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Trefil Quarry Annual Monitoring Report - 2017

9 May 2018

Trefil Quarry Annual Monitoring Report - 2017

Prepared for

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Trefil Quarry Annual Monitoring Report - 2017

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2	09/05/2018	Final	Final draft following client feedback	EMW	HJK	BCH
3						
4						

Contents

1 Introduction

1.1 Background

Gryphonn Quarries Limited was granted planning permission for the deepening of Trefil Quarry in February 2009. Planning Condition 20 of this permission states that *"A Water Management Plan will be submitted for the approval of the Planning Authority prior to commencement of the deepening operations at the site".*

The Environmental Impact Assessment (EIA) that supported the application for the revised planning permission at the quarry included a series of recommendations for monitoring and mitigation that would form the basis of the Water Management Plan (WMP) for the site (ESI, 2008).

The WMP for the site was presented by ESI (2009) and specified requirements for three key activities:

- Monitoring
- Mitigation measures
- Annual review

It was intended that the WMP would be subject to regular review and modification as necessary in the light of on-going data collection and presentation in annual monitoring reports.

Previous annual monitoring reports have been produced by ESI for the years 2010 to 2016. This annual report presents the data collected between January 2017 and December 2017 as well as a water balance. The annual report should be read in conjunction with an understanding of the hydrogeological conceptual model presented in ESI (2008). Monitoring data is available in electronic format upon request.

1.2 The quarry development

Gryphonn Quarries Ltd is permitted to work to approximately 412 mAOD (the base of the Dowlais Limestone), with the lowest point in the quarry base currently at c.413 mAOD. Prior to this permission, the consented level was 439 mAOD. The most recent quarry survey (taken November 2017) is included in Appendix A.

Dewatering is required to facilitate the dry excavation of the mineral. Maximum dewatering depths of 27 m will be required when the quarry reaches its permitted depth. The estimated rate of dewatering required to facilitate dry working is discussed in ESI (2008).

1.3 Potential receptors

The main receptors identified in the hydrogeological impact assessment (ESI, 2008) are:

- Shon Sheffrey Spring;
- The Nant Trefil; and
- Groundwater in the Carboniferous Limestone.

The impact assessment (ESI, 2008) concluded that proposed dewatering activities will not have any significant effect on flows in the Nant Trefil or Shon Sheffrey spring due to the recirculation of water discharged to the Nant Trefil.

The development poses risks from two main hazards with respect to groundwater and surface water quality:

- Spills from plant operating on site; and
- Discharge of sediment-laden water to surface water features including the Nant Trefil.

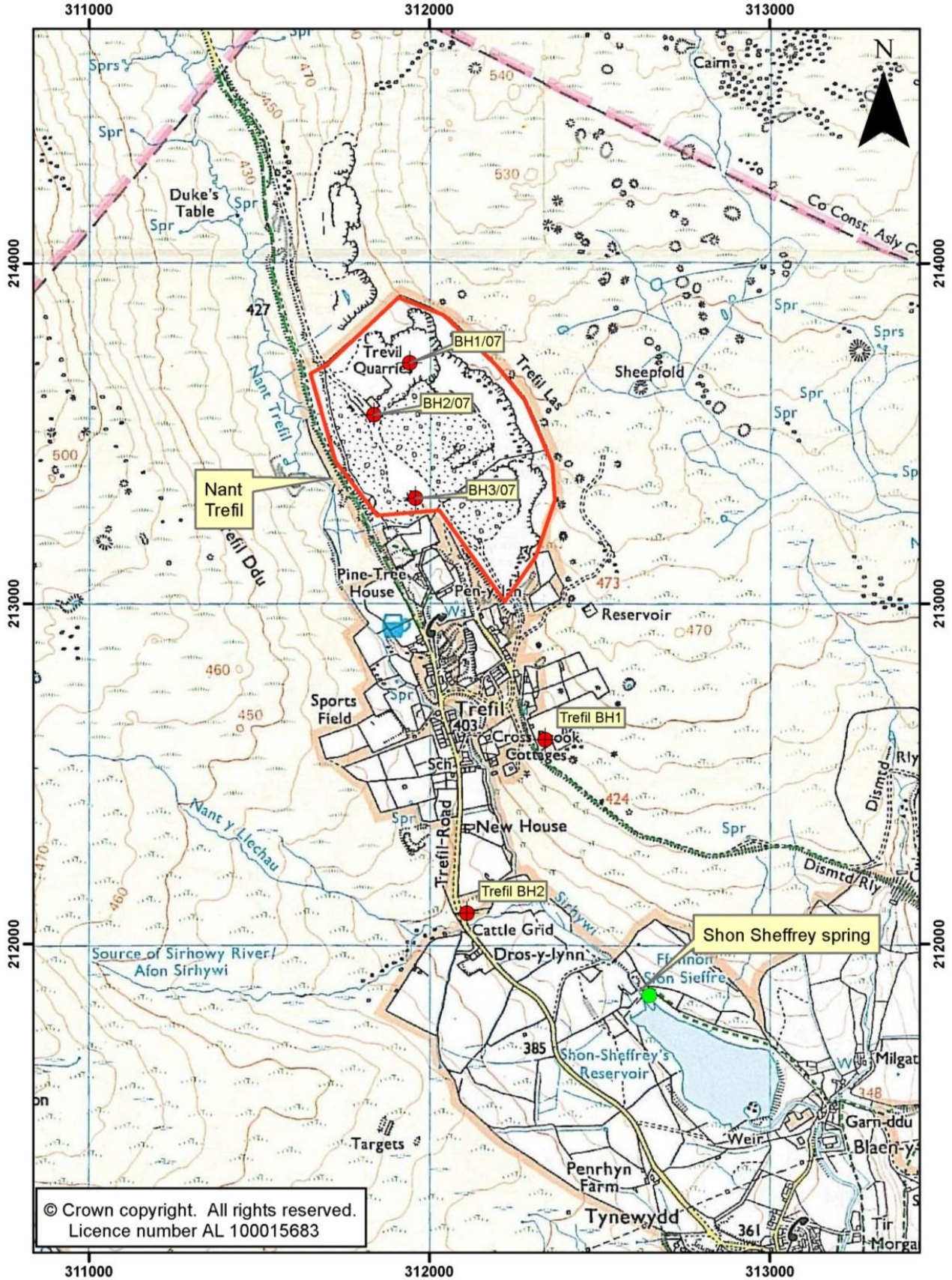
1.4 Monitoring regime

In order to quantify the level of impact at key sites and to ensure that the system is continuing to behave as predicted on the basis of the current conceptual model, a monitoring system has been implemented. The following monitoring regime is in place.

- Groundwater levels in the three boreholes on site (BH1/07, 2/07 and 3/07) are measured at weekly intervals (see Figure 1.1).
- Groundwater levels in Trefil Boreholes 1 and 2 are monitored at monthly intervals (see Figure 1.1).
- The rate of quarry pumping from the sump is monitored at weekly intervals by means of an in-line flow meter.
- The suspended solids/turbidity of the quarry discharge is measured by the quarry operator at weekly intervals together with a note of the weather conditions at the time.
- Daily rainfall data is monitored by means of a site rain gauge.
- The site drainage system is inspected on a daily basis to ensure that the oil booms are in place and that there is no visible oil downstream of the booms.

It will be necessary to continue monitoring until water levels have recovered to their equilibrium position. It is anticipated that this will be one or two years after quarry dewatering ceases.

Figure 1.1 Monitoring borehole locations



2 Monitoring Data

2.1 Rainfall

Daily readings of rainfall have been recorded from a rain gauge at the site since 1st February 2010 to the present. Data for the Trefil gauge is shown in Table 2.1 and presented in Figure 2.1. In 2017, a total rainfall of 1,216 mm was recorded at Trefil quarry. March, July and September saw above average rainfall whilst January, April, November and December were dryer than average. Months with high recorded rainfall often correspond with months showing elevated recorded pumping data - shown in Section 2.3.

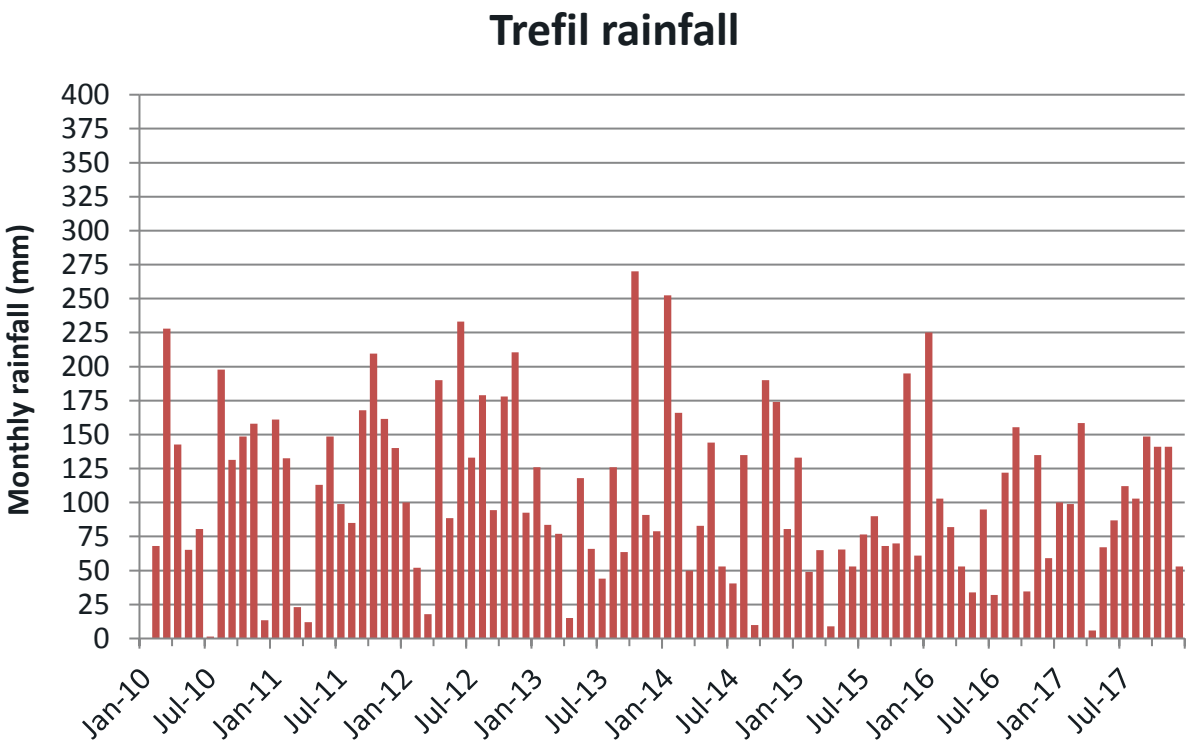
Monthly rainfall data were provided by the Environment Agency for a rain gauge located at Rhymney about 3 km to the south west of the Site from 1971 to 2003 (ESI, 2008). Average long-term rainfall data in that period is 1,655 mm/a. The recorded annual total at the Site may be an underestimate given the occasional gaps in the data record (as detailed below) and the nature of the gauge which means that any rainfall depth in exceedance of 50 mm is not recorded – rainfall events of this magnitude are rare.

Table 2.1 Monthly rainfall data at Trefil quarry

	Rainfall (mm)							
Month	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Jan		161	100	126	253	133	225	100
Feb	68	133	52	84	166	49	103	99
Mar	228	23	18	77	50	65	82	159
Apr	143	12	190	15	83	9	53	6
May	65	114	89	118	144	65.5	34	67
Jun	81	149	233	66	53	53	95	87
Jul	2	99	133	44	41	76.5	32	112
Aug	198	85	179	126	135	90	122	103
Sep	132	168	95	64	10	68	156	148.5
Oct	149	210	178	270	190	70	35	141
Nov	158	162	211	91	174	195	135	141
Dec	13	140**	93	79***	81****	61*****	59	53
Tot	**1,237***	**1,456**	**1,571**	**1,160**	**1,379**	**935**	**1,130**	**1,216**

**11 months only*
*** This is the total for 1 December 2011 to 22 December 2011.*
**** This is the total for 1 December 2013 to 25 December 2013.*
***** This is the total for 1 December 2014 to 23 December 2014.*
****** This is the total from 1 December 2015 to 9 December 2015*

Figure 2.1 Monthly rainfall – site data



2.2 Groundwater levels

The monitoring regime (as set out in the WMP and listed in section 1.4) states that weekly monitoring of on-Site boreholes (BH1/07, 2/07 and 3/07) and monthly monitoring of off-Site boreholes (Trefil Boreholes 1 and 2) is required. In 2017, groundwater levels at the onsite boreholes (BH1/07, 2/07 and 3/07) were collected 12 times, and 10 times at the off-site boreholes (Trefil Boreholes 1 and 2).

Groundwater level data for all five boreholes are summarised in

Table 2.2 and shown in Figure 2.2 and

Figure 2.3 respectively.

Groundwater levels in BH1 saw a fairly steep decline between December 2014 and August 2015 during which time the base of the quarry was deepened to working level 5 (Appendix A). Since this time water levels appear to be stable at this location (despite an anomalous low level recorded in August 2017) and the impact is not evident in other datasets suggesting that the impact is fairly localised.

Groundwater levels in other boreholes on-site have remained relatively stable[1]. It is noted that the drop in groundwater levels at BH1 appears to correlate with a reduction in the cumulative departure from mean (CDM) rainfall since January 2015 (Figure 2.2), although this trend is not evident in the other groundwater data sets.

[1] The only exception is groundwater level data obtained for BH2 in October 2014 which is likely erroneous.

Table 2.2 Groundwater level statistics

Borehole Name	Data Period	Frequency	Datum (mAOD)	Data period	Statistics (mAOD)			Range (m)
					Min	Arithmetic Mean	Max	
BH1	Sep 07 - Dec 17	Weekly to Dec 14 then monthly to Dec 17*	442.691	Full record	426.90	433.82	436.95	10.05
				2017	426.90	429.32	430.17	3.27
BH2	Sep 07 - Dec 17		452.753	Full record	435.99	438.57	447.57	11.58
				2017	436.47	437.48	439.44	2.97
BH3	Sep 07 - Dec 17		453.499	Full record	432.30	433.54	436.31	4.01
				2017	432.75	432.96	433.32	0.57
Trefil 1	July 09 - Dec 17	Monthly**	427.06	Full record	374.81	376.41	379.70	4.89
				2017	375.06	376.42	378.30	3.24
Trefil 2	July 09 - Dec 17		393.31	Full record	367.86	368.99	372.70	4.84
				2017	368.10	368.83	369.48	1.38

*No dips were taken in May 2017 and two dips were taken in October 2017
** No dips were taken in May and November 2017

Figure 2.2 Groundwater level hydrographs (on site)

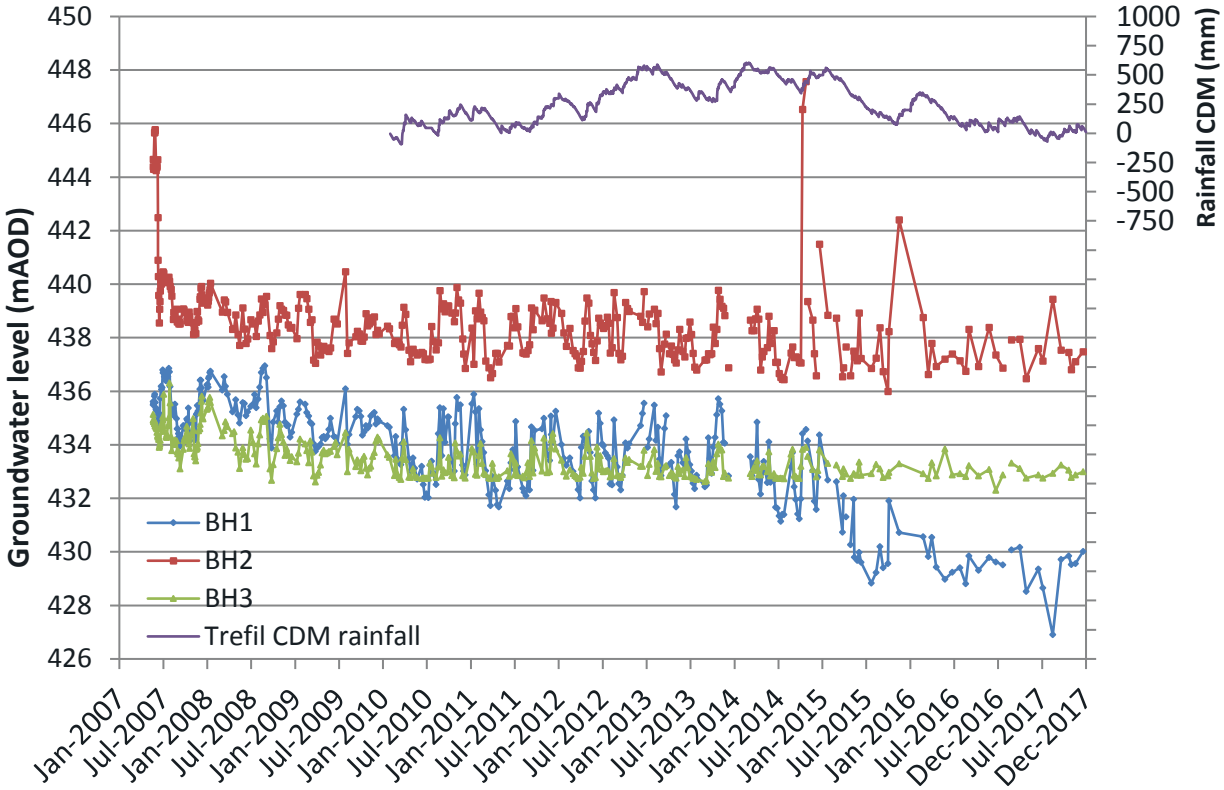
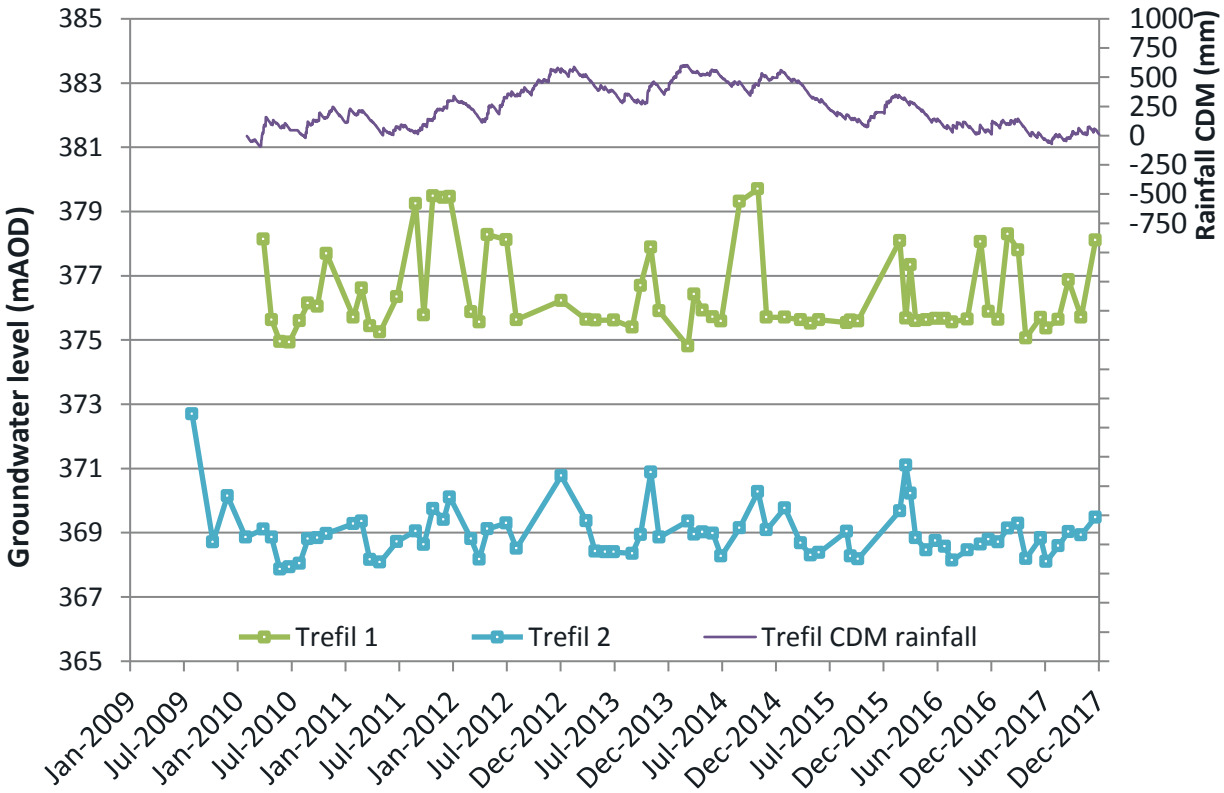


Figure 2.3 Groundwater level hydrographs (off site)



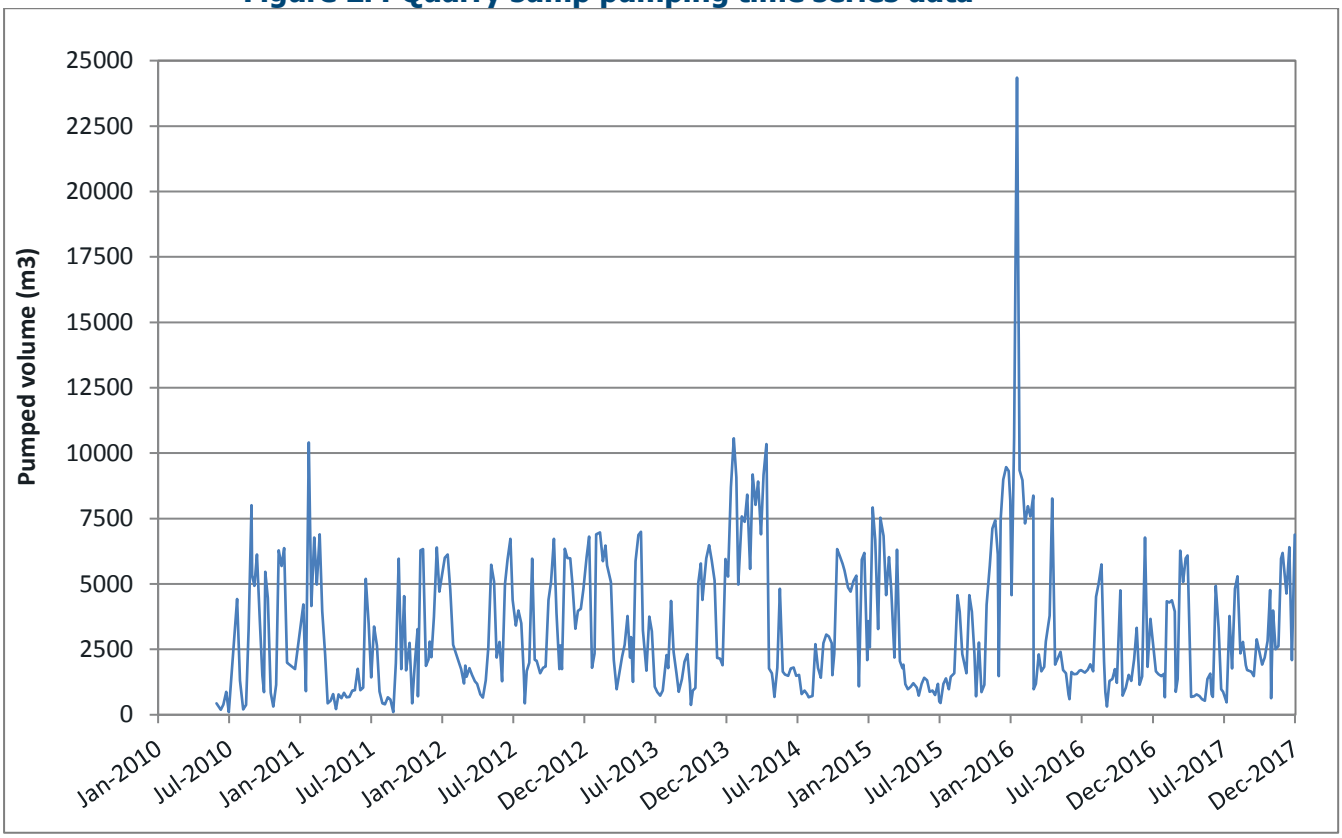
2.3 Quarry pumping

The rate of quarry pumping from the sump is monitored at weekly intervals by means of an in-line flow meter. The pump is operated manually when water levels in the base of the quarry are required to be lowered to carry out stone extraction. Records are available between 31 May 2010 to 31 December 2017, with monthly totals given in Table 2.3. A time series plot is given in Figure 2.4. Broadly speaking, pumping volumes over 2017 are towards the lower end of the range of observed totals which may be expected given the annual rainfall received.

Table 2.3 Monthly pumping totals

Date	Pumped volume (m^3)							
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Jan		19,680	19,610	23,860	38,580	27,970	57,810	6,910
Feb		22,590	6,860	25,020	23,360	22,210	32,210	17,830
Mar		4,540	7,220	8,150	38,570	14,240	9,780	24,770
Apr		3,140	5,340	13,820	24,160	4,420	13,970	2,890
May	430	4,300	17,820	24,210	10,470	5,670	7,070	4,830
Jun	1,460	10,670	23,320	9,690	6,560	3,750	8,140	10,770
Jul	5,830	8,760	12,830	6,740	4,700	5,950	6,920	10,830
Aug	17,180	1,750	13,790	10,970	6,620	12,400	18,160	14,010
Sep	17,000	15,900	9,600	6,900	13,040	12,400	5,940	8,500
Oct	12,220	9,240	20,080	17,520	26,020	9,690	8,040	12,330
Nov	20,330	19,400	20,070	18,370	20,010	26,390	7,880	21,260
Dec	1,750	17,040	21,060	17,300	18,860	44,920	13,720	20,010
Average m^3	**9,525**	**11,418**	**14,800**	**15,213**	**19,246**	**15,834**	**15,803**	**12,912**
m^3/d	**313**	**375**	**485**	**500**	**633**	**521**	**518**	**424**

Figure 2.4 Quarry sump pumping time series data



2.4 Suspended solids/turbidity of the quarry discharge

A discharge consent (reference: AN0258201) is associated with Trefil Quarry for discharge of trade effluent to the Nant Trefil. It specifies that the total suspended solids shall not exceed 100 mg/l and the concentration of total oil and grease shall not exceed 10 mg/l.

Turbidity of the quarry discharge is required to be measured by the quarry operator at weekly intervals together with a note of the weather conditions at the time. This data is then used to calculate the equivalent suspended solids concentration where no suspended solids data are available. This has been carried out since 9 April 2010 with twenty-one records collected in 2017; the data is presented in

Table 2.4 below.

In 2017 all suspended solids results are below the 100 mg/l threshold with the maximum derived suspended solid reading being 99.07 mg/l in June. This coincided with heavy rain weather conditions.

Table 2.4 Discharge turbidity and suspended solids results

Date	Weather Conditions	Sample Ref.	Turbidity Reading (NTU)	Equivalent Suspended Solids Reading (limit is 100mg/lts)	Comment
12-Jan-17	Wet, cold some snow	120117	2.52	8.87	NRW sample
2-Feb-17	Misty and wet	020217	120.72	63.17	
7-Feb-17	Cold with showers	070217	146.92	75.20	
17-Feb-17	Overcast	170217	107.01	56.87	
24-Feb-17	Bright	240217	189.27	94.66	
10-Mar-17	Misty, wet and windy	100317	162.07	82.16	
17-Mar-17	Dull with light rain	170317	145.77	74.67	
24-Mar-17	Dry and cold	240317	127.51	66.29	
29-Mar-17	Wet	290317	168.97	85.33	
5-Jun-17	Heavy rain	050617	198.88	99.07	
28-Jul-17	Wet & windy	280717	171.37	86.43	
3-Aug-17	Wet & windy	030817	187.77	93.97	
21-Sep-17	Misty with showers	210917	141.01	72.49	
23-Oct-17	Wet and windy	231017	148.56	75.96	
3-Nov-17	Misty and dull	031117	139.07	71.60	
9-Nov-17	Wet and overcast	91117	168.01	84.89	
17-Nov-17	Bright but cold	171117	163.27	82.71	
24-Nov-17	Bright	241117	148.77	76.05	
30-Nov-17	Bright but very cold	301117	133.59	69.08	
7-Dec-17	Wet	71217	140.77	72.38	
15-Dec-17	Bright but cold	151217	174.29	87.78	

NRW = sample collected by Natural Resources Wales

2.5 Site drainage system inspections

The site drainage system is inspected on a daily basis to ensure that the oil booms are in place and that there is no visible oil downstream of the booms.

Additionally, the quarry is inspected for the presence of voids (which might indicate the presence of fast pathways from the quarry to local receptors) on a weekly basis. No significant voids or drainage issues were identified in 2017.

During the 22 years that the quarry has been operated by its current owners there have been no reports of any contamination from hydrocarbons in any of the local watercourses. This suggests that the current precautionary measures are effective at protecting the local water environment from accidental spillages from operating heavy plant in the area.

3 Water Balance

The average quarry pumping rate for 2017 was 424 m^3/d. The total rainfall recorded at the Site in 2017 was 1,216 mm (see Section 2.1).

No potential evapotranspiration (PE) data were available for the Trefil site but having undertaken similar work for other sites in the region, it's estimated the total annual PE for the site is around 530.5 mm (based upon estimated regional long term average value).

The quarry catchment area is estimated to be about 20 hectares (2% of Shon Sheffrey Spring catchment area: ~10 km^2).

With a total annual rainfall for 2017 of 1,216 mm and an estimated annual potential evapotranspiration of 530.5 mm, this would imply a value of 376 m^3/d for recharge in the quarry catchment. Taking rainfall minus PE to approximate recharge may be considered a simplistic approach but is thought to be sufficient for this assessment.

The average pumping rate of c. 424 m^3/d in 2017 is larger than the estimated recharge over the quarry catchment area suggesting that the quarry is intercepting recharge over the quarry catchment as well as drawing in groundwater from a small area outside of the catchment, from a total of ~ 23 hectares.

The impact assessment (ESI, 2008) concluded that dewatering activities will not have any significant effect on flows in the Nant Trefil or Shon Sheffrey spring due to the re-circulation of water discharged to the Nant Trefil.

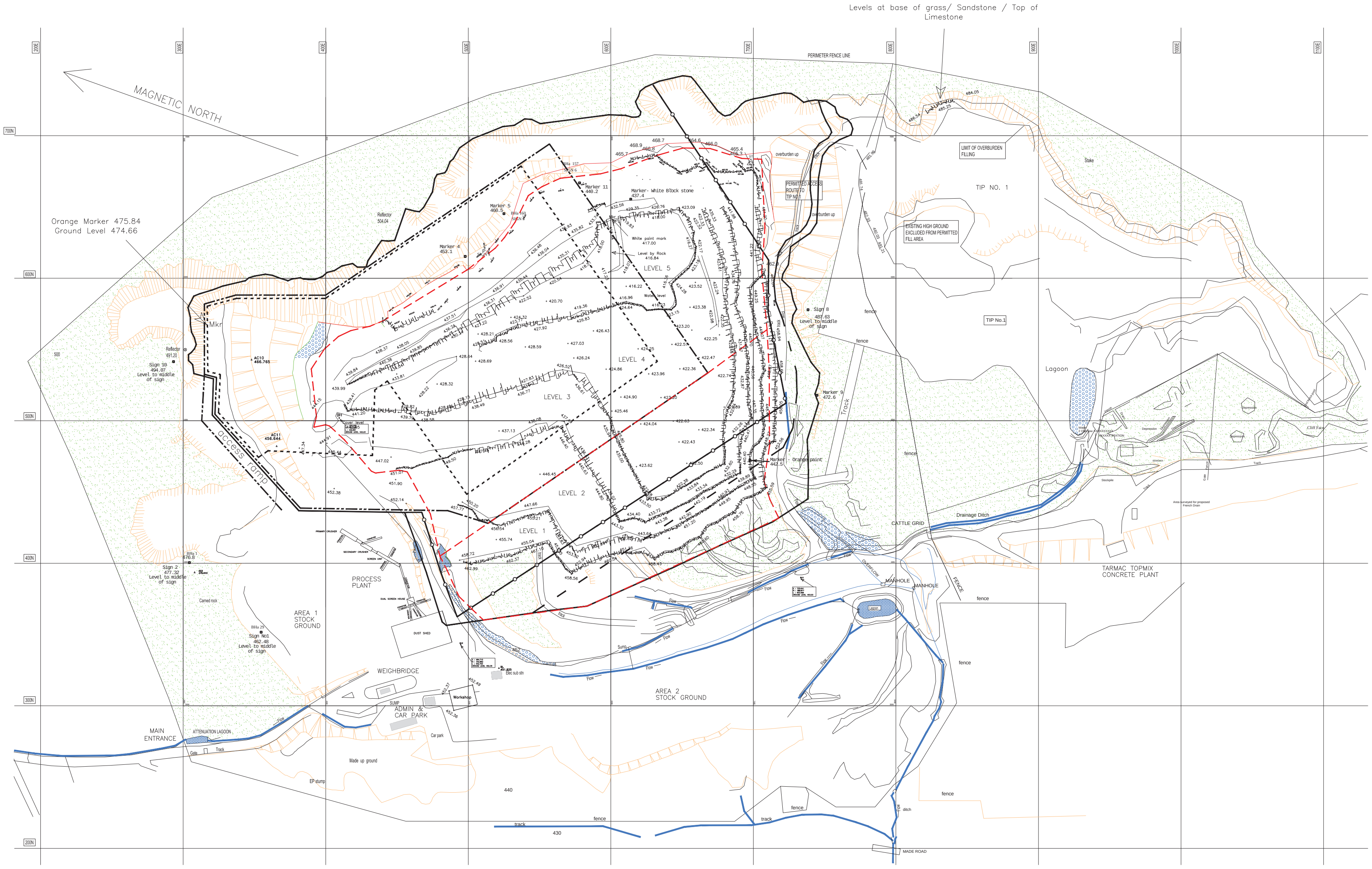
REFERENCES

ESI Ltd. (2008). Trefil Quarry: Hydrogeological Impact Assessment. Ref 6878R1rev1.

ESI Ltd. (2009). Water Management Plan - Trefil Quarry Deepening. Ref 6878TN1.

APPENDICES

Appendix A
Site survey



Reference marker coordinates
Sign 1 – 354.70E 351.68N 462.48
Sign 2 – 303.08E 398.94N 477.32
Sign 7 – 518.09E 412.48N 475.00
Sign 8 – 738.35E 577.90N 487.64
Sign 10 – 293.25E 541.48N 494.07
Coordinates are to the centre of the square yellow sign.

Paint mark 4 – 497.83E 615.31N 453.15
Paint mark 5 – 525.04E 645.31N 460.51
Paint mark 9 – 744.63E 517.87N 472.62
Paint mark 11 – 578.05E 666.90N 440.24
White block stone – 613.96E 655.45N 437.41
Orange paint mark – 697.58E 472.34N 442.54

KEY TO LINES

5 YEAR LINE
10 YEAR LINE
15 YEAR LINE
20 YEAR LINE
25 YEAR LINE

TREFIL QUARRY

GENERAL ARRANGEMENT & CLIFF FACE SURVEY

SHEET DIAGRAM	
One Sheet Only	SCALE: 1:1000 at A0
	JOB No. 5611H
	Drg. No. 5611H/1000A0/1.1
	DRAWN: MJH/AC
	CHECKED: MJH/AC
	APPROVED:
	DATE Nov 2017

NOTES

1. Site grid used.
2. North arrow indicates approximate North.
3. All levels relate to OS datum.
4. Refeference signs added June 2014
5. Boreholes 3 & 4 added on common April 2015.
6. Cliff faces all re surveyed 21st & 26th April 2016.
7. Cliff faces updated 08th /11/2017

LINE TYPES

Buildings
Kerbs, Walls
Fences
Top of banks
Bottom of banks
Hedges
Overhead Wires
Surface Change

CLIENT

Gryphonn Quarries Ltd.

ABBREVIATIONS

IC – Inspection Cover
CL – Cover Level
IL – Invert Level
UTL – Unable To Lift
ø – Pipe Diameter(m)

C/B – Close Boarded
C/I – Corrugated Iron
I/R – Iron Railings
P/R – Post & Rail
P/W – Post & Wire
B/W – Barbed Wire

EL – Eaves Level
RL – Ridge Level
BL – Basement Level
SL – Step Level
FFL – Finished Floor Level
T.O.W. – Top Of Wall
AV – Air Valve
B – Bollard
BB – Belisha Beacon
BH – Bore Hole
BT – British Telecom
CATV – Cable T.V.
CB – Tel. Call Box
LB – Letter Box
LP – Lamp Post
Mkr – Utility Marker
MP – Mile Post
P – Post
RE – Rodding Eye
RS – Road Sign
SC – Stop Cock

DP – Down Pipe
DK – Drop Kerb
EP – Electricity Pole
ER – Earthing Rod
FH – Fire Hydrant
FL – Flood Light
FS – Flag Staff
G – Gulley
G 1.2 – Girth of Tree (m)
GV – Gas Valve
JB – Junction Box
KO – Kerb Outlet
SP – Sign Post
SV – Stop Valve
TH – Trial Hole
TP – Telegraph Pole
TS – Traffic Signal
VP – Vent Pipe
WM – Water Meter

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