

Abandoned Mine Case Study: Nant y Mwyn Lead Mine

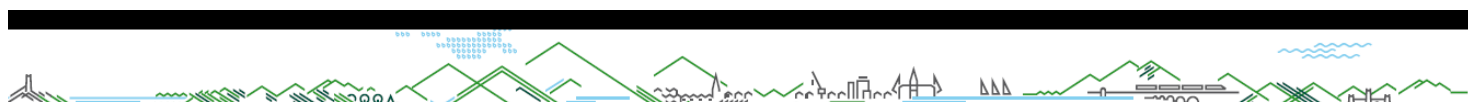


Nant y Mwyn Mine lies near the village of Rhandirmwyn, Carmarthenshire, 10 km north of Llandovery. The mine is geographically divided into two sites, the Upper Boat Level and the Deep Boat Level. The boat levels were similar to conventional drainage adits, however they were designed to maintain a depth of water in their floor to allow access by flat bottomed boats. The Upper Boat Level workings are the more extensive and are found along the valley of the Nant y Bai to the north of Rhandirmwyn. These constitute the collapsed Upper Boat Level portal, settlement ponds, dressing floors, engine house & chimney, and substantial spoil tips. The main Deep Boat Level workings are situated to the southwest of Rhandirmwyn in the valley of the Nant y Mwyn, although workings extend up the length of the valley to the northeast. The Deep Boat Level is also collapsed and the discharge issues from a shaft approximately 50 m back from its portal before entering the Nant y Mwyn via Church Terrace tributary.

The site has significant archaeological value with an area having been designated as a Scheduled Ancient Monument (SAM). This includes the 18th century engine house, 19th century winding house, adjacent boiler house and Cornish chimney stack. The mine is also being considered for designation as a Site of Special Scientific Interest (SSSI), primarily for its geological importance but also for the presence of rare lichens.

The mine is believed to pre-date Roman times and has a well documented history dating back to AD1530. Its final period of operation was in the early 20th century when, in 1929, a new flotation mill and power plant was constructed in the upper reaches of the Nant y Bai catchment, along with the sinking of a new shaft. The old crushing plant near the Deep Boat Level was also dismantled and moved to the new mill site. Although considerable effort was expended to clear out and improve conditions in the old workings, no significant amount of ore was ever processed and the mine finally closed in 1932. In the 1960s much of the development-rock dumps were removed for use in the construction of the nearby Llyn Brianne reservoir dam.

In 2011 we commissioned Atkins Ltd to conduct a scoping study to assess pollution from the site and identify potential remediation options. A conceptual site model was also published in 2011 by Cardiff University. These reports, and our 2012 Water Framework Directive (WFD) abandoned mines investigation, have given us a better understanding of the primary contaminant sources and pathways at the site.



Both the Nant y Mwyn and Nant y Bai tributaries are heavily contaminated with metals, failing European WFD standards for zinc, copper, lead and cadmium. They are also a significant source of metals to the Afon Tywi, causing the river to fail WFD standards for zinc and cadmium, with zinc remaining elevated for approximately 60km downstream of the mine. The Nant y Mwyn is a greater contributor of zinc and cadmium to the Tywi, whilst the Nant y Bai is a greater contributor of lead. The primary source of metals to the Nant y Mwyn is the Deep Boat Level, with additional minor inputs upstream, including Pannau Adit. The discharge from the Upper Boat Level is minimal and the primary source of the metals load in the Nant y Bai is diffuse runoff from the spoil tips and settlement lagoons.

We have calculated the size of a Vertical Flow Pond (VFP) passive treatment system required to treat the discharge from the Deep Boat Level, and in March 2014 commissioned CH2M Hill Ltd to assess the availability of land to construct such a treatment system. This study assessed three potential sites for a VFP and identified a preferred location.

We are also discussing the impact of pollution from the mine and potential remedial options with the Carmarthenshire Rivers Trust, Swansea Metropolitan University & Hydro Industries Ltd through the Upper Tywi Catchment Restoration Project, and members of the local community.

Impact on receiving watercourses

- Length of watercourses impacted: 65 km
- Waterbody ecological status:
 - GB110060036350, Tywi – Doethie to Gwydderig Moderate
- Nant y Mwyn also impacts on the following downstream waterbodies:
 - GB110060036250, Tywi – Llandoverly Bran to Cothi: Moderate
 - GB110060029290, Tywi – Cothi to spring tidal limit: Moderate
- Average mine water flow and quality:

	Deep Boat Level	Nant y Mwyn	Nant y Bai
Flow (litres/sec)	22	51	103
Zinc (ug/l)	11,000	6,000	500
Lead (ug/l)	97	74	280
Cadmium (ug/l)	34	19	2
Zinc load (kg/year)	7400	9600	1600
Lead load (kg/year)	66	120	900
Cadmium load (kg/year)	23	30	6.4

Benefits of remediation

- Over 12 tonnes of harmful metals (zinc, lead and cadmium) could be prevented from entering the Afon Tywi and subsequently the Afon Tywi Special Area of Conservation (SAC) each year. The Tywi is an important spawning ground for Twaite shad and is also one of the best rivers in Wales for otters.
- The receiving waterbody and those further downstream will be more likely to achieve Good Ecological Status, although there are other pressures on these waterbodies that will need to be addressed.
- Reduced contaminated sediment load to the Nant y Bai and subsequently Afon Tywi.
- Potential to demonstrate the effectiveness of a novel minewater treatment system.
- There may be opportunities for the creation of wetland habitat, with biodiversity benefits.
- Potential to develop partnerships with important stakeholders, including the local community.

