August 2025

Wales Metal Mines Programme Summary of Progress

Wales' industrial past presents us with a significant legacy of abandoned metal mines which cause extensive pollution to rivers and streams across Wales. Of 1,300 abandoned metal mines in Wales approximately 220 are estimated to be having a significant impact on water quality and the ecology of over 700km of watercourses.

Funded by the Welsh Government, Natural Resources Wales (NRW) and the Mining Remediation Authority (MRA) are working together to tackle this pollution and mitigate other hazards at these mines.

Through the joint Wales Metal Mines Programme (WMMP), we aim to reduce the pollution of land and rivers and mitigate other hazards and risks from abandoned metal mines. This will make our rivers cleaner and healthier, protect and improve the condition and resilience of ecosystems; promote and enhance health and well-being; celebrate and promote the heritage and amenity of metal mines and support and benefit local communities and stakeholders.

This significant programme of works involves extensive investigations to pinpoint the sources of pollution; the appraisal of remediation options and the design and implementation of engineering solutions. The programme has built upon the work of the Wales Metal Mines Strategy which identified 50 priority sites for remediation to be considered and put in place a small number of significant works.

We are actively working on 25 projects in the programme. These are at different stages of development and delivery, and some cover more than one mine site, where there are physical or hydraulic connections above or below ground.

Typically, projects are initiated with a monitoring programme to characterise the sites and identify the problems to be solved – the sources, pathways and levels of pollution, and the presence of other mine hazards. Possible interventions and remediation options are then considered before the development of detailed designs. The programme is also trialling novel treatment technologies with a number of Welsh businesses and academic institutions.

Since the programme's inception in 2020 it has delivered, or is in the process of delivering, the following outcomes.

- Monitoring programmes to collect evidence on the impact and sources of pollution at 88 abandoned mine sites
- Initial desk studies to begin to identify risks and prioritise further works at 81 abandoned mine sites
- Scoping studies to identify remedial options for pollution sources and other constraints or benefits of remediation at 27 abandoned mine sites.
- Feasibility studies to define the preferred remedial option at 21 abandoned mine sites
- Design of remedial options at 15 abandoned mine sites
- Remedial intervention at eight abandoned mines sites – including significant works on a collapsing adit at Cwmrheidol.
- Ecological and Arcaheological surveys have been undertaken at every site for which plans are being developed. These allow remedial plans to be designed around important features and identify opportunities for enhancing the biodiversity or heritage value of the sites.

Site specific case studies of works undertaken on abandoned metal mines in Wales since 2002

Cwm Rheidol Lead and Zinc Mine

Stream diversion works at Bwlchgwyn in 2007 prevented water entering a shaft into the mine workings which was shown to be connected to the Cwm Rheidol mine. Reducing the volume of clean water entering mine workings has the benefit of reducing the volume of contaminated water discharging from the mine, with the added benefit that less will requires treatment.

In 2009, works were completed to capture water discharges from Adits 6 and 9, conveying these flows safely in overgrowund pipes to reduce erosion of metal rich spoil tips and mobilisation of metals the works also facilitated accurate flow monitoring and a number of water treatment process trials.

The Wales Metal Mines Programme has subsequently completed significant works to minimise the risk of an uncontrolled release of mine water from Adit 9 with the associated pollution and flood risk. These works involved driving a new mine entry to bypass a collapsing drainage adit and allow the minewater to flow freely from the mine; rather than building up and discharging in an acute event. Such events were witnessed in the 1980s and to a lesser degree in 2016 when a single event was estimated to discharge over 720 m3 of very contaminated minewater in 4 hours.

In 2025 a major wildfire in the wider Cwmrheidol area passed through the upper parts of the mine site. The pipeline carrying mine water from Adit 6 was lost to the fire and mine water discharged to the surface and found its way through rock fissures into adit 9, so increasing the risk of overwhelming the blow out prevention works. Rapid deployment of contractors by the Mining Remediation Authority, in collaboration with NRW, to replace the pipework averted any significant consequences.

Design and feasibilty works are ongoing at Cwmrheidol to determine the best mine water treatment method and to identify further ways to minimise surface water ingress into the upper parts of the mine.

Parys Mountain Copper Mine

Anglesey County Council and Environment Agency Wales collaborated to reduce the risk of a 'blow-out': the uncontrolled release of mine water retained within the workings. This prevented the potentially catastrophic release of approximately 270,000 m^3 of highly acidic, metal-laden mine water into the Afon Goch Amlwch, with associated flood risk to the town of Amlwch. These works also reduced the discharge of mine water to the Afon Goch Dulas. Dissolved metals concentrations in the Afon Goch Dulas decreased by approximately: zinc 97%, cadmium 98% and copper 99%.

An area of Parys Mountain was formally designated by Anglesey County Council as contaminated land under Part 2A of the Environmental Protection Act 1990 due to risks to human health. Remediation works were subsequently undertaken as detailed in the Remediation Statement available on the council's website: Environmental Protection Act 1990 – Section 78 N (gov.wales).

Local Authorities are the principal regulators of Part 2A of the Environmental Protection Act 1990.

Frongoch Lead and Zinc Mine

At Frongoch Natural Resources Wales and its predecessor, Environment Agency Wales, has undertaken four separate phases of remediation work:

- 2011 – Stream diversion to prevent clean water entering mine workings.
- 2013 – Perimeter channel and attenuation pond to manage surface water.
- 2015 – Re-profiling and capping of c.70% of main area of mine waste.
- 2018 – Capping of remaining c.30% of main area of mine waste.

We have reduced the volume of mine water discharged from the Frongoch Adit by 82%, meaning less water will require treatment in the future. Dissolved metals concentrations have increased due to less dilution. However, the absolute quantities of dissolved metals (i.e. metals load) has been reduced by: zinc 47%, lead 67% and cadmium 47%.

Based on a comparison of mean data prior to 2011 and post-2018, the remediation works have reduced dissolved metals concentrations in the Frongoch Stream by: zinc 73%, lead 89% and cadmium 80%. The dissolved zinc load has remained similar, whilst lead and cadmium loads have reduced by 51% and 23% respectively.

In addition, many tonnes of contaminated mine waste have been prevented from being eroded each year and deposited in downstream watercourses, and from contributing further to pollution, particularly during flood events.

These works have improved water quality in two waterbodies: the Afon Magwr (via the Frongoch Adit and Nant Cwmnewydion) and the Nant Cell (via the Frongoch Stream) and reduced overall loads of metals in the Afon Ystwyth. In 2024 NRW's routine fisheries monitoring recorded Brown Trout in the Nant Cell downstream of Frongoch for the first time since recording began.

Further works have been undertaken by the WMMP to consolidate previous remediation, for example:

- replacing the liner on the surface water diversion channel to maintain flows and isolate the clean water from the mine waste.
- Maintaining and improving drainage pathways from the site to reduce sediment transport

In 2025 it is planned to install measures such as leaky dams upstream of the mine which will slow the flow of surface water is attenuated and that the diversion works installed in 2011 continue to operate and can handle potentially increased flows due to climate change.

Residual discharges from the Frongoch site and the Frongoch Adit continue to be sources of metals pollution to the Nant Cwmnewydion / Afon Magwr and Frongoch Stream / Nant Cell. Work is ongoing to assess and implement measures to reduce pollution from these remaining sources, as well as at other mines within the catchments.

Wemyss Tip – Nant Cwmnewyddion.

Adjacent to Frongoch Mine is the Wemyss mine and ore processing works. A single large conical waste tip has been subject to erosion of contaminated material since it was abandoned in the early 20th Century. In a single storm in 2012, and subsequently during Storm Darragh in 2024, rapidly increasing flows in the otherwise dry Mill Race stream caused the collapse of part of that tip, mobilising about 200m^3 of metal rich mining waste into the Nant Cwmnewyddion watercourse, a tributary of the Afon Ystwyth. In 2025, erosion control works were completed to protect the toe of the tip from high flows in the Mill Race Stream. The works have stopped the further erosion of the tip at that point and have protected and improved water quality and reduced contamainated sediment deposition in 25km of the Afon Magwr and Ystywth.

Further works are planned in 2025 to divert the Nant Cwmnewyddion stream away from the southern part of the Wemyss Tip where it is undercutting the waste material and causing small collapses which again result in metal contaminated sediment being dispersed into downstream catchment.

Dylife

A significant remedial intervention is planned at Dylife mine in the upper reaches of the Afon Twymyn, a tributary of the Dyfi, starting in 2026, which will involve surface water management to stop clean water from two streams entering the mine and eroding waste material. However in 2022 the dressing floor area of the mine was identified as a significant source of contamination, with active erosion of material during high flow events. To combat the ongoing downstream movement of metal rich sediment, erosion controls were designed and installed. In the short time these erosion controls have been installed they stopped the mobilisation of c.400m3 of contaminated waste material into the wider Dyfi catchment, protecting and improving water quality in at least 15km of the Afon Twymyn.

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Nant y Creiau and Esgair Lle

In 2024, works were completed to reduce erosion of a streamside mine waste facilities at Nant y Creiau Mine near Devil's Bridge and at Esgair Lle Old mine upstream of Ponterwyd. The works have stopped the active erosion of about 800m^3 of tip material into the wider Rheidol catchment and protected vital infrastructure such as power supplies which were at risk of collapse at Esgairlle. These works have protected and improved water and sediment quality in over 30km of the Afon Rheidol and its tributaries.

Further erosion control works are being considered at a number of other sites including Esgairffraith Mine (in the Upper Rheidol catchment), Nant y Mwyn (Tywi catchment), Rhoswydol in the Dyfi catchment, Esgair Mwyn (Teifi catchment), Pandora (Crafnant catchment). As we investigate more sites, it is likely that we will identify more of these opportunities to undertake relatively small scale works which have a significant impact and benefit to the environment.

Abbey Consols

Abbey Consols mine near Pontrhydfendigaid in the Teifi catchment is a significant source of contamination, affecting 25km of the river which is also a Special area of Conservation.

A novel treatment technology was trialled at Abbey Consols using a readily available and non-hazardous material – Sodium Carbonate, to precipitate zinc and other metals in the minewater. Those trials proved the technology had merit and a full scale trial is planned from 2026.

Initial phases of work were completed in 2021 to intercept the minewater underground and to enable it to be channelled to any future treatment plant. These works have also reduced the likelihood of an acute discharge or blow out.

Mine Water Treatment technology

In 2024/25, two other novel treatment technologies were successfully trialled by the WMMP.

Dispersed alkaline substate technology was to pilot scale field trials at Parys Mountain Copper mine (Ynys Mon) and at Cwmrheidol. This system uses an organic substrate prepared with an alkali producing material, to capture metals in an insoluble form. The technique is semi passive in that it requires little energy or frequent addition of chemicals to function. The trials were successful at both sites and the trial reports are being considered for practical applications.

In 2024/25, a large scale laboratory trial using minewater from Nant y Mwyn lead and zinc mine near Rhandirmwyn, Carmarthenshire was conducted by contracted researchers. The trial used high pressure compressed air to remove dissolved carbon dioxide from the minewater and in so doing increase the pH to a degree that zinc and other metals precipitated out of solution without the need for the addition of chemicals. The reports for this trial are awaited prior to any decisions being made about next steps.

Summary

Overall interventions at abandoned metal mines undertaken by the Wales Metal Mines Programme since 2020 have resulted in the improvement and protection of approximately 60km of watercourse. Approximately 1000m3 of contaminated mining waste material has been prevented from being mobilised by erosion across multiple sites. The risk of a catastrophic discharge from Cwm Rheidol has been minimised, reducing the risk of flooding, mobilisation of contaminated sediment and a serious pollution incident.

Further works are planned in 2025 and 2026 to reduce erosion of contaminated waste materials at multiple sites and significant works are planned to begin to manage the overall pollution risk from abandoned mine sites. Whilst these remedial works are being implemented numerous other sites are being investigated and remedial options developed, designed and prepared for delivery.

A number of the sites we are investigating were subject to significant remedial works in the 1980s and 90s, with a focus on mitigating risk to human health. Our focus is water quality which will require further works at these sites. But we will also identify opportunities for maintenance and refurbishment of assets which were constructed 30 to 40 years ago, and have degraded with time. These assets may be less able to cope with changing and often challenging climatic conditions such as the intense rainfall events.