Breedon Ltd – Tan-y-Foel Quarry

Transfer licence - Supporting Information (Document N° 2757/DAL/01 - text)

Please note: The configuration of Tan-y-Foel quarry and its water management are such that the data available does not fit readily into NRW Form WRH. The means of application in this situation was therefore discussed in detail with Mary Beckett, NRW Senior Permitting Officer. The content of this submission is in accordance with the approach discussed with her.

1. Background

Tan-y-Foel Quarry is situated approximately 3.7 km southwest of Cefn Coch, Welshpool, and extends to approximately 40 hectares (ha).

2. Geology

2.1 Bedrock geology

The bedrock geology beneath the site comprises the Penstrowed Grits Formation; a sedimentary rock composed of mudstones with greywacke sandstones. This comprises the economic mineral at the site. It is vertically to sub-vertically bedded, with the strike orientated southwest–northeast. The outcrop within the quarry void is shown on Photographs 2757/DAL/P1 and P2.

2.2 Superficial deposits

There are no superficial deposits directly over the site. The majority of the surrounding area is overlain by glacial deposits (principally glacial Till) and peat deposits.

3. Hydrogeology

The Penstrowed Grits Formation is designated by Natural Resources Wales as a Secondary (undifferentiated) aquifer; these are layers where it is not possible to attribute either category A or B to the rock type. In most cases this means that the layer has previously been designated as both minor and non-aquifer in different locations due to variable characteristics of the rock type.

Groundwater elevations were determined during an investigation of the quarry undertaken in August 2013 (Tan-y-Foel Quarry, Cefn Coch, Welshpool, Powys. Hydrogeological and Hydrological Impact Assessment, 6th August 2013. An excerpt of the report is appended). The groundwater contours are shown on Drawing 2757/DAL/01. The elevations were obtained from temporary boreholes installed in the quarry floor, which have been lost due to mineral extraction in the intervening period. Comparison of the groundwater contours and current site topography (Drawing 2757/DAL/02) show that the quarry floor is at, or slightly above, the watertable.

4. Quarrying operations

Mineral is extracted at Tan-y-Foel Quarry from two separate quarry voids, known as Quarry A and Quarry B. The two voids lie parallel to each other and are orientated southwest and northeast. They are separated by a ridge of rock which is unworked, due to its unsuitability for aggregate use.

Mineral is removed from the quarry faces by blasting and transported to the mineral processing plant by dump truck. The processing plant generates material for use in a range of

applications. A concrete plant is also located on-site which utilises mineral produced within the quarry.

5. Water management

5.1 Set-up

Water management is undertaken at Tan-y-Foel Quarry to ensure safe and efficient working, however that maintained within Quarries A and B differs, as disused below.

Water derived from both rainfall and groundwater is collected in a sump within the floor of Quarry A, from where it is pumped southwestwards. The installed pump is a 4" Flygt BS 2125 HT. The output of the pump with appropriate vertical and horizontal head losses applied is 13-15 l/s (pers comms pump suppliers 06/08/19). The pump specification is included in Appendix 2757/DAL/A1. A bi-furcating junction in the pipework allows diversion of a proportion of the pumped water to a storage tank for use on-site. Water is used for mineral processing, concrete production and dust suppression. The non-utilised water continues in pipework southwest-wards and is discharged into a settlement lagoon in the southwest extremity of the void of Quarry A. It discharges by gravity southwestwards, via a buried pipeline, into a series of settlement lagoons prior to discharge off–site, via the consented discharge point. A schematic of the water management system is given in Drawing 2757/DAL/03 and it is also shown overlaid on an aerial image, on Drawing 2757/DAL/04. A schematic cross-section showing the relationship between quarry configuration and water management features is shown on Drawing 2757/DAL/06.

The series of interconnected settlement lagoons allow the removal of fines lagoons prior to discharge off-site. The receiving watercourse is the headwaters of the Afon Rhiw.

Photographs of elements of the water management system are shown on Photographs 2757/DAL/P3 and P4.

Groundwater ingress and rainfall-derived water within Quarry B is conveyed to a perimeter ditch on the western boundary of the floor of the quarry void. It discharges by gravity southeastwards, passing beneath the public road and steep ground, before discharging to the lagoon system described above.

A small sump exists in the floor of Quarry B from where water is pumped to the holding tank in Quarry A. The abstraction is sourced from groundwater.

5.2 Origin of water

The origin of water discharged from the quarry was investigated in the 2015 assessment BCL report, referenced above, by use of a water balance. The pertinent section is included in its entirety below.

Water Balance

2.7.3.5 Pumping from the deep sump is undertaken using a diesel powered 100mm-diameter rotary impellor suction-pump. Within the current discharge configuration, the pump is capable of discharging some 25 litres per second (l/s).

2.7.3.6 Discussions with Site management indicate that during 2012, maintenance of a controlled and suppressed water level within the sump (estimated to approximate to circa 354maOD) required periodic pumping equating to some 6 hours per day during quarry operational hours.

2.7.3.7 From knowledge of pump running hours and performance, it is estimated that the averaged pumping rate made from Quarry A Sump during 2012 was some 540 cubic

metres per day (m^3/d), equating to an average instantaneous discharge rate of some 6.25 litres per second (l/s).

2.7.3.8 *Examination of rainfall data presented previously (table 6) indicates that local rainfall during 2012 was only marginally elevated above the LTA for the area. Thus, it is likely that that the pumping requirements experienced during 2012 are representative of the typical annual requirements at the Site (at least with respect to workings to some 354maOD; the estimated basal level of the deep sump).*

2.7.3.9 *Assuming the deep sump within Quarry A is fed by both rainfall runoff and groundwater, and that all runoff from the Quarry A were captured by the deep sump collector, calculation indicates that the proportion of pumping undertaken during 2012 that may be attributable to groundwater inflow to the sump is some 75% to 80% of the estimated average discharge rate (i.e. a groundwater component of circa 440m^3/d and a rainfall component of some 100m^3/d).*

The quarry is now at a greater depth than that which pertained when the BCL report was prepared. However, it is considered that the origins of the water discharged off-site will remain similar, and it has been assumed that approximately 75% is derived from groundwater, with the balance being rainwater.

5.3 Water volumes

Water volumes were not monitored until recently.

A flowmeter was installed adjacent to the pump in Quarry A in June 2019. A total of 8000 m^3 had been pumped from Quarry A by the end of July; thus on average 4000 m^3/month or 131 m^3/day were pumped. The known output of the pump is such that it can be inferred that it operates for approximately 2½ hours per day, 7 days per week.

Estimates of water usage have been made by site personnel and are summarised as below, for a 5 day operational week:

2757/DAL/T1: Estimated water usage		
	Volume (m^3)	
	Day	Month (22 days)
Mineral processing	30	660
Concrete production	7.5	165
Dust suppression	45	990
Total	82.5	1815

The volume of water abstracted from the groundwater sump in Quarry B, which is pumped to the tank in Quarry A, for use on site is not known, however an estimate has been made. The pump is an electro-submersible, with a 2" (50 mm diameter) discharge pipe, and operates, on average, for 1½ hours in the summer months. An estimate of output, with the pertaining head losses, is 200 l/minute, or 3.3 l/second. This equates to 18 m^3/day.

5.4 Discharge

Based upon the volumes utilised on-site, as described above, it can be estimated that the average discharge in June and July from Quarry A was 4000-1815 = 2185 m^3/month. This equates to a continuous rate of 0.85 l/s.

Discharge from Quarry B occurs by gravity drainage. There are no measurements of actual discharge, therefore the volumes of water leaving site from Quarry B are unknown. However, the similarity of 'footprints' of Quarries A and B and the relationship within each between the watertable and elevation of the quarry floor is such that it can be inferred that the discharge from Quarry B will be similar to that of A, ie 4000 m³/month.

The total discharge requirement from the site is thus 4000 + 2815 = 6, 185m3/month. This equates to approximately 206 m3 day or 2.4 l/s.

It is noted that there is a disparity between the dewatering volumes previously calculated (BCL 2015, 2.7.3.7) of 6.25 l/s, and those discussed above, derived from recent metering, with the latter being less. The difference is considered to be due to the fact that the recent data is only from summer months. The actual situation will become clearer as data accumulates.

There is considerable uncertainty in the volumes of water generated within the site and discharged off-site. The volumes of water pumped are now being monitored and recorded, therefore the understanding of fluxes within the system will increase rapidly with time.

The combined discharge from Quarries A and B is delivered passively to the silt lagoon system. The discharge consent is two-stage, with specific parameters for 'average' conditions, (Consent S/01/55287/T) and higher allowances for storm events, consent S/01/55291/T. The parameters of the two consents are summarised in Table 2757/DAL/T2 below and the full documents are given in Appendix 2757/DAL/A2.

2757/DAL/T2: Consent parameters					
Discharge reference	Volumes		Suspended solids (mg/l)	Comment	Date of issue
	Daily (m³)	Rate (l/s)			
S/01/5528287/T 01	691	8.0	50	No visible oil or grease	10/02/1999
S/01/55291/T	No limit	No limit	75	No visible oil or grease	17/03/1999

Supporting documents include:

Forms: WRH form

Drawings: 2757/DAL/01 – Groundwater contours (mAOD)

2757/DAL/02 – Topography of the northern sections of Quarries A and B

2757/DAL/03 – Schematic of water management

2757/DAL/04 – Overview of water management

2757/DAL/05 – Land ownership and planning boundary

2757/DAL/06 – Schematic cross-section

Photographs 2757/DAL/P1 - Quarry A, looking northeast

2757/DAL/P2 – Quarry B, looking northeast

2757/DAL/P3 - Sump in southwestern Quarry A, looking northeast

2757/DAL/P4 – Overview of settlement lagoon systems

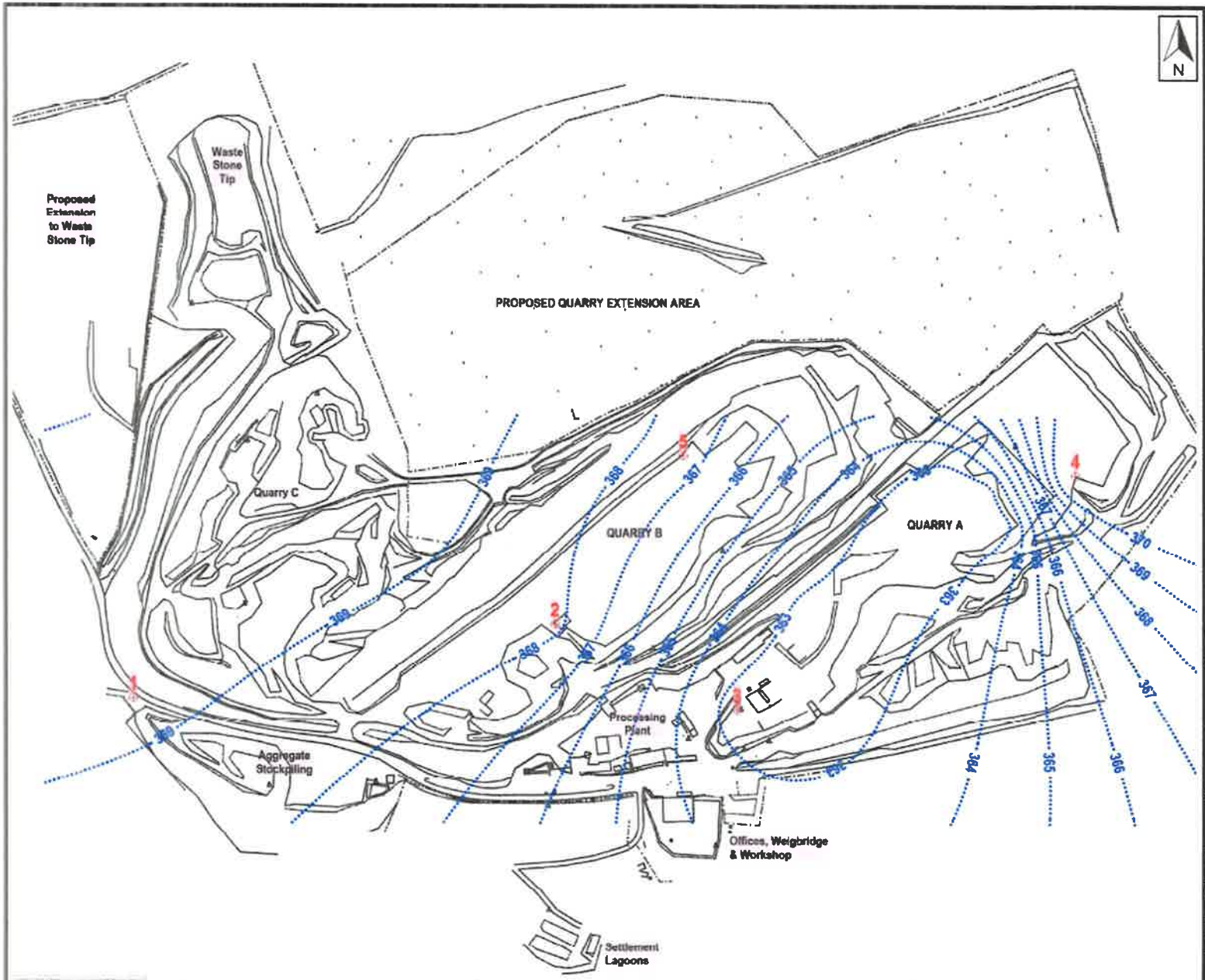
Appendix: 2757/DAL/A1 – Pump specification

2757/DAL/A2 – Environmental permit

2757/DAL/A3 – Excerpt from BCL HIA / ROMP report, August 2013

2757/DAL/A4 – Letter of Authorisation

DRAWINGS



Client	HV Bowens & Sons
Title	Groundwater Contours (m.AOD) Aug-15
Project	Tan-Y-Foel Quarry
Drawing	2757/DAL/01
Version	1
Date	Aug-19
Scale	

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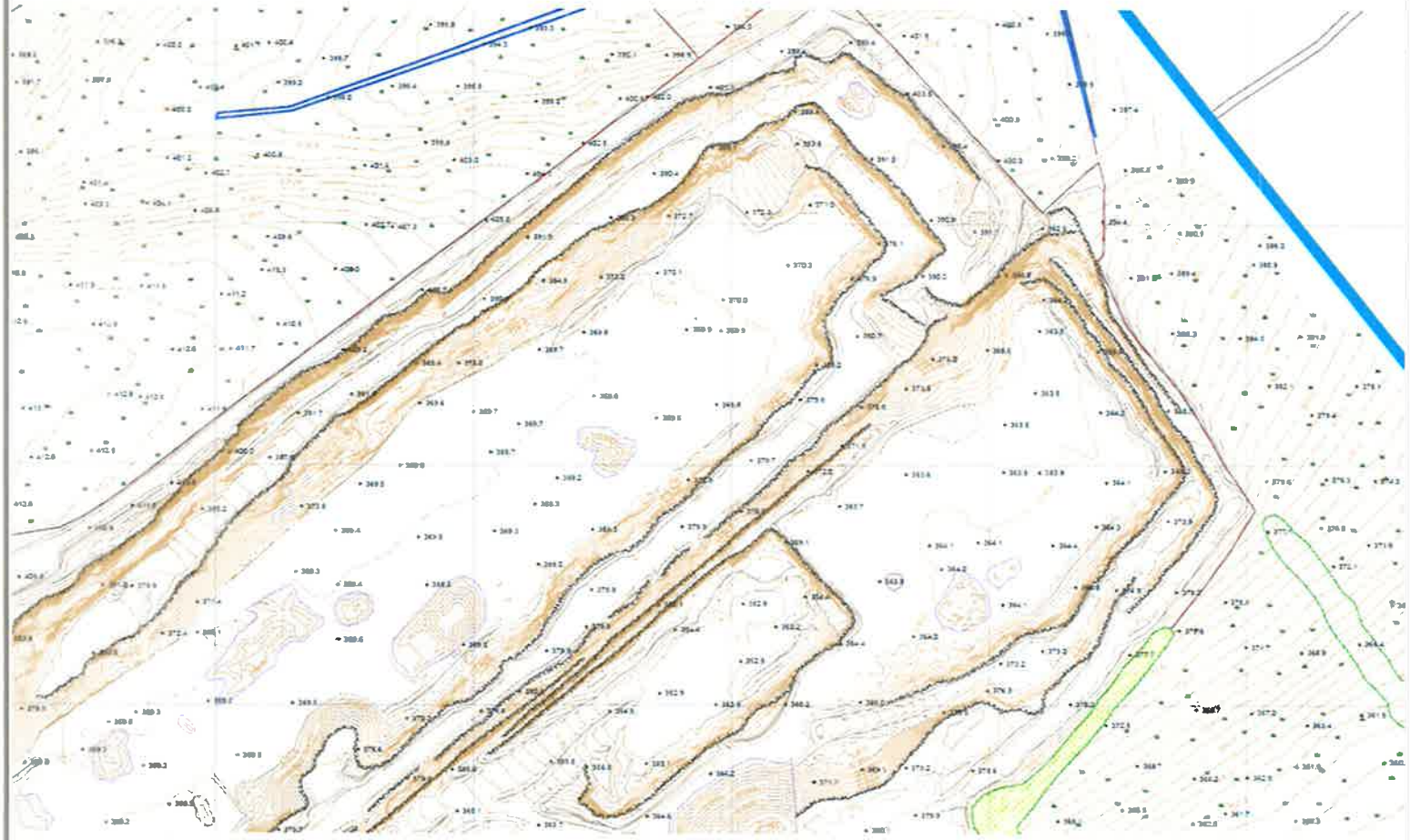

Client	HV Bowens & Sons
Title	Topography of the northern sections of quarries A & B
Project	Tan-Y-Foel Quarry
Drawing	2757/DAL/02
Version	1
Date	Aug-19
Scale	

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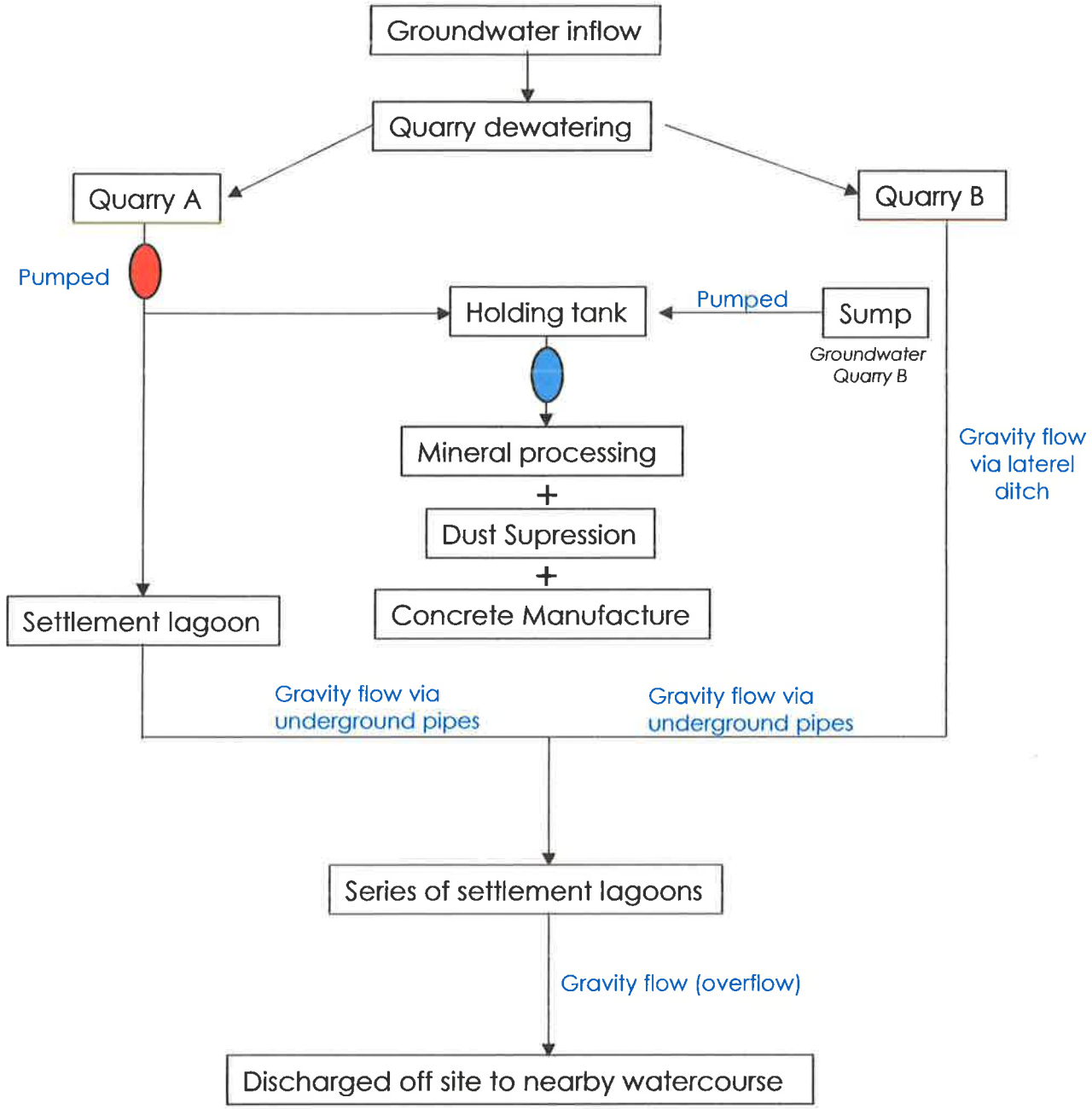

Legend

Full licence

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Client	H V Bowen & Sons
Title	Schematic of water management - NRW advice
Project	
Drawing	2757/DAL/03
Version	1
Date	Aug-19
Scale	nts

Scale correct at A4

Legend

- Approximate Site Boundary
- Watercourses
- Culvert
- Silt Settlement Lagoons
- Abstraction Sump

Water Outlets & Storage

- Water Pipe
- Gravity Overflow
- Buried Water Pipe
- Water Tank

Sump Pump and Discharge Points

- Sump Pump
- Consented Discharge Point

Quarries

- Quarry A
- Quarry B

Processing Plants

- Concrete Plant
- Mineral Processing Plant

Client	Breedon Group
Title	Overview of Water Management
Project	Tan y Foel
Drawing	2757/DAL/04
Version	1
Date	Aug - 19
Scale	1:5000

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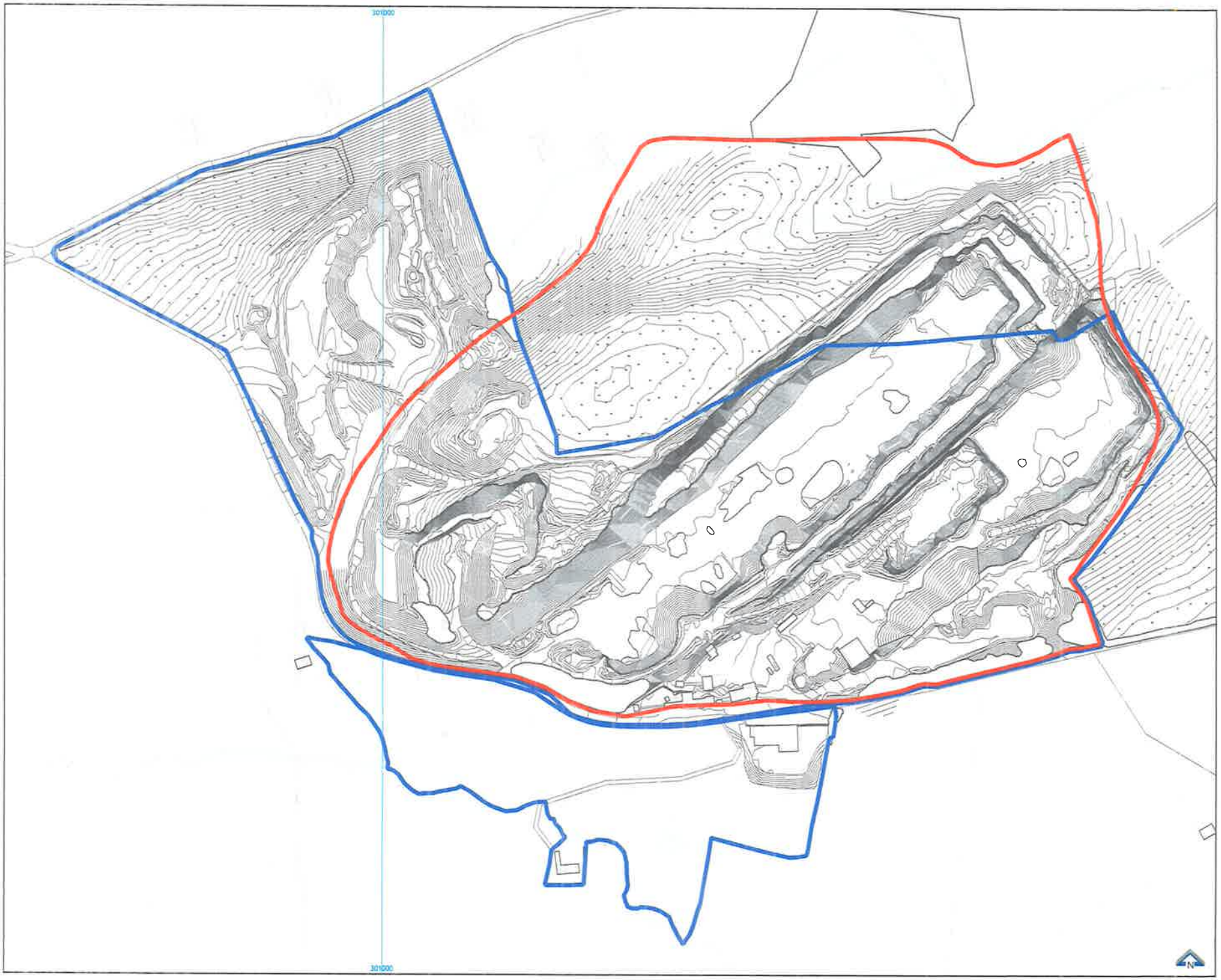


Legend

- Planning Boundary
- Land Ownership

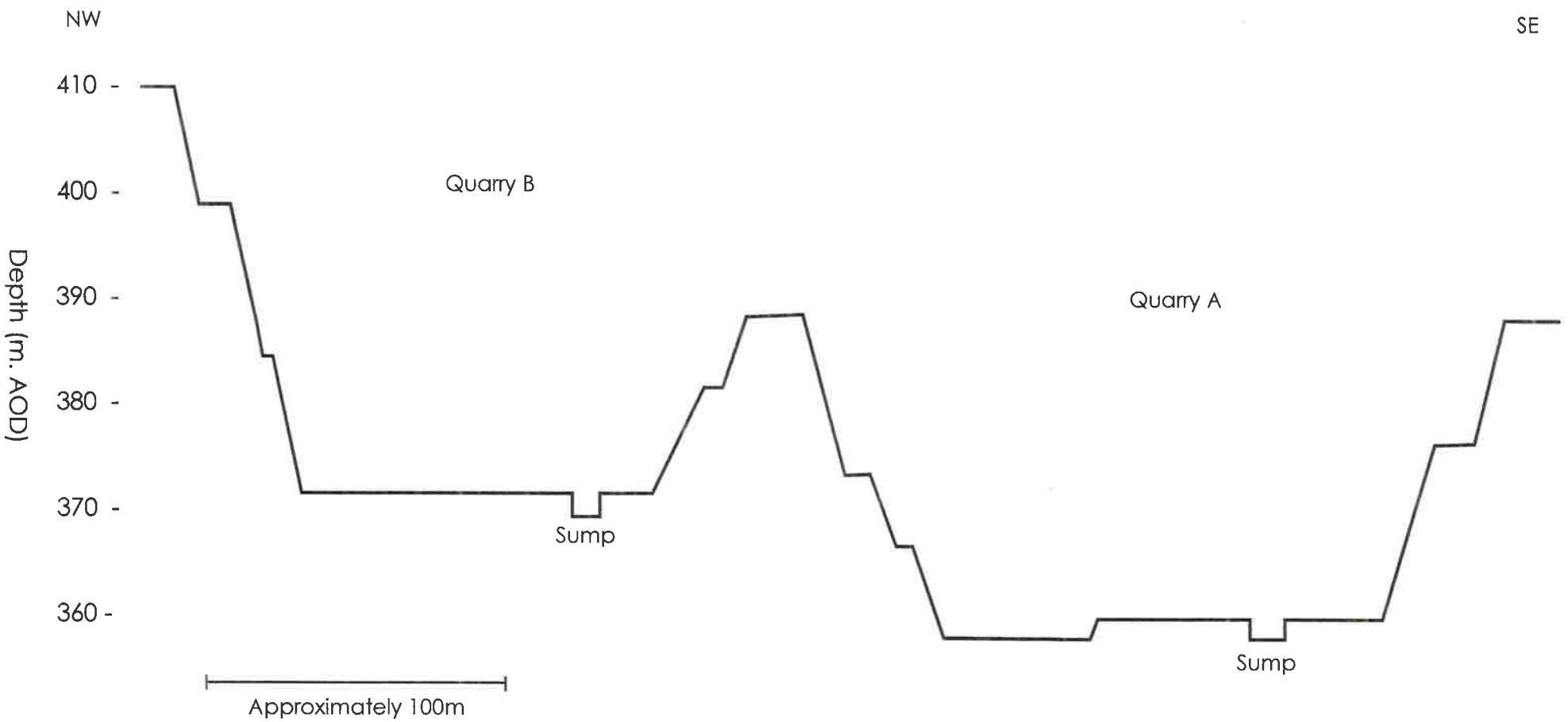
BREEDON

Tan y Foel

Ownership

Drawn by:	C J Burgess
Date:	09/08/19
Scale @ A3:	1:3000

Drawing No:	Revision:
TyF-19-04	-



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Client	H V Bowen & Sons
Title	Schematic Cross Section
Project	Tan-Y-Foel
Drawing	2757/DAL/06
Version	1
Date	Aug-19
Scale	n.a.

PHOTOGRAPHS

2757/DAL/P1: *Photograph of Quarry A, looking northeast - 18/4/19*

2757/DAL/P2: *Photograph of Quarry B, looking northeast - 18/4/19*

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Client	H V Bowen & Sons
Title	Photosheet 1
Project	Tan-Y-Foel
Date	Aug-19
Version	1

2757/DAL/P3: *Photograph of the sump in southwestern Quarry A, looking northeast - 18/4/19*

2757/DAL/P4: *Overview of settlement lagoon systems - 18/4/19*

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Client	H V Bowen & Sons
Title	Photosheet 2
Project	Tan-Y-Foel Quarry
Date	Aug-19
Version	1

APPENDIX 2757/DAL/A1

Pump specification