

Abandoned Mine Case Study: Frongoch Lead & Zinc Mine



Frongoch Mine is near the village of Pont-rhyd-y-groes, Ceredigion, and covers approximately 11 hectares. The mine produced lead and zinc ore from the late 1700s until the early 1900s, when it fell into disuse. From 1924 to 1930 the vast waste dumps were reworked to reclaim zinc and lead that had once been deemed uneconomical to recover. The mine is connected to nearby Wemyss Mine which worked the same mineral vein (The Frongoch Lode). The site is privately owned and has in recent years been used as a saw mill.

Frongoch Mine is a major source of metals pollution, causing a chemical and ecological impact on downstream watercourses. The mine is the primary cause of the Frongoch Stream, Nant Cell, Nant Cwmnewydion and River Magwr failing to achieve the environmental quality standards for zinc, lead and cadmium required by the European Water Framework Directive (WFD). It is also a major source of zinc to the River Ystwyth, contributing to its failure of WFD standards. Fish population surveys carried out on the Nant Cwmnewydion showed the stream to be virtually fishless downstream of the Frongoch Adit to its confluence with the Magwr. The Nant Cell was also shown to be devoid of fish above its confluence with the River Ystwyth.

In March 2011 we diverted the Frongoch Stream to prevent it flowing into the mine and thus reduce the amount of contaminated water discharging from the Frongoch Adit into the Nant Cwmnewydion. This work was funded by the Welsh Government's Contaminated Land Capital Fund. The flow from the adit reduced by approximately 80% and metal loads by approximately 50% after the stream diversion, making future treatment of this discharge more feasible. This work also increased dilution of metals in the Frongoch Stream and Nant Cell, causing zinc concentrations to reduce by over 70%.

In January 2013 we started work on a project to further reduce pollution from the mine. The project was partly funded by the European Regional Development Fund, provided through the Welsh Government, and was delivered with technical support from the Coal Authority. The aim was to prevent rain and surface water from coming into contact with the contaminated mine waste, thus reducing the amount of metals being mobilised and entering the Frongoch Stream.

The first phase of the project, completed in 2013, involved the construction of a channel around the mine, directing surface water to a lined pond. This reduced the amount of water flowing through the mine waste and controlled the amount of water leaving the site, reducing the risk of flooding downstream.

In the second and final phase, the waste dumps were re-shaped and capped with clay and soils to prevent water ingress and to encourage re-vegetation. We also built channels to carry the clean surface water into a series of ponds, creating a wetland habitat. The works were designed to be sympathetic to the extensive archaeological remains present at the mine, to preserve its heritage value for future generations. Dyfed Archaeological Trust carried out investigations at the site and recorded the features discovered during excavation of the mine waste.

The project was completed in June 2015 and we are currently monitoring its effectiveness. Early results have been encouraging with further reduction in metal concentrations, despite the wettest winter on record in Wales.





Impact on receiving watercourses

- Length impacted: 32km
- WFD water body ecological status:
 - Frongoch Stream & Nant Cell Moderate
 - Cwmnewydion & Magwr Poor
 - Lower Ystwyth to tidal limit Moderate

Monitoring data

	Frongoch Adit		Frongoch Stream		
	Pre-diversion	Post-diversion	Pre-diversion	Diversion-Phase 2	Post-Phase 2
Flow (L/s)	87	17	17	65	87
pH	6.95	7.04	6.72	7.03	7.05
Zinc (mg/l)	5.6	13.9	13.3	3.6	2.4
Lead (mg/l)	0.36	0.66	1.2	0.27	0.18
Cadmium (mg/l)	0.011	0.023	0.027	0.008	0.006
Zinc load (kg/yr)	12,895	7,074	6,580	8,164	7,688
Lead load (kg/yr)	911	343	500	744	629
Cadmium load (kg/yr)	27	12	12	19	16

Benefits of remediation

- More than 20 tonnes of harmful metals could be prevented from entering the River Ystwyth catchment and subsequently the Cardigan Bay Special Area of Conservation each year.
- Downstream waterbodies will be more likely to achieve Good Ecological Status, although there are other mining pressures on these waterbodies that will also need to be addressed.
- Reduced contaminated sediment load to downstream watercourses from the former tailings lagoon area.
- A large area of mine waste has been converted to a wetland and grassland habitat, increasing biodiversity.
- The remedial works completed to date are sustainable, requiring no energy and minimal maintenance.



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The Coal Authority

