Trefil Quarry Annual Monitoring Report - 2019

25 September 2020

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Trefil Quarry Annual Monitoring Report - 2019

Prepared for

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Final Report

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Trefil Quarry Annual Monitoring Report - 2019

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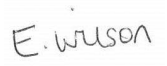
	Name	Signature
Author	Elizabeth Wilson	
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Issue	Date	Status	Comment	Author	Checker	Reviewer
1	29/06/2020	Draft	Draft for client feedback	EMW	HJK	BCH
2	25/09/2020	Final		EMW	HJK	BCH

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

The WMP for the site was presented by Stantec (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 ongoing data collection) and presentation in annual monitoring reports.

Previous annual monitoring reports have been produced by ESI (now Stantec UK) for the years 2010 to 2018. This annual report presents the monitoring data collected between January 2019 and December 2019 as well as an annual water balance. The annual report should be read in conjunction with the HIA (Stantec, 2008) which provides a description of the prevailing hydrogeological conceptual model.

The 2019 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 the current 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 Stantec (2008).

1.3 Potential receptors

The main receptors identified in the HIA (Stantec, 2008) are:

- Shon Sheffrey Spring
- The Nant Trefil

- Groundwater in the Carboniferous Limestone

The HIA (Stantec, 2008) concluded that proposed dewatering activities will not have any significant impact on flows in the Nant Trefil or at the 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:

- Fuel spills from plant operating on-site.
- Discharge of sediment-laden water to surface water features including the Nant Trefil.

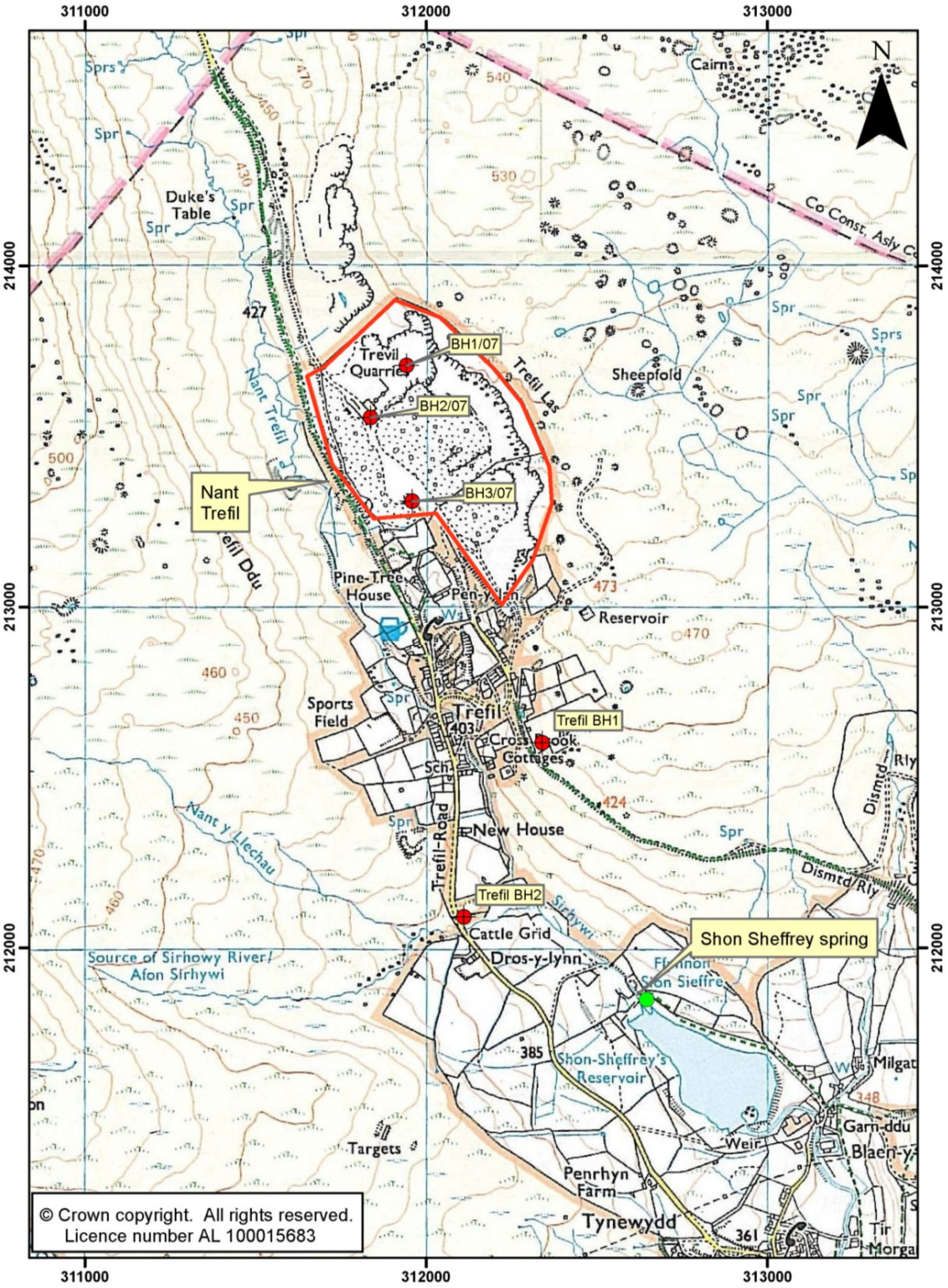
1.4 Monitoring regime

In order to quantify the level of impact at key receptors and to ensure that the hydrogeological 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 on-site boreholes (BH1/07, BH2/07 and BH3/07) are measured at weekly intervals (see Figure 1.1).
- Groundwater levels in Trefil BH1 and Trefil BH2 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 an on-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



Report Reference: 6878R12

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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 2019, a total rainfall of 1,184 mm was recorded at Trefil quarry. August to November saw above average rainfall whilst January and February were drier than average. Months with high recorded rainfall often correspond with months showing elevated recorded pumping data – as shown in Section 2.3.

The recorded annual rainfall total at the site may be an underestimate given the occasional gaps in the data record (as detailed below Table 2.1) and the nature of the gauge which means that any rainfall depth in exceedance of 50 mm is not recorded; it is noted that rainfall events of this magnitude are however, rare.

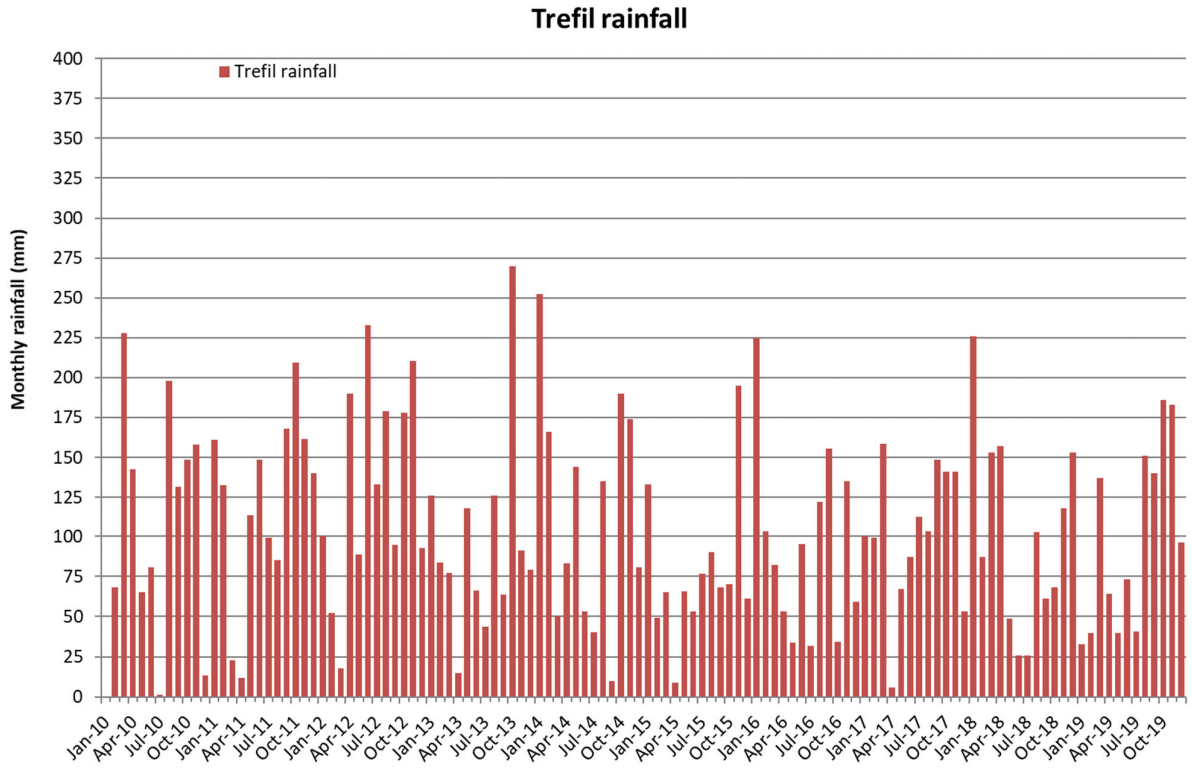
Monthly rainfall data were provided by the Environment Agency for a rain gauge located at Rhymney about 3 km to the south west of the site from 1971 to 2003 (Stantec, 2008). Average long-term rainfall data over that period was 1,625 mm/a.

Table 2.1 Monthly rainfall data at Trefil quarry

	Rainfall (mm)									
Month	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Jan		161	100	126	253	133	225	100	226	33
Feb	68	133	52	84	166	49	103	99	87	40
Mar	228	23	18	77	50	65	82	159	153	137
Apr	143	12	190	15	83	9	53	6	157	64
May	65	114	89	118	144	65.5	34	67	48.5	40
Jun	81	149	233	66	53	53	95	87	26	73
Jul	2	99	133	44	41	76.5	32	112	26	41
Aug	198	85	179	126	135	90	122	103	102.5	151
Sep	132	168	95	64	10	68	156	148.5	61	140
Oct	149	210	178	270	190	70	35	141	68	186
Nov	158	162	211	91	174	195	135	141	118	183
Dec	13	140[b]	93	79[c]	81[d]	61[e]	59	53	153	96[f]
Total	**1,237[a]**	**1,456**	**1,571**	**1,160**	**1,379**	**935**	**1,130**	**1,216**	**1,226**	**1,184**

[a] 11 months only
[b] This is the total for 1 December 2011 to 22 December 2011.
[c] This is the total for 1 December 2013 to 25 December 2013.
[d] This is the total for 1 December 2014 to 23 December 2014.
[e] This is the total from 1 December 2015 to 9 December 2015
[f] This is the total from 1 December 2019 to 20 December 2019

Figure 2.1 Monthly rainfall – site data



2.2 Groundwater levels

The monitoring regime (as set out in the WMP and summarised in Section 1.4) states that weekly monitoring of on-site boreholes (BH1/07, BH2/07 and BH3/07) and monthly monitoring of off-site boreholes (Trefil BH1 and Trefil BH2) is required. In 2019, groundwater levels were recorded at both the on-site and off-site boreholes on 11 occasions.

Groundwater level data for all five boreholes are summarised in Table 2.2 and shown in Figure 2.2 and Figure 2.3.

Groundwater levels in BH1/07 saw a gradual decline (with an overall fall in level of c. 4 m) between December 2014 and August 2015 during which time the base of the quarry was deepened to work level 5 (Appendix A). Since this time the BH1/07 groundwater levels appear to have been stable (at around 429 mAOD). No such water level impacts have been evident in other borehole datasets suggesting that the dewatering effects at BH1/07 are fairly localised. As such, groundwater levels in

BH2/07 and BH3/07 have remained relatively stable across the monitoring record[1]. It is noted that the drop in groundwater levels at BH1/07 appears to correlate with a reduction in the cumulative departure from mean (CDM) rainfall that has occurred since January 2015 (Figure 2.2), although this trend is not evident in the other groundwater data sets. The variability of groundwater levels at BH3/07 appears to have reduced over time although the minimum levels recorded have remained approximately the same throughout the monitoring record.

Data collected at the off-site boreholes (see Figure 2.3) shows no evident trends since data collection began. Groundwater levels declined following the high December 2018 readings at Trefil BH1 and Trefil BH2 until September 2019 when levels increased through to December 2019 by around 2 – 3 m.

Table 2.2 Groundwater level statistics

Borehole Name	Frequency	Datum (mAOD)	Data period	Statistics (mAOD)			Range (m)
				Min	Arithmetic Mean	Max	
BH1/07	Weekly	442.691	Full record (2007-2019)	426.90	433.62	436.95	10.05
			2019	428.77	429.51	430.53	1.76
BH2/07	Weekly	452.753	Full record (2007-2019)	435.99	438.50	447.57	11.58
			2019	436.82	437.24	437.62	0.80
BH3/07	Weekly	453.499	Full record (2007-2019)	432.08	433.51	436.31	4.23
			2019	432.08	432.94	433.39	1.31
Trefil BH1	Monthly	427.06	Full record (2007-2019)	374.81	376.36	379.96	5.15
			2019	375.19	376.27	378.54	3.35
Trefil BH2	Monthly	393.31	Full record (2007-2019)	367.86	369.01	372.70	4.84
			2019	368.04	368.95	370.38	2.34

[1] The only exception are selected groundwater level data obtained for BH2 in October 2014 which are likely to be erroneous.

Figure 2.2 Groundwater level hydrographs (on-site)

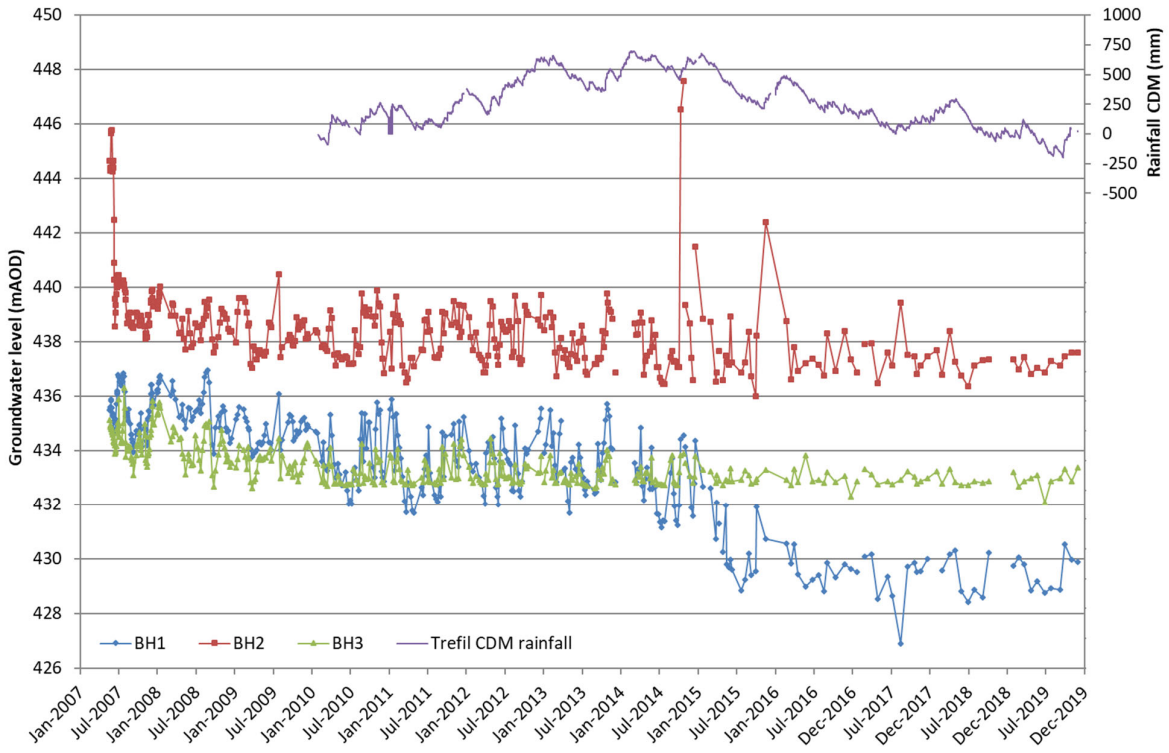
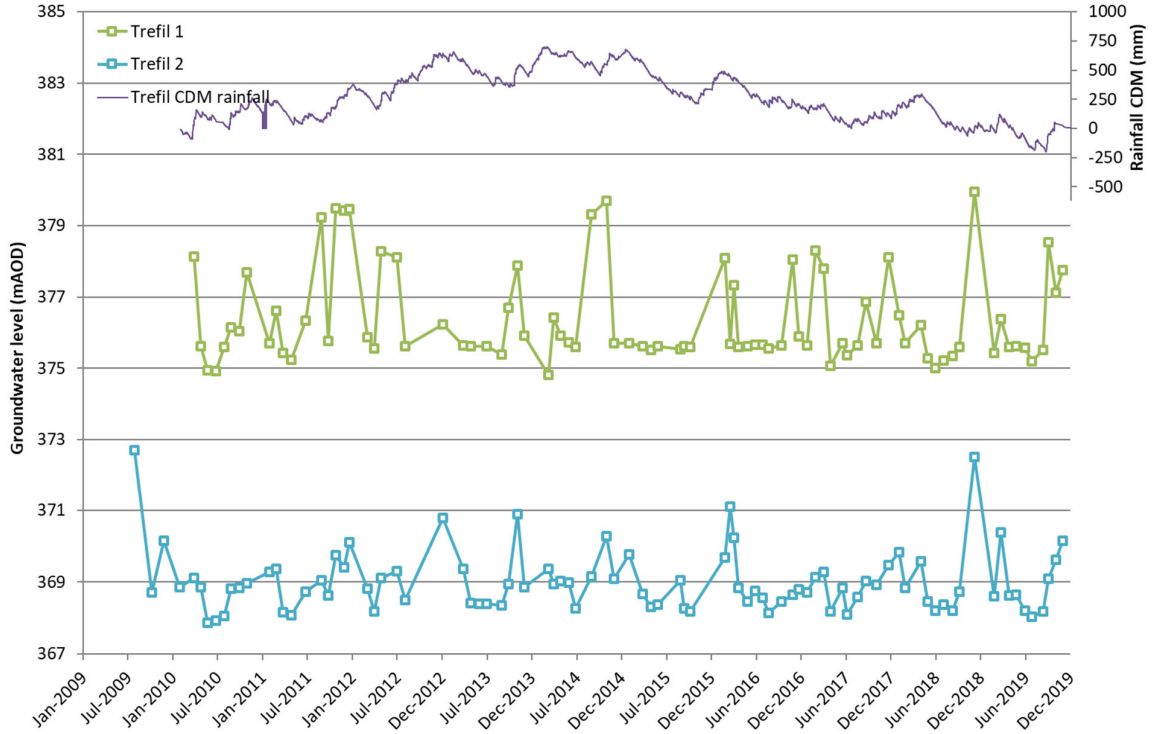


Figure 2.3 Groundwater level hydrographs (off-site)



2.3 Quarry pumping

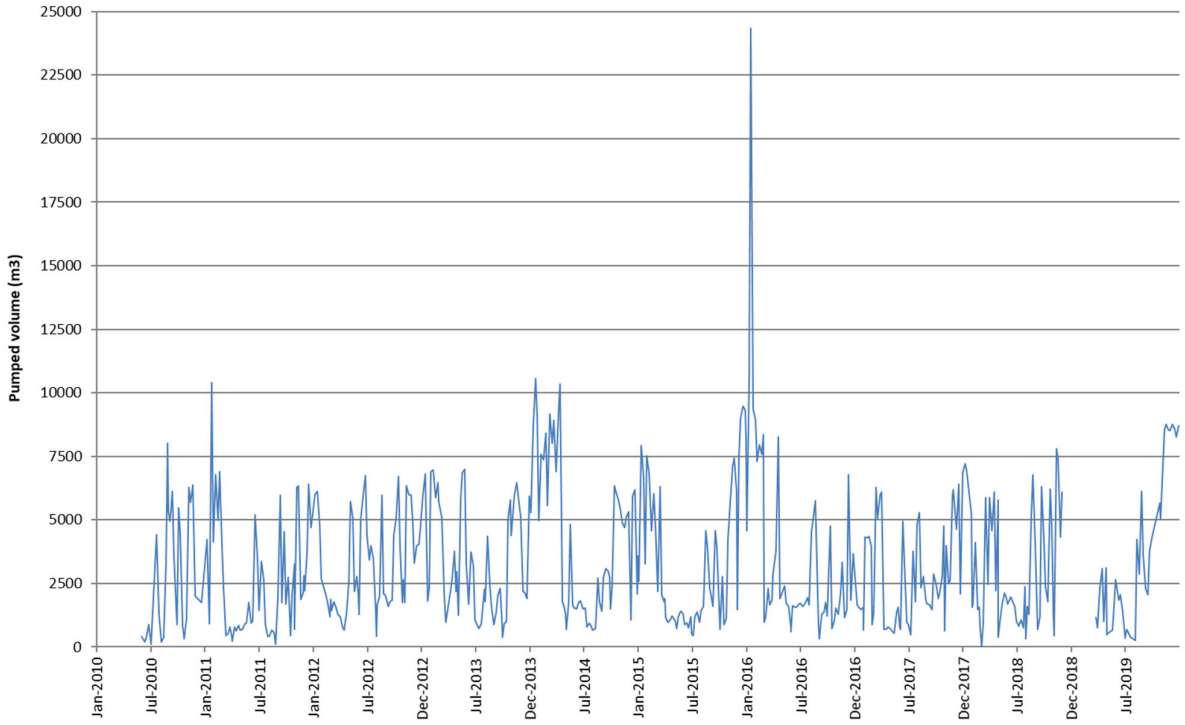
The rate of pumping from the quarry sump is monitored at weekly intervals by means of an in-line flow meter. The pump is operated manually when water levels in the base of the quarry are required to be lowered to carry out mineral extraction. Pumping records are available between 31 May 2010 and 31 December 2019, with monthly totals given in Table 2.3. A time series plot is shown in Figure 2.4. Broadly speaking, pumping volumes during 2019 were similar to those previously observed which may be expected given the annual recorded rates of rainfall. A new flow meter was installed on 22 March 2019 following a failure at the end of November 2018; hence no data are available during this period.

Table 2.3 Monthly pumping totals

Date	Pumped volume (m^3)									
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Jan	/	19,680	19,610	23,860	38,580	27,970	57,810	6,910	27,010	*
Feb	/	22,590	6,860	25,020	23,360	22,210	32,210	17,830	9,650	*
Mar	/	4,540	7,220	8,150	38,570	14,240	9,780	24,770	15,160	1,920
Apr	/	3,140	5,340	13,820	24,160	4,420	13,970	2,890	19,030	10,040
May	430	4,300	17,820	24,210	10,470	5,670	7,070	4,830	8,690	5,490
Jun	1,460	10,670	23,320	9,690	6,560	3,750	8,140	10,770	6,400	5,640
Jul	5,830	8,760	12,830	6,740	4,700	5,950	6,920	10,830	5,340	1,570
Aug	17,180	1,750	13,790	10,970	6,620	12,400	18,160	14,010	18,850	17,110
Sep	17,000	15,900	9,600	6,900	13,040	12,400	5,940	8,500	12,420	12,440
Oct	12,220	9,240	20,080	17,520	26,020	9,690	8,040	12,330	16,430	10,680
Nov	20,330	19,400	20,070	18,370	20,010	26,390	7,880	21,260	26,040	34,360
Dec	1,750	17,040	21,060	17,300	18,860	44,920	13,720	20,010	*	34,300
Average m^3	**9,525**	**11,418**	**14,800**	**15,213**	**19,246**	**15,834**	**15,803**	**12,912**	**15,002**	**13,355**
m^3/d	**313**	**375**	**485**	**500**	**633**	**521**	**518**	**424**	**494**	**400**

** = water meter failed at the end of November 2018 due to wear and hence no readings from December 2018 to 22 March 2019*

Figure 2.4 Quarry sump pumping time series data (daily totals)



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.

As part of the WMP, 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. Turbidity monitoring has been carried out since April 2010 with twenty-nine records collected in 2019; the 2019 data are presented in Table 2.4.

In 2019 there was just one reading above the 100 mg/l threshold on 7 March 2019 with the maximum derived suspended solid reading being 100.22 mg/l. This result coincided with heavy showers the previous evening.

Table 2.4 Discharge turbidity and suspended solids results

Date	Weather Conditions	Sample Ref.	Turbidity Reading (NTU)	Equivalent Suspended Solids Reading *(consented limit: 100 mg/l)*
02.01.19	Bright but cold	20119	143.08	73.44
22.01.19	Bright and cold	220119	47.8	29.67
08.02.19	Heavy rain showers	80219	174.37	87.81
12.02.19	Overcast and windy	120219	152.31	77.68
22.02.19	Bright	220219	169.77	85.70
04.03.19	Rain	40319	178.21	89.58
07.03.19	Heavy showers	70319	201.37	**100.22**
12.03.19	Heavy rain	120319	197.05	98.23
15.03.19	Heavy rain	150319	193.68	96.68
20.03.19	Bright	200319	162.11	82.18
08.04.19	Misty and wet	80419	187.03	93.63
29.04.19	Overcast	290419	179.77	90.29
09.08.19	Heavy rain	90819	167.33	84.58
16.08.19	Wet	160819	155.72	79.25
19.08.19	Overcast with showers	190819	161.06	81.70
29.08.19	Showers	290819	149.81	76.53
05.09.19	Overcast then bright	50919	132.49	68.57
25.09.19	Showers	250919	197.48	98.43
04.10.19	Wet and windy	41019	181.03	90.87
25.10.19	Raining	251019	128.01	66.52
31.10.19	Wet and misty	311019	137.88	71.05
04.11.19	Showers	41119	161.25	81.79

Date	Weather Conditions	Sample Ref.	Turbidity Reading (NTU)	Equivalent Suspended Solids Reading *(consented limit: 100 mg/l)*
08.11.19	Dry	81119	129.14	67.03
12.11.19	Showers	121119	124.61	64.95
22.11.19	Wet and dull	221119	122.35	63.92
29.11.19	Bright	291119	117.34	61.61
06.12.19	Heavy rain	61219	144.79	74.22
11.12.19	Wet and windy	111219	183.15	91.85
18.12.19	Wet and windy	181219	178.07	89.51

Note: bold readings exceeded the 100 mg/l threshold

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 on a weekly basis for the presence of voids (which might indicate the presence of fast pathways from the quarry to local receptors). No significant voids or drainage issues were identified during 2019, however, it was noted on 11 November 2019 that a residue of engine oil (spillage from the failed engine of the Max screen) was present in the open culvert opposite the dust sheds. Oil matts and the oil boom were used to clean up the low volume seepage.

During the 24 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 2019 was 400 m^3/d. The total rainfall recorded at the site in 2019 was 1,184 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 569 mm (based upon the estimated regional long term average value).

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

With a total annual rainfall for 2019 of 1,184 mm and an estimated annual potential evapotranspiration of 569 mm, this would result in a recharge rate of 337 m^3/d across 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. 400 m^3/d in 2019 is slightly 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 assumed catchment (i.e. from a total of c. 24 ha).

The impact assessment (Stantec, 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

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

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

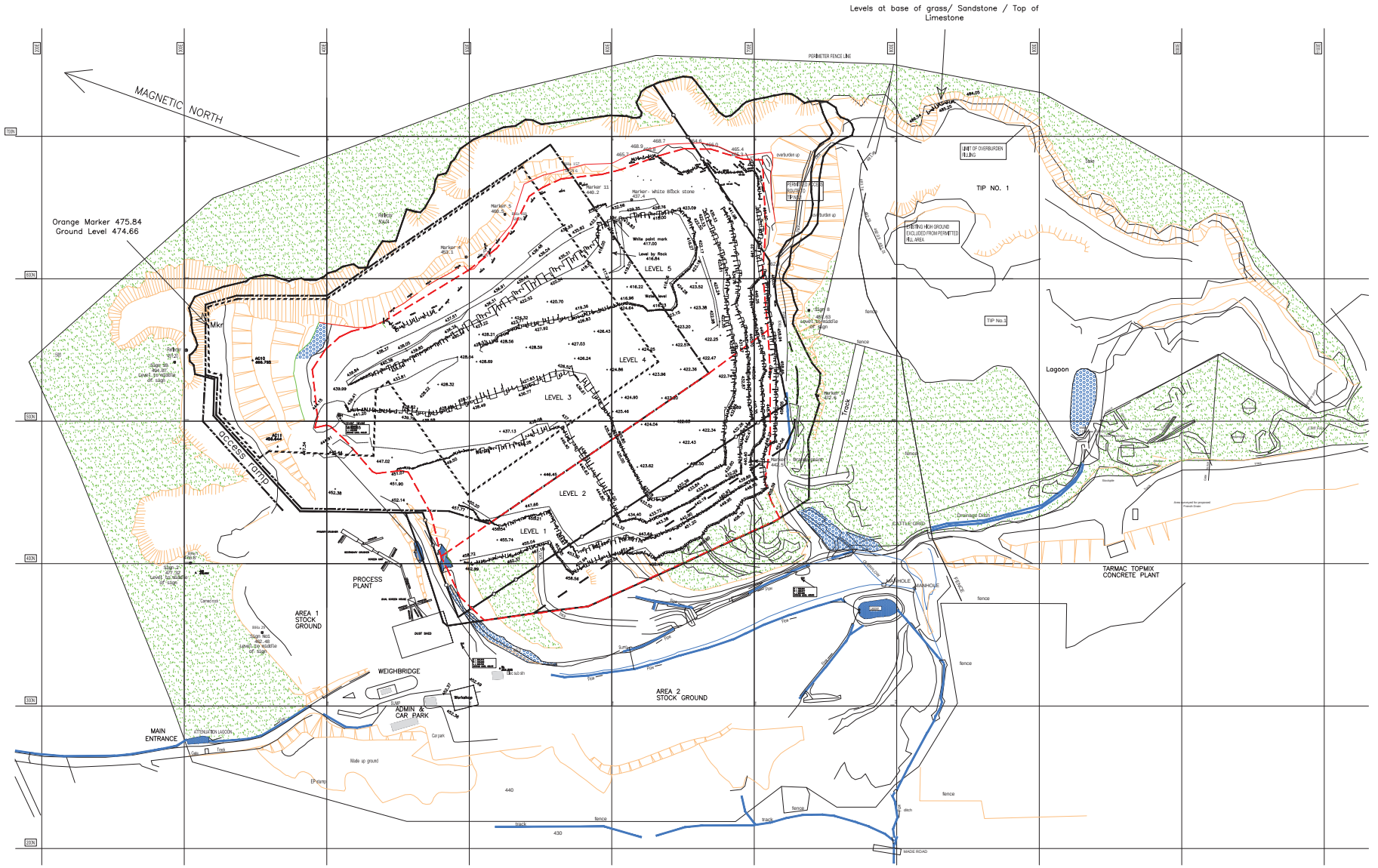
APPENDICES

Appendix A

Site survey

Report Reference: 6878R12

Report Status: Final Report



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/1000M/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. Reference signs added June 2014
5. Benchmark 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

Gryphons Quarries Ltd.

ABBREVIATIONS

IC	– Inspection Cover	C/B	– Close Boarded
CL	– Cover Level	C/I	– Corrugated Iron
IL	– Invert Level	U/R	– Iron Railings
U/S	– Unable To Lift	P/R	– Post & Rail
P	– Pipe Diameter(m)	P/W	– Post & Wire
		B/W	– Barbed Wire
EL	– Eaves Level	DP	– Down Pipe
RL	– Ridge Level	DI	– Drop Kerb
BHL	– Basement Level	EP	– Electricity Pole
FFL	– Finished Floor Level	ER	– Earthing Rod
FFL	– Pedestal Floor Level	TR	– Transformer
T.O.W.	– Top Of Wall	FL	– Flood Light
AV	– Air Valve	FS	– Flag Staff
BH	– Borehole	G	– Gully
BB	– Building Beacon	H	– Height of Tree (m)
BH	– Bore Hole	GV	– Gas Valve
BT	– British Telecom	JB	– Junction Box
CHIM	– Chimney	KO	– Kerb Outlet
CB	– Tel. Call Box	SP	– Sign Post
LB	– Letter Box	SV	– Stop Valve
LP	– Lamp Post	TH	– Trial Hole
MP	– OSBM Marker	TP	– Telegraph Pole
P	– Post	TS	– Traffic Signal
RE	– Rodding Eye	VP	– Vent Pipe
RS	– Road Sign	WM	– Water Meter
SC	– Stop Cock		

CONTRACT SURVEYS (WALES) LIMITED

CONTRACT SURVEYS

LAND AND ENGINEERING SURVEYORS SETTING OUT ENGINEERS

A QUALITY ASSURED ORGANISATION