Phase 3 Remediation Method Statement and Validation Plan

Bryntail Cottage, Y Fan, Llanidloes, Powys, SY18 6NU

The Bryntail Cottage Charity

Environmental Management Solutions –EMS Geotech

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Bryntail Cottage, Y Fan, Llanidloes, Powys, SY18 6NU

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Contents

SUMMARY REPORT

SUBJECT	COMMENTS
CURRENT USE & DESCRIPTION	Irregular in plan, the site covers approximately 0.12 hectares, is slightly undulating, slopes towards the southwest and is generally grass covered. A rough track passes centrally through the site. Bryntail Cottage is located in the eastern half and Miners Cottage in the western half. The property is no longer in use. A small port-a-cabin is located off-site, approximately 5m, south from Miners Cottage. The property is no longer in use. Hedgerow and a parallel Public Footpath (Glyndwr's Way) delineate the northern site boundary and post and mesh fencing the eastern boundary. The southern and western boundaries are open. Roughly vegetated ground that slopes from the north to the south and west is situated beyond the northern, southern and western boundaries. To the east is Bryntail (livestock) Farm. To the east, south and west are former mine workings associated with the Bryn-y-Tail (or Bryntail) Lead Mine. A former overgrown quarry is located immediately to the northwest.
PROPOSED USE	It is proposed to refurbish the existing Miner's and Bryntail Cottages to provide educational and short-term accommodation space for schools and youth groups.
HISTORICAL SUMMARY	The Bryntail Mine operated between 1708 and 1884 when the existing on-site structures (Miner's and Bryntail Cottages) and Bryntail Farm were constructed. The site has remained relatively undeveloped since this time. Miner's and Bryntail Cottages were leased, by Severn Trent Water, to the Central Secondary School in Birmingham for use as an educational camp in 1915 however the property is no longer in use.
GROUND CONDITIONS	The ground conditions encountered included a Made ground cover overlying clay rich weathered Bryn-Glas Formation soils and mudstone belonging to the Bryn-Glas Formation. Groundwater was not encountered to depths of up to 2.3mbgl.
HYDROGEOLOGY	The superficial Devensian Till (Diamicton) deposits are designated a Secondary Undifferentiated Aquifer. The underlying Bryn-Glas Formation bedrock is designated a Secondary B Aquifer. The site is not located within a groundwater Source Protection Zone.
HYDROLOGY	The nearest water features are an unnamed pond 145m to the east and the Afon Clywedog, approximately 430m to the southwest. The site is not in an area indicated to be at risk from flooding.

PREVIOUS GROUND REPORTS	EMS is not aware of any previous ground investigations having been conducted at the site. EMS have previously undertaken a Phase 1 Contamination Desk Study and Phase 2 Contamination Site Investigation Report that should be read in conjunction with this report and is referenced as: Phase 1 Geo-Environmental Desk Study Report, 'Bryntail Cottage, Y Fan, Llanidloes, Powys, SY18 6NU', EMS, E24812, dated 10th February 2022. Phase 2 Contamination Site Investigation Report, 'Bryntail Cottage, Y Fan, Llanidloes, Powys, SY18 6NU', EMS, E24812, dated 4th May 2022.

SUMMARY REPORT –REMEDIATION WORKS

SUBJECT	COMMENTS
INTRODUCTION	The aim of this 'Phase 3 Remediation Method Statement' is to detail the objectives, methodology and procedures for the proposed remediation of contaminated on-site soils resulting from the historical usage of the site. Upon completion of the remediation works, a Phase 4 Validation Report will be produced to demonstrate that the works have been carried out satisfactorily and remediation targets achieved.
REMEDIATION WORKS OVERVIEW	A 600mm thick capping system is required. Remediation works shall include removing all made ground to a depth of 600mm below final ground level. This will facilitate placing an engineered clean soil cap to act as a barrier to prevent end-users coming into contact with underlying contaminated soils. The engineered cap construction shall comprise a basal protective hi vis geo-textile membrane, placed onto the formation level. This will act to reduce / prevent inter soil mixing between contaminated and clean soils whilst also acting as a no dig barrier. Over the geo-textile marker layer 600mm of clean imported soil - subsoil / topsoil shall be placed. The sidewalls of the resultant void should also be lined with a geotextile membrane to act as an anti-soil mixing barrier between existing Made Ground and imported clean soils.
VALIDATION PLAN OVERVIEW	The validation report will include: • A remediation works summary. • A photographic record of the remediation works undertaken; • Details relating to the origins of imported soils; • Laboratory test certificates for analysis of PAH delineation / validation samples and imported soils; • A plan showing the locations of PAH delineation hand pits and validation pits; and • Waste consignment notes for all soils disposed of off-site.

1. Introduction

1.1 General

Environmental Management Solutions Limited (EMS) have been commissioned to undertake a Phase 4 Validation Report following the completion of remediation works at Bryntail Cottage, Y Fan, Llanidloes, Powys, SY18 6NU. Hereafter, referred to as 'the site'. The works have been commissioned David Holland (the agent) on behalf of The Bryntail Cottage Charity (the Client).

The proposed development includes refurbishing the existing Miner's and Bryntail Cottages to provide educational and short-term accommodation space for schools and youth groups. School visits are unlikely to last more than six nights and pupils are unlikely to visit the site more than once. No food for consumption purposes is currently grown or reared at the site or will be as part of the proposed development. Drinking water is currently supplied to site via Severn Trent Water supply networks. The proposed refurbishment works are being undertaken in association with the Bryntail Cottage Charity.

A plan showing the proposed site layout is included in Appendix A.

This Phase 3 'Remediation Method Statement' aims to detail the objectives, methodology and procedures for remediating contaminated soils at the site. Once the remediation works are completed, a Phase 4 Validation Report will be produced to demonstrate that the works have been carried out satisfactorily and remediation targets achieved.

The site has previously been subjected to a Phase 1 Desk Study and Phase 2 Contamination Site Investigation, by EMS. The findings were written up into Phase 1 and Phase 2 reports, which should be read in conjunction with this report and are referenced as:

- Phase 1 Geo-Environmental Desk Study Report, 'Bryntail Cottage, Y Fan, Llanidloes, Powys, SY18 6NU', EMS, E24812, dated 10th February 2022.
- Phase 2 Contamination Site Investigation Report, 'Bryntail Cottage, Y Fan, Llanidloes, Powys, SY18 6NU', EMS, E24812, dated 4th May 2022

1.2 Scope of Works

The agreed scope for the intrusive Phase 2 Site Investigation works included:

- Updating Phase 1 Desk Study in line with the Council's requests; Producing health and safety documentation and mobilising to site.
- Undertaking Cable Avoidance Tool (CAT) scans for all exploratory hole positions.
- Machine excavated trial pits to a maximum 3m depth, ground conditions permitting, to expose a larger soil quantity for inspection and assess the presence, nature and extents of Made Ground on-site. Trial pits will also facilitate collecting soil samples for logging and laboratory purposes.
- Logging, sampling and undertaking investigation works in general accordance with BS5930:2015, and BS10175:2011, by a suitably qualified Geo-Environmental Engineer.
- Determining each exploratory hole location using a tape measure or recreational handheld GPS unit.

- Laboratory chemical analysis of soil samples, to check for on-site contamination with a budget based on the following schedule:

    - 4 No. EMS Soil Suite 1: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, speciated PAH, Banded TPH, total cyanide, phenols, organic matter, Chromium (VI), total sulphate, water soluble sulphate, total sulphur, pH.
    - 10 No. Lead in soils.
    - 3 No. Lead leachate analysis.
    - 4 No. Asbestos in soil. and
    - Asbestos quantification (only where asbestos in soils is encountered).

- Compiling one Phase 2 Contamination Site Investigation report in electronic (in pdf format) summarizing desk study information; Detailing the site works undertaken and the ground conditions encountered; Including factual exploratory hole records, trial pit photos, and laboratory results; Including a revised conceptual site model and Quantitative Contamination risk assessment; Providing recommendations for further investigation works and potential Phase 3 remediation options where required.

1.3 Management Limitations

- This report has been prepared under the express instructions and solely for the use of the Client and the Client's agents in performance of EMS's duties under its contract with the Client. Should the Client wish to release this report to a Third Party for that party's reliance, EMS agree to such release provided that EMS assumes no duties, liabilities or obligations to the Third Party, that the Third Party does not acquire any rights whatsoever against EMS, and EMS accepts no responsibility for any loss incurred by the Client through the Client's release of the report to the Third Party.

- Copyright of this report is held by EMS.

- The findings of this report represent the professional opinion of experienced contaminated land consultants. EMS relied on the accuracy of third party documentary information contained in the consulted and is in no circumstances responsible for the accuracy of such information or data supplied. When considering this report due regard should be given to the terms and conditions of EMS's contract with the Client under which the report was prepared.

- EMS does not provide legal advice and the advice of legal professionals may also be required. All advice, opinions or recommendations within this report should be read and relied upon only in the context of the report as a whole. The advice within the report is based upon the information made available to EMS within the financial and timeframe constraints imposed.

- All work carried out in preparing this report has utilised and is based upon EMS's current professional knowledge and understanding of current relevant UK standards and codes, technology and legislation. Changes in this legislation and guidance may occur at any time in the future and cause any conclusions to become inappropriate or incorrect. EMS does not accept responsibility for advising the Client or other interested parties of the facts or implications of any such changes.

- The report is limited to the site boundaries identified by the Client and confirmed within this report. All boundary lines depicted on plans included within this report are approximate only and do not imply legal land ownership.

- The extent of the works was designed in-line with the Client's budget, which is considered suitable, and not limiting, for the proposed development.

- All observations relating to tree species, asbestos containing materials within structures or invasive weeds, such as Japanese Knotweed, does not constitute a formal survey of such features. The identification of such features is therefore tentative only. The report does not consider whether sensitive ecology or archaeology is present as these require consideration by professionals specialising in these matters.

- Following final issue of this report, EMS has no further obligation to advise the Client on any matters such as changes in legislation or codes of practice that may affect the advice contained within the report.

2. Land Use and Setting

2.1 Site Location

The site is situated approximately 6 km northwest of Llanidloes town centre at Bryntail Cottage, Y Fan, Llanidloes, Powys, SY18 6NU.

The National Grid Reference (NGR) for the site is E: 291810, N: 287070.

A Site Location Plan is included in Appendix A.

2.2 Site Description

Irregular in plan, the site covers approximately 0.12 hectares, is slightly undulating and slopes towards the southwest. Grass and trees, generally cover the site with some hardstanding around existing buildings and a rough unpaved / gravel track bisecting the middle, from north to south. The site itself is situated on elevated ground, to the northeast of the former Bryntail (Lead) Mine on the northern periphery of land from beneath which lead ore was extracted via shafts and adits that served the mine.

Two single-storey, stone cottages 'Bryntail Cottage' and 'Miners Cottage', with slate rooves are located on-site along with a portacabin. 'Bryntail Cottage', located in the eastern half of the site was empty during the walkover with some tables and chairs and used for educational purposes. At its eastern end was a roofless, drystone walled area that contained horseshoes, broken glass, bits of concrete, plastic sheeting and metal rods. 'Miners Cottage' is located within the western half of the site and is unoccupied. The portacabin, located to the south of Miners Cottage, was empty and sits on old foundations belonging to a historical structure. Bonfire remains are also present to the south of Miner's Cottage.

The cottages are listed buildings and historically provided accommodation for the mine manager and his family. Previously the cottages were leased to the Central Secondary School in Birmingham for educational and short-term accommodation purposes. The cottages are currently empty.

Hedgerow and a parallel Public Footpath, track, (Glyndwr's Way) delineate the northern site boundary, beyond which the ground slopes steeply upwards, is covered in grass and gorse and used for grazing livestock. Overgrown rock exposures belonging to a former quarry are present immediately beyond Glyndwr's Way, to the northwest of the site. Post and mesh fencing delineates the eastern site boundary, beyond which is Bryntail (livestock) Farm. The southern and western boundaries are open onto undulating and terraced ground that slopes downwards away from the site and is covered in grass and sporadic trees.

Historically the site and associated buildings belonged to the disused Bryntail Mine. A pool and apparent workings are shown approximately 150m to the east where ore would have been extracted and waste deposited. A disused shaft (Gundy Shaft) and stone former pump/winding house with associated spoil heap are located approximately 47m to the south. A second spoil heap is located approximately 100m to the west. Bryntail Mine (Disused) with associated buildings, where extracted ore would have been processed, is shown adjacent to the Afon Clywedog approximately 480m further west and downhill from the site.

The site is situated on undulating, elevated ground at approximately 304m Above Ordnance Datum (mAOD). The ground rising in the north and northwest to the Bryn-y-tail hill summit at approximately 403m AOD and the Llyn Clywedog reservoir and dam located 570m from the site. To the east, the ground

remains relatively flat. To the south and west, ground elevations fall into a valley, at around 200m AOD, through which the Afon Clywedog flows from roughly northwest to southeast.

A plan showing the existing site layout is included in Appendix A.

2.3 Site History

The Bryntail Mine operated between 1708 and 1884 when the existing on-site structures (Miner's and Bryntail Cottages) and Bryntail Farm were constructed. The site has remained relatively undeveloped since this time and the mine buildings fallen into decay. Miner's and Bryntail Cottages were leased, by Severn Trent Water, to the Central Secondary School in Birmingham for use as an educational camp in 1915 however the property is no longer in use.

2.4 Proposed Development

The proposed development includes refurbishing the existing Miner's and Bryntail Cottages to provide educational and short-term accommodation space for schools and youth groups. School visits are unlikely to last more than six nights and pupils are unlikely to visit the site more than once. No food for consumption purposes is currently grown or reared at the site or will be as part of the proposed development. Drinking water is currently supplied to site via Severn Trent Water supply networks. The proposed refurbishment works are being undertaken in association with the Bryntail Cottage Charity.

A plan showing the proposed site layout is included in Appendix A.

2.5 Ground Conditions Summary

2.5.1 Overview

The ground conditions encountered during the investigation works generally agreed with those anticipated from the published geological information. These generally comprised a sitewide Made Ground cover overlying clay rich soils and mudstone bedrock belonging to the Bryn-Glas Formation. No superficial deposits were encountered during the intrusive investigation works.

Details of the various stratigraphic units encountered are presented on the exploratory hole logs, included in Appendix B, and are discussed further in the following sections.

2.5.2 Artificial Ground

During the intrusive investigation works, with the exception of trial pit TP03, no surface hardstanding, buried services or structures were encountered in the trial and hand pits. In trial pit TP03, a concrete slab was recorded at 0.10m depth.

2.5.3 Topsoil and Made Ground Topsoil

No Topsoil / Made Ground Topsoil was encountered during the investigation works.

2.5.4 Made Ground

Made Ground was recorded sitewide in all trial and hand pits to between 0.10m (HP01, HP02 and TP03) and 2.10m (TP12 and TP13) depth. The deepest Made Ground being recorded between Bryntail Cottage and the northern site boundary. The encountered Made Ground was generally described as grass over

dark brown, brown, black and grey slightly gravelly/gravelly clay. In TP05, between 0.10m and 1.20m depth, Made Ground described as dark grey, black and brown clayey gravel was recorded. The Made Ground also included mudstone, brick, concrete, ash, coal, slag, burnt wood, breeze block and clay pipe.

2.5.5 Superficial Soils

No superficial deposits were encountered in the trial and hand pits during the investigation works.

2.5.6 Bedrock –Bryn-Glas Formation

The Bryn-Glas Formation bedrock was encountered in trial pits TP01, TP02 and TP04 to TP11 during the investigation works and included a weathered clay rich layer overlying unweathered mudstone to the maximum investigation depth, at 2.30m (TP04 to TP06).

The weathered clay rich Bryn-Glas Formation soils were generally described as firm orangish and grey brown clay with abundant mudstone lithorelicts. These soils were recorded to between 1.30m (TP01 and TP02) and 2.00m (TP04 to TP06 and TP09) depth.

The underlying unweathered rock layer was generally described as extremely weak dark grey mudstone that was recovered as angular fine to coarse gravel.

2.5.7 Groundwater

During the investigation works, no groundwater was encountered in the trial or hand pits undertaken up to depths of 2.3mbgl.

2.6 Hydrogeology Summary

The site is situated on elevated ground at approximately 304mAOD, with the Afon Clywedog river, approximately 430m to the southwest, at 200mAOD. Groundwater is expected to occur at depth and flow towards the south and west.

The superficial Devensian Till (Diamicton) deposits have been classed by Natural Resources Wales as a Secondary Undifferentiated Aquifer and the underlying Bryn-Glas Formation Bedrock as a Secondary B Aquifer.

The site is not located within a groundwater Source Protection Zone and there are no licensed groundwater abstractions recorded either on-site or within 250m of the site. The underlying superficial deposits and Bryn-Glas Formation Bedrock is designated as High Vulnerability.

2.7 Hydrology Summary

The site is situated on elevated ground overlooking the Afon Clywedog valley to the southwest with the ground sloping towards the south and west. The site is predominantly covered with grass, trees and some hardstanding. Therefore, surface water is anticipated to mainly percolate directly into the ground.

The nearest water features are the unnamed pond 145m east of the site, associated with the former Murray Shaft workings, and the Afon Clywedog, approximately 430m to the southwest. The Afon Clywedog flows south-eastwards to Llanidloes where it joins the River Severn.

A single registered discharge consent entry is recorded 30m to the north and licensed to Bryntail Cottage by the Environment Agency. No revocation date is supplied for this entry. There are no recorded licensed surface water abstraction entries either on-site or within 250m of the site.

According to the Natural Resources Wales website (www.naturalresoucres.wales/flooding) the flood risk from rivers is Very Low.

2.8 Previous Investigation Works

EMS undertook the intrusive Phase 2 site investigation works on 24th February 2022, which included 13 No. Trial pits (TP01 to TP13) and 2 No. Hand Dug Pits (HP01 to HP02).

Trial pits were selected to relatively quickly and easily expose a greater soil area, for logging purposes, obtaining samples for chemical analysis whilst providing a more reliable record of the ground conditions encountered. Trial pits were excavated using a mechanical excavator to between 1.50m (TP01) and 2.30m (TP04 to TP06) depth. Trial pit TP03 was terminated at 0.10m depth on a concrete slab between the Miner's Cottage and the portacabin. All trial pits were backfilled with arisings on completion.

Shallow hand dug pits were selected to obtain shallow soil samples for chemical analysis. The hand dug pits were undertaken to 0.10m depth to collect soil samples for chemical analysis. All hand pits were backfilled with arisings on completion.

Mature trees and some restricted access on-site meant that no trial pits could be undertaken towards the far north-eastern and south-western ends of the site.

Pits were generally located to give good sitewide coverage. Trial Pit TP05 was located to specifically target the area of bonfire remains.

All soil arisings were logged in general accordance with British Standard BS5930:2015 by an attending EMS Geo-Environmental Engineer.

Selected Made Ground samples from four trial pits (TP01, TP05, TP10 and TP13), between 0.10m and 0.80m depth, were subjected to chemical analysis for heavy metals, total cyanide, phenols, organic matter content, water soluble sulphate, total sulphate, total sulphur and pH, speciated polycyclic aromatic hydrocarbons (PAH), banded total petroleum hydrocarbons (TPH), and asbestos in soils / quantification. Additionally, 10 No. Made Ground samples from TP02, TP04, TP06 to TP09, TP11, TP12, HP01 and HP02 were subjected to lead in soils analysis. Lead leachate analysis was also conducted on 10 No. Made Ground samples.

With the exception of heavy metals, no significantly elevated chemical concentrations for non-metallic compounds, PAH or TPH in the samples analysed. No asbestos was recorded in the samples analysed.

However, in all 14 No. Made Ground samples analysed significantly elevated lead concentrations were recorded that were well in excess of the GACs for residential use with plant uptake (200 mg/kg) and without plant uptake (310 mg/kg). Recorded lead concentrations in soils ranged between 2,580 mg/kg (TP13 at 0.80m) and 29,900 mg/kg (TP02 at 0.20m). A single Made Ground sample (TP05 at 0.10m) also recorded an elevated arsenic concentration, at 69 mg/kg, which exceeded the GACs for residential use with plant uptake (37mg/kg) and without plant uptake (40 mg/kg).

It is expected that the Made Ground encountered has been sourced from the waste material extracted from the historical mine shafts, i.e. the Gundy and Murray Shafts, which has been used to reprofile the ground surface on-site. The high lead levels recorded resulting from the extracted mining spoil.

Significantly elevated lead concentrations, between 2,580 mg/kg and 29,900 mg/kg, and a single elevated arsenic concentration, 69 mg/kg, were recorded from sitewide Made Ground analysis following the investigation works and associated with the historical site usage. Lead leachate analysis indicates that this contaminant is likely to be mobile within the environment. The proposed development includes refurbishing the existing cottages for educational and short-term residential purposes. However, given the lead concentrations recorded there remains a moderate risk posed to human health from on-site contaminated Made Ground.

3. Remediation Options Appraisal

On-site Made Ground has been found to be contaminated with significantly elevated lead and some arsenic, which poses a moderate risk to human health.

The following table provides a summary of the types of chemical contamination that each featured remediation technology is suited to. The site requires remediation for Inorganics (including metals).

Summary of Viable Soil Remediation Options					
Remediation Option	Inorganics (including metals)	Petroleum hydrocarbons	Volatile organic compounds	Semi volatile organic compounds	PAH
Bioremediation	?	Y	Y	Y	?
Chemical immobilisation and solidification	Y	?	?	?	?
Containment	Y	Y	Y	Y	Y
Excavation	Y	Y	Y	Y	Y
Soil vapour extraction	N	Y	Y	?	?
Soil washing	?	?	?	?	?
Thermal desorption	N	Y	Y	Y	Y
Notes: Y - Viable remediation option ? - Potentially viable remediation option (less common or demonstrated) N - Not viable remediation option (or not known / demonstrated)					

Chemical immobilisation and solidification, Containment and Excavation have been identified as viable remediation options.

Chemical immobilisation and solidification techniques reduce the mobility of contaminants through physico-chemical reactions between the soil and a reagent. The contaminants are not removed but the contaminant pathways are effectively cut. It is considered that this process would not be suitable for landscaped areas within the near surface.

Containment and excavation are the remaining viable remediation options.

Capping systems are an engineered remediation solution to protect future site users from residual contamination. Capping systems place a predetermined thickness of certified clean subsoil and/ or topsoil over areas of insitu contamination to effectively cut contaminant pathways.

4. Detailed Remediation Method Statement

4.1 Remediation Works Objectives

All remediation works undertaken during the site development will aim to remove or break the pollutant linkages identified from previous desk study and investigation works.

Recorded lead concentrations in soils ranged between 2,580 mg/kg (TP13 at 0.80m) and 29,900 mg/kg (TP02 at 0.20m). A single Made Ground sample (TP05 at 0.10m) also recorded an elevated arsenic concentration, at 69 mg/kg, which exceeded the GACs for residential use with plant uptake (37mg/kg) and without plant uptake (40 mg/kg).

The objectives of the remediation works will include:

1. Excavation of contaminated material to achieve an agreed 600mm capping system at final site levels.

2. Placement of an agreed capping system to protect future site users within landscaped areas.

These remediation works required for the proposed development are outlined in the following sections.

All remediation works should be supervised and verified by an experienced Geo-Environmental Consultant and, upon completion, documented within a Phase 4 Validation Report.

4.2 Remediation Works -

The proposed development includes refurbishing the existing Miner's and Bryntail Cottages to continue providing educational and short-term accommodation space for schools and youth groups.

Within existing landscaped areas the on-site Made Ground has been found to be contaminated with significantly elevated lead and some arsenic, which poses a moderate risk to human health. A drawing showing the extents of the barn, the proposed parking / access area and the location of trial pit TP02 is included in Appendix A.

A 600mm thick capping system is required. Remediation works shall include removing all made ground to a depth of 600mm below final ground level. Upon completion, a hi vis geomembrane shall be lain in the resultant void and backfilled using suitably compacted imported clean granular fill. The source of these soils will be identified for validation purposes and ideally samples will be taken for chemical analysis prior to the soil being brought to site. Analysis of imported soils is required to show that they are 'clean' and suitable for use. Therefore, samples of imported soils will be analysed for:

- Heavy metals: (arsenic, cadmium, chromium, chromium (VI), copper, lead, mercury, nickel, selenium, zinc);
- Total cyanide;
- Phenols;
- Organic matter;
- Water soluble sulphate;
- pH;
- Total sulphate;
- Speciated PAH;
- Speciated TPH and
- Asbestos.

Testing should be to "Requirements for the Chemical Testing of Imported Materials for Various End Uses and Validation of Cover Systems v.1 May 2013" prepared by Welsh Land Contamination Working Group.

Sampling Frequencies and Analytical Requirements for imported material are presented within Table 3 the document.

The engineered cap construction shall comprise a basal protective hi vis geo-textile membrane, placed onto the formation level. This will act to reduce / prevent inter soil mixing between contaminated and clean soils whilst also acting as a no dig barrier. Over the geo-textile marker layer 600mm of clean imported soil - subsoil / topsoil shall be placed. The sidewalls of the resultant void should also be lined with a geotextile membrane to act as an anti-soil mixing barrier between existing Made Ground and imported clean soils. As detailed in Figure 1 below.

The remediation works shall be supervised, documented and verified by an attending Geo-Environmental Engineer.

Upon completion, the capping layer should be sown with grass seed using techniques such as hydro-seeding.

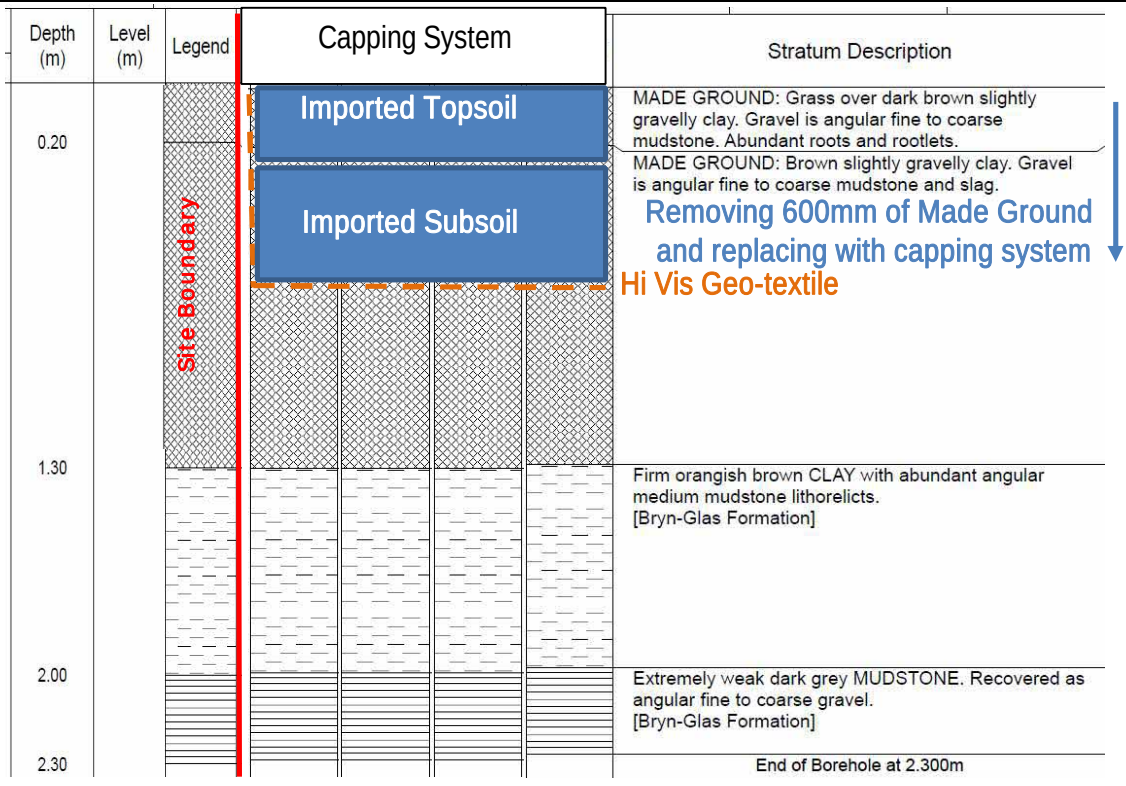


Figure 1 Proposed Capping System

4.3 Waste permitting

It is considered that Made Ground contaminated with heavy metals, i.e. lead, for off-site disposal would be classified as ‘hazardous waste’. Such waste will require pre-treatment prior to off-site treatment or disposal. Waste Acceptance Criteria (WAC) testing of the soils for disposal will also be required if the soil is to be disposed of to landfill. The waste code from the European Waste Catalogue (EWC) 2002 for the soils would be 17 05 03 ‘Soil and Stones, containing dangerous substances’.

4.4 Undiscovered Contamination

Any as yet undiscovered evidence of contamination identified during site works should be immediately reported to EMS who will put appropriate measures in place and inform the Local Authority at the earliest available opportunity.

Any proposed changes to the above methodology will be reported to the Local Authority for their comment/approval prior to implementation.

5. Validation Plan

5.1 Introduction

The aim of the validation plan will be to document that all remediation works have been satisfactorily undertaken to make the site suitable for use. All remediation works shall be recorded, documented (written notes / photographs) and inspected. This shall include:

A summary of the works undertaken.

- A documentary and photographic record of the works undertaken.
- Logs and photographs of hand pits undertaken to validate the cap construction.
- Laboratory test certificates and details of the origins of imported off-site soils used for clean cap construction.
- A plan showing the locations of all validation pits / works. Once the remediation works have been completed.

All validation records will be documented in a Phase 4 Validation Report to be provided to the Local Authority upon completion of the works.

5.2 Validation Reporting

The validation report will include:

- A remediation works summary.
- A photographic record of the remediation works undertaken;
- Details relating to the origins of imported soils;
- Laboratory test certificates for analysis of PAH delineation / validation samples and imported soils;
- A plan showing the locations of PAH delineation hand pits and validation pits; and
- Waste consignment notes for all soils disposed of off-site.

5.3 Undiscovered Contamination / Changes to Methodology

Any as yet undiscovered contamination identified during the remediation works should be immediately reported to EMS who will put appropriate measures in place and inform the Local Authority at the earliest available opportunity. Any proposed changes to the above methodology will be reported to the Local Authority for their comment/approval prior to implementation.

References

Phase 1 Geo-Environmental Desk Study Report, 'Bryntail Cottage, Y Fan, Llanidloes, Powys, SY18 6NU', EMS, E24812, dated 10th February 2022.

Phase 2 Contamination Site Investigation Report, 'Bryntail Cottage, Y Fan, Llanidloes, Powys, SY18 6NU', EMS, E24812, dated 4th May 2022.

Appendix A –Drawings and Plans

KEY:

Site Location

0 km 1

Approximate Scale:

EMSgeotech

Project Number:	E24812
Site:	Bryntail Cottage, Llanidloes, Powys, SY18 6NU
Drawing Title:	Site Location Plan

N

Bryntail Farm

Bryntail Cottages
(Former Mine Manager's
Accommodation)

SITE

Murray Shaft
and Workings
(Ore Extraction)

Gundy Shaft

Gundy Shaft
and Workings
(Ore Extraction)

Bryntail Mine (Western Shaft
& Workings – Ore Extraction,
Milling, Crushing & Sorting
Operations)

Key:

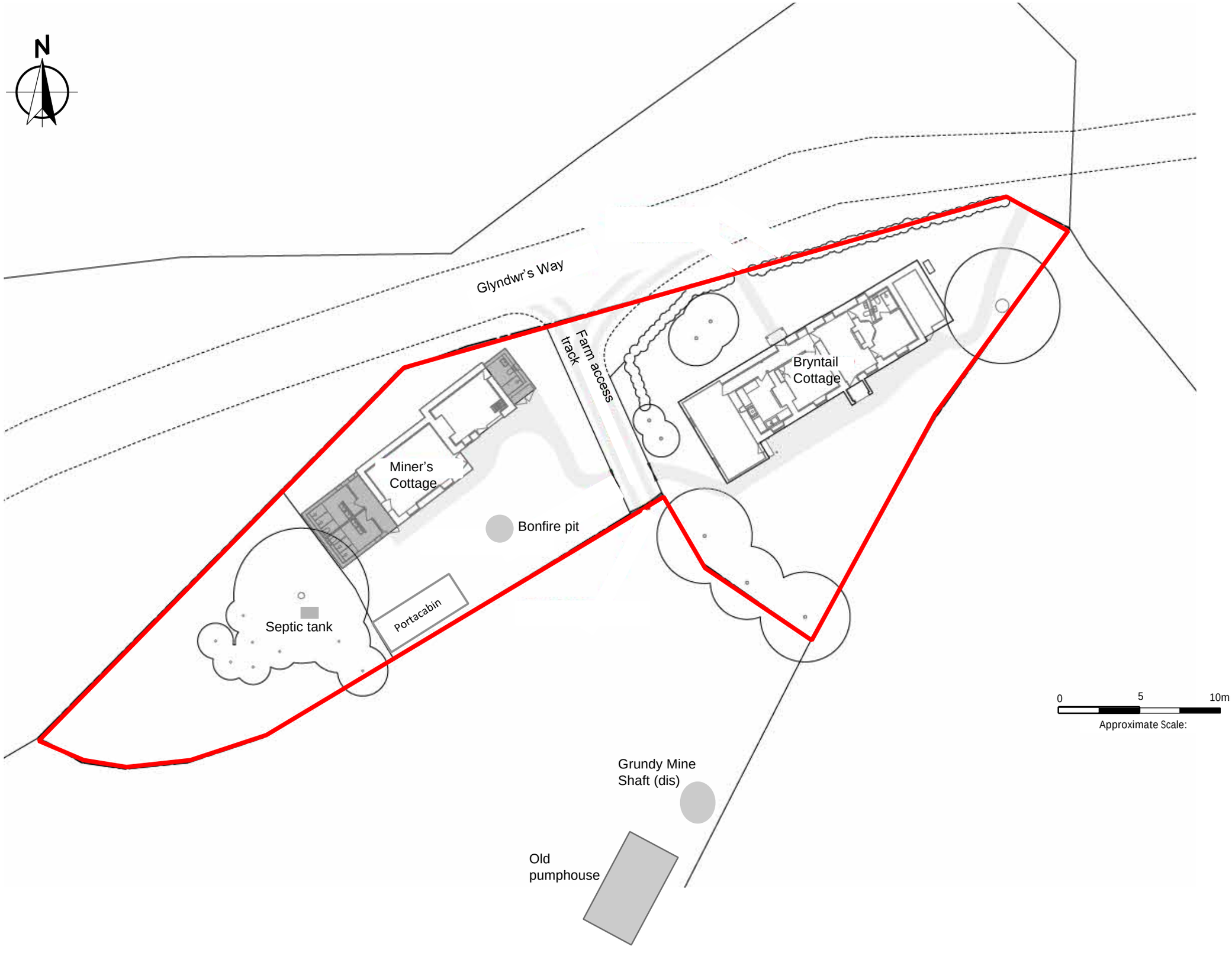
- Site Boundary.
- Bryntail Farm Boundary.
- Bryntail Mine Workings.
- Likely Route of Extracted Ore to the Bryntail Mine.
- River Flow Direction and Former Processed Ore Route.

0 400m

Approximate Scale:

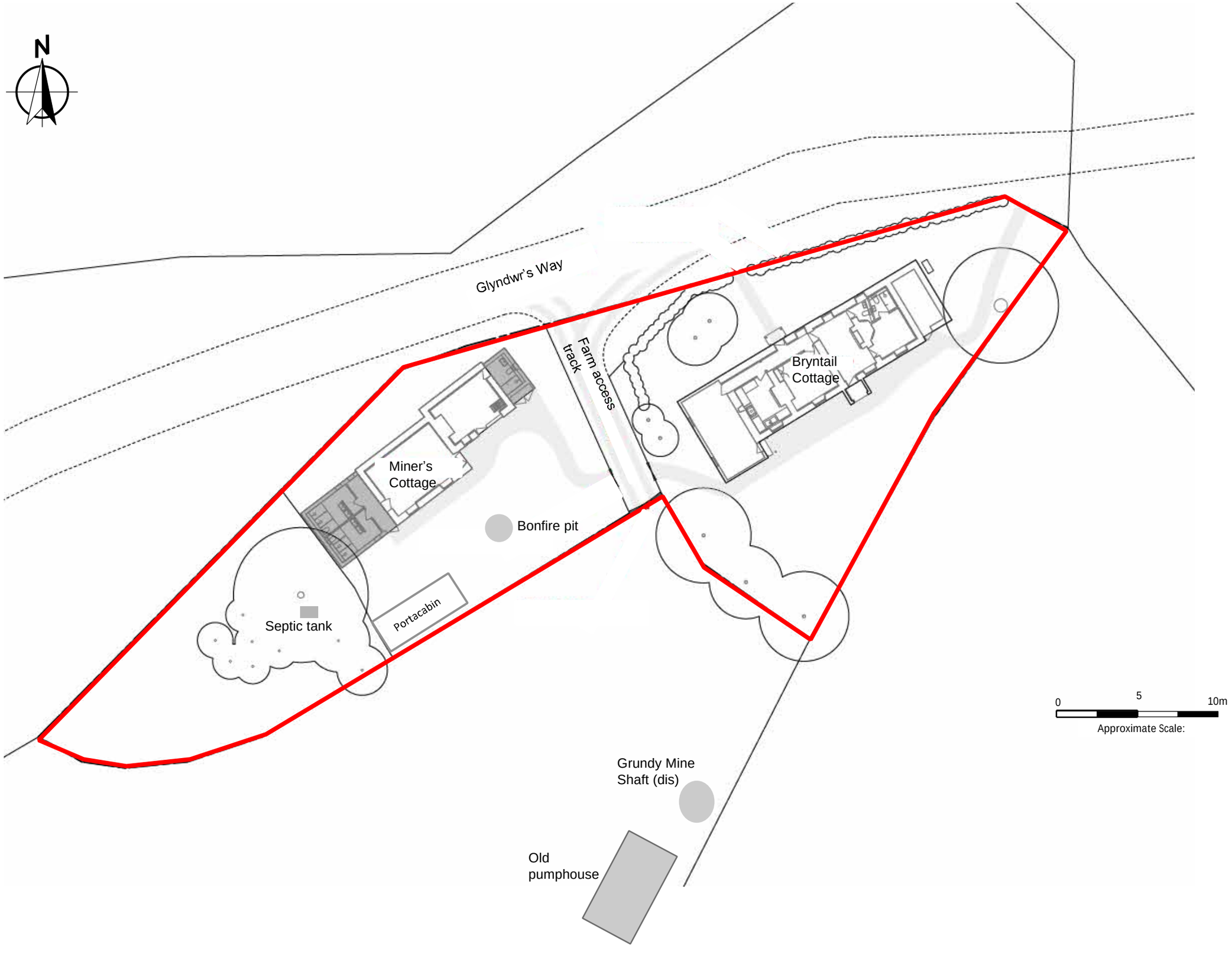
EMSgeotech

Project Number:	E24812
Site:	Bryntail Cottage, Llanidloes, Powys, SY18 6NU
Drawing Title:	Site Setting Plan



Extract taken from David Holland Architect & Designer drawing A1.1. Dated August 2021.

EMSgeotech	Project Number:	E24812
	Site:	Bryntail Cottage, Llanidloes, Powys, SY18 6NU
	Drawing Title:	Existing and Proposed Site Layout Plan



Extract taken from David Holland Architect & Designer drawing A1.1. Dated August 2021.

EMSgeotech	Project Number:	E24812
	Site:	Bryntail Cottage, Llanidloes, Powys, SY18 6NU
	Drawing Title:	Exploratory Hole Location Plan

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