

Legend

- Historically tipped quarry waste
- Valley Mire
- Auger holes
- Existing site boundary

Scale correct at A3

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Client Meyrick Estate  
Management Ltd

Title Hydrology of the valley mire

Project Caer Glaw

Drawing 3298/HLA/05

Version 1

Date March

Scale 1:1,000

**HIGH-LEVEL ASSESSMENT OF THE  
HYDROLOGY OF AN AREA OF VALLEY MIRE**

**CAER GLAW QUARRY**

**Report Reference: 3298/HLA  
Final version F1  
March 2022**

**Report prepared for:**

Meyrick Estate Management Ltd  
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## GENERAL NOTES

Title of report: High-level Assessment of the hydrology of an area of valley mire

Site: Caer Glaw Quarry

Report ref: 3298/HLA

Date: March 2022

Version	Date	Issued to
Draft version D1	8 <sup>th</sup> March 2022	Meyrick Estate
Final version F1	11 <sup>th</sup> March 2022	Meyrick Estate

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## 1 INTRODUCTION

### 1.1 Background

Granite is extracted at Caer Glaw Quarry for a range of uses in both the local and regional market. The volume of consented reserve remaining is such that additional mineral is now required to ensure the continuity of supply. An area of mineral to the north of the current quarry void has been identified as being suitable for lateral extension. The site location is shown on *Drawing 3298/HLA/01*.

Prolonged local knowledge of the estate and the results of an ecological assessment have highlighted the presence of an area of peat bog (valley mire) close to the area of the proposed quarry extension. The importance of preserving this habitat is recognised, therefore the need for a hydrological assessment to investigate the characteristics of the feature, and its sensitivity to mineral extraction in its vicinity, was identified.

Hafren Water Ltd was commissioned to undertake a high-level assessment of the hydrology of the valley mire and its surrounds.

### 1.2 Scope of assessment

The approach of the assessment is for it to be rapid and 'high-level', to identify the key characteristics of the valley mire. The outcome of the assessment is intended to inform decision-making concerning the boundary of the proposed northern extension. It will also guide further investigation and monitoring programme, if required subsequently.

### 1.3 Data sources

The following data sources were used in the preparation of this assessment:

Ordnance Survey

- Mapping at various scales

Natural Resources Wales (NRW)

- Designation of sites of ecological importance
- Rainfall data

British Geological Survey (BGS)

- Geological mapping
- Borehole logs

MAGIC website

- OS mapping
- Details of designated features of ecological interest

Meyrick Estate Management

- Topographic survey of the existing quarry and its surrounds

Consultants' reports

- Preliminary ecological appraisal. United Environmental Service Ltd, November 2021

Site visit (24/02/2022)

- Soil augering survey
- Site inspection
- Discussions with site personnel

## 2 BASELINE DATA

### 2.1 Landform

The landform in the vicinity of the existing quarry and the valley mire ranges in elevation between 25 and 65 metres Above Ordnance Datum (mAOD). The topography has a pronounced southwest-northeast 'grain', which is a result of the strong influence of the bedrock geology. Although generally subdued, higher areas, with exposed bedrock, exist, which are separated by low-lying, frequently boggy tracts. The vegetation and landform are shown on the aerial imagery, *Drawing 3298/HLA/02* and the ecological designations are shown on *Drawing 3298/HLA/03*.

The floor of the active quarry void is situated at approximately 41 mAOD. The valley mire comprises an elongate, flat-bottomed feature, which decreases in elevation from 67 mAOD at its southern extent, to approximately 62 mAOD at its northern margin. It is located to the east of both the existing quarry and proposed extension. In the vicinity of the quarry the western margins of the southern section of the valley mire abut against historically tipped waste material from the quarry. The valley mire is shown on *Photograph 3298/HLA/P1 (Photosheet PS1)*.

The elevation difference between the quarry floor and the closest section of the valley mire, under current conditions, is approximately 26 m.

The topography of the valley mire and its margins is shown on *Drawing 3298/HLA/04*.

### 2.2 Surface water

The existing quarry is located on a catchment divide: to the north streams are within the catchment of the Afon Caradog, which is itself a tributary of the Afon Crigyll. To the south watercourses form part of a complex network that discharges to Llyn Maelog, prior to entering the sea, close to Rhosneigr.

The characteristics of the surface water drainage at any location are strongly influenced by the nature of the near-surface deposits, which have disparate characteristics. On areas underlain by bedrock the drainage is within well-defined channels, whereas on areas of peat and Boulder Clay boggy ground occurs frequently. The areas of impeded drainage form the many areas of 'carr', which are of ecological interest in the region due to their water-supported flora and fauna.

The valley mire, which is the subject of this assessment, has a north-south orientated watercourse in its central northern section, which conveys water from the boggy ground.

The site visit was made after a prolonged period of high rainfall. It is therefore considered likely that the valley mire was seen close to its 'wettest' condition.

The lowest lying areas of the valley mire were saturated. Standing water was present throughout the site, interspersed between the boggy vegetation.

The valley mire, which is the subject of this assessment, is sub-divided into a southern and northern section. The southern has an area of approximately 0.15 hectares (ha) and is situated at an average elevation of 65 mAOD. This area is separated from the northern by a slightly raised area. A watercourse is located along a field boundary on the western margin of the southern section, which conveys water northwards. The flow in the watercourse was estimated at 0.25-0.5 l/s at the time of the site visit.

The northern section of the mire extends to approximately 0.7 ha and is similarly waterlogged. The mire narrows to its north due to the slight increase in ground elevations, resulting in channelling of flow out of the mire system. The flow in the stream at this area is estimated to be 0.5-1.0 l/s. The lateral margins of the valley mire comprise either exposed granite or small increases in ground elevation.

Photographs of the mire, illustrating all the described water features, are shown on *Photographs 3298/HLA/P3 and P4 (Photosheet PS2)*.

## **2.3 Geology**

### **2.3.1 Bedrock**

The bedrock in the vicinity of the valley mire comprises the Coedana Granite and is the same material as that extracted in the quarry. The granite locally forms topographic highs and is commonly exposed at the surface. The granite flanks the valley mire and is at times exposed immediately adjacent to water-logged areas (see *Photograph 3298/HLA/P4*).

### **2.3.2 Superficial**

British Geological Survey (BGS) mapping shows that superficial deposits occur sporadically in the region. The deposits are predominantly associated with Quaternary glaciation and comprise clay-rich till material.



The sub-surface characteristics of the valley mire area were investigated by a targeted shallow augering survey. Four auger tests were undertaken; their locations are shown on *Drawing 3298/HLA/05* and the results are summarised below.

3298/HLA/T1: Summary of augering survey		
Augering ID	Depth (m)	Description
A1	0-0.15	Brown, loose, abundant organic material
	0.15-0.35	Dark brown-black, peaty, becoming firmer
	0.35-0.7	Stiff, light-medium clay, sticky, no further progress possible
A2	0-0.2	Brown, loose, abundant vegetation
	0.2-0.5	Dark brown loam, some sand
	0.5	Bedrock
A3	0-0.2	Very wet, abundant organic material
	0.2-0.3	Becoming firmer, black/very dark brown, silty clay
	0.3-0.6	Very stiff, light grey clay, putty-like
A4	0-0.25	Abundant vegetation, loose, dark brown
	0.25-0.35	Dark brown loam
	0.35-0.65	Stiff, light-medium clay, very stiff, stick and putty-like

The nature of the 'basal' clay is shown on *Photograph 3298/HLA/P5 (Photosheet PS3)*.

## 2.4 Hydrogeology

### 2.4.1 Groundwater levels

The groundwater level within the bedrock can be inferred from observation within the quarry void. Standing water in a ditch/drain located in the west/central section of the quarry void occurs at an elevation of approximately 40 mAOD. This is just below the floor of the quarry void. Water was previously abstracted for use in a mobile crushing plant from a shallow waterbody/ditch. It was reported that water could be drawn from the feature continuously and that it never ran dry. From these observations it can be inferred that the groundwater level within the mass of the bedrock is situated at approximately 40 mAOD (see *Photograph 3298/HLA/P2 (Photosheet PS1)*).

The water level within the valley mire is effectively at ground level, thus situated at approximately 65 mAOD in the south and 63 mAOD in the north.

Three very minor flushes from the granite were identified during the site visit. These occurred at elevations of approximately 1 m above the water level in the majority of the mire. The inflows from these locations were so small that estimates of flow could not be made.

#### 2.4.2 Conceptual understanding of the valley mire hydrology

The morphology and near-surface geology of the valley mire is such that it forms a self-contained hydrological system, which is hydraulically isolated from the wider groundwater environment. The level of water within the mire is approximately 26 m above that of groundwater within the surrounding bedrock.

The principal source of water to the mire is rainfall, derived both directly and indirectly. The rainfall catchment of the mire is not significantly larger than the area of the mire itself, therefore the contribution of indirect rainfall (ie overland flow) is considered likely to represent a small proportion of the water within the system.

The overall direction of water movement within the mire is northwards. A stream is located within the southern section of the mire, which supplies water to the northern section. Outflow from the mire occurs in the north of the site, ultimately discharging into the Afon Caradog (see *Photograph 3298/HLA/P4, Photosheet PS2*).

### **3 ASSESSMENT OF POTENTIAL FOR IMPACT**

#### **3.1 Comment**

The extraction of granite has the potential to modify the extant water environment and hence impact upon the integrity of the valley mire. Effects could be direct, indirect or a combination of both. Furthermore, the potential to cause impact would vary over time, being dependant upon the stage of quarry development. These issues are addressed below.

#### **3.2 Water volumes**

The baseline assessment has indicated that water within the valley mire is sourced from direct rainfall, run-off from its catchment and, very small volumes from flushes from the granite. The amount of rainfall and surface water inflow is governed by the surface water catchment of the mire.

The proposed quarry extension would not impact upon the surface water catchment of the feature, therefore adverse impact is not anticipated via this mechanism.

The presence of a vertically extensive unsaturated zone between the water system within the mire and groundwater within the granite (approximately 25 m) is such that any modifications of the latter, caused by the proposed future mineral extraction, would not affect the hydrology of the valley mire.

The southern section of the valley mire has been located within 40 m of the quarry void for a prolonged period without known adverse impact. By analogy, the same absence of effects would pertain adjacent to the proposed northern extension.

#### **3.3 Water quality**

The absence of hydraulic continuity, either direct or indirect, between the quarry void and the valley mire is such that adverse impact on water quality is not anticipated.

There is considered to be no difference in the potential impacts upon the valley mire water environment either during mineral extraction or after the completion of site restoration.

## **4 RECOMMENDATIONS**

### **4.1 Monitoring**

An array of shallow dipwells could be installed across the valley mire to assess the long-term behaviour of water within the feature. The accrued data would allow the long-term behaviour of the mire to be determined and allow the early identification of impact. However, for the reasons discussed above, the latter is considered to be highly unlikely.

## 5 SUMMARY AND CONCLUSIONS

A high-level assessment has been undertaken of the hydrology of a valley mire located to the east of the current workings and proposed northern extension area. The purpose of the assessment was to determine whether the proposed, future mineral extraction had potential to impact adversely upon the integrity of the water-supported feature.

The assessment was informed by a review of existing sources, a site walkover and augering survey. The details of the site water management were obtained from reports, previous site experience and discussions with Hogan's personnel.

The assessment has found that the water within the valley mire is supported on a base of grey, firm clay. The clay may be either of glacial or sedimentary origin. The low permeability of the clay has resulted in a perched feature above a substantial thickness of unsaturated granite. The vertical difference between the water within the valley mire and groundwater within the granite is c25 m. It is demonstrated that groundwater within the bedrock and valley mire is hydraulically isolated.

The source of water to the mire is predominantly rainfall, which is derived from a relatively small catchment. The overall flow direction of water within the mire is northwards.

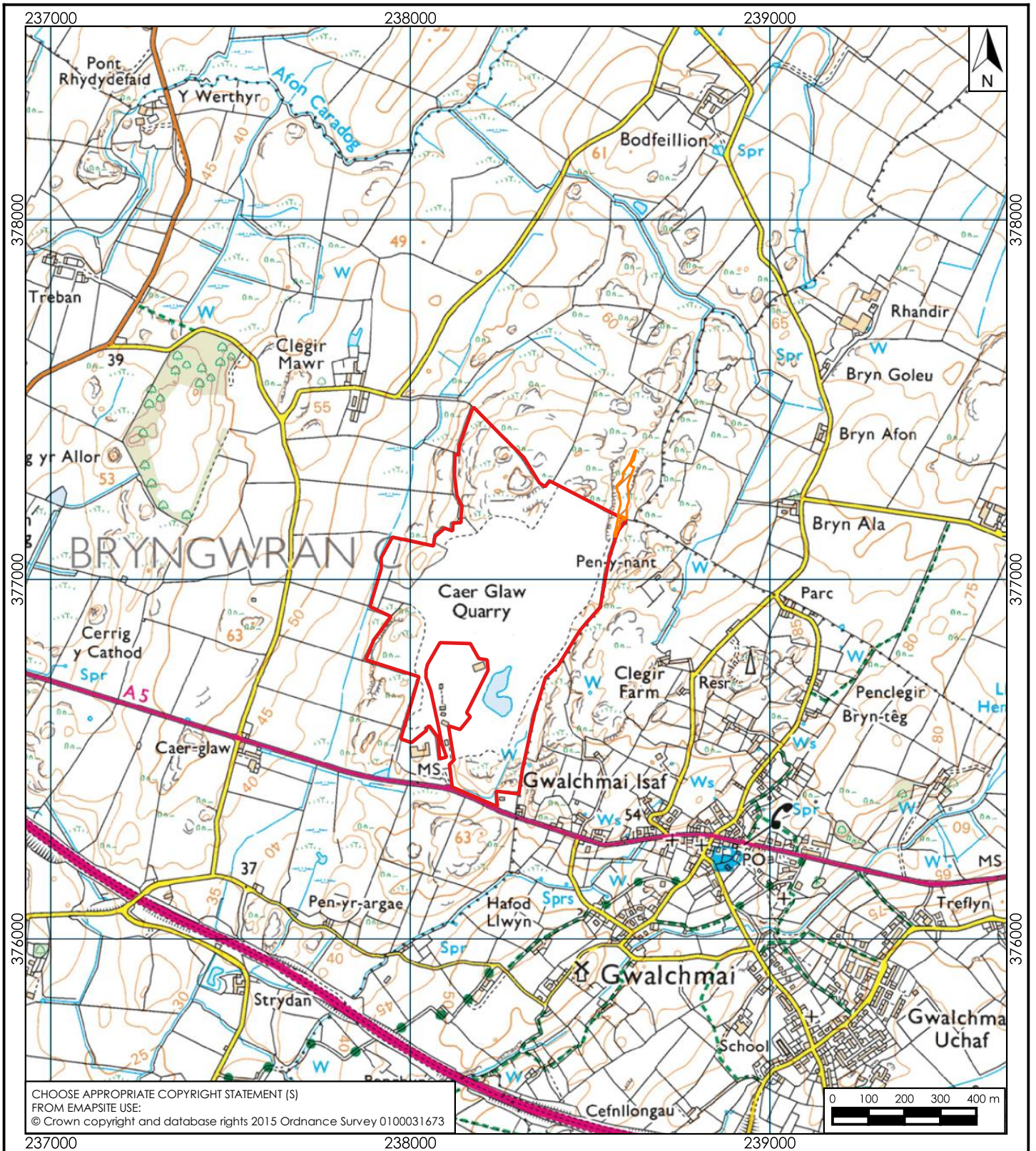
The southern part of the mire is located within 40 m of the quarry void and derogation of the feature cannot be observed and has not been reported. It is considered that mineral extraction could be undertaken within 10m of the western margin of the valley mire without adverse impact upon its hydrology.

It is concluded that the proposed northern quarry extension can be undertaken without adverse impact occurring on the valley mire.

Other potential adverse impacts on the ecology of the valley mire, such as the effects of noise, dust and potentially vibration, have not been assessed.

The installation and subsequent monitoring of an array of dipwells within the valley mire would allow temporal water-level variation to be determined and the long-term water level behaviour assessed.

## DRAWINGS

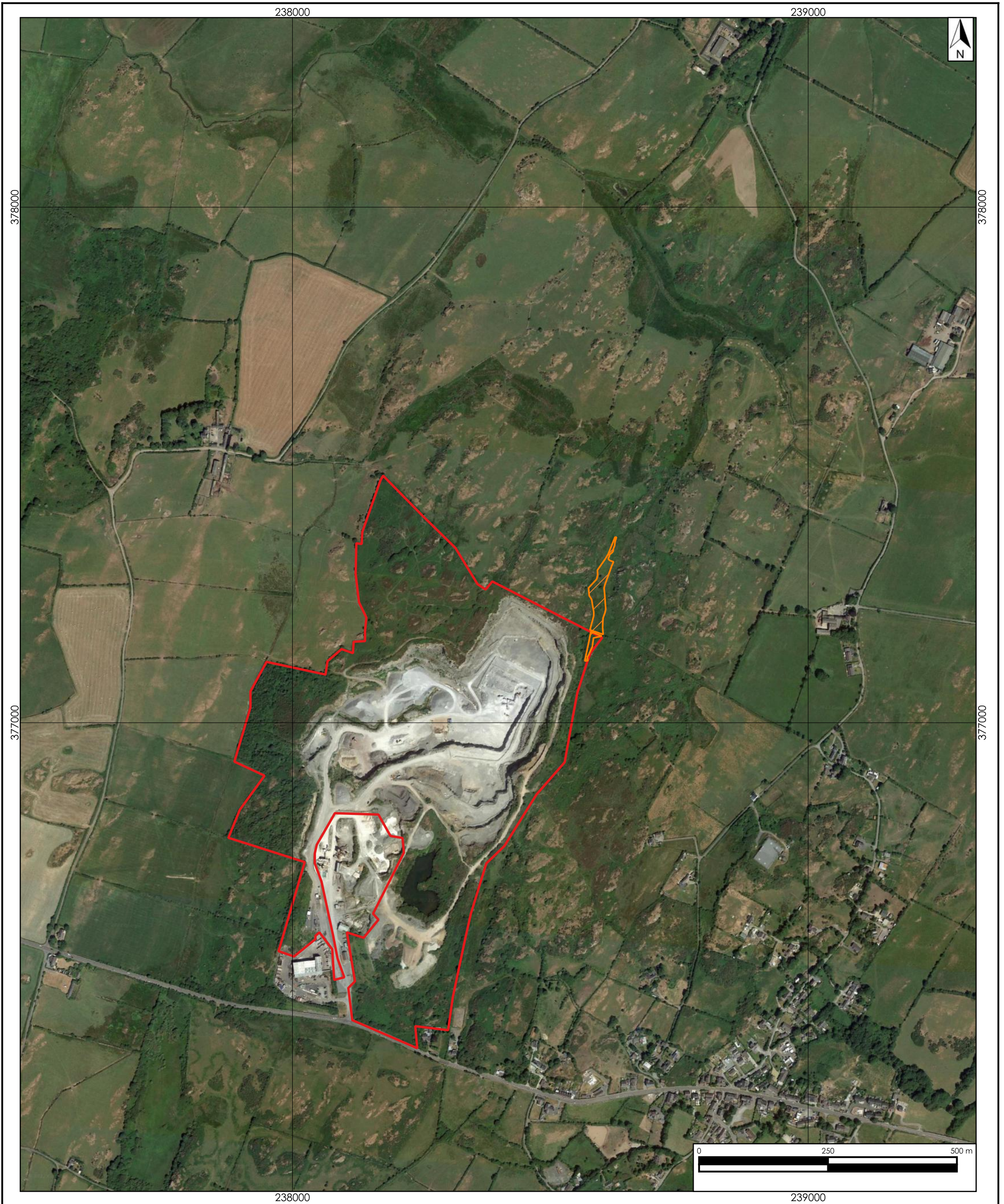


Legend

-  Valley Mire
-  Existing Site Boundary

Scale correct at A4

 <p>environmental water management</p> <p>Barkers Chambers • Barker Street • Shrewsbury • Shropshire • SY1 1SB www.hafrenwater.com • Tel. 01743 355 770</p>	<p>Client</p> <p>Meyrick Estate Management Ltd</p>	<p>Title</p> <p>Site Location (OS Map)</p>	
		<p>Project</p> <p>Caer Glaw</p>	
		<p>Drawing</p> <p>3298/HLA/01</p>	<p>Version</p> <p>1</p>
		<p>Date</p> <p>March 2022</p>	<p>Scale</p> <p>1:15,000</p>



Legend

- Valley Mire
- Existing Site Boundary

Scale correct at A3

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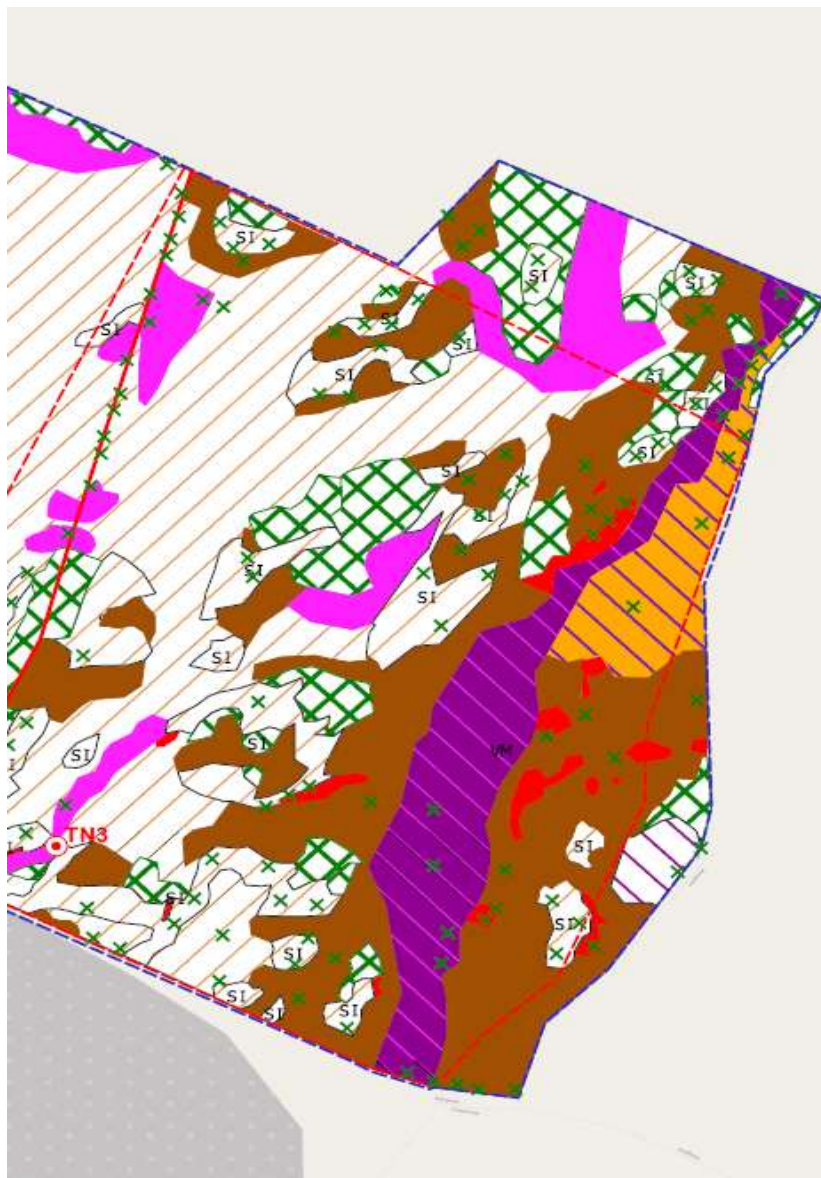
Title Site Location (Satellite Map)

Project Caer Glaw

Drawing 3298/HLA/02 Version 1

Date March 2022 Scale 1:7,000





**KEY:**

- A2.1 - Scrub - dense/continuous
- A2.2 - Scrub - scattered
- B1.2 - Semi-improved acid grassland
- B5 - Marshy grassland
- C1.1 - Continuous bracken
- E1.8 - Dry modified bog
- E2.1 - Neutral / acidic flush
- E3.1 - Fen - valley mire
- G1 - Standing water
- I1.4.1 - Other exposure - acid/neutral
- J2.5 - Wall
- Development boundary
- Survey boundary
- Target Notes

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Client Meyrick Estate Management Ltd

Title Caer Glaw Habitat Plan

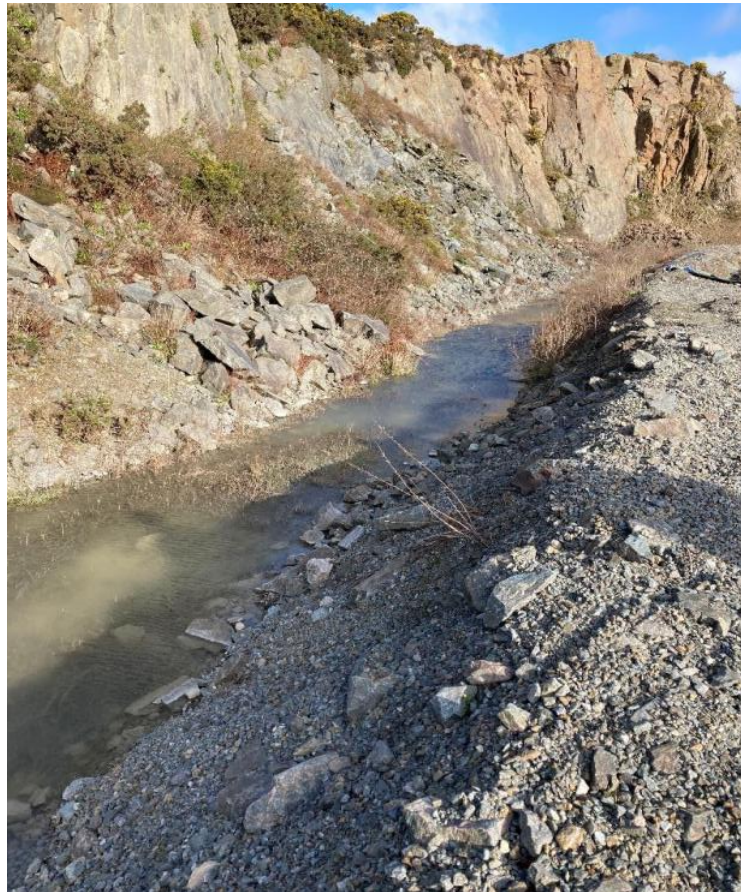
Project	Caer Glaw	
Drawing	3298/HLA/03	Version 1
Date	Mar-22	Scale As Shown



## PHOTOSHEETS



Photograph 3298/HLA/P1: General view of valley mire looking northeast



3298/HLA/P2: Water in the floor of the quarry void



Photograph 3298/HLA/P3: Granite exposed adjacent to waterlogged area



3298/HLA/P4: Outflow of water from north of the mire



3298/HLA/P5: Auger sample of grey, sticky clay