure 7, with levels in the local rivers Afon Mawddach, monitored at Tyddyn Gwladys (nearly 10km NE from the mine) and Afon Wnion, monitored at Dolgellau (nearly 6.5km ESE from the mine).

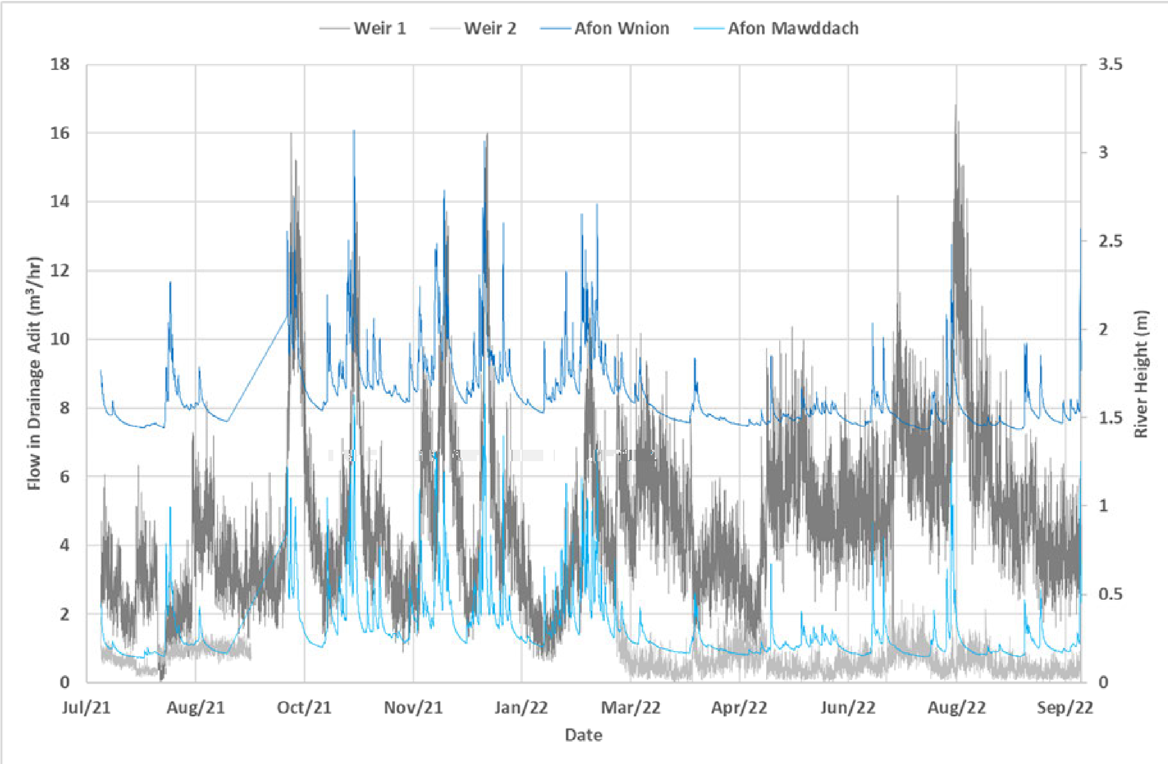

Figure 7 Variation of discharge rates from the Llechfraith drainage adit, Weir1, the flow from the flooded mining voids, Weir 2, and NRW monitored local river levels.

It is noted that both the rivers and the net discharge from the mine exhibit similar characteristics in response to flow from precipitation. This reinforces the findings of the Groudwater Science Ltd Llechfraith Adit survey that the bulk of the flow in the adit is from intercepted surface waters travelling to the groundwater.

Water Quality

To date 26 rounds of sampling have been undertaken, between March 2020 and September 2022, and analysed by ALS, Conventry.

It is noted that due to an error in the sampling bottle supply all samples collected from 26th October 2021 until 28th November 2020 had a fixing agent present, namely sodium thiosulphate, this is recorded in the analysis certificates from ALS Environmental, and whilst this has had no impact on the metal values there was an increase in electroconductivity and sodium levels due to the presence of this reagent.

Initially 3 sampling points were selected, upstream, the discharge and downstream, and these were subsequently expanded to 5.

- Upstream Sampling Point: from road bridge, approximately 300m upstream of Llechfraith mine site crossing the Afon Cwm Llechen. Sample ID: UB

Figure 8 Sampling point UB, arrow indicates point of sampling.

Note Hydro take off weir, in foreground, is independent of GMOW activities.

• Downstream Sampling Point: from Figra bridge, approximately 400m downstream of Llechfraith mine site, again crossing the Afon Cwm Llechen. Sample ID:

Figure 9 Sampling point LB, Figra bridge, arrow indicates point of sampling.

• Llechfraith Mine Discharge Point: from the Llechfraith mine drainage adit, discharging directly to the Afon Cwm Llechen. Sample ID: DA

Figure 10 Sampling point DA and additional sampling point IR, arrows indicate the points of sampling.

In addition to these 3 sampling points another discharge was identified in August 2020, on the western bank of the Afon Cwm Llechen, that has a notable contribution to the arsenic loading within the river.

- Vigra Drainage Adit Sampling Point: from the discharging stream from the adit on the western bank of the Afon Cwm Llechen. Sample ID: VA. *Note: although labelled as a drainage adit this turned out to be a culvert for a stream that passes through made ground.*

Figure 11 Sampling point VA, arrow indicates point of sampling. IR and DA sampling points are 30 to 40m downstream, and the mine yard is on top of the opposite, eastern bank.

In addition, an intermediate sampling point was added in the river to quantify this contribution from VA.

- Intermediate River Sampling Point: from the pool just upstream of the Llechfraith drainage adit, in the Afon Cwm Llechen. Sample ID: IR

Finally, January 2022 the waters flowing from the upper workings of the mine, passing through Llechfraith Adit were isolated from the waters flowing from the flooded lower workings. This was undertaken to understand the contribution to the current discharge of the groundwater inflow to the lower workings. This has resulted in 2 further sampling points Upper Weir, UW, capturing the isolated flooded Lower Workings discharge and the isolate Llechfraith Adit flow, LLP, from the Upper Workings of the mine. To date only 7 rounds of data have been collected for these new points.

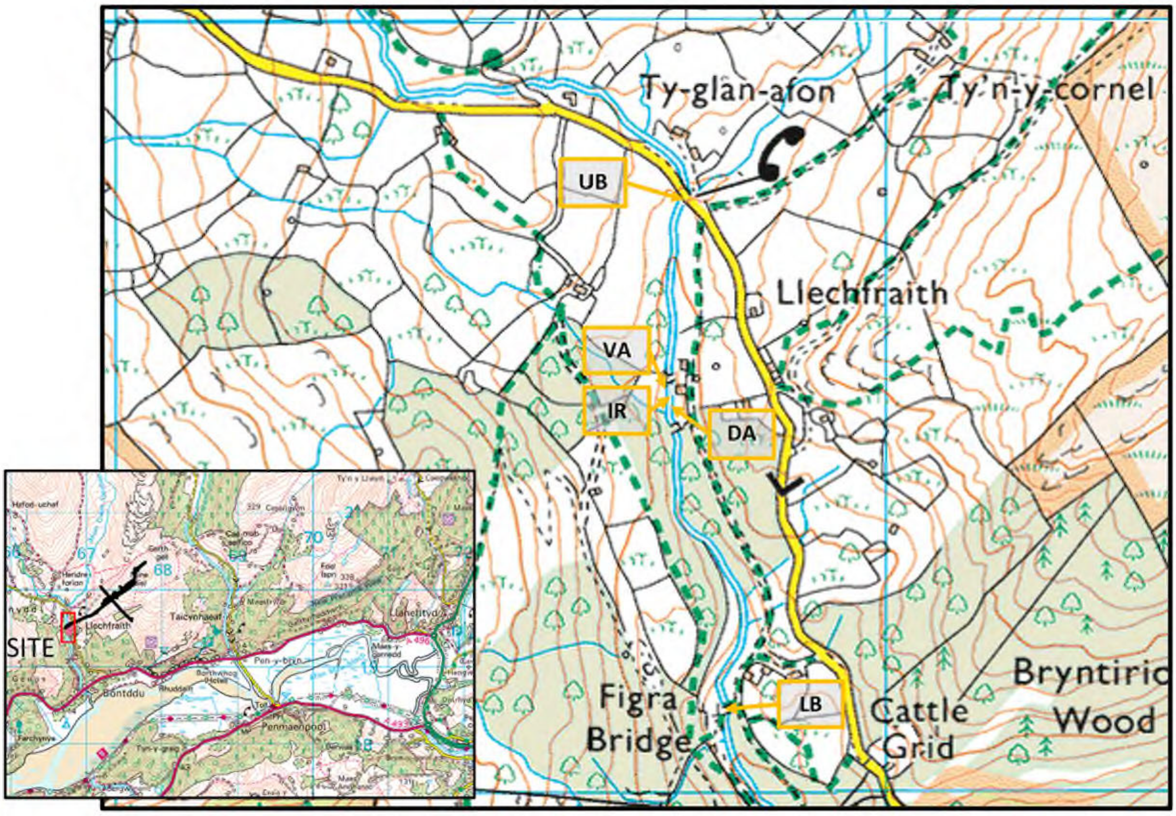

Figure 12 Location of water sampling points, inset illustrates extent of underground workings.

Finally, the flooded shaft was also sampled and profiled. The sampling of the water column was undertaken with the use of a Kemmerer water sampler, and samples were collected at 1m (Sample ID: DARU) and 10m (Sample ID: DARL) depths. These were compared to the final discharge from the adit and there was no discernible difference. Therefore, the adit discharge was deemed as being representative of the flooded Lower Workings waters.

Figure 13 Kemmerer water sampler, used to sample the flooded raise in the drainage adit

The water column was profiled by lowering a Van Essen CTD diver, that was set to record water depth, temperature, and electro-conductivity every second. A fishing rod and line were utilized to centre the diver within the water column. The line was kept taut with the weight of the diver during lowering, and the diver was raised once an obstacle was encountered.

Figure 14 Lowering the Van Essen CTD diver with a fish rod in the flooded Main Shaft from the Llechfraith Drainage Adit, No 2 Level

As can be seen in Figure 15 there is no discernable change in the water quality encountered in the water column profile, indicating there is little to no stratification of the water.

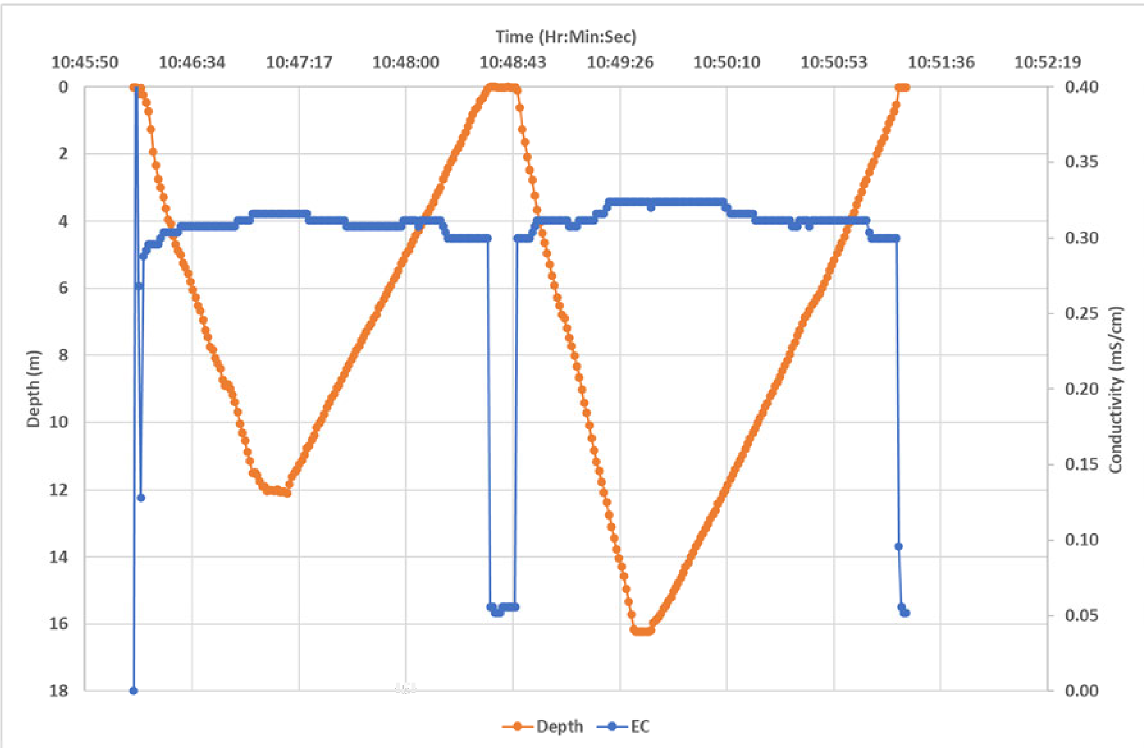

Figure 15 Flooded Main Shaft water profile 1st July 2020, an initial obstacle was encountered at 12m but on lowering again a depth of 16m was attained, very near the depth of the shaft from the floor of No 2 Level.

Water Quality

Reviewing the online documentation relating to Guidance: Surface water pollution risk assessment for your environmental permit (https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit) arsenic was identified as a chemical of concern. Zinc was generally below detection limits across all samples but was detectable in the discharge, twice at 5.4 and 5.6µg/L (detection limit for filtered zinc 5.0µg/L and the EQS is 10.4µg/L as bioavailable). All other analytes of concern were either not detectable or within acceptable limits.

It is noted that the zinc results for the 13th October 2020 are questionable, they are elevated across all samples and given the connection between samples they do not make sense, i.e. there is an elevated level at UB that declines at IR and then increases at LB. The increase at LB is beyond the contribution of either VA or DA. In addition, the majority of the reported total zinc values are less than the dissolved zinc values. Therefore, these results are disregarded in this assessment. Finally, due to an error in the supply of sampling bottles from ALS Environmental from the 26th October until the 28th November 2020, the EC values are elevated due to the presence of a fixing reagent in the supplied bottles, namely sodium thiosulphate. There is not a consistent increase in the EC reading and therefore, these values are only indicative.

The full results of all the sampling rounds are presented to NRW. The following table summarises the arsenic values detected.

Table 3 Detected arsenic values (µg/L) at the 7 sampling points.

Sampling Point	***Upper Bridge***	***Vigra Adit***	***Intermediate River***	***Upper Weir***	***Llechfraith Adit Diverted Flow***	***Drainage Adit***	***Figra Bridge***
As (µg/L)	**UB**	**VA**	**IR**	**UW**	**LLP**	**DA**	**LB**
16-Mar-20	<0.20					11.0	0.20
20-May-20	<0.20					11.0	0.52
01-Jul-20	<0.20					18.0	0.38
20-Aug-20	0.22	0.89	0.31			10.0	0.39
22-Sep-20	<0.20	0.59	0.20			7.4	0.47
13-Oct-20	<0.20	0.59	0.23			12.0	0.24
26-Oct-20	<0.20	0.49	0.22			3.9	0.22
31-Oct-20	<0.20	0.47	0.37			4.7	0.23
07-Nov-20	<0.20	0.50	0.34			14.0	0.36
14-Nov-20	<0.20	0.54	0.21			17.0	0.79
21-Nov-20	<0.20	0.42	0.67			14.0	<0.20
28-Nov-20	<0.20	0.47	0.20			9.4	0.29
22-Jan-21	<0.20	0.35	<0.20			9.5	0.22
12-Feb-21	<0.20	0.35	<0.20			9.4	0.26
12-Mar-21	<0.20	0.44	<0.20			11.0	0.23
23-Apr-21	<0.20	0.46	<0.20			10.0	0.42
27-May-21	<0.20	0.50	<0.20			5.2	0.23
23-Jun-21	0.21	0.47	<0.20			3.2	0.45
21-Jan-22	<0.20	0.35	<0.20	2.7	19.0	14.0	0.37
01-Mar-22	<0.20	0.34	<0.20	1.8	21.0	13.0	0.21
05-Apr-22	<0.20	0.39	<0.20	1.9	29.0	17.0	<0.20
09-May-22	<0.20	0.42	<0.20	1.7	32.0	19.0	0.38
10-Jun-22	<0.20	0.56	<0.20	1.7	34.0	20.0	0.24
07-Jul-22	<0.20	0.66	0.24	1.9	36.0	24.0	0.32
03-Aug-22	<0.20	0.66	0.21	3.9	36.0	26.0	0.27
15-Sep-22	<0.20	0.59	<0.20	2.2	41.0	24.0	0.39
Ave		***0.50***	***0.29***	***2.2***	***31.0***	***13.0***	***0.34***
90%		***0.66***	***0.61***			***24.0***	***0.50***

Note There are no results for VA or IR for the first 3 rounds of sampling as VA was not identified as a further potential source until the Summer 2020.

Results to date indicate that the arsenic values from the flooded Lower Workings are significantly lower than those from the Upper Workings.

Table 4 Recorded zinc values (µg/L) from all 7 sites during the monitoring period.

Zn (µg/L)	UB	VA	IR	UW	LLP	DA	LB
16-Mar-20	<5.0					<5.0	<5.0
20-May-20	<5.0					<5.0	<5.0
01-Jul-20	<5.0					<5.0	<5.0
20-Aug-20	<5.0	<5.0	<5.0			<5.0	<5.0
22-Sep-20	<5.0	<5.0	<5.0			5.60	<5.0
13-Oct-20	*29.00*	*38.00*	*5.30*			*31.00*	*42.00*
26-Oct-20	<5.0	<5.0	<5.0			<5.0	<5.0
31-Oct-20	<5.0	<5.0	<5.0			<5.0	<5.0
07-Nov-20	<5.0	<5.0	<5.0			<5.0	<5.0
14-Nov-20	<5.0	<5.0	*27.00*			5.40	<5.0
21-Nov-20	*5.20*	<5.0	<5.0			<5.0	<5.0
28-Nov-20	<5.0	<5.0	<5.0			<5.0	<5.0
22-Jan-21	<5.0	<5.0	<5.0			<5.0	<5.0
12-Feb-21	<5.0	<5.0	<5.0			<5.0	<5.0
12-Mar-21	<5.0	<5.0	<5.0			<5.0	<5.0
23-Apr-21	<5.0	6.60	<5.0			<5.0	<5.0
27-May-21	<5.0	<5.0	<5.0			<5.0	<5.0
23-Jun-21	<5.0	<5.0	<5.0			<5.0	<5.0
21-Jan-22	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01-Mar-22	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
05-Apr-22	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
09-May-22	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
10-Jun-22	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
07-Jul-22	<5.0	7.3	5.3	<5.0	<5.0	<5.0	5.4
03-Aug-22	<5.0	11	<5.0	<5.0	<5.0	<5.0	<5.0
15-Sep-22	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Ave							
90%							

Note Results from 13th October (in italics) disregarded due to probable analysis errors.

Table 5 Recorded electroconductivity (EC) values (µS/cm) from all 7 sites.

EC (µS/cm)	UB	VA	IR	UW	LLP	DA	LB
16-Mar-20	54					195	56
20-May-20	58					254	65
01-Jul-20	47					264	52
20-Aug-20	38	61	40			247	41
22-Sep-20	50	68	52			233	58
13-Oct-20	44	54	37			192	37
26-Oct-20	*68*	*86*	*73*			*243*	*74*
31-Oct-20	*66*	*86*	*71*			*226*	*70*
07-Nov-20	*70*	*89*	*76*			*193*	*77*
14-Nov-20	*70*	*87*	*70*			*228*	*77*
21-Nov-20	*70*	*95*	*77*			*187*	*72*
28-Nov-20	*46*	*95*	*76*			*224*	*78*
22-Jan-21	34	54	37			177	40
12-Feb-21	44	62	47			195	50
12-Mar-21	40	63	43			193	44
23-Apr-21	53	70	54			236	65
27-May-21	150	57	43			203	46
23-Jun-21	51	75	51			244	65
21-Jan-22	52	75	54	247	178	191	55
01-Mar-22	66	83	66	253	185	212	67
05-Apr-22	56	162	62	252	238	240	62
09-May-22	59	87	60	260	240	250	65
10-Jun-22	45	83	46	263	243	252	49
07-Jul-22	46	79	50	260	239	254	52
03-Aug-22	37	77	39	267	251	256	42
15-Sep-22	49	86	52	279	286	282	54
Ave	***56***	***80***	***56***	***260***	***233***	***226***	***58***
90%	***70***	***95***	***76***			***258***	***77***

Note: Samples analysed after the 13th October, until 28th November, are elevated due to a mistake with the supplied sampling bottles containing a Sodium Thiosulphate as a fixing reagent.

Proposed Dewatering Scheme

The proposed dewatering scheme would be to lower 1 to 2 submersible water pumps into Main Shaft from the Llechfraith Adit level and pump the water back through the Llechfraith adit to the mine yard. The pumps would be run off a 3-phase electric supply, from within the site workshop, and would have a float switch operation, such that they would switch on and off automatically, and do not run the pumps dry.

The pumps would be sized such that with the pumping head required and losses from pumping along the tubing a flow equivalent to 100m^3/day flow could be achieved in each pump, in a duty and standby arrangement.

To dewater the mining voids, it is estimated that the flooded mine voids are of the order of 800m^3, would take of the order of 2 weeks, on a 24/7 basis. This allows for dewatering and to counteract the continuous inflow of groundwater.

Therefore, the proposed system would operate in 2 phases;

- **Phase 1:** Dewatering, 2 parallel systems each with a capacity of 100m^3/day, operating circa 2 weeks
- **Phase 2:** Water level maintenance and current discharge diversion, a reduced system with a capacity of 1m^3/hr, operating for the duration of the exploration program. The second pump would act as an emergency standby.

As the pumped mine water is likely to disturb previously settled solids from the flooded workings it would then be treated by passing through a Siltbuster HB10 settlement tanks. The tank has a maximum design operating capacity of 10m^3/hr, with no settling reagents. Operating at just over 4m^3/hr (equivalent to 100m^3/day) is therefore, well within the proposed operating parameters and the mobilized solids should readily settle back out, see Appendix A Siltbuster settling trials. Given the sensitivity of the receiving environment no chemical additions will be made to the water, only unaided settling of solids will be promoted.

As the water enters the settlement tanks the EC value will be manually monitored and recorded, and daily water samples will be sent for analysis during Phase 1 and then monthly during Phase 2. In addition, an automated system will also continuously monitor the discharge for EC and flow, see Appendix A. Should the water entering the settlement tank increase in EC by more than 20%, the scheme will be paused and reviewed, independent external analysis of the water will confirm any significant changes in the water chemistry of concern.

The collected settled solids will be assayed, in order to be disposed of through an appropriately licensed waste operators. As these solids are currently in contact with the existing water system and are not having any notable environmental impact these solids are deemed to have little to low risk of any further environmental impact.

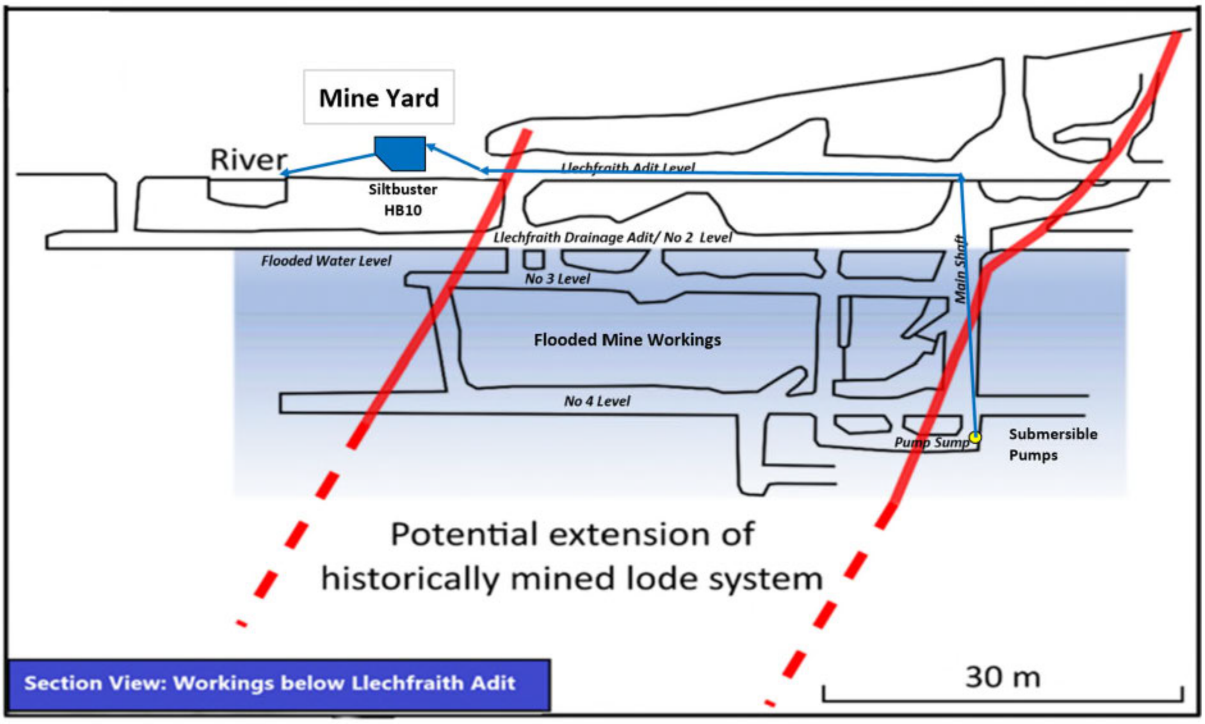

Figure 16 Schematic of proposed dewatering scheme

The following schematics summarise the proposed dewatering scheme and related flows.

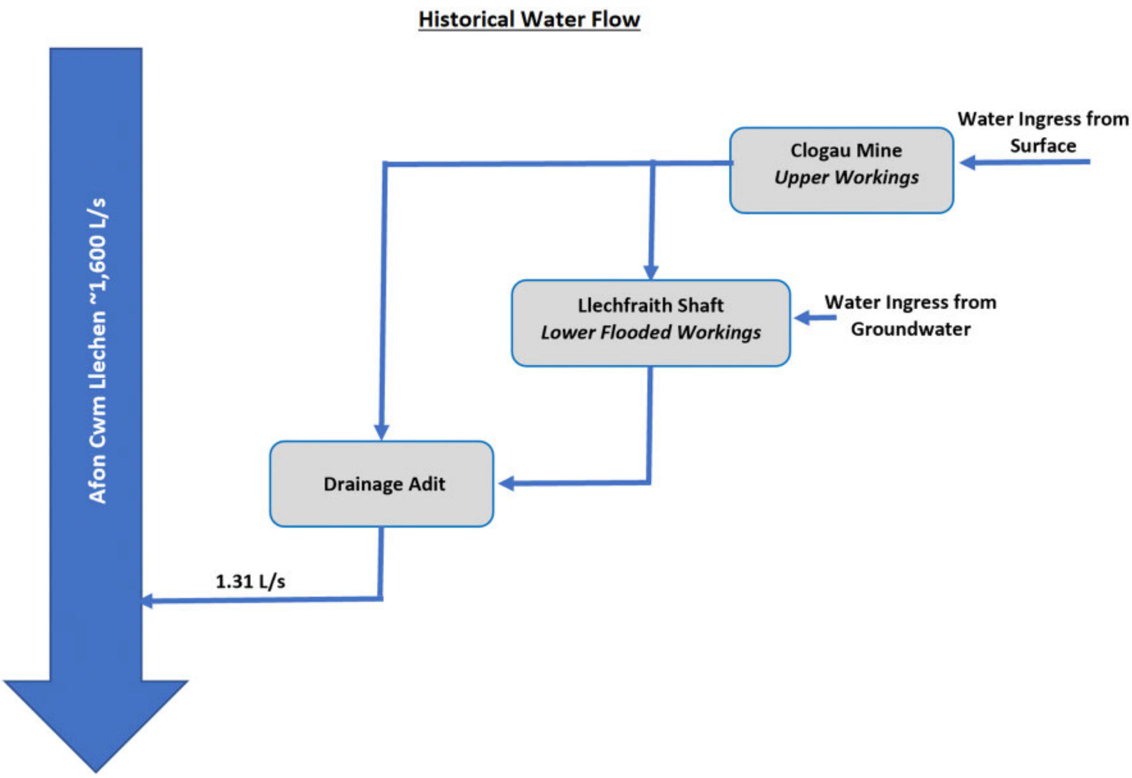

Figure 17 Historical flow of water through and from the Clogau Mine workings.

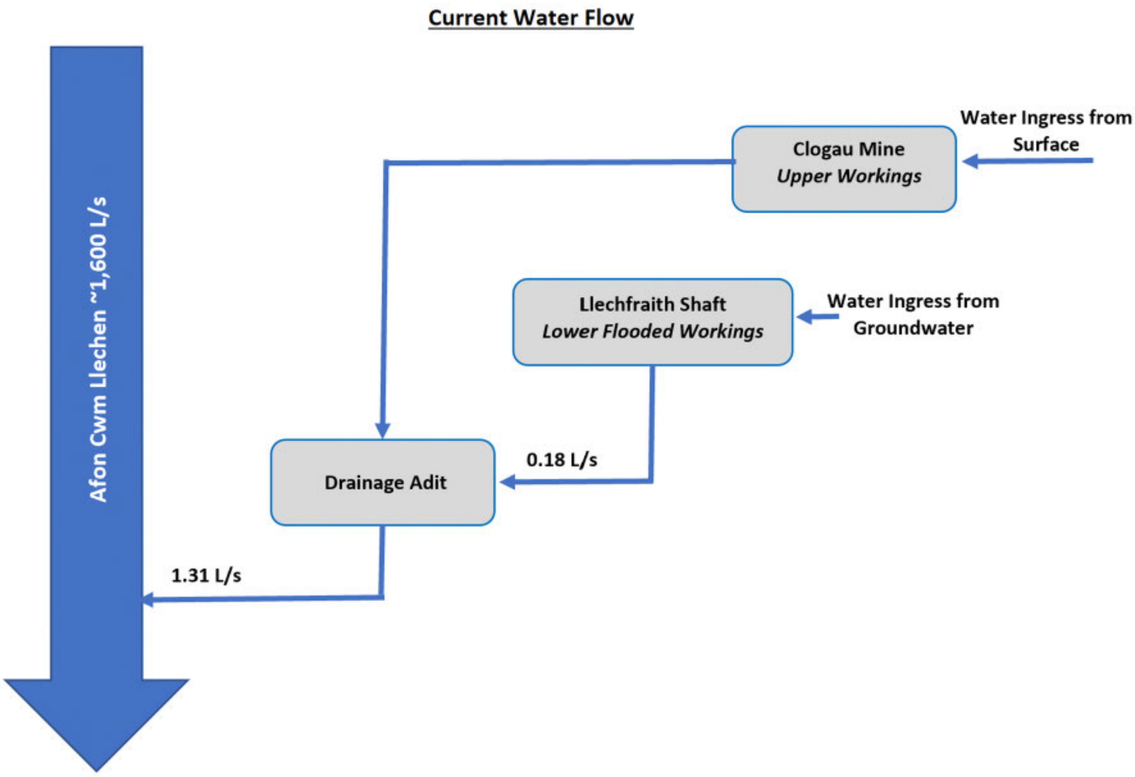

Figure 18 Current flow of water through and from the Clogau Mine workings. The Lower Flooded Workings are now isolated from the flows from the Upper Workings

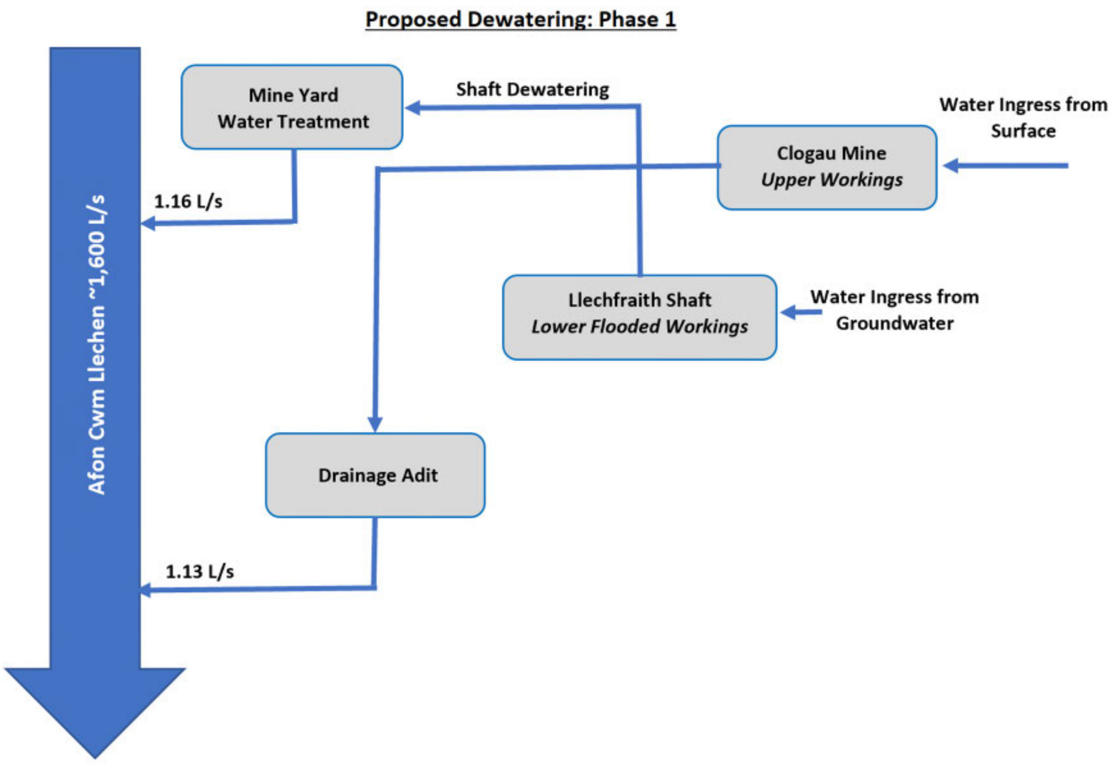

Figure 19 Proposed dewatering of the Lower Flooded Workings. Only the pumped waters will be treated.

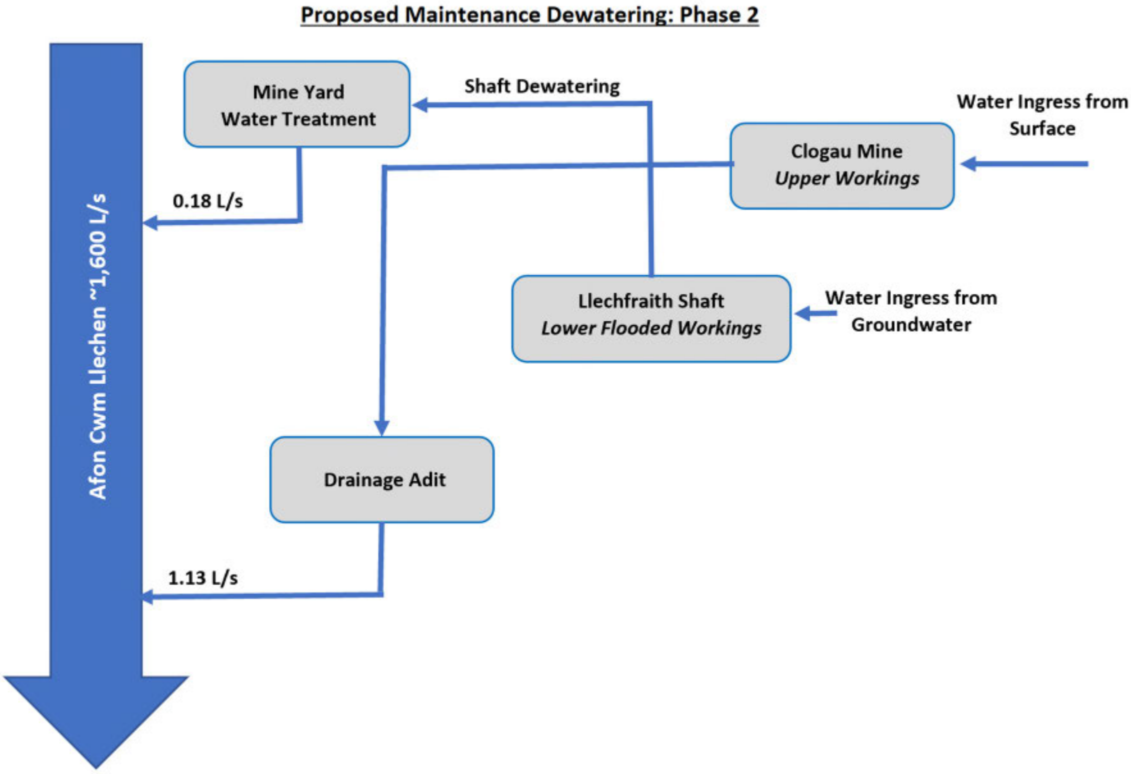

Figure 20 Proposed 'ongoing' maintenance pumping. Only the pumped waters will be treated.

The following pictorial represents the changes in flows proposed by the dewatering programme and the net effect on closure, ie after all operations cease.

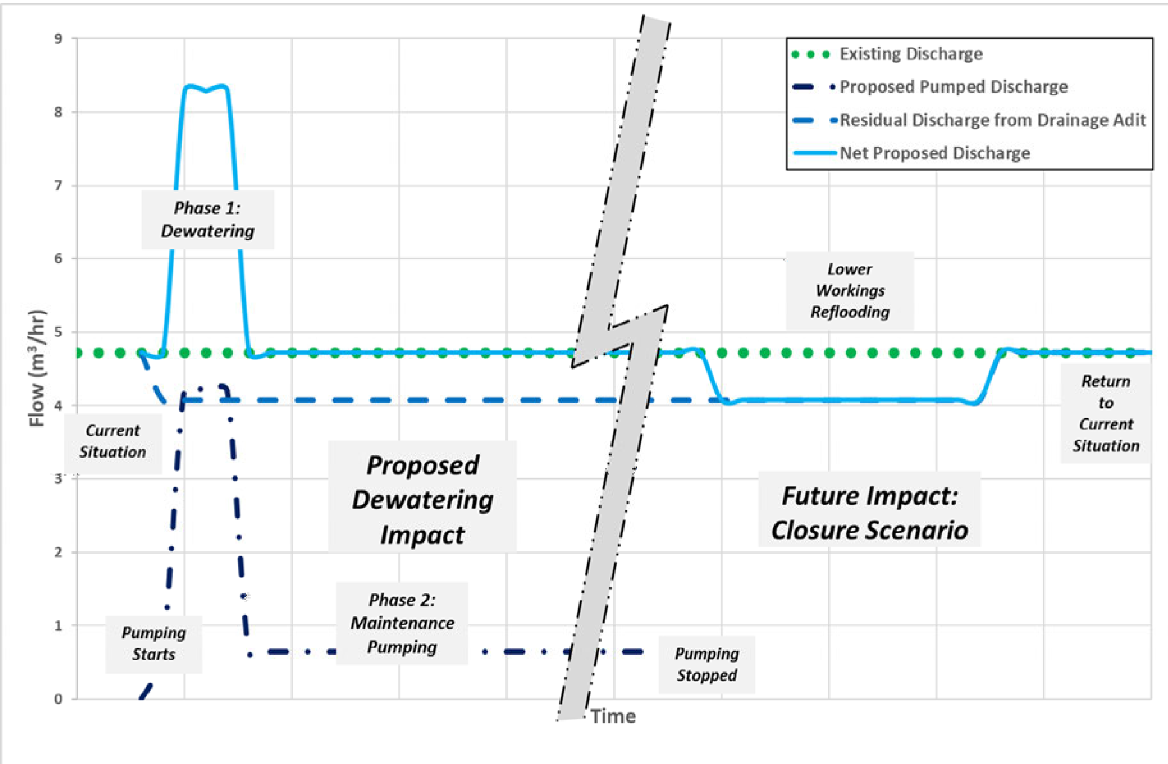

Figure 21 Depiction of Net and Individual Flows from mine during the various phases.

Ventilation

Ventilation of the mine utilises a 'natural ventilation mechanism'. Air is generally drawn into the mine through the open stopes at the highest point in the mine, as well as through the Ty'n-y-Cornel Adit, during the warmer Summer months. Air may also, under extreme weather conditions and for periods of time during the winter, enter through the Llechfraith Adit.

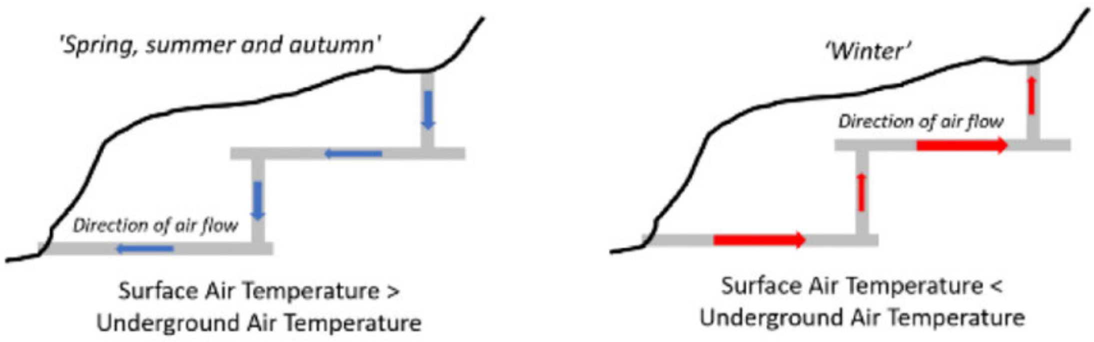

Figure 22 Schematic of the Natural Ventilation Mechanism within the mine.

In the sustained colder winter months, it is possible that the system can reverse, i.e., air entering the mine warms, decreases in density, and therefore rises through the workings. However, this has not been measured, due to restricted access during these months. Also, a change in the direction of flow would be expected to take some time, due to the momentum of the air within the mine requiring a sustained period of either cold or warming.

This system can also be driven by changes in pressure between the entry and exit points, as well as wind (a high wind on the hill side will create a low-pressure environment, when compared to the sheltered mine yard and as such the air flow will be drawn towards the low pressure).

Notwithstanding any reversal in the movement of air through the mine, the unreserved opinion of the Company's independent hydrogeological expert, Groundwater Science (Alastair Black MSc, BSc, FGS) is that the dewatering of the Llechfraith Shaft will not make any difference to the humidity levels in the Mine during those periods, in particular due to the significant water seepage that flows through the Mine throughout the year and due to the relatively tiny contribution that the surface area of the flooded shaft makes to the humidity levels in the Mine.

In contrast, the flooded Lower Workings are effectively a 'blind' working zone, i.e., the ingress and egress air routes are the same, and as a result when these levels are accessed a natural ventilation system will not function. Therefore, a mechanical ventilation system will be required. This system will operate independent of the natural system on the Llechfraith Level above and will be exhausted directly through the Llechfraith Drainage Adit. This isolation of the systems means that there will be no mixing of the two ventilation circuits and all heat/fumes generated during the exploration phase of works will be removed from the mine environment through this independent ventilation system.

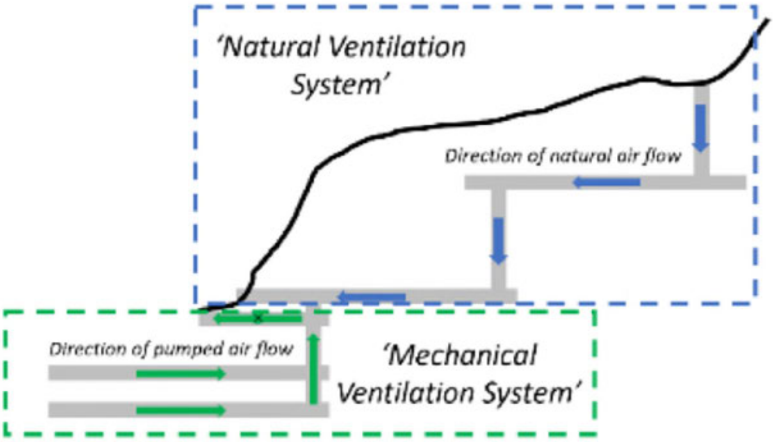

Figure 23 Schematic of proposed Mechanical Ventilation system for dewatered Lower Workings.

Closure of the Mine

Dewatering activities

On cessation of the current proposed dewatering activities, if the mineral resources do not prove economically viable then the dewatered workings will be permitted to naturally reflood and it is expected that both the net flows and water chemistry will revert to the existing situation, see Figure 21. There is an option of either maintaining the diversion of the waters from the Upper Workings or divert them into the Lower Workings to accelerate the reflooding. In addition, as no waste will be left in the mine there will be minimal impact on changes to the water chemistry. Finally, no flushing of sediment would be expected, as the rate of recharge would be significantly less than the rate of dewatering (15m^3/day compared to 100m^3/day), and it is expected that most of the mobile solids would have been mobilised during the dewatering phase and captured via the Siltbuster. The reflooded workings will relatively quickly attain a steady state, in terms of flow and chemistry, and revert to the current situation. However, should more void space be created, due to excavation, then the time it will take for the mining voids to recharge will increase.

In contrast, should the mineral resource prove to be economic then the shaft will be maintained in its dewatered state and going forward a full mine plan, including a closure programme, will be developed. It is highly likely that the resulting long-term discharge from any new development will not be materially different to the existing discharge.

Potential Closure plan

An integrated mine closure is a dynamic and iterative process that considers environmental, social and economic factors from an early stage of mine development and throughout the life of an asset. Mine closure is a process undertaken when the operational stage of a mine is ending or has ended, and the final decommissioning and mine rehabilitation is underway. A commonly cited general objective of mine closure is that it should ensure the long-term physical, chemical, and biological stability of the site to minimise potential environmental and health risks.

The process of mine closure involves the following:

- Remediation: The clean-up of the contaminated area to safe levels by removing or isolating contaminants. At mine sites, remediation often consists of isolating material from within the mine, capping tailings and waste rock piles with clean topsoil, and collecting and treating any contaminated mine water if necessary.

- Reclamation: The physical stabilisation of the terrain (dams, waste rock piles), landscaping, restoring topsoil, and the return of the land to a useful purpose.
- Restoration: The process of rebuilding the ecosystem that existed at the mine site (where applicable) before it was disturbed.
- Rehabilitation: The establishment of a stable and self-sustaining ecosystem, but not necessarily the one that existed before mining began. In many cases, complete restoration may be impossible, but successful remediation, reclamation, and rehabilitation can result in the timely establishment of a functional ecosystem.

Appendix A:

Water Treatment Trials

Results from sample

Sample received: February 2021
Project: SE22720 – Gold Mines of Wales - Dolgellau

Photo of Samples

Plate 1: Adit Sample as received

Plate 2: Adit Settling only 6mins

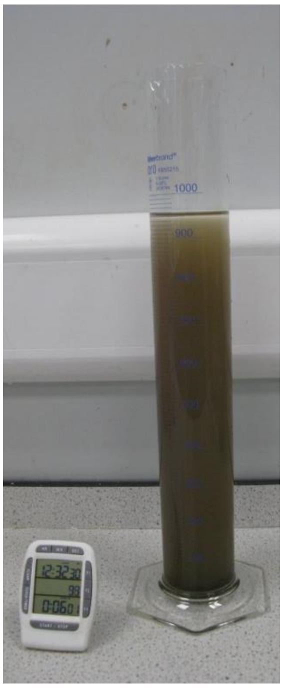

Plate 3: Adit Polymer & Settling 6mins

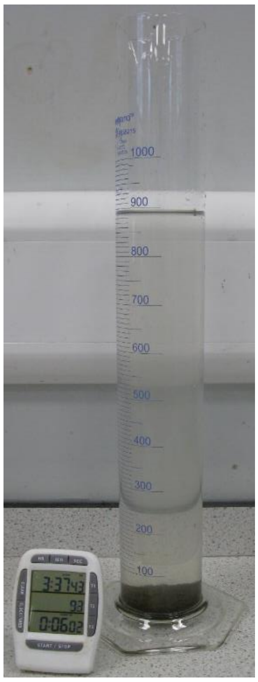

Plate 4: Shaft Sample as received

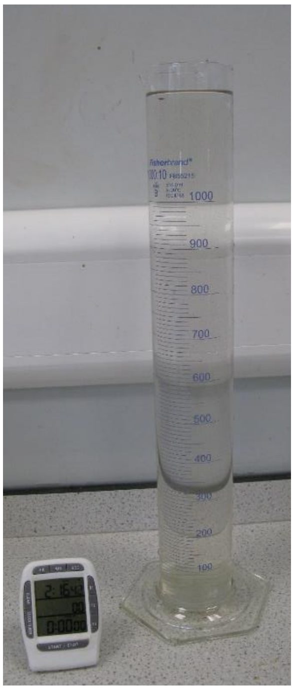

Plate 5: Shaft Settling only 6mins

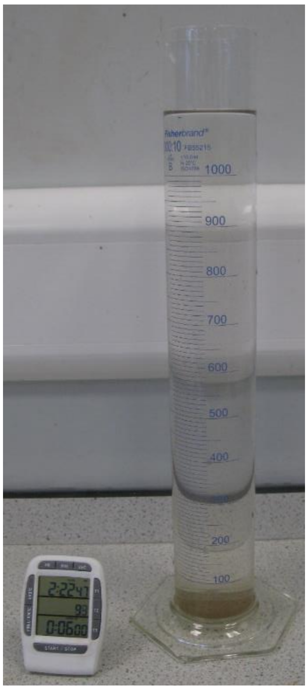

Plate 6: Shaft Settling only 60mins

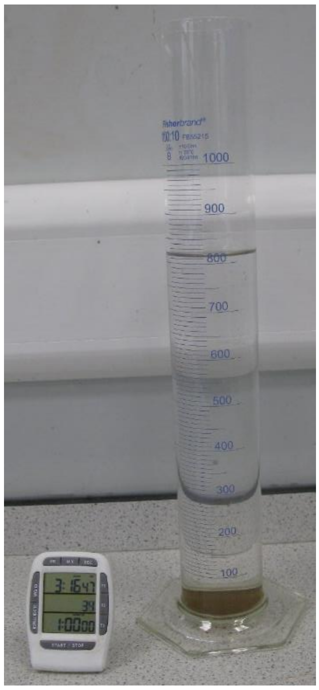

Table 1: Results of received samples

Sample	pH	TSS (mg/l)
Adit Raw	7.71	3,036
Shaft Raw	7.84	42

Following analysis of the raw sample, we undertook settlement tests with/without chemical pre-conditioning.

Table 2: Adit Test-work Results (Settlement Only)

Adit (21-161)			
Time (mins)	**Settling Velocity (m/h)**	**TSS (mg/l)**	**Clarity rating (1 = poor, 5 = tap water)**
3	2	1152	1
6	1	686	1
12	0.5	442	1
30	0.2	214	1
60	0.1	114	1
120	0.05	38	3

Table 2: Shaft Test-work Results (Settlement Only)

Shaft (21-161)			
Time (mins)	**Settling Velocity (m/h)**	**TSS (mg/l)**	**Clarity rating (1 = poor, 5 = tap water)**
3	2	24	4
6	1	20	4
12	0.5	15	4.5
30	0.2	9	4.5
60	0.1	2	5
120	0.05	1	5

Table 4: Adit Chemical Treatment Test Results

Time (Mins)	Rise Rate m/hr	TSS (mg/l)	% Removal TSS	Clarity Rating (1 = poor, 5 = tap water)	pH
3	2	25	99.18		
6	1	24	99.21	3.5	7.79
12	0.5	18	99.41		

Table 5: Chemical Treatment Dose Rates

	Adit (21-161) Treated with EM533 Polymer Only
Coagulant used	N/A
Ferric Chloride added As Iron (mg/L)	N/A
As Ferric Chloride Solution (40% wt/wt FeCl3)	N/A
Ferric Chloride Reaction time (seconds)	N/A
Polymer Used	EM533
Polymer dose as active (mg/L)	2
Polymer dose as neat product (ml/L)	0.006
Polymer dose as 0.1% active solution (ml/L)	2
Polymer Reaction Time (seconds)	20
Floc Strength (1 = weak, 5 = strong)	3
Floc Size (1 = pin floc, 5 = cornflake)	3

Siltbuster Ltd., Williams Building,
Kingswood Gate, Monmouth NP25 4EE
Tel: 01600 772256 Fax: 01600 775312

Clarity – real time, online, alarm and monitoring

The result of 18 months of development, numerous field trials and significant customer feedback, Clarity by Siltbuster offers data logging of discharged water but more significantly real-time alarm notifications either via SMS (text-message) or email should the equipment detect non-compliant water passing the probes.

The Clarity sensors are fitted at the end of the Siltbuster process train, prior to discharger. An example of the arrangement is shown below which shows monitoring of turbidity (reported as total suspended solids) and pH probe. The signal from the Siltbuster flow meter can also be linked to Clarity.

- The monitoring system will link a single control panel/display module, which will be mounted on to a stand adjacent to the SPS Equipment
- Monitoring Heads will be positioned on the discharge, to allow for the continuous monitoring of Turbidity (Reported as Total Suspended Solids), pH and flow
- 13 amp 240V or 110V power supply typically
- A flashing beacon will be fitted which will activate if the treated wastewater from the equipment is not within the discharge limits (pre-set parameters on the control panel)
- Remote access will be provided to users enabling Remote Monitoring via web portal (https://monitoring.siltbuster.com) or via our Siltbuster Clarity App (https://play.google.com/store/apps/details?id=com.siltbuster.clarity&hl=en_GB) – **Users will need to be registered by ourselves. We will then provide each user with a Username and Password to gain access to your site data.**

Rental prices per week ex VAT and ex works Monmouth

Monitoring base kit- consisting of GSM Module and Controller	£158
Conductivity sensor	£75
Suspended solids (turbidity) sensor	£189
Flow meter	£53

Typical availability for rental is one working week from receipt of Confirmed Order. SBL T&C Apply.