

# The Metal Mine Programme

Abandoned metal mines cause significant pollution in Wales, harming river ecology with metals like cadmium, lead, zinc and copper.

There are approximately 1,300 abandoned metal mines across Wales that have been estimated to impact over 700km of rivers.

Natural Resources Wales (NRW) and the Coal Authority (CA) are working together on the Metal Mine Programme to address this polluting legacy. The Programme is funded by Welsh Government.

The primary aim of the Programme is, where technically and financially feasible, to reduce pollution from abandoned metal mines to improve the health of our rivers, benefiting the environment, people and the economy.

In doing so this will directly contribute to the sustainable management of natural resources in Wales, and enhance community well-being benefits, as detailed in the Environment (Wales) Act 2016 and the Well-being of Future Generations (Wales) Act 2015.

## Project Objectives

**Dylife Mine is located 13km northwest of Llanidloes, Powys, on the mountain road to Machynlleth. The Afon Twymyn is a tributary of the Afon Dyfi and these rivers are part of the Meirionnydd catchment.**

The Dylife mine is a major source of metals which impacts the Afon Twymyn resulting in the watercourse failing to achieve the 'Good' status required by the Water Framework Directive (WFD) all the way to its confluence with the Afon Dyfi (20km).

As part of the Meirionnydd catchment management plan, mitigating pollution from abandoned metal mines is identified as one of the measures necessary to improve the status of WFD waterbodies within the catchment.

The main objective of the Dylife pollution control scheme is the long-term reduction of metal loading in the Afon Twymyn from the known inputs at Dylife, thereby contributing to significant betterment or "Good" surface water chemical status in downstream waterbodies.

Dylife  
Metal Mine

# The Dylife Site Area



## Physical Site

The site is situated near the confluence of two small and steep mountain streams (overall catchment area of roughly 3km<sup>2</sup>) located to the south of the hamlet of Dylife in Powys, 30km north east of Aberystwyth.

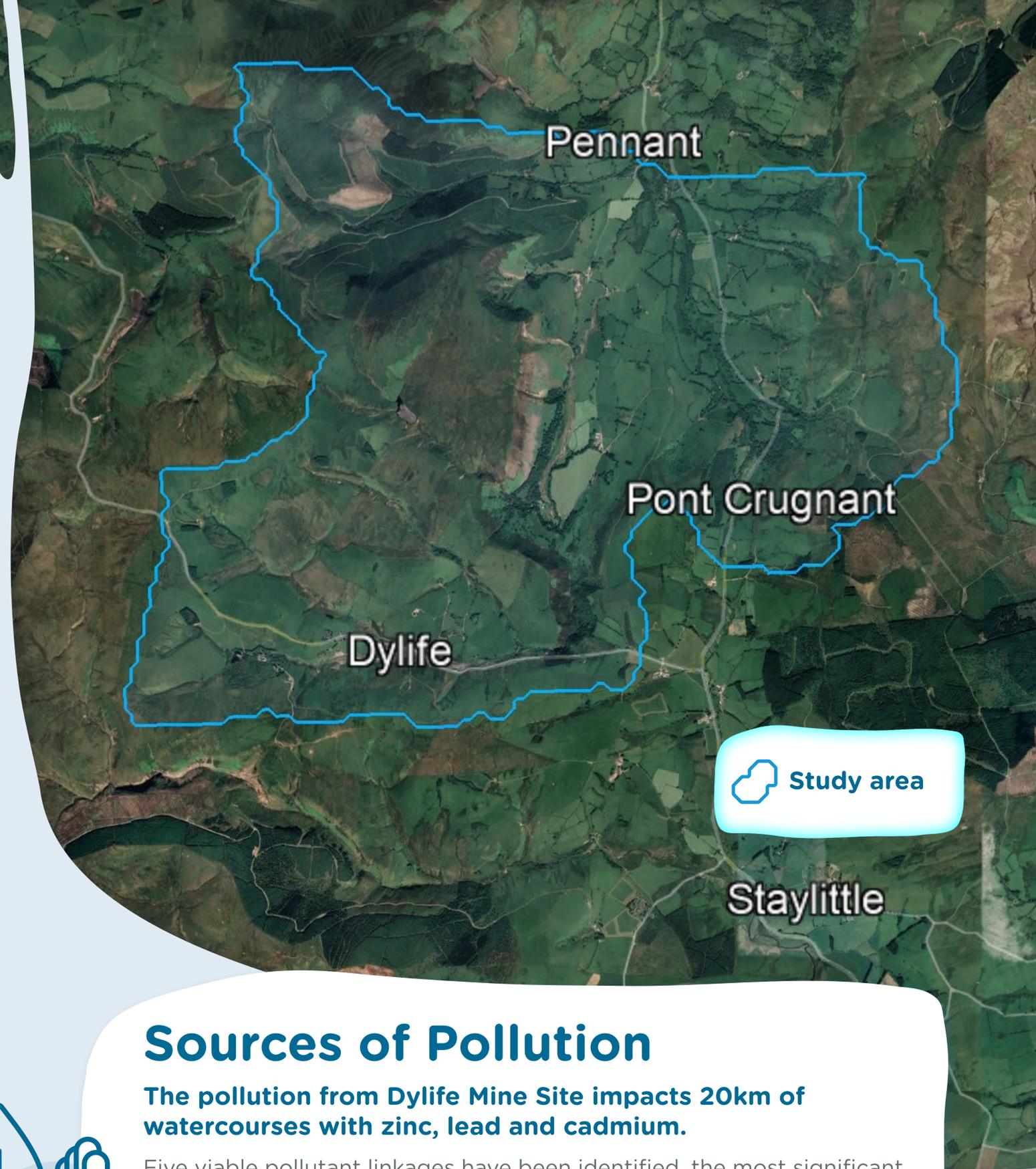
The main location of interest is where the Nant Dropyns enters a culvert under the Machynlleth road (minor road).

The Nant Dropyns joins the similarly sized Afon Twymyn immediately downstream of the culvert which then flows through a second culvert, again underneath the Machynlleth road.

## Study Area

An Environmental Baseline has been identified via ecological, hydrological and archaeological survey work and assessments, completed during development of the project from scoping to outline and detailed design.

This informs scheme design and ensures environmental mitigation and enhancements are delivered as part of the scheme. The study area and constraints are identified on board three and the plan opposite.



 Study area

## Sources of Pollution

**The pollution from Dylife Mine Site impacts 20km of watercourses with zinc, lead and cadmium.**

Five viable pollutant linkages have been identified, the most significant sources being the Hirnant Tips to the south of the road embankment, erosion of the dressing floor sediments and re-emergence of the Afon Twymyn from mine workings.

# Site Constraints

## Sensitive Habitats

The area supports a mosaic of vegetation types including mine spoil, bare rock and scree (which can constitute Calaminarian grassland) which has specialist lichen interest.

It also has areas of dry-heath, acid grassland, acid flushes and open water. These habitats are of ecological significance and qualify as Priority Habitats under Section 7 of the Environment (Wales) Act 2016.



## Site Designation

The Dylife Mine Site of Special Scientific Interest (SSSI) and the Dylife Mine Regionally Important Geological site (RIGS)

The southern area of the Dylife Mine is designated a SSSI and RIGS, cited due to its geological and mineral features which are of national and regional importance



## PROW / Cycle Route

A number of Public Rights of Way (PROW) pass through the study area, footpaths and bridleways, shown on, the minor road which bisects the mine site is also a National Cycle Route.

## High Importance Lower Plant Areas

Specialist moss and lichen surveys have been undertaken by experts on the site which has identified that some of the mine waste provides an important and highly specialised habitat (Calaminarian grassland) which supports a number of important metal tolerant lichens and mosses.



## Notable Ecology

Species which may use the site are ground nesting birds, bats and common amphibians and otters may also pass through the site. The sites habitats are concluded to be sub-optimal for both voles and badgers and there is low potential for areas of heath to support Adder, Slow-worm and Common Lizard.



# Dylife Site History

## Conservation Work

The **Welsh Mines Preservation Trust** have had involvement on site and preservation/conservation work has been undertaken including a project in 2007 to remove dumped material from the wheel pit on site and excavation of the adjacent winding house.

## High Heritage and Archaeological Value

**The site lies within Clywedog Valley Registered Historic Landscape with its value mainly associated with the heritage setting.**

It has high archaeological potential relating to historical mining activity, with extensive sensitive remains that require further archaeological assessment.

Areas of high, medium and low archaeological potential have been identified and mapped digitally by the Clwyd-Powys Archaeological Trust.

The principal areas of high potential are the collection of shafts, adits and associated workings focusing on the two main veins, known as Esgairgaled in the Nant Dropyns valley, and Llechwedd Ddu in the Afon Twymyn valley.

The latter area has more extensive remains and includes a large dressing floor area which contains the more contaminated waste material.

The site is not located near any Listed Buildings however there are a number of Scheduled Ancient Monuments (SAM) located over 600m to the south west of the site area.

## Mining History

**Mine workings at Dylife dates from Roman times or possibly earlier, however, the bulk of the mining occurred in the 19th century.**

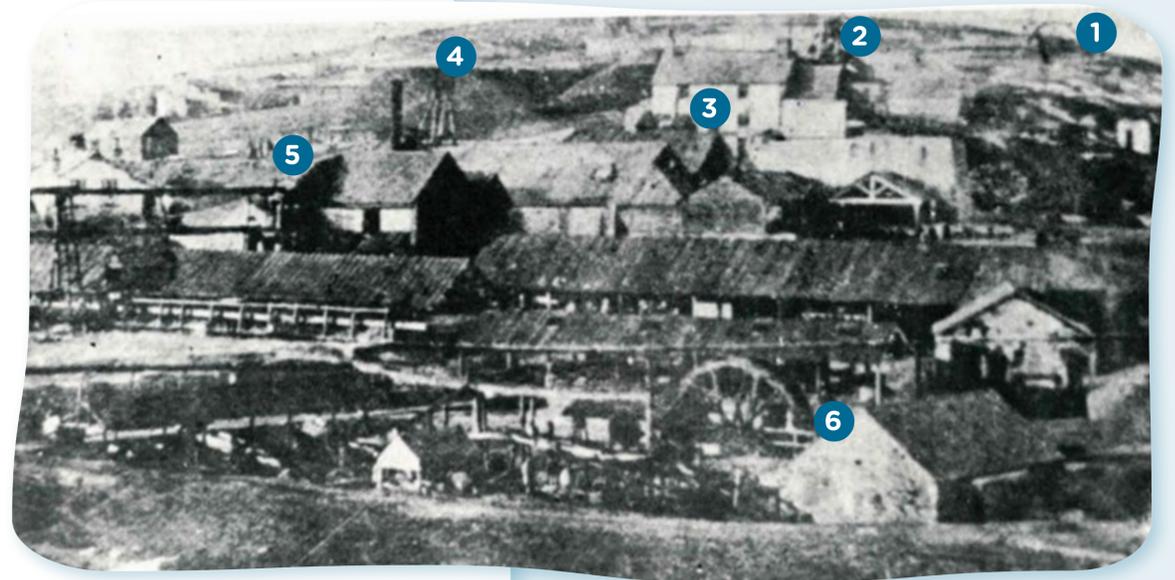
The mine site originally included three engine houses, a dressing mill, ten working shafts, earthworks, two small reservoirs and sundry stores, offices etc.

The remains of a number of buildings may exist under the mine spoil. The previous leat locations can still be noted in places.

The Village once thrived at Dylife with chapels, St David Church and vicarage, a school, which were all in existence by the 1850s, as well as a smithy and several inns (the Star Inn building still being present today).

**Dylife dressing floors in the late 19th-century (Bick 1985, 13) and as they are today.**

- 1 - Black Wheel
- 2 - Bradford's Shaft
- 3 - Mine Office
- 4 - Eastern Shaft
- 5 - Crusher wheel
- 6 - Dressing floor wheel



Source: Jones, N. W., 2016. Dylife Lead Mine, Powys: Archaeological Assessment. CPAT Report 1405.

# Options Considered

To develop the proposed scheme a number of options were considered against key criteria.

- The criteria included:
- environmental impacts
  - value for money
  - effectiveness
  - potential suppliers
  - site considerations
  - the ability to achieve 'Good' status for the water quality of the Lower Afon Twymyn.

	Option	Benefits	Risks & Constraints	Impact on Key Criteria						Decision	
				Changes to the Watercourses	Ease of Construction	Construction Costs	Environment	Effectiveness	Maintenance Costs		Meet Project Aims
Options reviewed and discounted at feasibility stage	<b>A</b> <b>Complete culverting of the Nant Dropyns and Afon Twymyn across the affected area.</b> Diversion of both watercourses through a closed pipe.	Removes pathway and prevents contamination of Afon Twymyn and Nant Dropyns.	Negative effects on naturalness of the watercourses and visual impact on the environment	⊖	○	○	○	⊕	○	○	⊗
	<b>B</b> <b>Reducing gradient of slopes on Great Tip and Hirnant Tip.</b> Excavation into and reprofiling of slopes	Reduces the amount of contamination contributed by surface water runoff from the deposits on both the Great Tip and Hirnant Tip.	<ul style="list-style-type: none"> <li>• Causes significant disturbance of geological interest and ecology.</li> <li>• High cost</li> <li>• Difficult construction</li> </ul>	○	⊖	⊖	○	⊕	○	○	⊗
	<b>C</b> <b>Diversion of the Nant Dropyns and Afon Twymyn watercourses</b> Diversion of watercourses from a point approximately 1km upstream of the mine.	Prevent loss of clean water to mine workings	<ul style="list-style-type: none"> <li>• Considerable construction and restoration effort</li> <li>• High construction costs</li> <li>• Loss of 'naturalness' of watercourses.</li> <li>• Only partial diversion of Nant Dropyns would reduce effectiveness</li> </ul>	○	○	⊖	⊖	⊖	○	○	⊗
	<b>D</b> <b>Capping on spoil on Great Tip and Hirnant Tip</b> An impermeable barrier would be laid over the spoil surface.	<ul style="list-style-type: none"> <li>• Prevent surface water passing through the spoil material and stop scouring and erosion during rain</li> <li>• Well established and highly effective in reducing water pollution where surface water runoff is on contact with mine waste.</li> </ul>	<ul style="list-style-type: none"> <li>• Risk to RIGS and SSSI designation</li> <li>• Destruction of sensitive ecology</li> </ul>	○	○	⊖	⊖	⊕	⊖	○	⊗
Options taken forward after feasibility	<b>1</b> <b>Do nothing</b> A mandatory standard baseline or reference scenario for consideration.	Maintains the existing ecological, geological and archaeological assets as recorded in baseline surveys	Continued pollution of the Afon Twymyn	○	○	○	⊖	⊖	○	⊖	⊗
	<b>2</b> <b>Surface water management</b> <ul style="list-style-type: none"> <li>• Lining of channels of Nant Dropyns and Afon Twymyn, and new culvert.</li> <li>• Installation of surface water drainage and groundwater barriers.</li> <li>• Capping of dressing floor.</li> <li>• Localised reprofiling and erosion protection of Great Tip and Hirnant Tip.</li> </ul>	<ul style="list-style-type: none"> <li>• Minimises creating artificial elements within the watercourses and preserves more natural processes. New culvert will alleviate flooding on the contaminated dressing floor</li> <li>• Interception of surface runoff reduces interaction of water with mine spoil</li> <li>• Prevents Nant Dropyns interacting with highly contaminated dressing floor spoil.</li> <li>• Erosion matting on Great Tips has smaller disturbance footprint. Modification of slope gradients on the tips will minimise the disturbance of sensitive lower plant communities and important geological features.</li> </ul>	<ul style="list-style-type: none"> <li>• Lining of the watercourses is technically challenging and costly Potential for increased volume and frequency of floodwater downstream.</li> <li>• Modification of drainage could restrict high way access during construction and or increased flooding to highway</li> <li>• Installation of erosion matting risks damaging an area with high value metallophyte interest.</li> <li>• Construction within dressing floor and on tips poses risk of disturbing, damaging or destroying archaeology or remains of previous mining buildings with cultural heritage value.</li> </ul>	○	⊖	○	⊕	⊕	○	⊕	⊕
	<b>3</b> <b>Install permeable reactive barrier (PBR) to address residual pollution from Great and Hirnant Tips.</b>	Intercepts water after infiltration through profile of spoil heaps and provides additional treatment of the water before discharge into Afon Twymyn.	<ul style="list-style-type: none"> <li>• Extensive engineering works.</li> <li>• Small volume of water treated</li> <li>• Increased disturbance of metallophyte lichens and geologically sensitive areas.</li> <li>• Engineering</li> <li>• High cost of construction and on-going maintenance</li> </ul>	○	⊖	⊖	⊖	○	⊖	○	⊗

# The Project Studies

## Flooding Assessment

**A flood consequence assessment has been undertaken which included modelling of the baseline conditions (current flows) and future flow conditions in the Nant Dropyns and Afon Twymyn produced by the proposed intervention works.**

Engagement has been undertaken with the lead local flood authority to discuss the findings and ensure all works meet their requirements.

## Scheme Development

**The Dylife Mine has been the subject of multiple reports dating from 1989, with a feasibility study completed in 2020 built on the existing site information to consolidate and confirm the basis and objectives for the proposed mitigation.**

The report included remediation optioneering and identified a preferred scheme, consisting of a series of pollution prevention interventions to deal with the viable pollutant linkages.

The feasibility study recommended additional surveys, assessments and stakeholder engagement to inform the design phases.

## Next Steps

**Further ecological surveys and assessments are planned for the detailed design phase with preparation of an Environmental Action Plan (EAP) which will outline mitigation measures to be implemented during construction.**

All necessary consents and permits will be obtained, for example, SSSI Assent for works within or adjacent to Dylife Mine SSSI from NRW and ordinary water course consent for works in the watercourses from

the Lead Local Flood Authority.

Clwyd-Powys Archaeological Trust (CPAT) will be consulted throughout the detailed design on the assessment of heritage impacts and subsequently we will produce a Written Scheme of Investigation for delivery of an Archaeological Watching Brief.

An assessment on the effects of the scheme on landscape and visual receptors will be undertaken and a Landscape and Ecology Management Plan (LEMP) produced during detailed design.



# What Are We Doing?

## Development Route

NRW intend to use its Permitted Development Rights relating to the modification of watercourses under the Town and Country Planning (General Permitted Development) Order (2015) granted under Part 15 of Schedule 2 to deliver the project.

## Temporary Work Completed

Temporary engineering works have recently been completed to the dressing floor which is already preventing erosion of contaminated materials on the dressing floor and improving surface water drainage.

## Traffic Management

The implications of the construction works on the mountain road which runs through the site has been considered, the intention at this stage is not to have full road closure, however, if road closure cannot be avoided, this would be of limited duration.



# Proposed Works

## Phasing of the Works

For practicality and to allow for monitoring and assessment to evaluate the efficacy of the works and inform any changes to the proposed design, it is proposed that intervention works are undertaken in four phases, although phases 1 and 2 will be combined.

### Phase 1

Lining of the Nant Dropyns channel, construction of a culvert to divert the Nant Dropyns flow away from the dressing floor and road drainage works.

### Phase 2

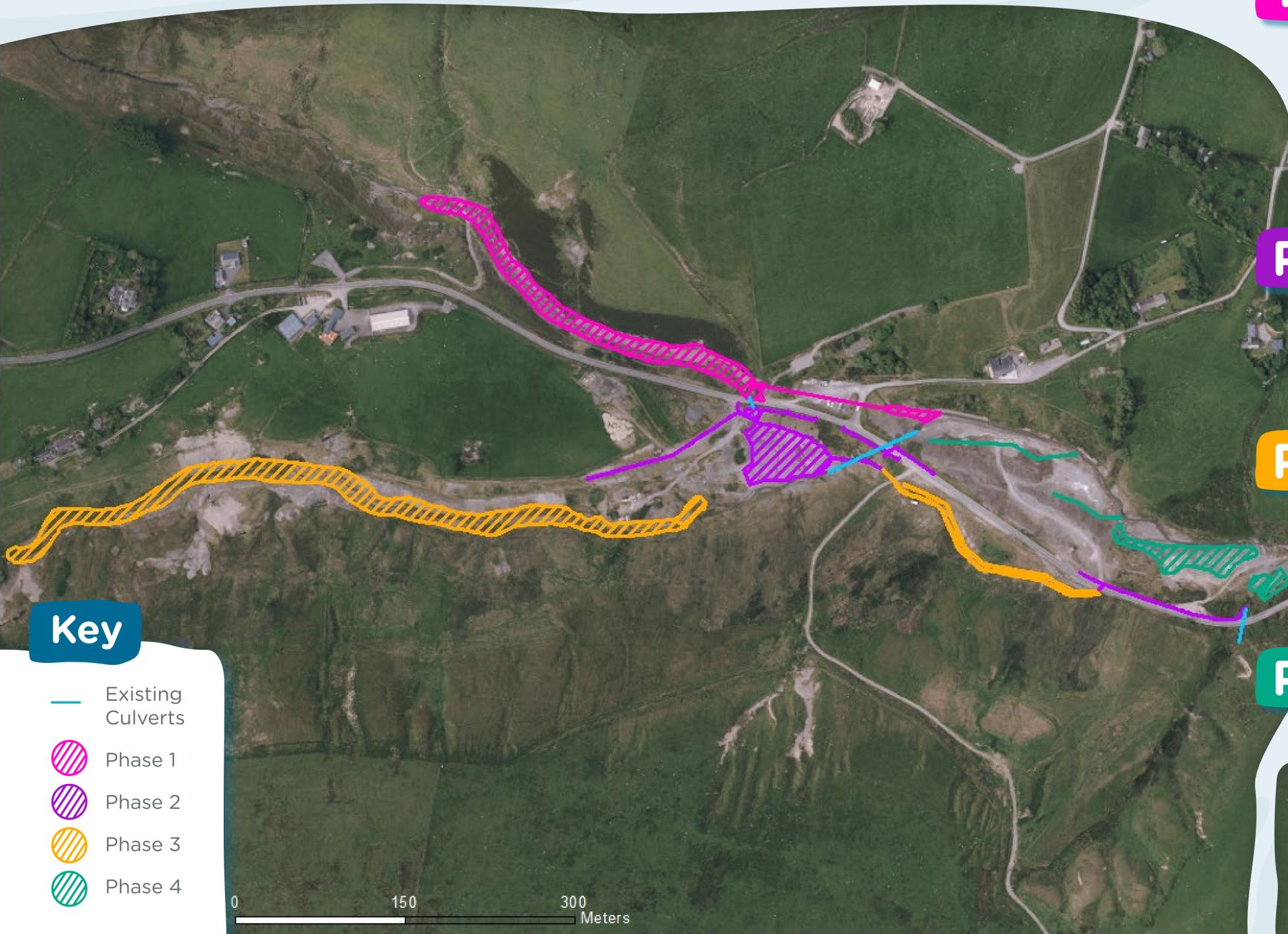
Lining of the dressing floor, construction of surface water drainage.

### Phase 3

Lining of the Afon Twymyn channel and construction of a groundwater cut-off barrier.

### Phase 4

Regrading, new drainage and stabilisation of the Hirant and Great Tips.



### Key

- Existing Culverts
- Phase 1
- Phase 2
- Phase 3
- Phase 4

0 150 300 Meters

# Benefits and Opportunities



## Benefits: WFD Status

The Afon Twymyn will be more likely to achieve 'Good' status, as defined by the Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017.



## Benefits: Water Quality

Approximately 9 tonnes of harmful metals could be prevented from entering the Afon Twymyn and the Afon Dyfi each year.

## Benefits: Environment

Protect and preserve the highly specialised habitat which includes a number of important metal tolerant lichens and mosses. Maintain the Dylife mine geological SSSI.



## Opportunities: Heritage

The mining legacy at Dylife dates back to the early 1600s. We will seek opportunities to record, preserve and promote this.

## Opportunities: Area Enhancements

We will seek to partner with natural beauty and heritage organisations such as Dyfi Biosphere Reserve, and promote the area's unique geological and ecological status to local communities and visitors.



## Benefits: Ecology

By reducing heavy metals in the watercourse and minimising contaminated sediment loss, conditions will be improved for fish, plants, invertebrates and other aquatic ecology.



# Indicative Timescales

**2024**

Development of Detailed Design for Phases 1 and 2, further consultation and completion of final ecological, heritage and landscape assessments.

**2025 to 2026**

Construction of Phases 1 and 2

**2026 to 2027**

Detailed Design and Construction of Phase 3

**2027 to 2028**

Detailed Design and Construction of Phase 4

Each phase of works will be followed by monitoring and assessment to evaluate the effectiveness of the works and inform any changes to the proposed design of future phases.

# Get In Touch

We want to hear from you as we develop the Dylife Mine Project and explore the wider environmental and social opportunities that could be developed as part of the remediation strategy for this site. More details are available on the Dylife Citizen Space page:

 [bit.ly/DylifeMetalMine](https://bit.ly/DylifeMetalMine)

And on the wider Metal Mines Programme on the NRW Metal Mines website:

 [bit.ly/MetalMineWaterPollution](https://bit.ly/MetalMineWaterPollution)

If you'd like to share your views, be added to an email mailing list, or have any questions please get in touch on the details below.

@ [Dylife@metalmineswales.co.uk](mailto:Dylife@metalmineswales.co.uk)

 **0300 065 3000**

You can give us your feedback in multiple ways.

You can fill out a paper feedback form and hand it to us here, or fill it out at home and mail to:

 **Freepost GRASSHOPPER CONSULT**

Visit the website where you will be able to find an online feedback form.



Old mines are dangerous places with many hidden hazards. Many of our projects are located on private land where public access is not permitted without landowner approval.

