Pandora Mine

Management of Mine Contamination Consultation on Options (Long List)

NRW is carrying out an appraisal of surface water management options to alleviate the contamination associated with Pandora Mine. This project is part of a drive to improve water quality of rivers and catchments under the Water Framework Directive (WFD). We are currently considering different options. As part of this process, our engineering and environmental consultancy Binnies LTD, are consulting with stakeholders on behalf of NRW to get feedback on potential options ('Long list'). This feedback will inform the selection of options ('Short list') and the design of any agreed surface water management interventions at Pandora Mine.

Background:

Pandora Mine was an operational zinc and lead mine from the 1840s until 1920. A little of its legacy can be seen at the surface, notably the spoil heaps (the large piles of stone near Caban Pandora and the black soil to the south of the road known as 'dressing floor' area) and remnants of old mine buildings. Below the surface**,** underground workings are still mostly open, any water that enters the mine outflows from the Pontifex Addit near Llyn Geirionydd.

Site Location:

Pandora Mine is south east of Llyn Geirionydd, near Trefriw, in Snowdonia National Park.

Mining Heritage and Ecology:

The Pandora Mine sits within an area of high archaeological and ecological sensitivity. Many features of archaeological and ecological interest exist across the site relating to the mine and its associated spoil heaps. These include ecological features of interest within the Mwyngloddiau Fforest Gwydir Special Area of Conservation (SAC), the Pandora Reservoirs Site of Special Scientific Interest (SSSI) and Mwyngloddiau A Chreigiau Gwydyr SSSI. In particular a number of rare plants are present that often grow on the metal rich mine spoil heaps, especially lichens and bryophytes forming 'Calamarian Grassland' habitat which grows on the exposed 'dressing floor' spoil heaps (the southern area of the mine where rock was processed).

An Ecological Assessment and Archaeology/Heritage Assessment of the site have been undertaken. Details of these are available upon request.

Remediation Driver:

Water enters the mine through the various shafts and washes through the spoil heaps. The mine and spoil heaps retain lead and zinc content, even though mining work has long ceased. Water leaving the mine, or that passes through spoil heaps, becomes contaminated with lead and zinc at levels that are harmful to the environment before flowing into Llyn

Geirionydd and downstream river network (Afon Crafnant and Afon Conwy). The elevated metals contribute to the Afon Crafnant being classified under WFD as 'moderate quality'.

In addition to this, a high flow of water through the mine could lead to local collapses within the mine. This would lead to pressures building up until the blockage is suddenly overcome, releasing a high volume of contamination into the water network, referred to as a 'mine blow out' and causing severe environmental issues downstream.

The proposed scheme will look at various options to manage the surface water across the site to try and reduce the amount of water that enters the mine and flows through the spoil heaps. This will help reduce the amount of lead and zinc contamination washing into Llyn Geirionydd, and will improve the water quality in the Afon Crafnant and Afon Conwy downstream. It will also be the first step to reducing the risk of the mine suffering a 'blow out'.

Benefits of Surface Water Management and Remediation:

- Reduction in the amount of contaminated water and contaminated sediment entering into downstream lakes and watercourses.
- Downstream water bodies will be more likely to achieve good ecological status under the European Water Framework Directive (WFD). Although there are pressures on these waterbodies from other mine water discharges these are being considered separately by NRW and collectively they can improve downstream water quality.
- There is potential to develop an educational resource at the site in line with the Well-being of Future Generations Act. For example, information boards within the Llyn Geirionydd car park area, explaining the remediation and ongoing site management, the mining heritage landscape and archaeology, ecology and biodiversity.

Considering the Options:

The results of recent studies have been integrated into the options appraisal in a holistic approach to safeguard sensitive features. The scheme will also be refined following a Geo-Environmental site investigation and will take into account feedback received as part of this consultation.

Given the complexity of the site it is likely that no single engineering intervention will be suitable across the area and a combination of interventions will be required.

An options 'longlist' workshop will be held by Binnies and NRW in August 2021 to review potential interventions and to derive a working shortlist of interventions that will form a preliminary strategy for the Pandora site. The current long list of options comprising 12 options or combinations thereof, these are detailed within Figure 1 and described below.

- **Option 1** Do Nothing – We always consider the option of taking no interventions as a comparison to the other options.
- **Option 2** – Line the existing channels that interact with the 'dressing floor' spoil tip (using plastic or clay liner) to prevent water becoming contaminated through contact with spoil and prevent contaminated spoil being washed downstream.
- **Option 3** – Create a channel above the spoil heap to prevent water entering the 'dressing floor' spoil area. Similar result to Option 2, preventing contamination of water in contact with spoil and reducing erosion of spoil and washing into downstream watercourses.

- **Option 4** – Install cover system over the 'dressing floor' spoil heaps (e.g. bentonite cap with soil cover system). However this may have adverse impact on the heritage and ecology of this area of spoil heaps.
- **Option 5** – Cap the Great Shaft – Concrete cap at rock head, with side grouting as required to make a low permeability seal. Backfilled with natural soils to ground level. Prevents water entering the mine system at this point and enhances the safety of the area.
- **Option 6** – Divert water from the Great Shaft by reshaping the ground locally and forming a channel away from shaft. This will stop/significantly reduce water entering the mine system at this point.
- **Option 7** – Pipe water through from the eastern spoil extent down through the site to avoid mine spoil heap and Caban Pandora. This will prevent the water interacting with any mine spoil and entering Great Shaft.
- **Option 8** – Reroute flow so that water from higher in the catchment runs to the north of the Pandora mining site. Would stop the water from entering the mine area. Some reprofiling of the hillside would be required to ensure that the water flows in the desired direction. This option would require the reinstatement of the currently disused reservoir.
- **Option 9** – Channel the water from Pandora Reservoirs through an engineered channel with tunnel or pipeline as required. This would divert the main source of water from the mining area away from the contamination.
- **Option 10** – Rewetting upland areas through blocking of streams with woody debris. This will increase water retention higher in the catchment and reduce surface water runoff by increasing infiltration to soil and groundwater. This option could act as a flood mitigation measure and a carbon sink while increasing the biodiversity of the area.
- **Option 11** – Reinstate historic leat that runs along the south of the mine area. This option is the similar in principle to Option 7 but carries water in a different direction entering Llyn Geirionydd from the southwest.
- **Option 12** – Divert water as it reaches the eastern point of the mine site down through topography to the northwest of the mine site. Avoids the mine spoil heap and Caban Pandora.

Questions:

We welcome and encourage feedback on the current options.

a) Do you have general concerns, queries or comments about the proposed engineering interventions?

b) Do you know of other opportunities we should be exploring for this site?

c) Do you have additional information that would improve our understanding of the site and enable a more informed decision? If so, would be willing to share the information with us?

The feedback response period is open for 15 days until the 28th of July 2021. We cannot guarantee that responses received after this date will be incorporated in the next phase of optioneering and final shortlisting.

Please provide your feedback by emailing McCarthyLJ@binnies.com or by post to: Liam McCarthy, Binnies UK Limited, 3rd Floor, One City Place, Queens Road, Chester, CH13BQ.

Appended:

- Figure 1: Long List Options for Consultation.