The Coal Authority

Resolving the impacts of mining

Cyfoeth Naturiol Cymru
Natural Resources Wales

Cwmystwyth Metal Mine Remediation Scheme: Environmental Constraints and Opportunities Record (ECOR) – Part A

September 2023

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Crynodeb Gweithredol

Lleolir safle mwynglawdd Cwmystwyth ar lethrau gogleddol Cwm Ystwyth, gerllaw Afon Ystwyth. Yn hanesyddol, roedd mwynau plwm a sinc yn cael eu cloddio a'u prosesu ar y safle, gan arwain at ddyddodion sborion mwyngloddio helaeth ar draws ardal y safle cyfan bron. Mae tair prif geuffordd, wedi eu gyrru i mewn i'r gweithfeydd o lefel yr afon, yn parhau i arllwys dŵr llygredig mwyngloddio i Afon Ystwyth. Yn y pen draw, mae Afon Ystwyth yn derbyn yr holl ddraeniau arwynebol ac is-wynebol o safle mwyngloddio Cwmystwyth, gan achosi iddo fethu safonau ansawdd dŵr sy'n seiliedig ar y Gyfarwyddeb Fframwaith Dŵr ar gyfer sinc, plwm a chadmiwm.

Mae'r Awdurdod Glo yn gweithio gyda Cyfoeth Naturiol Cymru (CNC) i gynnal nifer o astudiaethau dichonoldeb ar gyfer gwaith lliniaru llygredd mewn mwyngloddiau metel segur penodol yng Nghymru. Prif amcan y prosiect yw lleihau lefelau sinc, plwm a chadmiwm yn Afon Ystwyth gyda'r nod o gyfrannu at newid statws cemegol y Gyfarwyddeb Fframwaith Dŵr.

Mae'r Cofnod Cyfyngiadau a Chyfleoedd Amgylcheddol (ECOR) hwn yn cofnodi llinell sylfaen amgylcheddol y safle, yn dogfennu'r opsiynau a ystyriwyd ar gyfer prosiect lliniaru llygredd ac yn nodi'r opsiwn a ffefrir, yn ogystal ag amlinellu cwmpas yr asesiad amgylcheddol i'w symud ymlaen yn ystod cam dylunio manwl y cynllun.

Mae'r llinell sylfaen amgylcheddol yn nodi nifer o dderbynyddion amgylcheddol sensitif o werth a sensitifrwydd uchel o fewn parth dylanwad posibl y prosiect:

- Sawl safle rhwydwaith Natura 2000: ACA Elenydd, AGA Elenydd-Mallaen, ACA Grogwynion
- Y Safleoedd o Ddiddordeb Gwyddonol Arbennig (SoDdGA) canlynol â dŵr wyneb gyda'r nod o atal erydiad: SoDdGA Mwyngloddfa Cwmystwyth, SoDdGA Gro Ystwyth, AGA Elenydd-Mallaen
- Bryn Copa / mwynglawdd plwm a mwyngloddiau copr a sinc Cwmystwyth
- Tirwedd o Ddiddordeb Hanesyddol Ucheldir Ceredigion
- Rhywogaethau a warchodir: ystlumod, y frân goesgoch, yr hebog tramor

Yn dilyn sefydlu'r llinell sylfaen amgylcheddol, rhoddir disgrifiad o'r llwybrau llygredd allweddol y mae'n rhaid rhoi sylw iddynt er mwyn cyflawni prif amcan y prosiect. Yn gryno, mae'r rhain yn cynnwys:

- dal gollyngiadau llygredd o geuffyrdd amrywiol y mwyngloddiau;
- gwella rheolaeth dŵr wyneb ar y safle;
- leinio gwelyau nentydd i gadw dŵr nant ar wahân i'r dŵr daear halogedig;
- defnyddio mesurau rheoli erydiad i atal sgwrio priddoedd/sborion halogedig.

Disgrifir nifer o'r opsiynau ar gyfer mynd i'r afael â'r llwybrau hyn a ystyriwyd ar y cam dichonoldeb, ynghyd â rhesymau dros beidio â bwrw ymlaen â'r rheini i'w hystyried ar y cam rhestr fer. Disgrifir opsiwn a ffefrir sy'n cynnwys cyfres o fesurau amddiffyn rhag erydiad a dal dŵr wyneb gyda thriniaeth weithredol o ddŵr wyneb a mwynglawdd halogedig a ddelir o fewn gwaith trin dŵr.

Rhoddir ystyriaeth i nodweddion y prosiect a allai achosi effeithiau amgylcheddol. Mae hon yn amlinellu'r potensial ar gyfer nifer o effeithiau ar asedau amgylcheddol sensitif a gwerth uchel:

- Lleihad yn y gwaddod metelifferaidd sy'n cyrraedd SoDdGA Grogwynion, gan arwain at newid yn y prosesau ffisegol sy'n cynnal swyddogaeth y safle

- Gweithgarwch adeiladu a defnydd tir o fewn ACA Elenydd a SoDdGA Mwyngloddfa Cwmystwyth, gan gynnwys eu casgliadau o enau metalloffyt a byroffytau
- Gweithgarwch adeiladu ac addasiadau o fewn lleoliad yr heneb gofrestredig a'r dirwedd o ddiddordeb hanesyddol

Mae Asesiad Fframwaith Dŵr wedi'i gynnal ar y cynllun lliniaru arfaethedig sydd wedi nodi mai ychydig iawn o botensial sydd gan y gwaith arfaethedig i gael effaith negyddol ar statws neu amcanion y Gyfarwyddeb Fframwaith Dŵr dros amserlen cylch nesaf y cynllun, a bod y gwaith arfaethedig yn rhan hanfodol o'r mesurau lliniaru llygredd sydd eu hangen i wella ansawdd dŵr yn sylweddol yn rhan uchaf Afon Ystwyth.

Mae gwaith asesu o dan Reoliadau Cadwraeth Cynefinoedd a Rhywogaethau 2017 wedi nodi bod posibilrwydd o effeithiau ar gyfanrwydd safle Natura 2000 (ACA Grogwynion) sy'n gofyn am ddatganiad achos ar gyfer cael rhanddirymiad o dan y rheoliadau, y mae'n rhaid ei ystyried gan yr Awdurdod Cynllunio Lleol a Llywodraeth Cymru.

Rhagwelir na fydd y prosiect yn dod o fewn y disgrifiadau o unrhyw ddatblygiad a ganiateir o dan Orchymyn Datblygu Cyffredinol a Ganiateir. Hefyd, gan fod y prosiect wedi nodi effeithiau amgylcheddol sylweddol posibl, mae cais wedi'i wneud i'r Awdurdod Cynllunio Lleol i ddyluniad amlinellol y prosiect gael ei sgrinio ar gyfer yr angen am asesiad statudol o'r effaith amgylcheddol o dan Reoliadau Cynllunio Gwlad a Thref (Asesu Effeithiau Amgylcheddol) (Cymru) 2017. Os ystyrir bod y prosiect yn un sy'n gofyn am asesiad o'r effaith amgylcheddol gan yr Awdurdod Cynllunio Lleol, yna mae cwmpas ar gyfer yr asesiad statudol o'r effaith amgylcheddol wedi'i gynnwys yn y cais.

Mae'r Cofnod Cyfyngiadau a Chyfleoedd Amgylcheddol drafft hwn (ECOR – Rhan A) yn cael ei gyhoeddi ar gyfer ymgynghori â rhanddeiliaid allweddol ochr yn ochr â'r cais sgrinio. Unwaith y byddant wedi'u derbyn, bydd ymatebion ymgyngoreion yn cael eu cofnodi yn Atodiad A, a bydd y Cofnod Cyfyngiadau a Chyfleoedd Amgylcheddol (Rhan A) yn cael ei ddiweddaru lle bo'n berthnasol.

Er mwyn llywio'r dyluniad manwl, mae cyfres o arolygon/asesiadau amgylcheddol pellach a mewnbwn arbenigol wedi'i nodi:

Pwnc	Gofynion asesu a chydsynio pellach
Bioamrywiaeth a Chydnerthedd Ecosystemau	• Asesiad Rheoliadau Cynefinoedd o effeithiau ar ACA Elenydd, ACA Grogwynion ac AGA Elenydd-Mallaen • Cydsyniad SoDdGA ar gyfer SoDdGA Mwyngloddfa Cwmystwyth a SoDdGA Elenydd • Arolwg presenoldeb/absenoldeb ystlumod ac yna arolygon poblogaeth yn ôl yr angen • Arolygon adar magu • Arolwg o is-blanhigion (bryoffytau a chennau) a datganiad dull is-blanhigion

Dŵr	• Mewnbwn peirianyddol arbenigol i ddyluniad leinin cyrsiau dŵr i gynnal cludiant gwaddod afonol a chynnwys nodweddion afonol naturiol. Adolygu adroddiadau canlyniadau llifogydd. Angen asesiad sgrinio Cyfarwyddeb Fframwaith Dŵr. • Asesiad Risg Llifogydd, gan gynnwys effeithiau dim llifogydd afonol a pherygl llifogydd i seilwaith • Gofynion Cydsyniad Cwrs Dŵr Cyffredin i'w sgrinio gydag Awdurdod Llifogydd Lleol Arweiniol Ceredigion
Treftadaeth Ddiwylliannol	• Asesiad wrth y ddesg, Cynllun Ymchwilio Ysgrifenedig (WSI) a datganiad dull • Asesiad o'r Effaith ar Dreftadaeth • ASIDOHL2 • Arolwg adeiladau • Cydsyniad heneb gofrestredig
Tirwedd	• Asesiad o'r effeithiau gweledol ar y dirwedd hanesyddol a mireinio ymddangosiad terfynol deunyddiau ac adfer y dirwedd

Executive Summary

The Cwmystwyth mine site is located on the northern slopes of the Ystwyth valley, adjacent to the Afon Ystwyth. Lead and zinc ores were historically extracted from and processed at the site, resulting in extensive mine spoil deposits across almost the whole site area. Three principal adits driven into the workings from river level, continue to discharge contaminated mine water into the Ystwyth. The Ystwyth ultimately receives all surface and sub-surface drainage from the Cwmystwyth mine site, causing it to fail WFD based water quality standards for zinc, lead and cadmium.

The Coal Authority is working with Natural Resources Wales (NRW) to undertake a number of Feasibility Studies for pollution mitigation works at selected abandoned metal mines in Wales. The primary objective for the project is to reduce levels of zinc, lead and cadmium in the Afon Ystwyth with the aim of contributing to WFD chemical status change.

This ECOR records the site's environmental baseline, documented the options considered for a pollution mitigation project and identification of the preferred option, as well as having outlined the scope of environmental assessment to be taken forward during the scheme's detailed design stage.

The environmental baselining identifies numerous sensitive, high value and sensitivity environmental receptors within the project's potential zone of influence:

- Several Natura 200 network sites: Elenydd SAC, Elenydd-Mallaen SPA, Grogwynion SAC
- The following SSSI erosion prevention, surface watersites: Mynagloddfa Cwmystwyth SSSI, Gro Ystwyth SSSI, Elenydd-Mallaen SPA
- Copa Hill/Cwmystwyth Lead Mine, Copper and Zinc Mines
- Upland Ceredigion Landscape of Historic Interest

- Protected species: Bats, Cough, Peregrine

Following the environmental baselining a description of the key pollution pathways that must be addressed in order to achieve the primary project objective is given. These briefly comprise:

- capture pollution discharges from the mines various adits;
- improve management of surface water on site;
- line stream beds to keep stream water separate from the contaminated groundwater;
- use erosion control measures to prevent scour of contaminated soils/spoil.

Several options for addressing these pathways considered at feasibility stage are described, along with reasons for those not being taken forward for consideration at shortlist stage. A preferred option is described comprising a series of erosion protection and surface water capture with active treatment of contaminated captured mine and surface water within a water treatment plant.

Consideration of the characteristics of the project which could give rise to environmental effects is considered. This outlines the potential for several effects on sensitive and high value environmental assets:

- Reduction of metalliferous sediment reaching Growynion SSSI resulting in a change to the physical processes which support the function of the site.
- Construction activity and land take within the Elenydd SAC and Mwyngloddfa Cwmystwyth SSSI, including their assemblages of metallophyte lichens and byrophytes
- Construction activity and modification within the setting of the Scheduled Monument and Landscape of Historic Interest

A Water Framework Assessment has been undertaken on the proposed mitigation scheme which has indicated that the proposed works have very little potential for negatively impacting the WFD status or objectives over the timescale of the next plan cycle and that the proposed works form a critical part of the pollution mitigation measures required to achieve significant betterment of water quality in the upper Afon Ystwyth.

Assessment under The Conservation of Habitats and Species Regulations 2017 has identified that there is the possibility of effects on the integrity of a Natura 2000 site (Grogwynion SAC) which requires a Statement of Case for obtaining a derogation under the regulations which must be considered by the Local Planning Authority and Welsh Government.

The project is anticipated to not fall within the descriptions of any development permitted under General Permitted Development Order. Also, as the project has identified potentially significant environmental effects therefore a request has been made to the Local Planning Authority for the project's outline design to be screened for the need for a statutory Environmental Impact Assessment under The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. If the project in deemed to be an EIA project by the LPA then a scope for the statutory EIA has been included within the request.

This draft Environmental Constraints and Opportunities Record (ECOR - Part A) is being issued for consultation to key stakeholders parallel to the screening request. Once received consultee responses will be recorded within Appendix A, and the ECOR (Part A) updated where relevant.

In order to inform detailed design a suite of further environmental survey/assessment and specialist input has been identified:

Topic	Further assessment and consenting requirements
Biodiversity and Resilience of Ecosystems	• HRA of effects on Elynydd SAC, Grogwynion SAC and Elyndd-Mallaen SPA • SSSI assent for Mwyngloddfa Cwmystwyth and Elenydd SSSIs • Bat presence/absence survey follow by population surveys as required • Breeding bird surveys • Lower plants (bryophyte & lichens) survey and lower plants method statement
Water	• Specialist engineering input into design of watercourse lining to maintain fluvial sediment transport and include natural fluvial features. Revision of flood consequence reporting. WFD screening assessment required. • Flood Risk Assessment, including effects no fluvial flooding and risk of flooding to infrastructure • Ordinary Watercourse Consent (OWC) requirements to be screened with Ceredigion Lead Local Flood Authority.
Cultural Heritage	• Desk based assessment, WSI and method statement • Heritage Impact Assessment • ASIDOHL2 • Building survey • Scheduled monument consent
Landscape	• Assessment of visual effects on historic landscape and refinement of final appearance of materials and landscape reinstatement.

Contents

List of Figures

List of Tables

Appendices

PART A

1.0 Introduction

1.1 Background

The Coal Authority (CA) was commissioned by Natural Resources Wales (NRW) to undertake a feasibility study for remediation of pollution caused by abandoned metal mining at and around Cwmystwyth Mine, Ceredigion. This Environmental Constraints and Opportunities Report (ECOR – Part A) has been produced by the CA, on behalf of NRW as part of this feasibility study. Through the feasibility study an Outline Design of the 'Preferred Solution' for remediation of pollution arising from Cwmystwyth Metal Mine has been determined.

Environmental assessment (and management) is an iterative process that starts at the inception of a project and continues through project feasibility (options appraisal), detailed design, construction and operation. Good environmental assessment is an integrated process that influences and challenges project options and design, rather than being a standalone paper exercise. For reasons of transparency and justification of the decisions made and actions taken, the process needs to be appropriately documented, with that documentation being regularly updated as the scheme evolves and is ultimately implemented.

In accordance with NRW's environmental assessment procedures, this ECOR has been prepared to document the environmental appraisal undertaken to inform development of the schemes outline design to address the significant pollution emanating from the Cwmystwyth Mine site.

This ECOR (Part A) documents the environmental constraints and opportunities present within the study area (i.e. Environmental Baseline); how the environmental baseline has been appraised in development of the outline design (i.e. Option Appraisal); the scope of environmental assessment to be undertake going forward that will inform development of the scheme design (Environmental Assessment Screening and Scoping); and the potential wider environmental enhancements that could be delivered as part of the scheme (Multiple benefits).

The ECOR (Part A) is structured as follows:

- Section 1: Introduction – providing background to the proposed scheme and environmental appraisal / assessment;
- Section 2: Environmental Baseline – a description of the baseline scenario for each environmental topic and an overview of the studies undertaken to date;
- Section 3: Options Appraisal – an appraisal of the options considered to address pollution arising from the Cwmystwyth Metal Mine. Determination of the preferred solution and presentation of its outline design.

- Section 4: Environmental Assessment Scoping – identification of the scope of environmental assessment to be integrated into development of the schemes detail design.
- Section 5: Delivery of Multiple Benefits – an outline of wider opportunities and enhancements the project has potential to deliver.
- Section 6: Closing Note.

1.2 NRW responsibilities under the Environment Act and Well-being of Future Generations Act

NRW, in undertaking its work, is required to pursue the Sustainable Management of Natural Resources (SMNR) and to demonstrate the application of the principles of Sustainable Development (SD) generally. NRW considers the environmental assessment process well aligned with these principles, as demonstrated in **Table 1-1**. The environmental assessment process provides a systematic and transparent way of managing the environmental risks, avoiding, reducing or mitigating environmental impacts, thereby adhering to SMNR and improving sustainability. Thus identifying opportunities for delivery of multiple benefits.

Table 1-1: The role of environment assessment in demonstrating the principles of sustainable management of natural resources

SMNR (SD Principle)	Role of Environmental Assessment
Manage adaptively	Monitoring and audit of projects and their environmental effects with feedback into future projects. Continual improvement through the project lifetime.
Appropriate spatial scale	The options appraisal or consideration of alternatives determines the study area. Economic, technical and environmental aspects feed into this to ensure that the options/alternatives and their effects are considered at the appropriate scale.
Collaboration and engagement (Collaboration)	Internal and external stakeholder identification / engagement starts early, continuing throughout project development.
Public participation in decision making (Involvement)	Public engagement through drop in sessions at key stages in the project or engagement with community or user groups. Consenting route publicises project proposal.
Relevant evidence	Considers broad environmental baseline and trends with and without project implementation.
Take account of benefits and intrinsic value of natural	Identify ecosystem services provided by the natural resources in the study area (including through internal and external stakeholder engagement). The environmental assessment should

resources and ecosystems	seek to maximise wider benefits accruing to ecosystems and natural resources in the study area.
Short, medium and long-term consequences (Long-term)	Consider environmental effects throughout the life of the project. Planning, construction, operation & decommissioning. Taking into account the evolution of the baseline e.g. climate change.
Prevent significant damage to ecosystems (Prevention)	Identify ecosystem services provided by the natural resources in the study area (including through internal and external stakeholder engagement) and undertake appropriate assessment of potential impacts and provide for effective avoidance, reduction and mitigation of any negative effects; and the maximisation of any positive effects.
Building resilience of ecosystems	The environmental assessment must establish the current resilience of the local ecosystems when considering the impacts of a project. Then, through options appraisal and input to design, aim to avoid, reduce or mitigate negative effects and maximise positive effects (multiple benefits), which will protect and enhance resilience.

By applying these principles throughout the lifetime of projects, NRW can maximise its contributions to Well-being Objectives and fulfil its duty to protect (Wildlife and Countryside Act, 1981 (as amended)) and enhance biodiversity (Section 6 of Environment Act) and the water environment (Water Framework Directive, as enacted locally).

NRW Well-being Objectives are:

1. Champion the Welsh environment and the sustainable management of Wales' natural resources
2. Ensure land and water in Wales is managed sustainably and in an integrated way
3. Improve the resilience and quality of our ecosystems
4. Reduce the risk to people and communities from environmental hazards such as flooding and pollution
5. Help people live healthier and more fulfilled lives
6. Promote successful and responsible business, using natural resources without damaging them
7. Develop NRW into an excellent organisation, delivering first-class customer service

1.3 Project Description

Motivation for this project is ongoing failure to achieve WFD Good overall status for the waterbodies on the Afon Ystwyth, as listed in the Reasons for Not Achieving Good Status spreadsheet and Failing Waterbodies Report. The project forms part of the wider Metal (Non-Coal) Mine Programme being undertaken in partnership between NRW and the Coal Authority.

Abandoned mines are the principle cause of waterbodies in Wales failing to achieve European WFD standards. The Metal Mine Strategy for Wales (Environment Agency Wales 2002) identified the 50 abandoned metal mines causing the greatest impact on rivers in Wales by the potential ease with which remediation works could be completed[1].

Figure 1-1 shows the location of the Cwmystwyth site in its context with other Ceredigion mine sites currently being considered for remediation (Cwm Rheidol and Frongoch & Wemyss).

The Afon Ystwyth system is impacted by numerous metal mines for the majority of its length (including tributaries). The main river headwaters initially contain little to no metals, but concentrations subsequently increase to levels above recognised Environmental Quality Standards (EQS) as a result of the mineralised local catchment and diffuse pollution from small scale historical mining. Impacts increase significantly as a result of diffuse and point source inputs from the Cwmystwyth Mine site (**Plate 1-1**), leading to the ongoing classification of the Ystwyth (Headwaters to confluence with Nant Cell - GB110063041720) waterbody as Moderate overall due to zinc, cadmium and lead concentrations at the assessment point.

Additional impacts have been identified from some tributaries (Nant Cell - Frongoch mine and Afon Magwr - Wemyss Mine & Frongoch Adit discharge) and inputs from Grogwynion Mine and Level Fawr resulting in continued failure to achieve Good status for the downstream Ystwyth (confluence with Nant Cell to the tidal limit - GB110063041710) waterbody.

Mine water from the connected workings and elevated metal loadings from streams have been characterised by NRW as a major contributor to lead (Pb), zinc (Zn) and cadmium (Cd) loadings within the receiving waterbody, with Zn, Pb, Cu and Cd identified as Reasons For Not Achieving Good Status (RNAGS) in the latest WFD based assessments.

It appears from simple modelling that WFD status change is not possible for either Ystwyth waterbody, even with 100% removal of metals at Cwmystwyth. However, effective treatment of identified sources at Cwmystwyth, will significantly improve water quality and dependent ecology in the Ystwyth (headwaters to confluence with Nant Cell) waterbody.

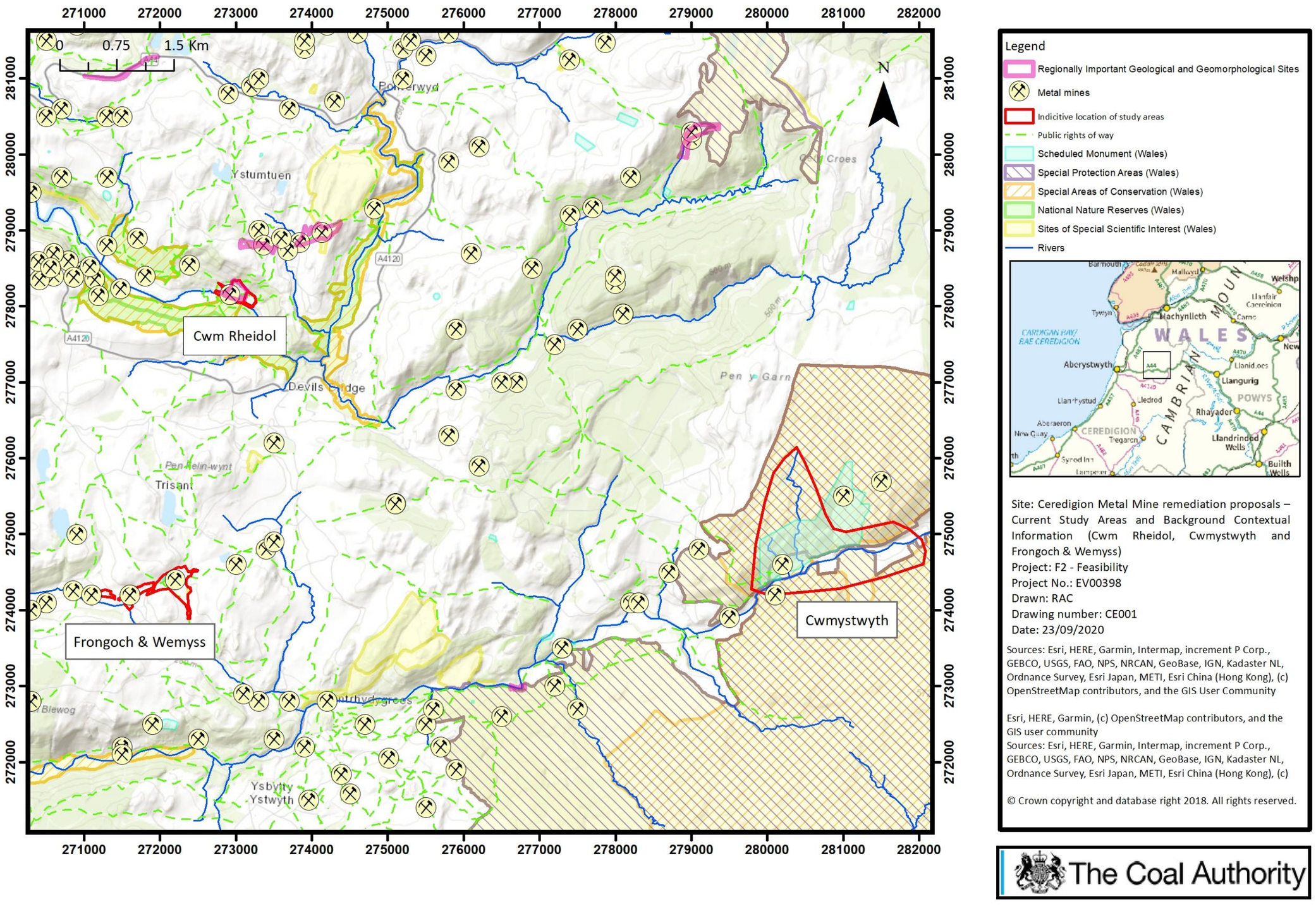
[1] https://naturalresourceswales.gov.uk/about-us/what-we-do/water/metal-mine-water-pollution/

The proposed remediation work described in this document is aimed at significantly reducing zinc, cadmium and lead loadings (by up to 50% in immediate downstream sections). Maximising these reductions requires both the treatment of identified mine water discharges and the prevention (reduction) of erosion and leaching of metal rich mining spoil and river channel sediments at the Cwmystwyth Mine (including tributaries that traverse the mine site).

Point source, dissolved phase contamination would be addressed through direct treatment of mine water discharges at Cwmystwyth, while the diffuse pollution would be addressed through the removal of spoil deposits from within the functional floodplain of the Afon Ystwyth, erosion protection for channels of existing tributaries and through interception drains to prevent clean surface water infiltration through existing mine spoil.

Plate 1-1: View looking east towards Cwmystwyth site (2019)

Figure 1-1: Ceredigion Metal Mine Remediation Proposals – Current Study Areas and Background Contextual Information



1.4 Project Objectives

The project aims to reduce significantly the concentrations of dissolved lead and zinc in the Ystwyth (by up to 50% immediately downstream), as well as a significant (but currently unquantified) reduction in the amount of fine-grained, metal-rich sediment entering the main river system and the associated dissolved-phase contamination resulting from leaching. Also the project seeks to directly improve a ~7km stretch of the river downstream of Cwmystwyth and enable the possibility of up to 23km of the river (including sections both upstream and downstream of the mine site) to achieve WFD status change from Moderate to Good.

Through achieving this the project aims to also contribute to the following NRW Wellbeing objectives:

- Champion the Welsh environment and the sustainable management of Wales' natural resources
- Ensure land and water in Wales is managed sustainably and in an integrated way
- Improve the resilience and quality of our ecosystems
- Reduce the risk to people and communities from environmental hazards such as flooding and pollution
- Help people live healthier and more fulfilled lives

2.0 Environmental Baseline

Figure 2-2: Cwmystwyth Metallophyte Plant Zones

Figure 2-3: Highest Sensitivity areas of Calaminarian Grassland from Surveys by Pryce 2020

Table 2-1 includes a summary of baseline environmental conditions for environmental receptors / topics associated with the Cwmystwyth study area (Error! Reference source not found.). To inform the environmental baseline a number of surveys have been undertaken of the study area, a list of these surveys is provided within Appendix B, copies of these survey reports are available on request from NRW.

Figure 2-2: Cwmystwyth Metallophyte Plant Zones

Figure 2-3: Highest Sensitivity areas of Calaminarian Grassland from Surveys by Pryce 2020

Table 2-1 outlines the associated challenges and opportunities and references strategic level evidence that has been reviewed to determine these.

An Environmental Constraints and Environmental Opportunities Plan (Figure 2-1) has been prepared to visually portray key data within the study area. This outlines the Study Area boundary and key constraints and opportunities based on the baseline information presented in **Figure 2-2**: Cwmystwyth Metallophyte Plant Zones

Figure 2-3: Highest Sensitivity areas of Calaminarian Grassland from Surveys by Pryce 2020

Table 2-1.

As part of this early data gathering stage, an informal consultation exercise with Key Planning and Environment Stakeholders has also been undertaken. This primarily involved an information cascade about the site, including provision of an earlier draft of **Figure 2-2**: Cwmystwyth Metallophyte Plant Zones

Figure 2-3: Highest Sensitivity areas of Calaminarian Grassland from Surveys by Pryce 2020

Table 2-1 to set context regarding the known environmental baseline at the site. Consultees were encouraged to review the information and provide an informal consultation opinion. A list of consultees and details of the responses received (April/May 2019) are contained in **Appendix A**.

Figure 2-1: Cwmystwyth - Environmental Constraints Plan

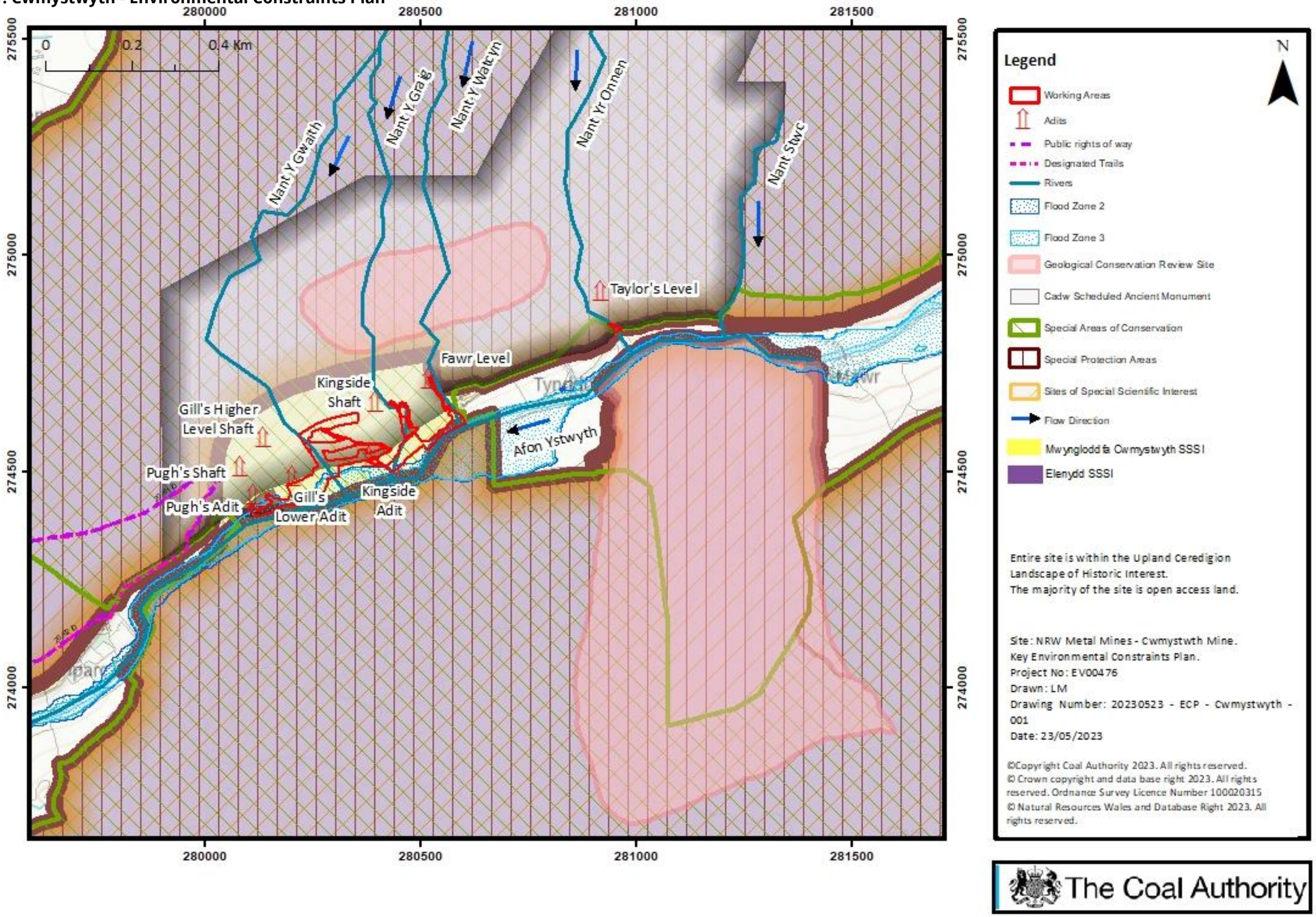


Figure 2-2: Cwmystwyth Metallophyte Plant Zones

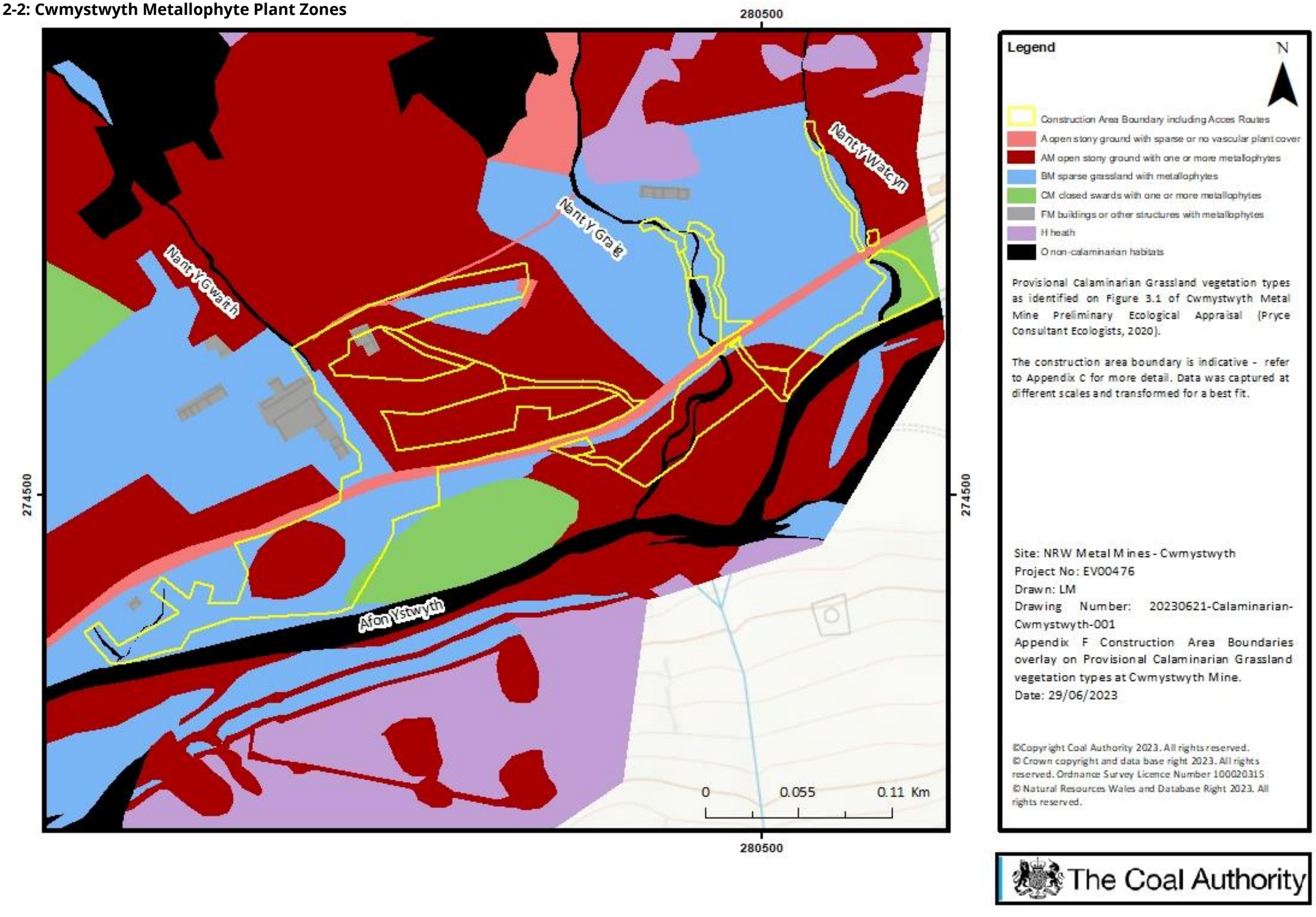


Figure 2-3: Highest Sensitivity areas of Calaminarian Grassland from Surveys by Pryce 2020

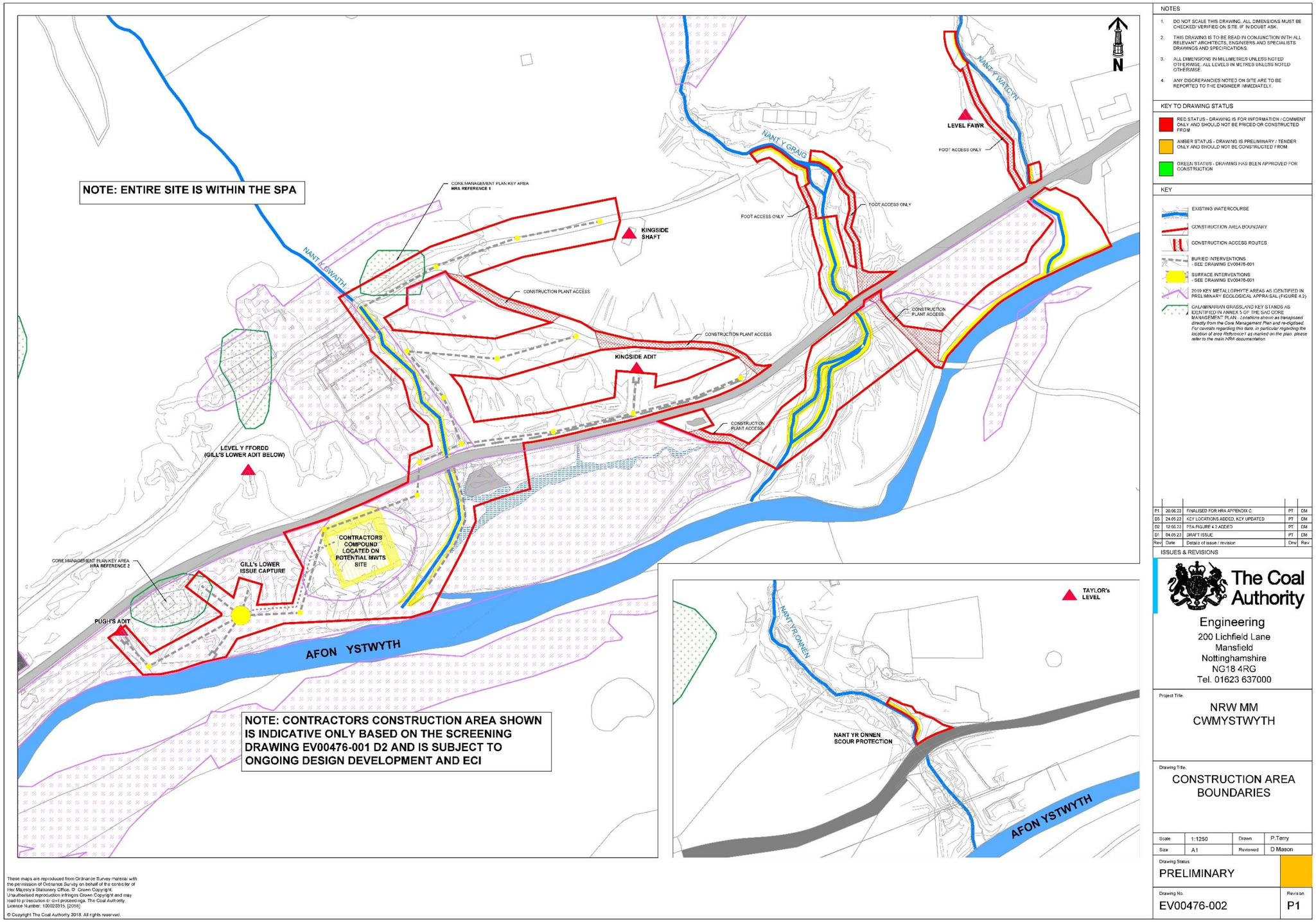


Table 2-1: Baseline Condition including Challenges and Opportunities

Topic – Receptor / Resource	Summary of Current Baseline Information	Local Challenges, Trends and Opportunities
Population & Human Health	• Site is owned by the Cambrian Mines Trust (CMT). • The site is accessed from the minor road that runs along the bottom of the valley on the northern side of the Afon Ystwyth, which links the B4574 to Rhayader to the southeast. • The nearest receptor is a farm alongside the minor road/site at its eastern extent. Other isolated farm buildings are present in the general area. The small village of Cwmystwyth lies to the west. • The site is crossed by numerous footpaths and is located within a 'right to roam' area. • One Public Right of Way (PRoW) passes through the feasibility study area. PRoW 20/61/D – this footpath extends north from the road up the valley side through the study area before turning westwards and out of the study area. This route connects with a moderately dense PRoW network beyond western parts of the study area (*Lingard Farrow Styles: NRW Metal Mine Feasibility, Preliminary Landscape Appraisal, Cwmystwyth, Ceredigion, Prepared for: Natural Resources Wales on behalf of The Coal Authority Ref: 2997, February 2019*). • The Borth to Devil's Bridge to Pontrhydfendigaid Trail (also known as Mal Evans Way) is marked on OS mapping following the route of PRoW 20/61/D through the study area. This designated trail is promoted via tourism website 'Discover Ceredigion' (http://www.discoverceredigion.co.uk/English/what/walking/Pages/Cambrian-Mountains-Walks.aspx) . The trail includes way-marking signs within and in the vicinity of the study area. The section passing the study area (section 4) is supported by a leaflet, namely 'Devil's Bridge to Pontrhydygroes' by Ceredigion County Council Tourism Service. This section is ~18km in length and with regard to mining at Cwmystwyth notes: (*Lingard Farrow Styles, 2019*). *'a fascinating view up into the valley, scarred by man's activity for thousands of years. This celebrated mine has no less than 30 lodes (veins of ore) and 84 surface features (shafts, adits and stopes). Copa Hill, in the distance, was the site of bronze age open cast mining… …Take the track to the right that climbs below the oaks past spoil heaps and mine workings now overgrown with lichens and mosses. On the hillside opposite the ruins of many miners' cottages and a plethora of tracks and adits can be seen'.* • The Cambrian Way and Cistercian Way pass through Cwmystwyth village to the west of the study area. • National Cycle Route 81 passes alongside the site (along the minor road through the study area) connecting Aberystwyth and Wolverhampton. • Much of the central and western parts of the study area are designated as Open Access Land, including the main mining complex, valley sides and part of the valley bottom. These areas of Open Access Land extend beyond the study area to cover much of the surrounding uplands. A number of tracks pass through the central mining areas but these have been closed to vehicular access where they join the road (*Lingard Farrow Styles, 2019*). • Historically there has been an issue on the site from disturbance as a result of off-road vehicles and fly-tipping *(The Core Management Plan (Including Conservation Objectives) incorporating Elenydd-Mallaen Special Protection Area Elenydd Special Area for Conservation (SAC) Coetiroedd Cwm Elan SAC Cwm Doethie Mynydd Mallaen SAC (Countryside Council for Wales (CCW), 2013)).* • Due to the steep slopes, loose mining waste and subsurface workings over much of the former mine area, large areas of the site are considered unstable and unsafe for general access. • The River Ystwyth receives all surface and sub-surface drainage from the mine, causing it to fail European Water Framework Directive (WFD) standards for zinc, lead and cadmium. Improvements could lead to fisheries potential.	• Future Generations Act https://gov.wales/topics/people-and-communities/people/future-generations-act/?lang=en The Well-being of Future Generations (Wales) Act 2015 is about improving the social, economic, environmental and cultural well-being of Wales. The Act puts in place seven well-being goals. Those with most relevance for this project being: o A globally responsible Wales; o A resilient Wales; o A healthier Wales; o A Wales of vibrant culture [and thriving Welsh language]. • NRW Well-being Statement https://naturalresources.wales/media/681164/nrw-well-being-statement.pdf ; Objective 4 of the NRW Well-being Statement is to "Help people live healthier and more fulfilled lives". This in turn contributes to the 'healthier Wales' Wellbeing Goal where it is noted that "Natural resources make a significant contribution to the physical health and mental wellbeing of people in Wales. (For example, trees help to absorb pollutants and improve air quality; access to nature and greenspace has positive impacts on physical and mental health.)" Aims of this above include for NRW to "Encourage outdoor recreation and learning at our own facilities and in the wider environment," and "Increase opportunities for local access to the natural environment that help bring communities together, while also offering learning and development to help foster community pride and a sense of place". • Ceredigion Well-being plan (*Ceredigion Local Well-being Plan 2018-2023 - Agreed by Ceredigion Public Services Board 16 April 2018 Published 1 May 2018*) https://www.ceredigion.gov.uk/media/3956/local-well-being-plan-2018-2023.pdf Population of 74,600 people, 23.2% of 4-5 year old children are overweight or obese in region, high proportion of the population are over 65 (23% and increasing) and young people of University age (17%). Fourteen SACs, 100 SSSIs and seven National Nature Reserves. The Ceredigion Well-being documents Community Resilience Action plan notes a medium term aspiration to (among other items) promote nature connectedness. The Individual Resilience Action also makes reference to a medium term promotion of community initiatives that encourage healthy behaviours with the longer term aim being to promote a prevention agenda for individuals using the opportunities provided by community initiatives, such as community gardens and active lifestyles. The following two guiding principles in the Ceredigion Well-being Plan may be of particular relevance to this project: o Create conditions for communities to support individuals from all backgrounds to live fulfilling, independent lives. Develop and sustain social networks, and cultural and linguistic opportunities in order to enhance well-being and maintain independence. o Create environmentally responsible and safe communities that can adapt and respond to the effects of climate change. Support communities to enhance their relationship with the natural environment and prepare for extreme weather events. • CMT aspirations for the future document (undated) http://www.cambrianmines.co.uk/Cambrian%20Mines%20Trust%20Wish%20List%20-%20FINAL%20VERSION.pdf

		• DAT Cwmystwyth Management and Protection Plan (2014) http://www.cambrianmines.co.uk/Cwmystwyth%20Mines%20Management%20and%20Protection%20Plan%20FINAL%20VERSION%20(small).pdf The above documents provide a brief summary of the CMT aspirations for future works at the Cwmystwyth Mines site. Item 8 in the document provides an aspiration to work with NRW for any future water treatment works at the site. Other aspirations (many of which are of relevance to population/human health) in the documents include: o ITEM 1: Signage to indicate ownership; o ITEM 2: Improved interpretation panels and signage; o ITEM 3: Improvement of the area adjacent to the B4574 to the south of the mill (including access); o ITEM 4: Improved Car Parking across the site area; o ITEM 5: Re-opening of the original track to the mine yard; o ITEM 6: Restoration of the portal to Level Fawr and improvement of underground access; o ITEM 7: Restoration and improvement to the packwall entranceway and portal to Taylor's Level; o ITEM 9: Rebuilding of Neville Place and Staff House; o ITEM 10: Hydro-Electric Scheme; o ITEM 11: Establishment of a 'Mid Wales Mining Trail' • Sustrans Review of the National Cycle Network 2018 https://www.sustrans.org.uk/sites/default/files/file_content_type/ncn_review_report_paths_for_everyone.pdf • Sustrans Review and Action Plan for Wales 2018 https://www.sustrans.org.uk/sites/default/files/file_content_type/ncn_review_action_plan_walesbilingual_web_2.pdf Cycle Route 81 is not one of the current 'activation' projects being progressed in Wales. No specific threats noted to this trail in available documentation. However, signage issues are noted as being common to the Network. Split into three main areas (all may be of relevance to this study) – Signage issues that need fixing/amending; Signage that promotes the Network (including education information); and Signage that directs users towards the Network (including from train stations). <u>There is potential for the project to deliver against the above through exploring opportunities relating to access improvement, community engagement, signage/promotion of existing (and potentially new) networks and provision of additional signage/interpretation panels. It will also be important to work closely with CMT regarding their aspirations to understand what may be achievable through the remediation scheme and what the remediation scheme could potentially facilitate for future implementation. Consideration should also be given to engaging CMT and their volunteer network where possible to support with on site activities as part of a community engagement strategy. Any public access etc. would also need to be undertaken in reference to the significant heritage, ecological, landscape and geological interest on site with appropriate consultation/consenting in place.</u>
Biodiversity & Resilience of Ecosystems	• The Ystwyth sea trout fishery is currently classified as 'at Risk' (NRW Know Your River – River Ystwyth Salmon and Sea Trout Catchment Summary Note 2015). In the case of the Ystwyth, there are "low" reported rod catches of salmon. • The Afon Ystwyth is divided into two WFD reporting waterbodies, which have the following biological WFD categories: o Ystwyth - headwaters to the confluence with the Nant Cell (GB110063041720). Ecological Quality: Moderate. (Fish: High, Invertebrates: Good, Diatoms: Good, Macrophytes: Good, however these scores are uncertain) o Ystywth - confluence with the Nant Cell to Tidal Limit (GB110063041710). Ecological Quality: Poor (Fish: Poor, Invertebrates: Good, Diatoms: Good, Macrophytes: Good, however these scores are uncertain) <u>Designated Sites</u> *On Site*	• Core management plan (including conservation objectives) Incorporating: Elenydd – Mallaen Special Protection Area (SPA) and Elenydd SAC and underpinning SSSIs - 17 April 2008: https://www.naturalresources.wales/media/671965/Elenydd_cSAC_core_English.pdf The above document outlines conservation objectives for the special features of this large designated site. This does not include specific actions for qualifying bird species (of the SPA) but provides habitat related actions. Conservation management issues across the designation vary but include air pollution, overgrazing, invasive species (e.g. rhododendron), fertiliser use etc. Due to the extent of the designation many of these are not applicable to the study area itself. Specific reference is made to the fact that "*Disturbance from off-road vehicles and fly tipping are on-going issues*" within the Cwmystwyth Mine site.

- Elynydd SAC entirely covers the Cwmystwyth site. Qualifying Annexe I habitats within the designated site and wider Cwmystwyth study area being – Calaminarian grasslands (developed as a result of the mining heritage), blanket bogs, European dry heaths, and Oligotrophic to mesotrophic standing waters of the *Isoeto-Nanojuncetea*. Floating water-plantain *Luronium natans* an Annexe II habitat is also present. Old sessile oak woods and *Tilio-Acerion* forests of slopes, screes and ravines are also present within the SAC but not within the study area. Of the above, the Calaminarian grasslands are most critical to this baseline understanding of the likely remediation proposals as they are present throughout the site and of high value;
- Two SSSIs are present on site – they are part of the SSSI network underpinning the international designations: Mwyngloddfa Cwmystwyth and the larger Elynydd SSSI.
- The verges along both sides of the road through the study area (B4574) are designated as a roadside verge reserve (non-statutory designation). http://map.ceredigion.gov.uk/connect/?mapcfg=PROTECTED_VERGES .

Off Site

- Elenydd - Mallaen Special Protection Area (SPA) has a similar boundary to the SAC; however, it excludes the former lead mine workings at Cwmystwyth (the site) running adjacent to the former mine working extent. The following Annexe 1 species are known to breed within the SPA: Merlin, Peregrine Falcon and Red Kite.
- Grogwynion SAC lies approximately 8 km southwest of the study area. This designation is hydrologically linked to the Cwmystwyth site with the Ystwyth flowing directly from the study area before passing through the SAC. This SAC is of relevance for this study due to the reliance of its lower plant interest on metal loading in the ground and hydrological connection to the Cwmystwyth site. The SAC is under pinned by Gro-Ystwyth SSSI Units.
- The Gro-Ystwyth SSSI citation https://naturalresources.wales/media/665763/SSSI_1636_Citation_EN001db99.pdf notes there is *"A rich and unique assemblage of lichens is found at Grogwynion, including species associated with metal-rich habitats*." and that "*Parts of the now abandoned Grogwynion and Gwaithgoch metal mines are included in the site. On the abandoned spoil heaps and remains of buildings there has developed a rich metallophyte lichen flora, including a number* of nationally scarce species such as Vezdaea acicularis, Gyalidea subscutellaris and Thelocarpon impressellum."
- The Grogwynion SAC register entry https://naturalresources.wales/media/631171/SAC_UK0030160_Register_Entry001.pdf confirms the primary reason for designation as being the presence of Annex 1 Calaminarian grassland of the *Violetalia calaminariae* and dry heaths. The core management plan states "*the section of the river Ystwyth known as Grogwynion SAC is the largest known area of such communities in England and Wales. They comprise open areas of bare shingle and heather, rich in lichen species, (the SAC features Calaminarian grassland and European dry heath) amongst bands of great wood- rush, acid grassland, scrub, marshy grassland, broadleaved woodland, and small streams and backwaters*." And that "*The river deposits and spoil heaps and buildings of abandoned metal mines at Grogwynion support a rich assemblage of rare lichens, including a number of species that are specially adapted to the concentrations of heavy metals, known as metallophyte lichens. Lichen species that are normally montane are present at low altitudes at this site and contribute to making this lichen assemblage unique. One species, Epigloea filifera, found at Grogwynion, is known nowhere else in Britain*."
  https://naturalresources.wales/media/672442/Grogwynion%20SAC%20Plan%20English%20(edit).pdf
- The Cwmystwyth mine site is also hydraulically linked to the West Wales Marine (Gorllewin Cymru Forol) SAC and the Northern Cardigan Bay (Gogledd Bae Ceredigion) SPA albeit approximately 29 km away. The qualifying features of these designations being harbour porpoise (SAC) and red-throated diver (SPA). The mine is not the only (or majority) contributor to metal pollution in the Ystwyth which discharges into the SAC/SPA.

Habitat Types

- A number of European priority interests are present at and around the site including Calaminarian grasslands (on the exposed mine spoil), European dry heaths, Blanket Bogs, and *Luronium natas* (floating water plantain).
- The 2019 study area (Pryce Consultant Ecologists, 2020) including a western extension from the main mine site was noted as supporting a mosaic of vegetation types including mine spoil, bare rock and scree (all potentially including Calaminarian grassland), broad-leaf woodland, gorse-dominated dry-heath, acid grassland, species-poor acid grassland, improved grassland, stands of Bracken, and water courses. All except species-poor acid grassland and improved grassland are of ecological significance and qualify as Habitats of Principal Importance for Conservation of Biological Diversity under section 7 of the Environment (Wales) Act 2016.
- Of greatest significance is the presence of Calaminarian grasslands over much of the mine site itself – see lower plant interest below.

- http://jncc.defra.gov.uk/ProtectedSites/SACselection/n2kforms/UK0012928.pdf

  Identified threats and pressures on the Elenydd SAC are identified as:

  - HIGH risk (both inside and outside of the site) from air pollution/air-borne pollutants;
  - MEDIUM risk (inside site) from grazing and other ecosystem modifications;
  - MEDIUM risk (both inside and outside of the site) from fire and fire suppression;
  - LOW risk (inside site) from outdoor sports and leisure activities, recreational activities; and
  - LOW risk (both inside and outside of the site) from invasive non-native species.

- http://jncc.defra.gov.uk/pdf/SPA/UK9014111.pdf

  Identified threats and pressures on the Elenydd - Mallaen SPA are identified as:

  - MEDIUM risk (inside site) from forest and plantation (management and use), fire and fire suppression and grazing;
  - MEDIUM risk (both inside and outside of the site) from hunting and collection of wild animals and renewable energy use;
  - LOW risk (inside site) from improved access to the site; and
  - LOW risk (both inside and outside of the site) from outdoor sports and leisure activities, recreational activities, changes in abiotic conditions and problematic native species.

- It should be noted that these are the threats and pressures known at the time of preparing the plan(s). Absence of a pressure/threat does not mean that a specific project will have no impact under Article 6(3).

- Core management plan (including conservation objectives) for the Grogwynion SAC – 10 March 2008: https://naturalresources.wales/media/672442/Grogwynion%20SAC%20Plan%20English%20(edit).pdf

  The above document outlines conservation objectives for the special features of the SAC. Conservation management issues include mainly successional vegetation changes and in particular scrub, gorse & Japanese knotweed encroachment.

  http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0030160.pdf

  Identified threats ,pressures and activities with impacts on the Grogwynion SAC are identified as:

  - HIGH risk (both inside and outside of site) from invasive non-native species and problematic native species;
  - MEDIUM risk (inside site) from 'other; ecosystem modifications;
  - MEDIUM risk (both inside and outside of the site) from air pollution/air-borne pollutants

- Local Biodiversity Action Plan / Targets. http://www.ceredigion.gov.uk/resident/coast-countryside/conservation-and-wildlife/ceredigion-biodiversity-action-plan/

  Chough have a local species action plan which notes that "*The species is highly reliant on the availability of these specialised nest sites and also on the presence of short coastal heath, acid grassland and cliff slopes in which to forage*." One of the factors identified as affecting the species being "*Low availability of suitable nest sites as the unstable nature of rock faces in much of Ceredigion, results in the rapid collapse and subsequent loss of some suitable nest sites*."

  Pipistrelle bats also have a local species action plan – two of the factors identified as affecting this species include "*The degradation and destruction of bat habitats in the countryside and the loss of natural roosting sites e.g. trees with hollows, splits, flaking bark and ivy and feeding areas such as sheltered hedges and waterside habitats*" and "*Health and safety measures to remove damaged, diseased or unstable trees from next to roads, footpaths and buildings can damage bat habitats."*

  Roadside verges also have an action plan which notes that "*A number of 'Roadside Reserves' have been identified because they contain uncommon plant species or groups of plants."* This plan sets a number of targets but these lead up to the date 2010 only.

	• Japanese knotweed known to be present along the Ystwyth catchment (Pryce Consultant Ecologists, 2020); however, none recorded at site to date. <u>Lower Plant interest</u> • The study area is of particular significance for Calaminarian grassland and this is appreciated by the SAC designation covering the area. • The site is the most significant metallophyte lichen site in Wales. • *Mapping the extent of Calaminarian grassland at Mwyngloddfa Cwmystwyth SSSI, C. Forster Brown, S.P. Chambers, NRW Evidence Report No: 203 (2017)* provides a map showing Cwmystwyth Mine Calaminarian and associated communities together with a species list. The Cwmystwyth site was found during this survey to comprise of a mix of the Calaminarian 'communities' (as previously defined by Simkin (2014)). Two categories were found to be particularly dominant at the site – AM (open stony ground with one or more metallophytes) and BM (open grassland with one or more metallophytes). Some small areas (few in number) were categorised as HM (Calaminarian heath with one or more metallophytes) or as DM (Bryophyte communities with one or more metallophytes). Eighteen locations on site were found to be particularly important for metallophyte species (and by extension, the Calaminarian), these are detailed and mapped in the 2017 report. The report also notes that what perhaps marks the site out in comparison with other metal mine sites, is the sheer extent of the Calaminarian. Whilst it is patchy, it is widespread, and also covers a large overall area due to the spread of the former workings. • A number of lichens (30+ species) are supported by this habitat, including a number of rare species; this is the only known British location of the lichen*, Placythiella hyporhoda*. One rare metallophyte moss (*Ditrichum plumbicola*) identified at the site is listed in the Red Data Book and is a UK BAP priority species, as are three 'noteworthy' species of fern. The UKBAP/S7 Red List liverwort *Cephaloziella nicholsonii* is also known to be present. • The Elenydd SAC Core Management Plan confirms that the extent of the mine spoil tips at Mwyngloddfa Cwmystwyth are not decreasing in height or area except as a result of the natural process of weathering and erosion. All the rare lichen species recorded at this site that are characteristic of soils or rocks with a high metal content, are present with their populations either stable or increasing. The open sward of lichen-rich grassland includes characteristic grass species such as common bent, sheep's fescue, silvery and early hair-grass. Yorkshire fog is only occasional within the sward and perennial rye-grass is absent. • The 2019 Pryce Consultant Ecologists (Pryce Consultant Ecologists, 2020) survey confirmed the extent and value of the mine site for lower plants. An indication of the areas identified (from previous surveys and 2019 work) as being of highest sensitivity for lower plants are shown on Figure 2-2 and Figure 2-3. <u>Protected/Notable Fauna</u> • The underground mine workings are important for migrating and hibernating bats (species known to be present including Daubentons, whiskered, Brandt's, Natterer's, brown long-eared and the lesser horseshoe), The Core Management plan notes that "*Access for hibernating bats in the system of underground workings is maintained. All four species previously recorded from the site, namely Daubenton's, Natterer's, Brown longeared and Whiskered bats are present during the winter months*." • The Pryce Consultant Ecologists (2020) report confirms the potential for bats to roost within the mine shafts, adits and old buildings on the mine site. • Peregrine Falcons have nested in the area for many years and chough are likely to use the site for nesting *(*Environment Agency Wales remedial design for Cwmystwyth mine, Ceredigion, Wales - feasibility study November 2006. Parsons Brinckerhoff Ltd). SPA adjacent with species that are likely to move between the SPA and mine site. • The Pryce Consultant Ecologists (2020) report notes that otter are known on the Ystwyth catchment and may therefore pass through the site; use of streams higher up within the mine by otters is less likely. The report also notes potential for amphibians to use ephemeral pools along this river corridor; however, due to water quality and inundation potentially low-quality habitat for these species. Reptiles could be present on site, in particular along margins with heathland vegetation. Notable invertebrates could make use of the site. • Water voles are known to be present in the upper tributaries of the Site (Ceredigion County Council consultation comment October 2020). Although, Pryce Consultant Ecologists (2020) report states that habitats on site provide limited opportunities for Water Vole.	• Local Development Plan Biodiversity Policies - https://www.ceredigion.gov.uk/oldicm/utilities/action/act_download.cfm?mediaid=51572&langtoken=eng Policy DM14: Nature Conservation and Ecological Connectivity "*Development will be permitted where it protects and, where possible, enhances biodiversity, geodiversity and ecological connectivity across Ceredigion, including local sites and local priority species and habitats. Where it is appropriate to the scale and location of the development and opportunities exist, development should incorporate nature conservation education and access, providing the site's ecological or geological integrity can be safeguarded.*" "*Biodiversity enhancements could be achieved through increasing/restoring habitats or increasing/improving opportunities for species. These enhancements should aim to contribute to Local BAP (LBAP) targets and/or improving ecological connectivity. Depending on the proposal, it may be more appropriate in some cases to provide enhancements to a statutory/non-statutory site."* Policy DM15: Local Biodiversity Conservation *"Development will be permitted where:* *1. A step-wise approach is adopted to ensure there will be no significant negative effects to biodiversity and ecological connectivity both on-site and off-site;* *2. Appropriate species, habitats and wildlife corridor/stepping stone enhancements have been incorporated into the development through good landscape and building design, or where applicable will be carried out offsite;* *3. With regard to developments affecting LNRs, sites that meet SINC criteria and priority species and habitats, there is an overriding social, economic or environmental need for the development that outweighs the losses to biodiversity (after mitigation), the development could not reasonably be located elsewhere and these losses can be readily and fully compensated within the local area; and* *4. Where necessary, management plans are produced and agreed with the LPA and developments phased to take into account mitigation and compensation measures."* • The Nature Recovery Plan for wales sets out clear objectives of our necessary response to the Nature Emergency https://gov.wales/sites/default/files/publications/2020-10/nature-recovery-action-plan-wales-2020-2021.pdf • The Mid Wales area statement which under the Improving Biodiversity theme includes 'Making nature a priority through planning, policy and practical measures' and 'Improving the Favourable Conservation Status of designated sites. The sustainable management of land and water theme includes 'Develop catchment and landscape scale approaches to tackle pollution at source' and 'Work across sectors to maintain, improve and restore water quality and river habitat'
Land (for example: land take)	• Land historically used for metal mining; no current or future extraction anticipated. • The area is built of rocks of Silurian and Ordovician age, and the landform is typical of the 'slate uplands' of south-central Wales, with plateau separated by steep-sided valleys;	

	• Mwyngloddfa Cwmystwyth SSSI (on site) is designated both for its geological and biological value. The geological interest at this site lies both in the spoil tips and in the underground workings and is contiguous with an area of national mineralogical importance located at Graig Fawr and Copa Hill, in the adjacent Elenydd SSSI. Some impacts currently on geological value associated with wash-out in high flow events. • Site lies within Cambrian Mountains Environmentally Sensitive Area (ESA).	
Soil (for example: organic matter, erosion, compaction, sealing)	• Exposed spoil throughout study area; • Combination of Grade 4 (poor), 5 (very poor) and non-agricultural in the local area. • Previous use of site (lead mine) will have resulted in significant ground contamination. • Significant erosion in the south of the site during high rainfall events.	• CMT 'aspirations for the future' document (undated) http://www.cambrianmines.co.uk/Cambrian%20Mines%20Trust%20Wish%20List%20-%20FINAL%20VERSION.pdf • DAT Cwmystwyth Management and Protection Plan (2014) http://www.cambrianmines.co.uk/Cwmystwyth%20Mines%20Management%20and%20Protection%20Plan%20FINAL%20VERSION%20(small).pdf Item 3A of the above, relates to improvement of the area adjacent to the B4574 to the south of the mill - specifically Item 3A: Managing the stream course. This details the aspiration to prevent ongoing erosion in this area. There is potential for the project to reduce wash out through appropriate surface water management.

Water
(for example: hydromorphological changes, quantity and quality)
	• Adjoining waterbodies noted as:
	  ○ Ystwyth - headwaters to the confluence with the Nant Cell (GB110063041720). Cycle 3 (2021) Baseline overall status: Moderate. Chemical: Moderate, Ecological: Moderate, Driving factors: Cadmium, Lead Zinc.
	  ○ Ystwyth - conf with Cwmnewydion to tidal limit (GB110063041710). Cycle 3 (2021) Baseline overall status: Poor. Chemical: Moderate, Ecological: Poor, Driving factors: Fish.
	  ○ Data accessed: https://waterwatchwales.naturalresourceswales.gov.uk/en/
	• Cwmystwyth Mine lies in the upper catchment of the Afon Ystwyth. The Afon Ystwyth flows southwest from Cwmystwyth, turning northwest before discharging into Cardigan Bay at Aberystwyth;
	• The northern slopes of the Ystwyth Valley are drained by four tributary streams: Nant y Gwaith, Nant y Graig, Nant Watcyn and Nant yr Onnen into the Afon Ystwyth, although the Nant y Gwaith is lost to ground from a point directly behind the dressing mill during all but the highest flow conditions. The steep nature of the Ystwyth valley has led to the development of incising watercourses and a waterfall (Nant y Graig).
	• Site is in an exposed valley, flow of tributary streams sensitive to high rainfall events. Run-off rates variable. High run-off rates also have an effect on diffuse pollution entering the Afon Ystwyth and erosion of geological, heritage and ecological features;
	• The Afon Ystwyth receives all surface and sub-surface drainage from the mine, causing it to fail European WFD standards for zinc, lead and cadmium.
	• The Ystwyth catchment falls within the Western Wales River Basin District The most recent classification results for the Western Wales River Basin District indicate that 42% of water bodies achieved good or better overall status (Western Wales River Basin Management Plan 2021 – 2027).
	• The main contaminants of concern to water quality in this study are zinc, lead, copper and cadmium.
	• No Groundwater Source Protection Zones present in area.
	• Sea trout fishery downstream on Ystwyth is classed as “at risk”.
	• There are some small bodies of water e.g. ponds across the site. Any diversion for an active treatment scheme may result in these drying up.
	• Part of site (nearest river – south of the minor road) is within Flood Zone 3 and Flood Zone 2. There does not appear to be risk of surface water (or reservoir) flooding on the site; although there are locations in proximity at risk.
	• The River Ystwyth is not considered a main river at the location of the study area (main river classification starting west of the B4343 approximately 7 km downstream).
		• River Basin Management Plan - National Programme of Measures (PoM) 2022 – CYM49 - Deliver metal (non-coal) minewater preventative and remediation programme as identified under the Metal Mine Strategy for Wales
		• Current WFD objectives for both Ystwyth waterbodies are to achieve “good” status by 2027. Uncertainty of achieving this is objective is acknowledged due to the presence of a European Site being associated with the waterbody.
		• Local Development Plan https://www.ceredigion.gov.uk/oldicm/utilities/action/act_download.cfm?mediaid=51572&langtoken=eng
		Policy DM11: Designing for Climate Change “*The LDP will help ensure that development addresses the implications of climate change by requiring that:*
		1. justified development in the flood zone is resilient and adaptable to the effects of flooding; and
		2. the long term sustainability of the development has been taken into account.”
		
		• CMT 'aspirations for the future' document (undated) http://www.cambrianmines.co.uk/Cambrian%20Mines%20Trust%20Wish%20List%20-%20FINAL%20VERSION.pdf
		• DAT Cwmystwyth Management and Protection Plan (2014) http://www.cambrianmines.co.uk/Cwmystwyth%20Mines%20Management%20and%20Protection%20Plan%20FINAL%20VERSION%20(small).pdf
		
		Item 3A of the above, relates to improvement of the area adjacent to the B4574 to the south of the mill - specifically Item 3A: Managing the stream course. This details the aspiration to prevent ongoing erosion in this area and as a result to prevent further erosion of the slimes dump on the southern side of the road which is directly polluting the River Ystwyth.
		
		It is noted that the project is an essential element of an integrated programme required to deliver WFD objectives. SIMCAT modelling suggests treating Pugh’s and Gill’s adits will provide: 30% removal of zinc, 8% Pb removal, 21% Cd and 2% Cu. Treating the point and diffuse sources to 100% removal would result in a reduction of 46% zinc, 43% lead, 42% Cd and 100% Cu (Coal Authority, 2019).

Air	• Site not located within a sensitive area, no known Air Quality Management issues or potential exceedances of Air Quality Standards.	• A press release from Ceredigion County Council in 2004 stated that concentrations of most of the priority air pollutants in Ceredigion are low and overall air quality in the County is very good.
Climate (for example: greenhouse gas	• Site is unlikely to be a significant carbon sink. • Study area includes land with known river flood risk (land closest to river south of minor road).	• Local Development Plan https://www.ceredigion.gov.uk/oldicm/utilities/action/act_download.cfm?mediaid=51572&langtoken=eng

emissions, impacts relevant to adaptation)		Policy DM11: Designing for Climate Change "*The LDP will help ensure that development addresses the implications of climate change by requiring that:* *1. justified development in the flood zone is resilient and adaptable to the effects of flooding; and* *2. the long term sustainability of the development has been taken into account."*
Material assets	• The site is accessed from the minor road that runs along the bottom of the valley on the northern side of the Afon Ystwyth, which links the B4574 to Rhayader to the southeast. • The site is crossed by numerous footpaths and is located within a 'right to roam' area. • National Cycle Route 81 passes alongside the site. • Overhead telecommunications and power cables are known in the vicinity of the site (Utilities Search Report 2022). • No railway/canal crossings or in proximity. • No current proposals for minerals extraction.	• Local Development Plans
Cultural heritage (including architectural and archaeological aspects)	• Rich heritage value on site. Site owned by CMT who have a Management and Protection plan and as part of this an aspirations list. • Work at the Cwmystwyth Mines can be dated back as far as the Bronze Age (c.2300 BC - c.800 BC), and continued intermittently over many centuries until all activity finally ceased in around 1939 and was later abandoned in 1950 (*HRS Wales: Cwmystwyth Lead Mine, Cwmystwyth, Ceredigion. Richard Scott Jones (BA, MA, MCIfA), Report No: 206, February 2019, Cultural Heritage & Archaeological Feasibility Study*). • Entire site north of minor road (& small area to south) is included within the Copa Hill/Cwmystwyth Lead, Copper and Zinc Mines Scheduled Ancient Monument (entered as Reference Cd145 on 2nd December 1997). The citation for the site notes that "*the monument comprises the remains of a lead mining complex, which also produced copper and zinc. Work at the Cwmystwyth Mines can be dated back as far as the Bronze Age (c.2300 BC - c.800 BC), and continued intermittently over many centuries until all activity finally ceased in around 1939. The visible features within the scheduled area include numerous shaft and adit entrances, areas of opencast working, water-management and transport systems, extraction and dressing processes with their power systems, as well as remains of office and residential buildings, garden plots and even an early 20th-century tennis court*". • The HRS Wales 2019 report notes "*The monument is of national importance for its potential to enhance and illustrate our knowledge and understanding of mining technology from the Bronze Age and as such it represents one of the earliest and best studied known metal mining sites in the British Isles*". • The site is within the eastern section of the Upland Ceredigion Landscape of Historic Interest. The Cwmystwyth area of this landscape is noted as "*an old industrial landscape. The remains of metal mining are spread across the floor and sides of the steep-sided, craggy valley of the Ystwyth."* http://dyfedarchaeology.org.uk/HLC/uplandceredigion/_uplandceredigioneast.htm#cwmystwyth • Given the above the HRS Wales 2019 report notes that "*all features associated with the mine are high value heritage assets*". • The HRS Wales 2019 report also notes "*Archaeological work at the Cwmystwyth Mines has been very extensive over the years with key published works ..... This sub surface exploration work has revealed an extraordinary level of preservation from continuous mining at the site from the Bronze Age up to 1950 when the mine was finally abandoned."* • Recorded archaeology on site comprises remains directly associated with the metal mining industry, including finds of Roman date, or remains indirectly associated with the industry such as abandoned worker cottages. This is a well-defined area comprising the industrial archaeology of the metal mining industry. Bronze age findings also to the east at Banc Tynddoll; • An archaeological watching brief during groundwork investigation works at the Cwmystwyth Lead Mine, managed to establish the character of the below ground deposits in the targeted areas. A small number of the trenches managed to expose finds and features of significance. The groundwork managed to confirm the positions of the buried Kingside Adit and the buried former course of the Nant y Gwaith stream. A trench positioned to the southwest of the remains of the 19th Century Crusher House, revealed a cobbled surface with reused packing material from mine waste was found to exist buried beneath turf and shallow top soil. This cobbled surface is very likely 19th Century in date and almost certainly the remains of a dressing floor that served the processing at the Crusher House. Although only a small section of this cobbled surface was exposed, it does suggest that this cobbled surface survives extensively in area surrounding the Crusher House. Ground works also exposed fragments of timber, the most significant timbers recovered were the remains of two former oak tramline sleepers, other interesting timbers	• CMT 'aspirations for the future' document (undated) http://www.cambrianmines.co.uk/Cambrian%20Mines%20Trust%20Wish%20List%20-%20FINAL%20VERSION.pdf • DAT Cwmystwyth Management and Protection Plan (2014) http://www.cambrianmines.co.uk/Cwmystwyth%20Mines%20Management%20and%20Protection%20Plan%20FINAL%20VERSION%20(small).pdf The above documents provide a brief summary of the Cambrian Mines Trust aspirations for future works at the Cwmystwyth Mines site. Item 8 in the document provides an aspiration to work with NRW for any future water treatment works at the site. Other aspirations which are of particular relevance to cultural heritage (both in terms of its protection and as part of a thriving local culture) and the threats on the Scheduled Monument in the documents include: ○ ITEM 2: Improved interpretation panels and signage; ○ ITEM 3: Improvement of the area adjacent to the B4574 to the south of the mill (including access); ○ ITEM 4: Improved Car Parking across the site area; ○ ITEM 5: Re-opening of the original track to the mine yard; ○ ITEM 6: Restoration of the portal to Level Fawr and improvement of underground access; ○ ITEM 7: Restoration and improvement to the packwall entranceway and portal to Taylor's Level; ○ ITEM 9: Rebuilding of Neville Place and Staff House; ○ ITEM 10: Hydro-Electric Scheme; ○ ITEM 11: Establishment of a 'Mid Wales Mining Trail' The above document also notes that "*A number of factors are contributing to the deterioration of the site. These include misuse of the site by off road vehicles, fly tipping and vandalism. Further damage has occurred through the digging out of spoil tips for building materials. These can all cause significant damage to the designated features and habitats. Damage through erosion is also being caused by flash flooding, where streams are exposing archaeological remains, undermining structures and also eroding some of the contaminated fines and slimes dumps on the site, which leads to polluted material draining straight into the River Ystwyth. Below ground, the mine workings are also noticeably deteriorating through natural decay and movement. Underground revetment walls are failing and timber artefacts (supports, ladders, launders etc) are rotting*." • Future Generations Act https://gov.wales/topics/people-and-communities/people/future-generations-act/?lang=en The well-being goal of most relevance here being - a Wales of vibrant culture [and thriving Welsh language]. • NRW Well-being Statement https://naturalresources.wales/media/681164/nrw-well-being-statement.pdf As part of the above NRW have committed to *"protect Wales' cultural heritage and archaeology across the land and water we manage"* and *"Promote the cultural importance of our landscapes and seascapes as part of Wales' heritage"*

	recovered were five short lengths of degraded timber planks, possibly from a former wood lined chute positioned alongside the Nant y Gwaith. • There are no listed features on the Cwmystwyth site. The nearest are located at Cwmystwyth (Briwnant Cottage and Attached Cottage – Grade II) located approximately 1.5km southwest and Ty Llwyd and Outbuilding at Ty Llwyd located approximately 2.1km to the northeast). • Due to the rich heritage value of the site, presence of above and below ground archaeology and its national importance the entirety of the Cwmystwyth site has been noted in the HRS Wales 2019 report as being of 'high' archaeological sensitivity.	• Ceredigion Well-being plan (Ceredigion Local Well-being Plan 2018-2023 - Agreed by Ceredigion Public Services Board 16 April 2018 Published 1 May 2018) https://www.ceredigion.gov.uk/media/3956/local-well-being-plan-2018-2023.pdf The delivery of the Ceredigion Well-being Plan includes a period of asset mapping – this will research further how communities work, how people see the relationship between themselves and the places where they live, work and visit, and will investigate how the assets (including cultural), contribute to well-being. • "*Guide to good practice on using the register of landscapes of historic interest in Wales in the planning and development process*", *Revised (2nd) edition including revisions to the Assessment process (ASIDOHL2), 2007.* All landscape areas identified on the Register (including Upper Ceredigion) are of national importance in the Welsh context. There are three key principles underpinning the identification of historic landscape areas: o the conservation of the key characteristics of historic landscapes as those landscapes evolve; o the conservation of historic landscapes ensuring the transfer of maximum historic meaning and value when contemplating landscape change; and o key historic characteristics within historic landscapes, like historic buildings or archaeological sites, are irreplaceable. As part of this there is an expectation that there is a *"need to assess the potential effects of a development, in terms of any lasting alteration it will cause, in relation to the whole of the historic landscape on the Register, not just the elements or characteristics directly affected in the 'footprint' area*". It is also noted that "*The effects of direct, physical impacts are irreversible, but equally damaging, indirect impacts can occur through the severance or disruption of the functional or visual connections between elements, or through the consequential degradation of the visual or other amenity of elements, or through a combination of these factors*". • http://dyfedarchaeology.org.uk/HLC/uplandceredigion/cwmystwyth.htm notes that the stone built structures (including industrial) in the Cwmystwyth part of the Upland Ceredigion Historic Landscape Character area are "*in a perilous condition*". • Local Development Plan https://www.ceredigion.gov.uk/oldicm/utilities/action/act_download.cfm?mediaid=51572&langtoken=eng Policy DM19: Historic and Cultural Landscape "Development affecting landscapes or buildings which are of historical or cultural importance and make an important contribution to the character and interest of the local area, will be permitted where the distinctive appearance, architectural integrity or their settings will not be significantly adversely affected. Where possible development should enhance these qualities and special character." Local heritage interest in site and extensive local knowledge of workings and their importance/threats to them. There is potential for the project to deliver against the above through working with the CMT to support their aspirations for the site in relation to preservation of its cultural heritage. These include exploring opportunities for consolidation of existing structures on site, providing new viewpoint locations and education through interpretation panels and improved access. Recording and evaluation during site works will also provide additional baseline information to add to the wealth of knowledge regarding the historic interest of this site.
Landscape	• The site is not within an AONB or National Park.	• NRW Well-being Statement https://naturalresources.wales/media/681164/nrw-well-being-statement.pdf

- Landmap confirms the site is within the following, all of which have been categorised as outstanding or high landscape value:
    - Cwmystwyth Geological Landscape (CRDGNGL278) which is noted as a glacial mountain valley;
    - Ponterwyd upland grassland mosaic Landscape Habitat (CRDGNLH038);
    - Upper Ystwyth Valley Visual and Sensory Landscape (CRDGNVS331), noted as open upland valleys;
    - Cwmystwyth Historic Landscape (CRDGNHL102);
    - Lead Mining Landscape (cultural landscape – CRDGNCL036).
- The study area falls within the Upper Highlands Special Landscape Area (SLA - 12) (Local Development plan – Proposals Map 4) https://www.ceredigion.gov.uk/oldicm/utilities/action/act_download.cfm?mediaid=51583&langtoken=eng and https://www.ceredigion.gov.uk/oldicm/utilities/action/act_download.cfm?mediaid=52053&langtoken=eng An SLA being a non-statutory designation applied by the local planning authority to define areas of high landscape importance within their administrative boundary. The area is noted as "*An extensive upland area, centred upon Pumlumon forming the eastern edge of Ceredigion……Includes a number of SSSIs and the Elenydd SAC and Elenydd-Mallaen SPA*".
- The site is within the north-western section of the Upland Ceredigion Landscape of Historic Interest.
- Lingard Farrow Styles (*NRW Metal Mine Feasibility, Preliminary Landscape Appraisal, Cwmystwyth, Ceredigion, Prepared for: NRW on behalf of CA Ref: 2997, February 2019*) note that "*residents are unlikely to readily obtain views [to any finalised scheme in] the mining area from their properties due to building orientation and screening by vegetation and topography*."
- There are significant views into the site form the minor road that passes through it and Cycle 81 which follows the road.
- Lingard Farrow Styles in the 2019 study also note that there is an "*impressive view*" into the mine from along the Borth to Devil's Bridge to Pontrhydfendigaid Trail/PRoW 20/61/D as it passes to the west of the site (before it turns westwards).

The above states that landscapes have played a significant role in the development of distinct cultural practices, such as local building techniques which use local materials and locally specific art and literature.

- Landmap notes the following key threats/management recommendations of relevance to the study area:
    - Geological Landscape – "*Ensure that no features or natural systems of geological or geomorphological significance in the area (incl. mines) are lost or damaged (e.g. due to development or forestry)*";
    - Historic Landscape – Acknowledgement that "*management of mining related features is problematic for a variety of reasons, including issues of access, safety, damage, degradation, conservation and pollution."* Principle Management recommendation being to "*Conserve historic landscape elements where possible, work towards developing short and long term management strategy*."
    - Cultural Landscape – it is noted that the condition of the landscape is "Improving (- through the efforts of community-based regeneration and the Welsh Mines Preservation Trust and the Welsh Mines Society.)" The principal management recommendation being to provide "Support for community-based regeneration initiatives, the Welsh Mines Preservation Trust and the Welsh Mines Society." As well as "*selective reconstruction/consolidation of important features*".

- The LANDMAP Guidance Note 1: LANDMAP and Special Landscape Areas 2017 https://cdn.naturalresources.wales/media/680613/landmap-guidance-note-1-landmap-slas-2017.pdf?mode=pad&rnd=131472694160000000 notes that "*Landscapes designated as a SLA may be unique, exceptional or distinctive to the local authority area."*

  "*The SLA designation can be used to raise awareness of the special characteristics, qualities and importance of a locally valued landscape so that it can be promoted as a positive management tool for targeted landscape management guidelines and grant bids. It can also help raise awareness and recognition for valued landscapes outside those that are nationally designated (e.g. National Parks and AONBs)."*

  SLA-specific design guidance may be available from the local authority (to be confirmed). This guidance where available is intended to aid planners and developers to "*promote development that enhances local landscape character, distinctiveness and landscape quality*".

- Specific policy/management issues noted for SLA 11 that are of most relevance to this project (https://www.ceredigion.gov.uk/oldicm/utilities/action/act_download.cfm?mediaid=52053&langtoken=eng) include:

    - Management of historic landscape elements.
    - Management of habitats – both in terms of those with statutory protection and increase in variety elsewhere.
    - Management and enhancement of key habitats and species (Section 42 and Local Biodiversity Action Plan).
    - Ecosystem approach should be incorporated into development.
    - Potential for landscape scale initiatives and biodiversity enhancements.
    - Reinforcement of a sense of 'bro' through appropriate design measures.

- Local Development Plan https://www.ceredigion.gov.uk/oldicm/utilities/action/act_download.cfm?mediaid=51572&langtoken=eng

  Policy DM17: General Landscape *"Development will be permitted provided that it does not have a significant adverse effect on the qualities and special character of the visual, historic, geological, ecological or cultural landscapes and seascapes of Ceredigion, the National Parks and surrounding area by:*
  1. causing significant visual intrusion;
  2. being insensitively and unsympathetically sited within the landscape;
  3. introducing or intensifying a use which is incompatible with its location;
  4. failing to harmonise with, or enhance the landform and landscape; and /or

		5. losing or failing to incorporate important traditional features, patterns, structures and layout of settlements and landscapes. *Where possible development should enhance these qualities and special character. "* Policy DM18: Special Landscape Areas (SLAs) *"Proposals for development within Special Landscape Areas (SLAs) will be assessed in relation to scale and nature of development and their ability to be accommodated without significant damage to, and where possible the enhancement of the valued visual, historic, geological, ecological and cultural characteristics of the SLA."* Policy DM19: Historic and Cultural Landscape *"Development affecting landscapes or buildings which are of historical or cultural importance and make an important contribution to the character and interest of the local area, will be permitted where the distinctive appearance, architectural integrity or their settings will not be significantly adversely affected. Where possible development should enhance these qualities and special character."* There is potential for the project to deliver against the above through exploring sensitive design of proposed infrastructure and considering opportunities for access improvements, signage/interpretation panels and new viewpoint locations. The prominent views of the site (from the road, cycle way and PRoW 20/61/D) in particular should be considered. The scheme should not detract from the current iconic views of the site.
Cumulative effects	• Other NRW led remediation projects at metal mines in Ceredigion include Frongoch-Wemyss, Cwm Rheidol, Abbey Consols and Esgair Mwyn • With the exception of the Frongoch-Wemyss site all are on different catchments to the Cwmystwyth scheme however there may be cumulative benefits as a result of the works that should be considered for these (e.g. linked heritage trails and signage). • The Cwmystwyth, Frongoch and Wemyss mine sites all discharge into the River Ystwyth. Cwmystwyth discharges into the river directly at site; Frongoch via the Nant Cell; and Wemyss (encompassing Wemyss site, Wemyss tips and Frongoch Adit) via the Nant Cwmnewydion and the Afon Magwr. • The Cwmystwyth Mine lies approximately 7.5 km upstream from the confluence of the Nant Cell (discharge from Frongoch) and Ystwyth. The Ystwyth then flows downstream a further 1.8 km before passing through the Grogwynion SAC (Calaminarian grassland). The Afon Magwr joins the Ystwyth approximately 5.2 km downstream of the SAC (although it is upstream from one of the Gro Ystwyth SSSI units). • Cumulative and in-combination effects on the Grogwynion SAC will require consideration as proposals develop. • Cumulative and in combination effects on marine designations as a result of all schemes may also need to be considered. • Baseline information regarding other projects (proposed/in construction) and plans, has not been obtained at this feasibility stage.	Identified threats, pressures and activities with impacts on the Grogwynion SAC are outlined in the biodiversity section above.

3.0 Summary of options

3.1 Introduction

Through site non-intrusive investigations and assessments, as outlined within the Cwmystwyth Metal Mine Feasibility Report (Coal Authority, 2022), key pollution sources and pathways to the Ystwyth River have been identified for the site. These include (see **Figure 2-1** for site feature locations):

- Pollution emanating from Pugh's Adit, as well as from Gill's Lower Adit and Kingside Adit.
- The Nant y Gwaith disappears in sections across the dressing floor, and the culvert under the road is blocked by stone washed down by the river. The Nant y Gwaith picks up contamination from the tips as it flows across the dressing floor.
- Scour of the bank of the Nant y Graig is causing contamination of the stream and making the channel unstable. The Nant y Graig is also receiving contamination from the tips.
- Spoil adjacent to the Nant y Watcyn and Nant yr Onnen is being eroded and undercut and is contaminating the streams.
- Spoil heaps are located throughout the site with slimes (extra fine spoil) present adjacent to, and causing contamination of, the Afon Ystwyth.

For long-term management of the above mine legacy pollution and to achieve the project objectives (ECOR Section 1.4), interventions are needed to address the above referenced pollution sources and pathways to the Ystwyth River. Through workshops and site discussions by technical specialists from NRW, the Coal Authority and other technical partners, three broad interventions were identified as needing to be delivered:

1: Preventing clean water from Afon Ystwyth tributaries (Onnen, Watcyn, Gwaith, Graig) picking up contamination from running over/through extensive mine spoil.

2: Dealing with contaminated runoff and drainage from the adits and extensive areas of exposed mining spoil in proximity to Afon Ystwyth and tributaries.

3: Creation of long term stable spoil deposits within mine site, prevent encroachment onto public road and associated drainage.

A number of options have been considered in which to deliver each of the three broad interventions, this section of the ECOR discusses and documents the appraisal of these options, before presenting the preferred option and its outline design.

3.2 Options rejected during feasibility stage

The following alternatives have been considered to deliver the project or to address one of the pollution linkages outlined in section 3.1 above. However, these have options have been rejected on grounds of feasibility or failure to meet the project objectives.

Treatment downstream of Afon Yswyth downstream of Grogwynion SAC.

Undertaking treatment outside of the boundaries of all designated sites has been considered. However, given the likely sediment transport connection between Cwmystwyth and Grogwynion avoiding potential impact on the Grogwynion SAC would involve not mitigating sediment pollution from running off the Cwmystwyth mine site. Not mitigating this pollution linkage would likely effectively exclude the project contributing to WFD status change in the waterbodies between Cwmystwyth and Grogwynion SAC. Further, technical limitations on the scale of treatment make removal of dissolved metals by treating the full flow of the Afon Ystwyth practically unfeasible. Overall, this option would result in no effective reduction in levels of metal pollution in the upper reaches of the Afon Ystwyth (waterbody GB110063041720, Ystwyth headwaters to confluence with Nant Cell) precluding the chance of WFD status change in this water body. Therefore this option would not meet the project objective regarding the contribution to WFD status change.

Treatment outside boundaries of designated sites.

Consideration was given to options to collect contaminated water for treatment outside the boundaries of the designated sites on the Cwmystwyth Mine (Elenydd SAC, Mywngloddfa Cwmystwyth SSSI, Copa Hill/Cwmystwyth Lead, Copper and Zinc Mines Scheduled Ancient Monument). This would require collection of all discharges from the Cwmystwyth Mine and transfer these to a treatment facility outside the site boundary. This presented the following limitations:

- Although the treatment building would be outside the protected areas infrastructure to collect and pump the mine water outflows would still be required within the boundary of the sensitive areas. Therefore although the disturbed area may be slightly reduced this option would still require construction within sensitive habitats of the SAC and SSSI and within the scheduled monument to capture contaminated water at source. However, there would be no permanent land take within the SAC, SSSI and Scheduled Monument to accommodate a treatment plant.
- Transfer of the mine water would require additional continuous pumping which would increase energy requirements and the associate carbon emissions.
- Lack of erosion protection would result in continued input of metalliferous material and leaching into the Afon Ystwyth and its tributaries. Reducing the effectiveness of the pollution mitigation project.

This option was eliminated from further consideration as this would incur significant additional running costs for pumping contaminated water to a treatment plant, additional land take required for a treatment plant and the visual impacts on residential dwellings in likely candidate areas for treatment station without a significant reduction in the amount of disturbance within the designated sites.

Phytostabilisation/Vegetative capping or artificial capping of spoil heaps

Using in-situ treatment this method would seek to establish vegetation on spoil heaps to reduce the erosion and associated contaminated runoff from the site entering the Afon Ystwyth and its tributaries. This would be achieved by either application of a proprietary product to provide a growing and stabilisation medium or by capping with liner and topping with clean soil. In either option the physical soil characteristics of the site would be significantly altered likely resulting in the loss by modification of substantial amounts of calaminarian grassland habitat. This option was eliminated due to questions about the capital costs of capping large areas, the permanent loss of substantial areas of the calaminarian grassland and the modification of the cultural heritage context of the spoil heaps as they would be obscured by vegetation.

Reinstatement of historical leat above the Cwmystwyth mine

This option considered the possibility of restoring a historical leat above the Cwmystwyth mines site. The leat would transfer surface water from all tributaries along the leat and through the mine site eliminating scour, erosion and infiltration through mine spoil which currently occurs as tributaries travel through the mine site reducing the amounts of dissolved and particulate metals entering the Afon Ystwyth. Reinstatement of the leat would enhance the mining heritage context of the site as an example of a working original mining feature. However, the physical condition of the leat is likely to be poor and due to the topography areas for engineering works are likely to be large and require significant access through the mine site. Redirection of all flow through the leat will also significantly modify the geomorphological and hydrological function of the site as the tributaries will no longer carry surface water. Therefore this option was discounted due to the technical difficulties in restoring the leat, likely broad access across the site disrupting the calaminarian habitat and the further modification through substantial changes in site hydrology.

Removal and disposal of contaminated spoil deposits from Ystwyth floodplain and tributaries

Removal and disposal of the most contaminated materials from within the Ystwyth floodplain and tributaries would reduce the amounts of contaminated particulates mobilised by the river and tributaries contributing to pollution. However, this would result in large quantities of contaminated waste being removed to landfill which may affect local or regional landfill capacity. There would also likely be widespread disturbance of habitats within the site. Removal and reprofiling of the spoil would also damage the cultural heritage context provided by the spoil heaps.

Passive mine water treatment

Several systems of passive treat were considered during feasibility. All would involve construction of a filter bed filled with a medium to provide treatment of the metal contaminated water. The lack of readily available costing made comparing the economic viability of these methodologies impractical. These methods would all require significant land take in comparison to an active treatment plan. This

would potentially increase the project footprint in a sensitive landscape and habitat. Large treatment beds would also present a larger challenge to obscure from views when compared to active systems which could be housed in a building which could be made to appear similar to other buildings within the valley. Due to the large land take, uncertainty over costs and technical infeasibility of some methods the option for passive treatment was discounted in favour of an active treatment option which would be likely to have a smaller overall footprint and clearer predictions for construction and running costs.

3.3 Preferred Option / Outline Design

Decisions on the most environmentally favourable option have been based on the options which avoid or are likely to minimise negative effects on the highest importance receptors. Particular attention has been paid to Calaminarian habitats which are a feature of the Elynydd SAC and to the landscape and cultural heritage value of the Scheduled Monument and historic mining features.

Further to consideration of the key positive and negative environmental aspects, along with technical feasibility and costs of each option. The preferred options for delivering the broad interventions that will reduce metal loading into the Afon Ystwyth and subsequently deliver water quality betterment, are shown on a drawing in **Figure 3-1** and listed below:

The main interventions proposed are:

Drainage, Channel Interventions and Mine Water Capture

The following engineering works are to be completed in advance of the construction of the proposed active mine water treatment scheme (MWTS). The purpose of these works is to prevent direct erosion, redirect or separate existing clean water flows away from contamination sources, removal/relocation of contaminated slimes (fine grained metal ore processing residues) material within the Ystwyth flood plain and the capture of known point source contamination (mine water discharges) for future treatment. Works on the water courses crossing the mine site comprise:

- Nant y Gwaith – Provision of new impermeable channel lining (concrete with cobble facing to floor & walls), fully reinstating the former mining channel previously used to convey discharged water from the hydro-power house down to the culvert beneath the public road.
- Nant y Graig, Nant y Watcyn and Nant yr Onnen - Engineering works to protect banks where mine spoil is exposed to erosion / undermining (dry stone wall facing /gabion erosion protection), in combination with a lined channel (Nant y Graig only) across the extensive delta of spoil and sediments deposited by the stream onto the main river channel floodplain.
- Afon Ystwyth – Provision of erosion protection (gabion) on northern riverbank at confluence with Nant y Graig (delta deposit banks either side of the lined channel discharge).

Other engineering works comprise:

- a new interceptor drain to collect uncontaminated run-off from above tips and transfer flows into the new Nant y Gwaith channel;

- a new interceptor drain to collect contaminated run-off from spoil deposits to the north of the identified mine water discharge at Kingside Adit;
- a new toe drain collecting mine water seepages and contaminated run-off along the north side of the public road; and
- new drains to collect mine water seepages on the main river northern (right-hand side) floodplain.

New drainage designed to capture discharge from:

- Pugh's Adit;
- Gill's Lower Adit; and
- Kingside Adit

Ancillary works associated with the above comprises:

- Construction of a Pumping Well at the convergence of the various drainage runs, with a pumped connection to the new mine water treatment facility. The well will incorporate an Emergency Overflow discharging directly into the adjacent main river channel.
- A new road-side ditch on the north side of the public road for road drainage and to prevent vehicular access onto the Scheduled Monument to the north.
- Removal/relocation on site of the mining slimes deposit to the south of the public road (off-site removal a last resort if treatment and retention on site is not permitted).
- Preparation of an area of ground, including ground stabilisation works to host the proposed mine water treatment plant and associated car parking / off-road access route.

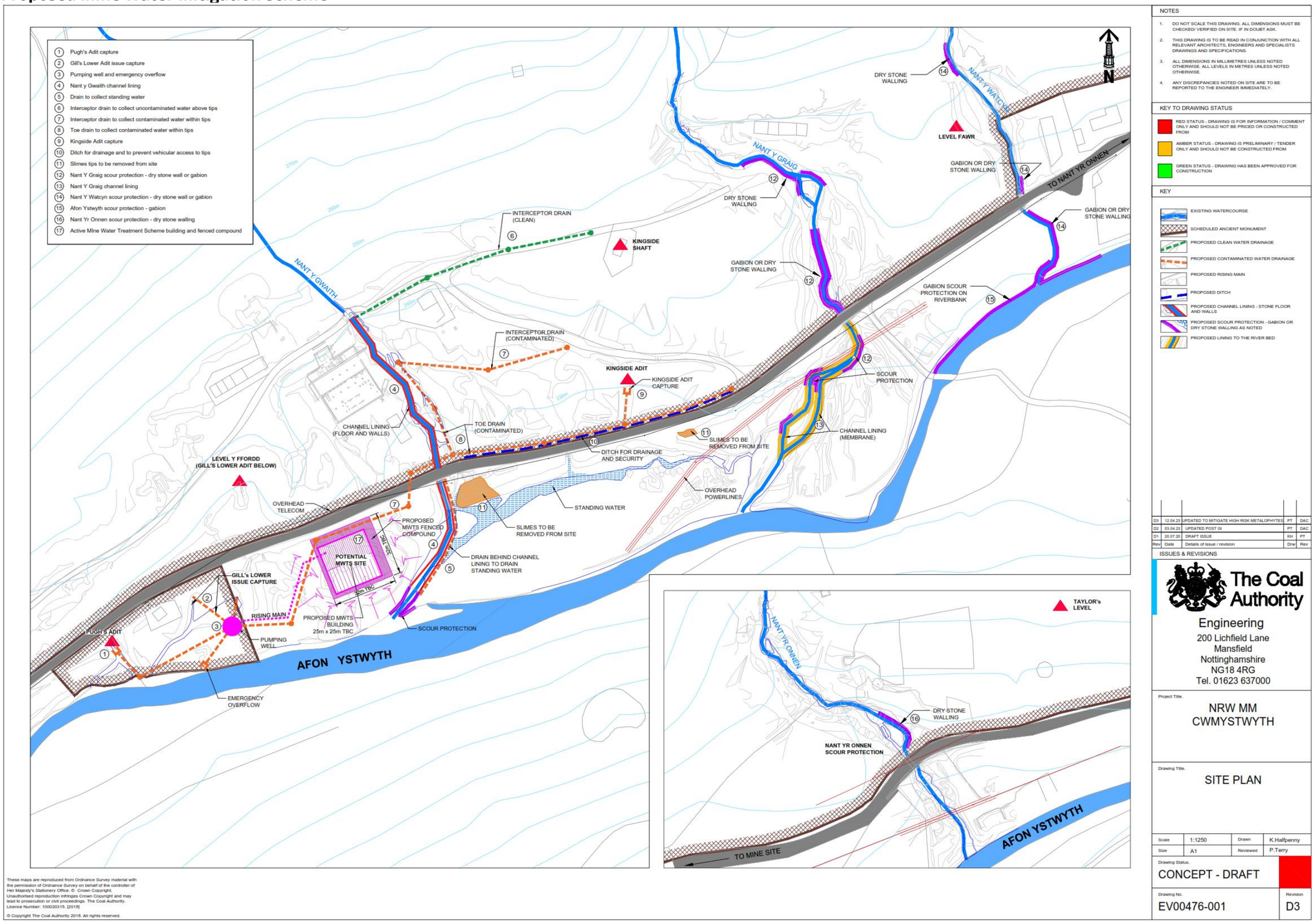
In order to carry out these works wider temporary construction areas will be required to accommodate the contractor's compound and welfare area, machine access corridors and individual work areas to allow for a safe working area and temporary storage of spoil and construction materials.

Active Mine Water Treatment Scheme

Following the completion of the intervention measures detailed above a further c.12 months of water quality and flow monitoring data collection will be carried out. This will be used to confirm and refine the treatment process detail within the MWTS facility. Final process design and the commencement of construction of the MWTS will follow after this (subject to any extant planning conditions). At this stage, it has been assumed that a full scale active water treatment process will be employed (worst case) that will require the following elements:

- Construction of a MWTS building and fenced compound to incorporate off road parking, deliveries and waste management.
- Installation of a pumping facility and rising main from the Pumping Well to the MWTS building.
- Continued operation and maintenance of the MWTS with a minimum design life of 40 years (with major capital refurbishment at Year 20).

Figure 3-1: Proposed Mine Water Mitigation Scheme



4.0 Environmental Impact Assessment (EIA) Screening

4.1 Introduction

Given nature of works set out within the outline design, there project will require planning consent. As the project lies within the boundary of multiple sensitive sites and receptors, an Environmental Impact Assessment screening opinion has been sought from Ceredigion County Council in accordance with the Town and Country planning (Environmental Impact Assessment) Regulations 2017.

The following sections set out the information that has been provided to the Local Planning Authority to assist with the screening and scoping of the project under the relevant regulations.

4.2 Characteristics of the Improvement Works

The characteristics of the project in relation to its effects on the environment and natural resources are described in **Table 4-1**.

Table 4-1: Description of the main characteristics of the improvement works.

Area occupied by the Project: (Inclusive of temporary compounds and access arrangements)	The total area occupied by the works will be approximately 2.31 hectares.
Cumulative effects with other existing or approved projects:	These works are part of a programme of works to improve the water quality in the Afon Ystwyth. No other known projects at this time that do not form part of this programme.
Use of natural resources:	Construction activities are unlikely to require large quantities of natural resources. Operation of treatment plant will have ongoing energy requirements which will have associated carbon emissions and use of resources.
Production of waste:	Materials balance on the project is likely to be broadly neutral. Mine spoil will be redistributed on site rather than disposed of at landfill.
Pollution and nuisances:	The project will reduce levels of water-borne pollution. Construction activities may cause some noise which could affect local residents, but this will be limited to certain activities and temporary in duration.
Risk of major accident or disasters relevant to the improvement works,	Deep excavations (>4m) within loose spoil has potential to result in collapse or land slip, these would

including those caused by climate change:	likely be minor due to limited working areas. Major landslips would not be anticipated as a result of works.
Risks to human health:	None anticipated. The project will prevent further metal contaminated water and solids entering the Afon Ystwyth.

4.3 Location of the Improvement Works

Refer to Table 2-1 which describes the environmental baseline and identifies the sensitivities of the geographical area in proximity of the improvement works.

4.4 Characteristics of the Potential Impact

In order to assist with determining whether any of the characteristics of the proposed works are likely to have a significant effect on the surrounding environment the Table 4-2 describes the characteristics of the likely effects arising from implementation of the project. The information provided duplicates that provided to the LPA. No judgement has been made regarding the likely significance of any environmental effects so as not to prejudice the decision of the determining officer.

Table 4-3: Characteristics of potentially significant impacts by environmental topic area

Environmental Topic	Sensitive Sites or Receptors	Potential for Significant Effects and Environmental Opportunities	Avoidance and Mitigation Strategy
Population and Human Health	4no. Residential dwellings within 300m. B4574 Pontarfynach to Rhayader	<u>Construction Phase</u> Construction noise and vehicular access routes have potential to create nuisance for local residents and users of Public Right of Way (PRoW). Temporary road closures may be necessary during some phases of work adjacent to public highway. This may increase response times for emergency services. <u>Operational Phase</u> Mine water treatment plant is unlikely to be a source of any odour or noise which would be considered a nuisance. Additionally the closest residential property is approximately 300m from the treatment plant. Maintenance of active treatment will slightly increase traffic along B4574 likely to comprise occasional HGV deliveries and regular car/van journeys. These additional journeys are not anticipated to be sufficiently frequent or numerous that this would constitute a significant alteration of daily traffic volumes. <u>Opportunities</u> Improvement of interpretation panels and signage along with upgrading car parking facilities will contribute to Cambrian Mines' Trust aspirations to improve the recreational and educational use of the site.	It is expected that standard construction good practice (e.g. netregs or Ciria guidance) will be followed and mitigation measures to minimise nuisance caused by noise and visual intrusion will be employed on site. Residents and other interested stakeholders will be consulted on and informed of any construction activities as the project progresses. These requirements will form part of the project tender requirements which will ensure these are considered within the delivery contractor's CEMP. Temporary closure of PRoW will be undertaken with further consultation of the Ceredigion Council PROW Officer. Temporary road closures and diversions will be undertaken in consultation with the Local Highway Authority following their procedures for Temporary Traffic Regulation Orders.
	Public Right of Way – 20/61/D Borth to Devil's Bridge to Pontrhydfendigaid Trail	<u>Construction Phase</u> Temporary closure of PRoW is likely to be required during construction activities for safety reasons. Construction noise and visual intrusion from plant, machinery, personnel and other construction activity is likely to temporarily reduce the recreational value of this asset. <u>Operational Phase</u> No permanent changes are expected to public access to the PRoW. Potential for visual changes which could alter the recreational value of this PRoW are considered within the landscape topic, below.	
	National Cycle Route 81	<u>Construction Phase</u> Temporary road closures may be necessary during some phases of work adjacent to public highway. Diversions will likely be lengthy and via busier highways. <u>Operational Phase</u> No change anticipated.	
Biodiversity and Resilience of Ecosystems	Elynydd SAC & SSSI	<u>Construction Phase</u> Disturbance of habitats within Elenydd SAC during construction is likely to occur across an area of 2.31ha which covers 0.03% of the total designated site. The affected area falls within two habitat features of interest within the SAC; • Calaminarian grassland (Habitat code: 6130) of which the project will cause disturbance within 9% of the total available of this habitat type	A project Habitats Regulations Assessment (HRA) has been undertaken to determine the potential effects on the Natural 2000 network sites. Potential for adverse effect upon Grogwynion SAC has been identified through Appropriate Assessment stage. The project must seek to proceed via HRA Derogation Notice. SSSI assent will be required for any work within or adjacent to the following SSSIs:

Environmental Topic	Sensitive Sites or Receptors	Potential for Significant Effects and Environmental Opportunities	Avoidance and Mitigation Strategy
		• European dry heath (Habitat code: 4030) of which less than 0.01% of the total habitat area would be subjected to disturbance. No effect is anticipated on any other Annex I habitat or Annex II species that are qualifying features for this designation. <u>Operational Phase</u> Permanent land take for a treatment plant building, surface water drainage and erosion protection would result in permanent loss of approximately 0.34ha calaminarian grassland habitat. No overall change is anticipated in the availability or quality of European Dry Heath during operation due to natural recolonization following construction activity. Further consideration of the specific effects on metallophyte rich calaminarian grassland is given under the section relating to Mwyngloddfa Cwmystwyth SSSI, below, which comprises part of this SAC.	• Elenydd SSSI • Mwyngloddfa Cwmystwyth SSSI The following further detailed surveys will be undertaken: • Bat surveys - comprising summer, swarming and hibernation activity at adits, shafts and mining building remains. • Breeding bird surveys – with focus on peregrine, merlin and chough • Updated checks for water vole activity and otter resting places prior to commencement of construction • Detailed lower plant survey work to inform avoidance and appropriate mitigation measures. Following any survey discovering a protected species the advice of an appropriately licensed ecologist will be sought to develop appropriate mitigation and prepare an application for a protected species license.
	Mwyngloddfa Cwmystwyth SSSI Also containing: Habitats of Principal Importance: Calaminarian grassland Protected Species: Bats	<u>Construction Phase</u> Construction activity will disturb an area within the SSSI totalling 16.3% of the total designated area. As part of the preliminary ecological appraisal areas known to support high value metallophyte lichen and bryophyte species have been mapped. The total known habitat supporting these species was estimated at 5.77 hectares. The project boundary encroaches on an area covering 0.7 hectares of this known coverage. Therefore it is estimated that 12.1% of the current known highest value metallophyte habitat within the SSSI will be affected by the project. Excavation and vehicle movements have potential to damage and destroy individual specimens of nationally rare metallophyte lichens and bryophytes associated with mine spoil which are a primary feature of the site's interest. Due to their slow growth damage to individual lichen species resulting from disturbance could require long recovery times. Therefore, although temporary, damage from construction may have long recovery times and therefore have limited reversibility. Noise and vibration from construction activities in proximity of shafts and adits has potential to disturb roosting bats which are a feature of biological interest at this site which is described as a regionally significant hibernation site. Disturbance of roosting bats during hibernation would affect overwintering success thereby leading to deaths and reduced populations of bats at the site. <u>Operational Phase</u> New surface water drainage and redistribution of mine spoil have potential to change the distribution of Calaminarian habitats on site. Changes in soil/spoil moisture levels due to drainage will potentially permanently alter distribution of lichen and bryophyte species on site. Modifications to adit portals could prevent access to bat roosting and hibernation habitat if access grilles were installed. Stopping up or alteration of mine entrances	

Environmental Topic	Sensitive Sites or Receptors	Potential for Significant Effects and Environmental Opportunities	Avoidance and Mitigation Strategy
		could modify below ground airflow permanently negatively changing conditions for suitability as a hibernation roost. Opportunities Stabilisation of mine spoil prevents loss of physical substrate by erosion processes and secures physical features that support Calaminarian habitats from longer term degradation. Effects on the geological aspects of this site are considered within the Land topic, below.	
	Grogwynion SAC & Gro Ystwyth SSSI	Construction Phase No direct effect on Grogwynion SAC are anticipated during the construction phase. Operational Phase Preventing erosion of mine spoil on site will to reduce volumes of metalliferous course and fine grained material entering the Afon Ystwyth. This has potential to reduce deposition of metalliferous sediment further down the Ystwyth catchment. Grogwynion SAC is dependent upon metalliferous sediment deposition within the river shingles to maintain metallophtye habitat. Effects from this change would not be immediate but has potential to cause decline in quality of habitat for metallophyte species, which are very high value and a key feature of the Grogwynion SAC, over the long term. However, a poor understanding of the physical processes underlying the function of the Grogwynion SAC leaves a large degree of uncertainty on the magnitude of any potential impact.	
	Elynydd-Mallaen SPA & SSSI	Construction Phase Although beyond the boundary of the site, anthropogenic disturbance through noise and line of sight to construction activities has potential to affect breeding merlin and peregrine which are key features of the Elynydd-Mallaen SPA. Known peregrine nesting sites lie within 100m of the proposed works. Habitat suitable for breeding merlin lies approximately 10m from the works. This may result in reduced breeding success of nationally important species during construction. Operational Phase No effects are expected on continued use of merlin or peregrine nesting sites and habitat as a result of operation of the site. No effect on foraging or resting opportunities for these species using habitats within or outside the SPA boundary.	
	Protected Species: Chough Otter Water vole	Construction Phase Works in proximity of adits or shafts are likely to cause noise and vibrations which could affect any chough present resulting in temporary disturbance and abandonment of a nesting site. Excavation and movement of vehicles, machinery and personnel adjacent or within river banks have potential to affect otters and water voles through temporary anthropogenic disturbance or destruction of a resting place. However, a	

Environmental Topic	Sensitive Sites or Receptors	Potential for Significant Effects and Environmental Opportunities	Avoidance and Mitigation Strategy
		preliminary ecological appraisal has given limited suitability within the project area for resting and foraging opportunities for these species. Although otter are known to be present on the Ystwyth it is likely that these only move through this section of the river and do not utilise it for resting or foraging. Water voles are known in the upper reaches of tributaries of the Afon Ystwyth which run across the site but habitats are limited in their capability to support foraging or burrows. Therefore it is anticipated that these species are unlikely to be using habitat within the site, but presence cannot be excluded. Operational Phase Modification of adit portals or shafts through installation of grilles or stopping up would reduce or prevent access to suitable resting sites for chough. Installation of erosion protection will harden sections of the banks of Afon Ystwyth and tributaries within the site. These will not reduce the site's suitability for commuting otter. These sections are also unlikely to be suitable for resting or foraging water vole. Therefore there will be no effect on habitat availability for these species.	
Land	Mwyngloddfa Cwmystwyth SSSI (geological features)	Construction Phase Construction of surface water drainage, treatment plant and treatment of slime heaps will cause temporary disturbance of the spoil material a feature for which the SSSI is designated. The disturbance will be up to 4m in depth and of a width required to enable safe construction. No change is expected in the underground workings or mineral lodes that form the other features of interest. Operational Phase Erosion protection works will eliminate or greatly reduce erosion of spoil heaps at the site which is a long term threat to the feature's geological integrity.	Construction Phase Drainage trenches will be backfilled using previously excavated spoil material to reinstate appearance and maintain mineralised deposits in situ.
	Elenydd SSSI (geological features)	Construction Phase Construction of scour protection on the Nant Y Watcyn will occur on the boundary between the Elenydd SSSI and Mwyngloddfa Cwmystwyth SSSI and a small area of scour protection on the Nant Yr Onnen will occur within the Elenydd SSSI. These works will not alter the surface or sub-surface mineral lodes which are the feature of interest for this site. Operational Phase There will be no permanent change to the geological interest of the Elenydd SSSI.	No changes to the interest feature therefore no mitigation is considered necessary.
Soil	Considerable heavy metal contaminated ground present throughout the site.	Construction Phase Removal of any waste spoil arising would likely be heavily contaminated and may be considered hazardous waste. Large quantities of such waste are not anticipated and there should be no burden on landfill capacity.	Although the nature of the site means materials are highly contaminated, suitable measures can be implemented and controls put into place via the EAP and Materials Management Plan (MMP).

Environmental Topic	Sensitive Sites or Receptors	Potential for Significant Effects and Environmental Opportunities	Avoidance and Mitigation Strategy
		Potential for release of metal rich sediments as a result of spoil movement on site which could enter local watercourses through surface runoff. Any release of material would be minor and temporary. <u>Operational Phase</u> The project will prevent surface water runoff from becoming contaminated by interaction with metal rich spoil. Groundwater interception will also prevent infiltration of surface and ground water though mineral spoil heaps to prevent these becoming contaminated by dissolved metals. Drainage will also collect contaminated runoff for treatment before discharge into surface watercourses. This will contribute to significant reduction in the levels of dissolved metals entering the Afon Ystwyth, benefitting water quality in the waterbody.	
	Agricultural Land Classification Grade 4 and Grade 5 land.	Soils on the site are of poor agricultural value. The will be no effect on any high value agricultural land as a result of the project.	Not required.
Water	WFD waterbodies: Ystwyth - headwaters to the confluence with Nant Cell (GB110063041710: poor status)	<u>Construction Phase</u> Excavation and temporary material stockpiling within floodplain and banks of main channel and tributaries has potential to cause pollution of the watercourses by contaminated silt/sediment. Any release of material would be short term and low volume. Permanent improvement of water quality in the Afon Ystwyth water bodies as a result of reducing metal contamination. <u>Operational Phase</u> Reinforcement of approximately 100m of Afon Ystwyth's right bank will increase artificial structures in the waterbody. The extent of this modification is small within the context of the length of waterbody and introduces no barriers to dispersal of aquatic organisms (e.g. fish) along the waterbody. The project WFD assessment does not concluded that this would introduce any barrier to the watercourse achieving good status. Modification of tributaries by lining may increase flow velocities. This may increase scour of the river bed within the main channel during peak flows. Segregation and treatment of contaminated surface runoff and mine discharge will result in reduced concentrations of dissolved lead and zinc immediately downstream of the site. Erosion protection will result in an unquantified reduction of fine grained metal rich sediment entering the Afon Ystwyth. These will be a large contribution towards improvement of the chemical status within the upper Afon Ystwyth (GB110063041710). Direct improvements are anticipated on a stretch covering approximately 7km downstream of the site. Also works will facilitate the future betterment to up to 23km of the river, including lower reaches (GB110063041720).	A CEMP will be in place to ensure controls for sediment contaminated surface water runoff and management of mine water flows during construction. This is expected to employ industry best practise (e.g. NetRegs Guidance for Pollution Prevention 5). WFD Compliance Assessment has been completed and demonstrates that the proposed works have very little potential for negatively impacting the WFD status or objectives over the timescale of the next plan cycle. The works are designed to contribute to the programme of measures developed to address metal mine pollution, relating to the Afon Ystwyth waterbody adjacent to and downstream from the Cwmystwyth mine site. Completion of the works will significantly reduce the metal loadings to the main river in the form of both suspended sediment and dissolved contamination. The proposed works form a critical part of the pollution mitigation measures required to achieve significant betterment of water quality in the upper Afon Ystwyth (which is currently on the RNAG list due to mining impacts). Works to ordinary watercourses will require Ordinary Watercourse Consent (OWC) from the Lead Local Flood Authority.
	Ystywth - confluence with Nant Cell to Tidal Limit (GB110063041720: moderate status)		
	WFD ecological status of the Afon Ystwyth headwaters to	Current WFD assessment cite levels of zinc contamination as a reason for the waterbody not achieving good ecological status. Reduction of pollution pressures	

Environmental Topic	Sensitive Sites or Receptors	Potential for Significant Effects and Environmental Opportunities	Avoidance and Mitigation Strategy
	the confluence with Nant Cell (GB110063041710: moderate ecological status)	by up to 50% within Afon Ystwyth is likely to relieve suppression of proper ecological function and contribute towards raising WFD ecological status.	
	Afon Ystwyth - Flood Zone 2 and 3	Construction Phase Excavation, stockpiling and machinery will be used within the floodplain and main channel Afon Ystwyth. In the event of a significant storm these may represent a risk of exacerbating or causing flooding if any material stockpiles or equipment enter the watercourse during flood events and create or contribute to blockages which increase severity of downstream flooding. Operational Phase The proposed project will alter surface water drainage and watercourses within its footprint. Storm flow volumes are not anticipated to change due to the project as surface runoff catchment areas will remain unchanged. Peak flows within the Afon Ystwyth during storm events may be increased by faster conveyance of storm flows through lined tributary channels. Any effect would be limited due to the short distances of lining proposed. No downstream properties lie within the floodplain of the Afon Ystwyth until the village of Pont-rhyd-y-goes approximately 6km downstream. Therefore any minor changes are expected to have only local effects on rural land. The proposed development contains water treatment which could be considered vulnerable to flooding. This element of the project lies outside of both flood zones 2 and 3. The elements of the project within flood zones 2 and 3 are watercourse erosion prevention measures and drainage which are considered to constitute water compatible development.	Due to the development including a building with a footprint exceeding 100m2 it is anticipated that a drainage plan will be produced and subject to approval from the SuDS Approving Body. Design of highway drainage will require liaison with Local Highway Authority to ensure design meets required standards.
Air	No AQMA notified in Ceredigion. 4no. Residential dwellings	Construction Phase Vehicles and plant used during construction will not be present in sufficient numbers to cause any potential threat to air quality standards. Construction activities have potential to cause dust nuisance during dry weather. Operational Phase There are no currently designated air quality management areas that suggest local air quality is at risk of exceeding the quality standards. The plant is unlikely to produce any airborne particulates or gases that would contribute to an exceedance of any air quality standard.	Standard health and safety and pollution prevention measures (e.g. netregs pollution prevention guidelines) are anticipated to be sufficient to reduce or negate the potential for windblown dust. Further consideration will be required for potential odour nuisance at the detailed design stage once water treatment methodology has been determined.
Climate	Carbon emissions	Construction Phase Operation of plant and vehicles will produce carbon emissions. Materials used within construction will have embodied carbon emissions. These emissions are anticipated to only be minor due to duration of work and quantities of material. Operational Phase Active treatment plant will require permanent energy input therefore there will be scope 2 emissions of GHG associated with energy consumption. Chemical inputs may also be necessary for operation of active treatment plant and therefore will have scope 3 emissions of GHG associated with materials and transport through supply chain.	Likely carbon impact of materials to be considered during detailed design. Longevity of materials will be considered to reduce need for replacement and frequency of future maintenance activities. Future projects will investigate the possibility of using renewable energy to reduce ongoing carbon emissions associated with energy consumption.

Environmental Topic	Sensitive Sites or Receptors	Potential for Significant Effects and Environmental Opportunities	Avoidance and Mitigation Strategy
	Atmospheric regulation ecosystem services.	The project will not affect any habitats or geology that function as a regulator of atmospheric carbon.	No further action necessary.
	Climate adaptation on river with capacity for flooding (Flood zone 2 and 3).	No known flooding issues which could be affected. The project contains no elements that would affect the future climate change adaptation (Risks of increasing the incidence or severity of flooding due to the project are considered under the water topic above)	Any drainage will be designed to incorporate additional storm storage capacity for changes due to climate change.
Material Assets	Minor road following valley floor linking the B4574 to Rhayader. National Cycle Route 81. Building remains from previous mining activities.	<u>Construction phase</u> Temporary full or partial closures of public highway may be required to enable construction of elements of the project. This has potential to cause nuisance to local residents and other road users due to lengthy diversion. Potential effects on remains of buildings from previous mining activity are considered under the Cultural Heritage topic, below. <u>Operational Phase</u> Changes to surface water channels and drainage has potential to increase the incidence or severity of surface flooding on a local road during storm events. The project will not modify access to private land. No change to users of the public highway in the long term. Negligible increase in traffic for deliveries and inspection of the treatment plant.	<u>Construction Phase</u> Closures and any required diversions to be agreed with Local Highway Authority and undertaken through the appropriate procedures. <u>Operational Phase</u> Highway drainage and culverts to be designed in accordance with requirements of Local Highway Authority and Lead Local Flood Authority. Project will develop a drainage strategy at detailed design to ensure sufficiency of drainage and climate change adaptation requirements to avoid increasing risk of flooding during storm events on the local highway. Flood risk assessment is to be carried out and include risk of flooding to infrastructure.
Cultural Heritage	Scheduled Monument: Copa Hill/Cwmystwyth Lead, Copper and Zinc Mines (CD145). Upland Ceredigion Landscape of Historic Interest. All superficial deposits are of high archaeological sensitivity. Therefore the potential for previously unrecorded archaeology exists. Historic mining industry features: buildings and spoil tips.	**Visual effects on the historic landscape are considered as part of the landscape topic, below.** <u>Construction Phase</u> Excavation and use of machinery within close proximity of the scheduled monument creates potential for accidental damage to remains of ruined mine buildings which are part of the scheduled monument. Additionally these activities may disturb, damage or destroy previously unstudied buried heritage features and archaeological evidence rated as high sensitivity due to their importance in understanding historical mining methods and operations within the scheduled monument. <u>Operational Phase</u> Works will make permanent visual modifications within the curtilage and setting of ruined mining buildings which are part of the scheduled monument, such as: • Addition of urbanising features used as erosion protection, such as gabion baskets and concrete canvas lining of watercourses totalling approximately 500m • Minor modification of landform by excavation of material and preparation of treatment plant foundation • Installation of water treatment facility with approximate footprint of 1000m^2. These changes also have the potential to modify the cultural heritage context element of the Upland Ceredigion Landscape of Historic Interest for which the Cwmystwyth Mine forms part of this area noted for its industrial landscape.	Further detailed heritage impact assessment (HIA) of the potential effects on cultural heritage assets is required, and will be undertaken as per the following methodologies: • Assessment of the Significance of the Impact of Development on Historic Landscapes (ASIDOHL2) • Full desk based archaeological assessment with Written Scheme of Investigation and working method statement. Measures for reducing or mitigating effects identified by the assessments will be incorporated into the detailed design and Pre-Construction Information for inclusion in a CEMP to be employed by the contractor on site. All assessment results and control/mitigation measures will be compiled into a request for Scheduled Monument Consent from Cadw. Scheduled Monument Consent will be required prior to commencement of any construction activity.

Environmental Topic	Sensitive Sites or Receptors	Potential for Significant Effects and Environmental Opportunities	Avoidance and Mitigation Strategy
		The operational phase of the project is not anticipated to have any ongoing negative effects on undisturbed archaeological evidence. <u>Opportunities</u> To enhance and preserve the mining heritage features within the project boundary the following measures will be considered: • Record and consolidate the remaining mining structures on site. • Erosion protection will preserve the mining spoil heaps and prevent further deterioration of the heritage asset and potentially protect undisturbed archaeology from future erosion and weathering. • Reinstatement of former stone channels and culverts will restore a historic feature of the scheduled monument which is currently in poor status.	
Landscape	The site lies within the Cambrian Mountains National Landscape Character Area (NCLA21). The site forms a part of the following landscape designations: • Upper Northern Uplands Landscape Area (SLA 12) • Upland Ceredigion Landscape of Historic Interest. The site is a potential element in views from the following receptors: 4no. residential dwellings Public Right of Way – 20/61/D Public Right of Way = 20/62/D National Cycle Route 81	**Effects on cultural heritage aspects of landscape context are considered under the Cultural Heritage Topic, above.** <u>Construction Phase</u> Temporary visual and sensory effects from construction activity, plant and vehicles are likely to reduce tranquillity and visual amenity for recreational users of PRoW, National Cycle Route and local residents. Minor landform changes from stockpiles and excavation to install interception drains will be temporary and localised. <u>Operational Phase</u> There will be negligible change to tree cover or vegetation pattern as a result of the project. Land use pattern within the wider landscape will be unaffected. The project will introduce a new building with approximate footprint of 1000m^2 into the existing rural landscape. As type of treatment required has not been determined the exact height of the proposed housing is not known, but would be unlikely to exceed the heights of existing nearby residential buildings. Any such structure will be visible from valley slopes which could be urbanising and discordant with the mining heritage context of the existing landscape. This feature will be present in the valley bottom limiting its prominence in views from the wider landscape beyond the slopes of the Ystwyth Valley. Erosion protection and scour prevention interventions have potential to add modern urbanising features, such as gabion baskets, discordant with the rural and cultural heritage setting of the landscape. These features will lie along 500m of watercourse channels on tributaries and the River Ystwyth and therefore be below ground level likely limiting effect on wider views of the landscape, but may be visible from the opposing valley slopes. This will limit any visual changes to a local level due to size of the affected area, topography and vegetation. Modifications with urbanising have the potential to alter the mining heritage context of the site within the surrounding landscape character. The site provides important cultural context within the wider landscape and the proposed	No feasible alternative has been identified that would fall outside the designated landscape areas. Measures to avoid, reduce and mitigate sensory effect for residents and recreational visitors to the location are included within Population and Human Health topic above. Considerations of biodiversity elements of the landscape are considered within the Biodiversity topic above. Further assessment of landscape and visual effects of the final design will be undertaken. The assessment will consider mitigation including use of sympathetic construction materials and methodologies to preserve the landscape's visual and cultural character (for example using dry stone walls for erosion protection and sympathetic materials or cladding for housing any treatment plant) which could be incorporated into the project's detailed design. Measures to avoid and reduce effects on the cultural heritage aspects of the landscape have been described in the previous section.

Environmental Topic	Sensitive Sites or Receptors	Potential for Significant Effects and Environmental Opportunities	Avoidance and Mitigation Strategy
		urbanising features could negatively alter the sites contribution to the cultural context and sense of place within the wider landscape. Minor alterations of landform due to redistribution of mining spoil and slime heaps, and creation of treatment plant foundations will be localised and likely to have negligible effect on landscape context or views. Opportunity for enhancement of the historic context of the site can be achieved by designing plant housing, channel lining and erosion in keeping with existing remains of historic mining buildings and stone channels.	
Cumulative Effects	Grogwynion SAC & Gro Ystwyth SSSI	In combination with other projects forming part of the NRW Metal Mines Programme this project would reduce inputs of contaminated sediments within the Afon Ystwyth catchment. The Grogwynion SAC and associated SSSI is potentially dependent on the disposition of contaminated sediments to arrest successional change and maintain habitat for metallophyte lower plant interest which is a key feature of the site. Previously constructed Frongoch mitigation project indicated that changes at Frongoch would be unlikely to be significant in isolation but that future projects, such as this one may have in combination effects.	Current HRA will include and consider previous impact from remediation at Frongoch on the Nant Cell, a tributary of the Afon Ystwyth.

4.5 Scope of further work

As a Town and Country Planning EIA screening opinion has yet to be received from Ceredigion County Council it is currently unknown whether a statutory EIA and Environmental Statement will be required, and if required the scope of that EIA.

Whether or not a statutory EIA and Environmental Statement is needed, as a minimum the project will require the following assessment and surveys in order to inform further project development and to gain statutory consents:

Biodiversity

- Habitats Regulations Assessment (HRA) (Conservation of Habitats and Species Regulations 2019)– A draft HRA has been produced where it has not been possible to conclude no adverse effect upon Grogqwynion SAC. This draft will need to be reviewed and updated as the project develops. Where it's not possible to conclude no adverse effect the HRA will also need to include:
    - Statement of case, including declaration of no suitable alternative and identification of Imperative Reasons of Overriding Public Interest.
    - Identification of suitable compensation measures to ensure continued integrity of Natura 2000 network
- SSSI Assents - Mwyngloddfa Cwmystwyth SSSI and Elenydd SSSI
- Bat survey, including summer, swarming and hibernation activity at mine entrances and remains of mine buildings
- Breeding bird surveys with focus on merlin, peregrin and chough
- Further detailed lower plants surveys within proposed works footprint to inform detailed avoidance, translocation and mitigation measure.

Water

- Water Framework Assessment (WFD) Assessment; A Preliminary WFD (Scoping) Assessment has been undertaken which has concluded that further WFD Assessment for this project will not be required given the project will have an overall improvement to the adjoining waterbodies. Should the scope of the project outline design change the Preliminary WFD Assessment will be reviewed and updated where necessary.
- Flood Risk Assessment, including effects on fluvial flooding and risk of flooding to infrastructure
- Ordinary Watercourse Consent (OWC) requirements to be screened with Ceredigion Lead Local Flood Authority.

Land

- SSSI assent for Mwyngloddfa Cwmystwyth SSSI and Elenydd SSSI

Cultural Heritage and Historic Landscape

- Desk based archaeological assessment, WSI and archaeological method statement
- ASIDOHL2
- Building survey
- Scheduled monument consent

Landscape

- Landscape and Visual Impact Assessment

5.0 Delivery of Multiple Benefits

In line with NRW's duty under the Environment Act they seek to deliver multiple benefits through their projects.

A draft list of potential environmental enhancements that could be accommodated as part of the remediation works at Cwmystwyth is provided in **Table 5-1**. They are also shown where appropriate on the Environmental Opportunities Plan (**Figure 5-1**). These have been identified where the scheme has potential to further deliver against NRW's wellbeing objectives as noted within **Section 1.4** "Project Objectives", therefore promoting the SMNR and meeting both NRW and the local Public Services Boards Well-being Objectives/Priorities.

Table 5-1 has been developed through stakeholder liaison (April/May 2019), a project innovations workshop (May 2019) and the feasibility study process itself.

We will seek to embed enhancements into the design of the project as far as possible and work collaboratively in their delivery; however, it is not within the scope of this remediation project to deliver all enhancements listed. This list will be refined as the project progresses; it is likely that most will not be achievable as part of this particular proposal. Future schemes or projects at the site could look to re-consider remaining opportunities.

Wider/Strategic Opportunities are outlined separately in **Appendix C**. These are opportunities that will continue to be considered by NRW (in parallel to detailed design) but are unlikely to be feasible as part of the remediation proposals alone. They are likely to require strategic partnerships and proposals to be pulled together.

Table 5-1 Potential Environmental Enhancements (multiple benefits)

Potential environmental enhancement (to be considered further during detailed design stage)	Effectiveness at providing environmental improvement	Timescales	Strategic Drivers
	High / medium / low	*Long-term (10+ years)* *Medium-term (5-10y)* *Short-term (1-5years)*	*e.g. NRW well-being objective 2, WFD, Core Management Plan*
Water quality enhancements arising as a direct result of the proposed options. In turn, this could benefit a number of habitats and species along the river corridor.	High	Long-term	WFD NRW Well-being Objectives 2, 3 and 4
Involve CMT and their volunteer network with on-site activities as part of a community engagement strategy.	Medium	Short-term	NRW Well-being Objectives 1 and 5
Potential detour from existing long-distance trail. The Borth to Devil's Bridge to Pontrhydfendigaid Trail passes through part of the study area and there is an opportunity for additional waymarking of a detour towards the main mine building complex. This opportunity for a waymarked detour to the main mine building complex also applies to the Cambrian Way and Cistercian Way further west. Any enhancement such as provision of new trails would need to be considered for their potential impacts on the SSSI/SAC and the NRW Environment Team should be involved in any discussions with CMT and other stakeholders about their development.	Medium	Medium-term	Future Generations Act Goal 5 'A Wales of Cohesive Communities'
Safety improvements on site that could be provided as part of the remediation works (e.g. signage/fencing/grilles over adits etc.) may help facilitate CMT providing trails through site at a later stage – i.e. working towards providing a safer site for them to consider making more open to public in future etc. This would need to tie into a Site Management Plan with targeted objectives agreed as to what could be included in the remediation project and what is a wider strategic aim.	Medium	Medium-term	NRW Well-being Objective 5
Potential for a heritage trail through site. Provision of a circular heritage walk around the site (incorporating land south of river if it would be feasible for a bridge or suitable alternative to be constructed in future). Consideration to be given to provision of wheelchair access on main site etc. Websites, leaflets, signage etc. would be required to promote to trail. Potential to make access routes required for the remediation works themselves suitable for long-term use to support CMT's aspiration for more accessible pathways through site & future educational facilities. May not provide a full walking route as part of the remediation work itself but would potentially make this an easier achievement for CMT longer term if some infrastructure is left in place following remediation work. Consideration to be given to what may be appropriate as design develops. Any enhancement such as provision of new trails would need to be considered for their potential impacts on the SSSI/SAC and the NRW Environment Team should be involved in any discussions with CMT and other stakeholders about their development.	Medium	Medium-term	NRW Well-being Objective 5
Re-opening of original track to mine yard. Consider whether work access is required during the remediation that would facilitate CMT ITEM 5: Re-opening of the original track to the mine yard or whether this could be incorporated into proposals even if no remediation works access is required through this point. CMT ITEM 5 notes "*The present track way entrance is located adjacent to Nevill Place and has been blocked off with dumps of stone to prevent unauthorised access. It is proposed that these are removed and a gated entrance constructed. Boulders would also be strategically to prevent off-road access*." If no remediation works access is required at this location, then this may need to form part of the wider strategy for the site.	Medium	Medium-term	NRW Well-being Objective 5

Any enhancement such as provision of new trails would need to be considered for their potential impacts on the SSSI/SAC and the NRW Environment Team should be involved in any discussions with CMT and other stakeholders about their development.			
Provision of a dedicated path to the mill area. Consider whether work access is required during the remediation that would facilitate CMT ITEM 3b: Managing access to the mill area of the site. This considers "*construction of a dedicated pathway on the northern side of the B4574 to direct pedestrians from the parking area to the south of the road up to the mill area. The proposed route would run along the eastern edge of the former stores building that lies to the south of the mill.*" If remediation works access is required through this location, then any access provision could be made suitable for longer term use as a pedestrian footway. If no remediation works access is required at this location, then this may need to form part of the wider strategy for the site.	Medium	Medium-term	NRW Well-being Objective 5
Consider whether the remediation works could include provision of signage on site (either end of site on road) denoting ownership by CMT – tying in with CMT ITEM 1 (Signage to indicate ownership)	Low	Medium-term	
Cycle Route 81 signage. Consider signage improvement to tie in with Sustrans general aims for improving signage across the network: - Fix/amend existing signage along sections of Cycle Route 81 in/close to site; - Add educational signage along Cycle Route 81 (also see CW Op12).	Low	Medium-term	NRW Well-being Objective 5
Interpretation Panels. Replace/update existing boards along Cycle Route 81/ road. Provide new information boards: - Borth to Devil's Bridge to Pontrhydfendigaid Trail (also PRoW 20/61/D) at its eastern-most point as it passes through the site where there is an impressive view of the workings and up the valley to the east. - At new car parking provision (CW Op21) Consider installation of interpretation boards at other locations identified by CMT ITEM 2 (Improved interpretation panels and signage). Include information about the remediation works themselves (as part of the wider story re mining legacy), heritage value of site (what can be seen/old photographs etc.) and ecological/geological interest as well as information regarding health and safety risks present at former mine workings.	Medium	Medium-term	NRW Well-being Objective 5 Future Generations Act goal 6 'A Wales of vibrant culture and thriving Welsh language'
It may be appropriate to undertake consolidation work at the former Crusher House (close to Pugh's Adit) during works at this location. Opportunity to restore (& potentially utilise) the building as part of a treatment facility that may be required (may need an extension) to promote its long-term preservation and also screen new infrastructure that is required for treatment. This would be subject to appropriate consultation with DAT and Cadw and Scheduled Monument consent however as well as full consideration of impact on lower plants (that could be present on walls and surrounding ground). This would also tie in with Landmap Management Objectives for the local area in particular "*selective reconstruction/consolidation of important features*"	High	Medium-term	NRW Well-being Objective 2 Future Generations Act Goal 6 'A Wales of vibrant culture and thriving Welsh language'
Pugh's Adit and Gill's Lower Adit Improvement Works. During remediation works at this location consideration could be given (through appropriate consultation with CMT and other bodies) to improvements at these locations both in terms of visual improvement and health and safety/access measures.	Medium	Medium-term	NRW Well-being Objective 2 Future Generations Act Goal 6 'A Wales of vibrant culture and thriving Welsh language'
Kingside Adit Stabilisation Works – consideration of stabilisation works that may be appropriate at this feature.	Medium	Medium-term	NRW Well-being Objective 2
Potential to support CMT ITEM 7: Restoration and improvement to the packwall entranceway and portal to Taylor's Level "*To improve the outward appearance of this adit level by removing the existing inappropriately placed grill."*	Medium	Medium-term	NRW Well-being Objective 2 Future Generations Act Goal 6 'A Wales of vibrant culture and thriving Welsh language'
Potential to support CMT ITEM 6: Restoration of the portal to Level Fawr and improvement of underground access. "*To restore the portal entrance and erect a replica plaque above the entrance. Facilitate materials and equipment being able to be taken into the mine."*	Medium	Medium-term	NRW Well-being Objective 2

			Future Generations Act Goal 6 'A Wales of vibrant culture and thriving Welsh language'
Potential to support CMT ITEM 3A which suggests "*Re-routing part of the stream outflow into the former Mill Tailrace, following archaeological investigation to confirm its route on the northern side of the road."* Consider whether this could be incorporated into surface water management proposals at this location.	Medium	Medium-term	NRW Well-being Objective 2 Future Generations Act Goal 6 'A Wales of vibrant culture and thriving Welsh language'
Potential to support CMT ITEM 3A which suggests "*Dry stone revetment walls adjacent to eroding fines and slimes dumps could be constructed [*to the south of the mill area*] to mitigate against further erosion of these sources of contamination into the River Ystwyth*." Consider whether this could/is appropriate to form part of the remediation/surface water management proposals for the site.	Medium	Long-term	NRW Well-being Objective 2 Future Generations Act Goal 6 'A Wales of vibrant culture and thriving Welsh language'
Potential to provide permanent car park provision close to road (north side) as a result of spoil repositioning and to enable site compound during remediation works etc. This could tie in with CMT ITEM 4 (Improved Car Parking across the site area).	Medium	Long-term	NRW Well-being Objective 5
Provision of localised ecological enhancements where appropriate during works in particular considering Local Biodiversity Action Plan species in locality (e.g. pipistrelle bat and chough) and SPA/SAC qualifying habitats/species. Consultation with appropriate bodies to determine appropriate measures. For example, project could consider installing bat roost boxes if suitable locations can be identified (bats already known to roost on site so could add to opportunities for species present). E.g. installation of underground roost chambers which could be incorporated into any slopes created or could incorporate roost boxes into structure consolidation works (e.g. at the Crusher House – CW Op13) subject to appropriate consultation/consenting. Consider the designated roadside verge through the site and whether any additional survey/distribution mapping is required and any specific enhancement that could be incorporated into the remediation works for the verge/key species present.	Medium	Medium-term	NRW Well-being Objective 3 Biodiversity Action Plans SPA/SAC/SSSI Management Plans
Visual improvements possible through spoil heap reprofiling to the north of the road.	Medium	Medium-term	NRW Well-being Objectives 2 and 3
Hydro-power optioneering and design. If active treatment is required at this site there is opportunity to incorporate a hydro-electric scheme into the remediation proposals to generate the necessary energy required. This will need consideration as feasibility develops. Could also consider re-use of historical leat system as part of this opportunity. This ties in with CMT ITEM 10: Hydro-electric scheme which considers allowing a private company to use the site for a hydro-electric scheme with a view to this creating a fund source for CMT to enable stream culverting and footpath creation.	High	Long-term	NRW Well-being Objective 1
Bury 'Treatment' Facilities. Re-profiling of soil north of the road may give an opportunity to bury storage containers for use as the active treatment facility – would only then need to see the 'door' and could be angled appropriately.	Medium	Long-term	NRW Well-being Objective 2
Support to CMT in identifying or using match to leverage potential funding sources for their work. Support with applications etc.	Medium	Medium-term	NRW Well-being Objective 2
Potential for re-use of waste materials. Provision of waste from treatment to other facilities which could make use of them – e.g. source of zinc. Any potential for iron exchange on site (using surplus power if on site generation) so that CMT have metal to sell?	Medium	Medium-term	NRW Well-being Objective 2
Realtime Data Capture. Installation of monitoring on site that could then make use of broadband (along road) to provide a live feed to the site for educational facilities.	Medium	Long-term	NRW Well-being Objectives 1 and 7
Lime mortar use in restored buildings which could create new habitat for lichens and ferns.	Low	Medium-term	NRW Well-being Objective 2
Use of metal pipes that will 'age' for any exposed pipework NRW NRM Team Ceredigion (Senior Conservation Officer) May 2019 Consultation response includes "It was also thought that there was the potential to enhance the historic landscape eg by using metal pipes that quickly rust"	Low	Medium-term	NRW Well-being Objective 2
Promotion of remediation works and cultural value of site at local education facilities – 6th form colleges, Universities, schools etc. Presentations, information drop etc.	Low	Short-term	NRW Well-being Objectives 1 and 7
Provision of material to groups such as Russell Society or National Museum. If any material is being removed/relocated this provides a potential rescue collecting opportunity for the National Museum and/or groups such as the Russell Society. Consultation would be beneficial with these groups if this is required.	Low	Medium-term	NRW Well-being Objectives 1 and 7

Appendix A – Responses from the Environmental and Planning Consultees (informal consultation phase), April/May 2019 relating to the Cwmystwyth Site

Consultee Organisation / team	Consultee Response (excerpt relevant to this site only taken from full consultation response)	Feasibility Stage Response
Cadw	a) Do you have any additional baseline information you would be willing to share with us for these sites? NRW are regularly provided with up-dated GIS mapping showing the location of scheduled monuments. The documentation submitted to Cadw demonstrates that NRW has identified designated assets and undesignated historical assets potentially impacted by the proposed water treatment works. The main repositories for reports etc. are with the local archaeological trusts (Historic Environment Record - HER) and RCAHMW (National Monuments Record - NMR). Cadw receives information as a result of consented work at scheduled monuments, which is also copied to the HERs and NMR. [Cadw has numerous reports for Cwmystwyth; to avoid duplication we suggest that NRW provides us with a list of their existing sources / information and we can fill in any gaps.} b) Do you know of any other local opportunities we should be exploring for these sites? The Royal Commission on the Ancient and Historic Monuments of Wales may have other information held in the National Monument Record https://rcahmw.gov.uk/ Local historic societies may have relevant information which has not been deposited with the RCAHMW or local archaeological Trusts. c) Do you have general concerns, queries or comments about the project? It is vital that Cadw are consulted at an early stage regarding any proposed works located within a scheduled area which might damage a scheduled monument. Such 'works' include disturbance or building up of the ground surface (e.g. watercourse culverting, channelling with gabions, capping of the spoil heaps excavation, installation of stakes or posts, replacement fencing or new fencing, pipework, gabions etc.), new additions (e.g. equipment, structures or buildings), and work to historic buildings/structures (e.g. repairs, restoration or conversion). These works require Scheduled Monument Consent (SMC): https://cadw.gov.wales/historicenvironment/help-advice-and-grants/makingchanges/schedmonconsent/?lang=en The local archaeological trusts should be contacted to discuss potential impacts on undesignated assets.	Table 5 includes liaison with CADW regarding reports they hold for the site.
Dyfed Archaeological Trust	Thank you for your email, dated 12th April 2019, regarding the Metal Mine Feasibility Study. This report notes that the three mine sites in our area: Cwm Rheidol, Frongoch-Wemyss and Cwmystwyth, are all rich in heritage and we recommend that an archaeological desk-based assessment (DBA) of each site should be undertaken and these should help inform the scope of further archaeological mitigation required within each scheme. The DBAs should adhere to the standards and guidance provided by the CIfA (2014, updated 2017).	Heritage appraisal undertaken as part of this feasibility study. Consideration of further assessment outlined in Section 4 above.
NRW NRM Team Ceredigion	For any groundworks I would like to see restoration to a more natural/in-keeping habitat, not improved grassland and our goal should be Calaminarian grassland as per my comments for Frongoch. I don't like the reference to the use of gabions, even in seasonal water features. I think we should be looking for something more in keeping and look to replicate the stone and clay lined channels that they would have utilised in the 19th century. While it would be nice to have stone arched culverts, we should at least have the portals arched rather than plastic twin-wall pipe. There may be wider protected species interest, notably bats, but this will depend on the more detailed proposals.	Concept design has sought to consider these comments – to be explored further at detailed design stage.
NRW NRM Team Ceredigion (Senior Conservation Officer)	Comments in relation to the biological interest of Cwm Ystwyth Mine SSSI/SAC a. Do you have any additional baseline information you would be willing to share with us for these sites?	

Consultee Organisation / team	Consultee Response (excerpt relevant to this site only taken from full consultation response)	Feasibility Stage Response
	Whilst the most important report is the one that you identify by Forster Brown and Chambers in 2017, there is also an older survey: Dyfed Wildlife Trust Wales Metal Mine Survey 1992-93. In DMS here: https://cyfoethnaturiolcymru.sharepoint.com/teams/landmanps1/psce/mwcws/Science/Flora/SN87%20Cwmystwyth%20survey.aspx b. Do you know of any other local opportunities we should be exploring for these sites? You note the possibility of a micro hydro scheme. We previously looked at the potential for this and thought that with careful design, damage to the biological interest could be avoided and there was the potential for enhancement eg by re-construction of buildings using traditional lime mortar which could create new habitat for lichens and ferns. It was also thought that there was the potential to enhance the historic landscape eg by using metal pipes that quickly rust. c. Do you have any general concerns, queries or comments about the project? As shown in the Forster Brown – Chambers report, there are Calaminarian grassland communities within the feasibility study area and careful siting of any works will be needed to avoid damage to this SAC habitat. Expert advice from a lichenologist with specialism in metallophyte lichens will be needed. The landscape and historic interest of the site is very high. Any new works will need sensitive design.	
NRW Conservation Geologist	I'm writing to let you know that I do not have any issues from an Earth science perspective over any of the potential remediation proposals. Indeed, from an environmental perspective, remediation of all four mines would be very welcome.	
NRW Geomorphologist	From a fluvial geomorph perspective we need to ensure that the proposals pose either beneficial or minimal impact to the physical form and processes (e.g. sediment conveyance through the reach, plus the ability of the river to naturally move laterally) of the rivers and their riparian zones. Not being an expert in mine remediation at present I think the proposals would benefit from elaboration on the types of treatment (both the "active" and "passive" forms) that are potential options. Alternatively involving us at the "long list" Options stage would be useful in order that we can provide feedback on the potential options and then a more informed preferred option can be subsequently developed. We are generally very happy to meet up on site to discuss options and find ways to work around constraints. For example I note that channelling with gabions, or culverting, is proposed at Frongoch – this is something that would generally go against NRW policy, but alternatives using river restoration techniques to provide the same (and more) benefits are often possible following discussion at an early engagement site meeting. As I have discussed Dylife with old colleagues, and agree that a hydropower scheme appears to be the best solution here. However, the scheme would either need to be designed to continue to convey upstream sediments to downstream reaches in times of high flow (and is this acceptable from a contamination point of view), or a sediment budget is undertaken to put in place a management plan that mechanically moves this material on a regular basis. As mentioned, many thanks for the engagement, but I think further discussion/meetings are required to inform and flesh out the potential options at each location.	Geomorphologist to be consulted as design progresses.
NRW Landscape officer	The consultation document is extremely interesting, really clear and very comprehensive. It's great to see the landscape and historical landscape issues featuring so strongly. I can't think of anything to major to add. Due to the potentially high landscape impacts, I would be really glad to be kept up to date and would be keen to attend a site visit is any are arranged. I would also be interested to see the specific landscape reports that you mention are due. I will let my 'virtual landscape' colleagues know that the work is ongoing in case they hear of any other relevant initiatives in the area. It is good to see links already made to the Source to the Sea, Pumlumon project etc. The only minor point I could add at the moment would be that it would be useful to identify in a little bit more detail the expected end use of the restored sites. This could include who will be responsible for them and identify any budgets going forward. On Frongoch Phase 1 this did not seem to have been agreed (although I appreciate landowner issues were a problem) It is helpful in the design stage to have this in mind though. If possible avoiding 'over engineered' and 'over tidy' design solutions can help the sites to develop a more interesting habitat. Considering micro topography can also be helpful.	2019 Landscape Report (*Lingard Farrow Styles: NRW Metal Mine Feasibility, Preliminary Landscape Appraisal, Cwmystwyth Mine, Ceredigion, Prepared for: Natural Resources Wales on behalf of The Coal Authority Ref: 2997, February 2019*) provided to NRW for cascade to landscape officer in June 2019. NRW Landscape Officer to be included in consultation through project duration. Concept design has sought to avoid 'over engineered' and 'over tidy' design solutions – to be explored further at detailed design stage. Consideration of end use of site has been included in Table 5. See also Wider Opportunities table in Appendix C.

Consultee Organisation / team	Consultee Response (excerpt relevant to this site only taken from full consultation response)	Feasibility Stage Response
NRW Lower Plant Species Specialist	The Coal Authority report looks generally accurate (although at one stage they say "bryophytes (ferns)" which is wrong), but the way it is written downplays the ecological importance of the mines. The fact Cwmystwyth is SAC for its Calaminarian is mentioned rather in passing, but is potentially a showstopper and really does need to be spelled out in no uncertain terms: whatever remediation works take place will need to avoid damage to the SAC and SSSI feature, that will not be easy, and this international importance frankly trumps issues with the local fish population. I'm sure we can come up with solutions if we all work together, perhaps even with a win-win.	Baseline amended to highlight importance of on-site SAC and Calaminarian grassland.
NRW Protected Sites	*No comment provided at this stage*	
NRW Protected Species	*No comment provided at this stage*	
NRW Public Service Board member	*No comment provided at this stage*	
NRW WFD Co-ordinator	*No comment provided at this stage*	
Wildlife Trust of S & W Wales	*No comment provided at this stage*	
Ceredigion Council - Ecology	*No comment provided at this stage*	
Ceredigion Council - Enterprise	*No comment provided at this stage*	
Ceredigion Council - PRoW Officer	*No comment provided at this stage*	
Ceredigion Council - Land Drainage	*No comment provided at this stage*	
Ceredigion Council - Landscape	*No comment provided at this stage*	
Ceredigion Council - Planning	*No comment provided at this stage*	
Ceredigion Council - Public Service Board	*No comment provided at this stage*	
Ceredigion Council - Public Service Board	*No comment provided at this stage*	
Sustrans Wales	*No comment provided at this stage*	
National Waterfront Museum	*No comment provided at this stage*	
National Museums &	*No comment provided at this stage*	

Consultee Organisation / team	Consultee Response (excerpt relevant to this site only taken from full consultation response)	Feasibility Stage Response
Galleries of Wales		
Royal Commission on the Ancient and Historical Monuments in Wales (RCAHMW)	*No comment provided at this stage*	
Russell Society	a) Do you have any additional baseline information you would be willing to share with us for these sites? AC-NMW holds suites of mineral specimens representative of the ore, gangue minerals and perhaps more importantly the dump-formed post-mining minerals for which a number of the mine dumps are of international importance. All of the specimens are available for study. These include 190 samples from Frongoch Mine, 133 from Cwmystwyth Mine, 58 from Dylife Mine and just 2 from Cwmrheidol Mine. The reason for the low number from Cwmrheidol Mine is due to the unstable (decaying) nature of the sulphides (in particular marcasite and pyrite) resulting in very little having been available to collect. AC-NMW also hold information regarding the mineralogy of these sites some of which is available on our mineralogy of Wales website at https://museum.wales/mineralogy_of_wales/ and also within publications and our collections database. The Russell Society membership have extensive knowledge of the mineralogy of these mine dumps – in particular the range of internationally rare post mining dump-formed secondary minerals. b) Do you know of any other local opportunities we should be exploring for these sites? If it is agreed that any of the mine dumps are to be removed/relocated this would provide a potential rescue collecting opportunity for the National Museum and/or groups such as the Russell Society. It would be advantageous to involve these groups/organisations in any plans involving dump removal/disturbance. c) Do you have general concerns, queries or comments about the project? Cwmystwyth Mine is less of a concern mineralogically depending on which part of the site is affected	Table 5 includes the potential rescue collecting opportunity noted by the Russell Society.
Cambrian Mines Trust	a) Do you have any additional baseline information you would be willing to share with us for these sites? I know Wemyss, Dylife and Cwmystwyth well, both above and below ground and have carried out geological studies at each - you are welcome to any of these results b) Do you know of any other local opportunities we should be exploring for these sites? No c) Do you have general concerns, queries or comments about the project? 1- the purple 'heritage value' land on the map needs to include the area to '351' NW of Penparc which is a Bronze Age site 2 - it could have been mentioned that most of the site N of the road is a SAM as well as an SSSI 3 - I think the approach is correct; deal with Pugh's and the Kingside and then see what difference is made before going wild on other schemes. 4 - there are numerous M.Sc-type studies of metal loading in the streams here, they need to be collated and reviewed critically	

Appendix B

References

References are provided below for existing Cwmystwyth documentation that was reviewed/used to gather baseline information as part of this study:

- Atkins. (2010). Technical Memo – Review of Cwmystwyth Monitoring Data to end 2009 and the 2008 Monitoring Summary Report Recommendations.
- Coal Authority (2020). Cwmystwyth Metal Mine Remediation Feasibility Report
- Dyfed Archaeological Trust (2014). Cwmystwyth Mines Ceredigion: Management and Protection Plan.
- Environment Agency (2012) Frongoch Metal Mine Remediation Project Habitat Regulations Assessment (Stage 2)
- HRS Wales (2019): Cwmystwyth Lead Mine, Cwmystwyth, Ceredigion. Richard Scott Jones (BA, MA, MClfA), Report No: 206, February 2019, Cultural Heritage & Archaeological Feasibility Study
- Hughes., Simon (1981): The Cwmystwyth Mines
- Lewin J., Davies B. E. and Wolfenden P. J. (1977) Interactions between channel change and historic mining sediments. In: Gregory K. (ed.) River Channel Changes. Wiley and Sons, Chichester, 353-367
- Lingard Farrow Styles (2019): NRW Metal Mine Feasibility, Preliminary Landscape Appraisal, Cwmystwyth, Ceredigion, Prepared for: Natural Resources Wales on behalf of The Coal Authority Ref: 2997, February 2019
- Parsons Brinckerhoff Ltd. (2006). Scoping Consultancy for Remediation Design of Former Metal Mines in Wales – Cwmystwyth Feasibility study.
- Simkin., Janet: A Survey of Calaminarian grassland in mid-Wales - 2015 - Evidence rpt 061
- C. H. Swain, P. A. Brewer, M. G. Macklin & J. Simkin (2005) The ecological, geomorphological and geochemical controls on river shingle heath development on the Afon Rheidol and Afon Ystwyth, Ceredigion. University of Wales, Aberystwyth CCW Contract Report No. RE0492
- Miller Research Evaluation Consulting: Upland Regeneration Study Pentir Pumlumon Final Report July 2017 (study approved by Cynnal y Cardi Local Action Group and commissioned by Ceredigion County Council)
- Natural Resources Wales: Metal Mine Remedial Programme – Cwmystwyth: Environmental Screening Advice Note (2017)
-
- C. Forster Brown & S.P. Chambers (2017): Mapping the extent of Calaminarian grassland at Mwyngloddfa Cwmystwyth SSSI; Natural Resources Wales Evidence Report No: 203

Online sources that formed part of the Environmental Desk Study (review of online publicly available information) are listed below:

- https://cdn.naturalresources.wales/media/679801/cwmystwyth-mine-case-study_2016_06.pdf?mode=pad&rnd=131596369420000000
- https://gov.wales/topics/health/publications/healthier-wales/?lang=en
- https://gov.wales/topics/people-and-communities/people/future-generations-act/?lang=en
- https://magic.defra.gov.uk/MagicMap.aspx
- https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/find-protected-areas-of-land-and-seas/designated-sites/?lang=en
- http://lle.gov.wales
- https://www.biodiversitywales.org.uk/Environment-Wales-Bill
- http://www.ceredigion.gov.uk/resident/coast-countryside/conservation-and-wildlife/ceredigion-biodiversity-action-plan/
- http://naturenet.net
- https://naturalresources.wales/media/681496/know-your-river-river-ystwyth-salmon-and-sea-trout-catchment-summary.pdf
- https://beta.gov.wales/agricultural-land-classification-predictive-map
- https://www.naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en
- https://historicwales.gov.uk
- http://cadw.gov.wales/historicenvironment/protection/historiclandscapes/?lang=en
- https://landmap-maps.naturalresources.wales/

Appendix C

Wider/Strategic Opportunities

Opportunity	Description
Review/Update of Site Wide Management Plan (including consideration of Strategic Links/Partner Opportunities)	The Cambrian Mines Trust (CMT - site owners) already have a Management and Protection Plan in place for this Site (*Cwmystwyth Mines, Ceredigion: Management and Protection Plan, 2014 prepared by Dyfed Archaeological Trust (DAT) for CMT*). It may be appropriate to support an update of this to review aspirations and consider funding/partnering opportunities for any consolidation/improvements work that form part of this and potential tie in with local Wellbeing Strategy, Tourism and other initiatives. Due to the presence of international wildlife sites and the Scheduled Monument on Site full consultation would be required with NRW, CADW and DAT. Other partners/strategic links may be identified through local consultation and as the project progresses. Pentir Pumlumon (Plynlimon Tourism) initiated an Upland Regeneration Study in 2017 covering the Ceredigion uplands which includes a cultural/heritage action plan (among other actions) which could be referred to in any Site management plan. (*Upland Regeneration Study Pentir Pumlumon Final Report July 2017, Miller Research Evaluation Consulting*). The study was approved by Cynnal y Cardi Local Action Group and commissioned by Ceredigion County Council. Remediation works & associated enhancements likely to be a part of this wider management plan rather than be the driver/funding source. It should be noted that ITEM 8 in the CMT document provides an aspiration to work with NRW for any future water treatment works at the site. As part of this plan there would ideally be a key message and targeted objective of what can be achieved within the scope of remediation works.
Potential Strategic Link/Partnering/Funding Opportunities	• Cambrian Mines Trust – promotion, signage, long-term masterplanning, support with funding opps etc. • Pentir Pumlumon (Plynlimon Tourism) commissioned an Upland Regeneration Study in 2017 covering the Ceredigion uplands which includes a cultural/heritage action plan (among other actions) which should be referred to in any Site management plan. (Upland Regeneration Study Pentir Pumlumon Final Report July 2017, Miller Research Evaluation Consulting). The study was approved by Cynnal y Cardi Local Action Group and commissioned by Ceredigion County Council. • Sustran links & promotion of site (including detours) • STW & Welsh Water tie in at board level re clean water/catchment management • Ceredigion CC for promotion of trails & funding etc. (masterplan engagement also) • Long term management of site – local community opportunities etc. • Growing Mid Wales (Ceredigion & Powys joined initiative supported by Welsh Government) • Mid Wales Tourism Forum • Central Wales Economic Forum • HLF • Elan Links • Summit to Sea • Wildlife Trust • Other strategic links/partners may be identified through local consultation and as the project progresses.
Consolidation of Structures in Scheduled Monument	Potential to undertake essential consolidation work at other buildings within the Scheduled Monument to minimise risk of collapse. Would require substantial consultation/on site meetings with Cadw and DAT and agreement about funding/mechanism/long-term maintenance etc. Scheduled Monument consent would be required.

	This would also tie in with Landmap Management Objectives for the cultural landscape value of the local area "selective reconstruction/consolidation of important features". For example, CMT ITEM 9: Rebuilding of Neville Place and Staff House.
Education Potential on Site	Consideration of how the site could be utilised in future for educational purposes. Formal/informal.
Ceredigion Well-being plan Asset mapping	The delivery of the Ceredigion Wellbeing Plan includes a period of asset mapping – this will research further how communities work, how people see the relationship between themselves and the places where they live, work and visit, and will investigate how the assets (including cultural), contribute to well-being. Potential for Cwmystwyth (and other local mine sites) to tie into this in terms of cultural heritage value etc. Strategic link opportunity?
Incorporate Site into a Long Distance Mining Trail	Incorporate the Cwmystwyth Site into a long-distance heritage trail through the wider landscape tying in with other Metal Mines (and other heritage assets) in the locality. This would tie in with ITEM 11 of the CMT Site Management and Protection Plan: *Establishment of a 'Mid Wales Mining Trail'* Could most likely make use of existing designated trails through and tie in with 'Spirit of the Miners' walking routes but additional trails/signage may be required. Would most likely require footpath improvements, signage, educational material and suitable publication (online and through leaflets etc.). The Miller Upland Regeneration Study (on behalf of Pentir Pumlumon) comments: *"There is a rich range of historic sites to explore around the mining history of the [Ceredigion] Uplands area. Although work has been done through earlier initiatives to draw attention to this, there remains scope to devise networked trails with guides or interpretation materials to build an understanding of the industrial history of the Uplands."*
Provision of Local Heritage Trail	Utilise the existing public right of way network and identify suitable viewpoints from this towards points of interest within the Site. At these viewpoints there may be located interpretative signage and mining artefacts from the site such as metalwork and geological samples. Any route would benefit from appropriate way-marking and promotional material such as a website entry and/or leaflet. Appropriate seating may also be considered.
Large scale hydro power generation	Potential for power generation using head from upper limits of catchment. Would require a partner to enable/facilitate the works – remediation could benefit from use of the power; owners could benefit from financial rewards & power for on-site visitor centre etc. Remediation works to consider potential for future use of Site in this way (even if not in place for works themselves) and to design infrastructure to enable this in future (resilience/future potential etc.).
Visitor Centre	Provision of a Visitor Centre on Site?
Commercial Enterprise	Provision of commercial enterprise opportunities on site through restoration of buildings and use of hydro power etc. E.g. pottery, metal work etc.
Link to Elan Valley Visitors Centre	Promotion of site through information provision at this location. Signage towards site from here?
Elan Links	Potential to tie in with the Elan Links project work – two key tie in's "protecting/restoring historic sites" and "increasing access, recreation opportunities etc."

Other renewable energy sources	Consider potential for other renewable energy sources on site – e.g. solar.
Wider Mining Information Cascade	Maximise exposure within workshops/conferences through presentations/information boards etc. about the remediation proposals – e.g. NAMHO. In particular any cultural heritage aspect the projects are bringing etc.
Public Goods Payments	Potential for funding for landowners/managers of the Sites depending on assets present/created – additional guidance due 2019.
Information Download to Local Educational Facilities	Promotion of remediation works and cultural value of Site at local education facilities – 6th form colleges, Universities, schools etc. Presentations, information drop etc. Potential for calibrated measurements to be provided in real time to educational facilities. Chemistry, flow etc.

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