Keegan Quarries Limited

TROMMAN QUARRY

Tromman, Rathmolyon, Co. Meath

Environmental Impact Assessment Report
for further Quarry Operations

Hydrogeological and Hydrological Assessment

August 2019

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BCL CONSULTANT HYDROGEOLOGISTS LIMITED

EXPERIENCE & QUALIFICATIONS

BCL is an independent consultancy specialising in all aspects of hydrology and hydrogeology as they relate to minerals extraction, water supply and environmental issues.

Henry Lister (the author of this report) holds a Batchelor of Science (Honours) degree [Applied Geology] conferred by Plymouth University, 1992 and a Master of Science Degree [Groundwater Engineering], Newcastle University, 1994.

BCL has provided specialist services and advice to the extractive industry since 2000. During this time, experience has been gained from involvement in the study of hydrogeological and hydrological systems in connection with planning matters at over 100 quarries throughout Ireland and the United Kingdom.

1 INTRODUCTION

1.1 Background

1.1.1 Keegan Quarries Limited (the Applicant) has commissioned the preparation of an Environmental Impact Assessment Report (EIAR), seeking consent for further quarrying at Tromman Quarry (the Site), near Rathmolyon, County Meath.

1.1.2 The EIAR will accompany a planning application (the Application), which will seek to secure planning consent to continue operations under Section 37L.

1.1.3 The Applicant has appointed a specialist mineral planning consultancy, Quarryplan Limited (QPL), to coordinate the production of the EIAR.

1.1.4 Quarryplan has instructed BCL Consultant Hydrogeologists Limited (BCL) to assess the potential hydrological and hydrogeological impacts associated with the Quarry Development Proposals.

1.2 Data Sources

1.2.1 Site specific data include the following:

i. Topographic surveying (28th August 2018) supplied by the Applicant.

ii. Walk over inspection of the Site (made by BCL on 31st October 2018).

iii. Water features survey (BCL).

iv. Groundwater level data collected at Site piezometers and local water supply boreholes/wells, as supplied by the Applicant.

v. Dewatering discharge data supplied by the Applicant.

vi. Regular sampling of surface water and groundwater for laboratory analysis.

vii. Planning application ref: TA30334. Continuance and extension of quarrying of limestone at Tromman (Keegan Quarries Limited). Chapter 6 of Environmental Impact Statement (EIS), prepared by Declan Brassil & Company (DBC) working with O'Neill Ground Water Engineering Limited (OGE). Submitted September 2003. Hereafter referred to as *Reference 1*.

viii. Planning application ref: TA30334. Conditional permission granted March 2004, with Inspector's Report PL17.206702 (dated 13th July 2004) received from An Bord Pleanála (ABP). Hereafter *Reference 2*.

ix. Discharge Licence 04/2, issued by Meath County Council (MCC) in 2004. Hereafter *Reference 3*.

x. Planning application ref: TA 60629. Extension of quarrying of limestone at Tromman (Keegan Quarries Limited), extending on to land on southern side of the R156 Road; and establishment of a concrete block plant. Chapter 8 of EIS, prepared by DBC. Submitted January 2007. Hereafter referred to as *Reference 4*.

xi. Planning application ref: TA 60629. Permission refused November 2008, with Inspector's Report PL17.226884 (dated 13th November 2008) received from ABP. Hereafter *Reference 5*.

xii. Planning application ref: TA 900976. Extension to the existing permitted extraction area at Tromman (Keegan Quarries Limited). Chapter 8 of EIS, prepared by DBC working with Minerex Environmental Limited (MEL). Dated May 2009. Hereafter referred to as *Reference 6*.

xiii. Planning application ref: TA 900976. Response to request for Further Information, DBC. Dated 2nd November 2009. Hereafter referred to as *Reference 7*.

xiv. Planning application ref: TA 900976. Response to submissions / objections to proposed quarry extension, prepared by MEL, dated 3rd March 2010. Hereafter referred to as *Reference 8*.

xv. Planning application ref: TA 900976. Conditional permission granted January 2010, with Inspector's Report PL17.235960 (dated 20th April 2010) received from ABP. Hereafter *Reference 9*.

xvi. Planning application ref: TA 30258 seeking permission for extension of Rathmolyon Quarry (also known as Castletown Quarry, Readymix Ltd). Chapter 6 of EIS, prepared by Tom Phillips and Associates, working with MEL. Submitted July 2003. Hereafter referred to as *Reference 10*.

xvii. Planning application ref: TA-70175, EIS for Castletown Quarry, completed by Golders Associates Ireland, April 2007. Hereafter referred to as *Reference 11*.

xviii. Planning application ref: TA 170519 seeking permission for continued use of the previously permitted development at Castletown Quarry (Kilsaran Concrete). Chapter 6 of EIS, prepared by SLR Consulting Ireland (SLR). Submitted May 2017. Hereafter referred to as *Reference 12*.

xix. Planning application ref: TA 170519. 1st Party Appeal of Conditions 2 & 36, SLR. Dated 10th April 2018. Hereafter referred to as *Reference 13*.

1.2.2 Both published and unpublished documents and other sources of information that have been examined include:

i. Mapping published by the Ordnance Survey of Ireland (OSI), Geological Survey of Ireland (GSI) and Environmental Protection Agency (EPA).

ii. GSI Well Records.

iii. EPA surface water quality data.

iv. Flood Mapping published by the Office of Public Works (OPW).

v. National Parks and Wildlife Service (NPWS): Spatial mapping & citation information for Designated Sites of ecological interest.

vi. Met Éireann: Rainfall data.

vii. Geological information and quarry layout plans provided by the Applicant.

viii. Institute of Geologists of Ireland (2007) Recommended Collection, Presentation and Interpretation of Geology and Hydrogeological Information for Quarry Developments and Geology in Environmental Impact Statements – A Guide.

ix. Working Group on Groundwater (2004) Guidance document GW8: Methodology for risk characterisation of Ireland's groundwater.

x. EU Floods Directive (2007/ 60/ EC) of the European Parliament and of the Council of 23rd October 2007 on the assessment and management of flood risk: Official Journal L288/ 27-34.

1.2.3 At the time of report preparation, in addition to topographic site survey data, information relating to the existing layout of the quarry, as supplied by Quarryplan, or their agents, comprises:

i. *Drawing 00153-181029-dwg-01v2*: "Current Survey".

ii. *Drawing 00153-181029-dwg-02v2*: "Phase 1".

iii. *Drawing 00153-181029-dwg-03v2*: "Phase 2".

iv. *Drawing 00153-181029-dwg-04v2*: "Phase 3".

v. *Drawing 00153-181029-dwg-05v2*: "Phase 4".

1.2.4 It is understood that v3 of these plans have been submitted but the only alteration to the plans is the scale of 1:500, as prescribed by legislation.

1.3 Report Structure

1.3.1 The topography, geology, hydrology and hydrogeology of the study area are described in *section 2*.

1.3.2 An account of the Proposed Development, including description of intended working methods and water management measures, is given in *section 3*.

1.3.3 Assessment of the potential impacts of the Proposed Development and description of mitigation measures proposed to ameliorate significant such impacts are made in *section 4*.

1.3.4 Report conclusions and recommendations are given in *section 5*.

2 BASELINE STUDY

2.1 Site Location & Boundaries

2.1.1 The Site is located in the Townland of Tromman (Co. Meath), some 2.2 kilometres (km) northwest of Rathmolyon Village; and some 6.4 km south of the town of Trim. The Site is bounded to the west by Kilsaran's Tromman Quarry, to the south by the regional road R156 and to the north and east by agricultural fields.

2.1.2 The Irish Grid Reference (IGR) for the centre of the existing quarry is easting ^{2}77700, northing ^{2}50100.

2.1.3 The boundary of the Application Area is illustrated upon the application development drawings.

2.1.4 The totality of the Operational Site has a well-established planning history dating back to the original consent for a quarry and associated works in 1998 (97/1868), followed by ancillary consents for the northern concrete products yard in 2001 (00/2075) and 2003 (TA/20408) which provided consent for the mobile block making plant and for the structure for manufacturing concrete floors and associated works in each instance.

2.1.5 In 2004, under PL17.206702 (PA ref. TA/30334), approval was provided for the bulk of what is now the operational quarry, some 13.94 hectares (Ha); the consent consumed and superseded the earlier permission. This application was accompanied by an Environmental Impact Statement and provided for extraction across the quarry void to a level of 13 metres above Ordnance Datum (maOD). The current floor level in the deepest section of workings is 27 maOD.

2.1.6 Under PL17.235960 (and PA ref. TA/900976), the extraction area of the quarry was enlarged by *circa* 2.85 Ha, extending on to land towards the southern extent and to the east of the original quarry. The depth limit in the extension area was set at 50 maOD.

2.1.7 In July 2019, under PL17.305049, a substitute consent application was submitted to seek authorisation for the unauthorised development of ancillary plant and structures at the quarry site totalling some 21.64Ha in extent, from a baseline date of 2013. In addition, the application also covered unauthorised continuation of extraction and associated mineral processing activities and the continued use and or operation of previously authorised structures beyond the expiry of extraction consents on 5th August 2018.

2.1.8 The Proposed Development (the subject of the current planning application) incorporates the entirety of the substitute consent site and involves a lateral extension of the quarry area to encompass the overburden landform abutting the northern end of the existing void. In addition, the quarry face will be advanced some 20-25 m along the bulk of the western margin, in line with previous permissions. In this way, the physical extraction area would be enlarged by some 2.55 Ha.

2.1.9 The development proposals do not involve any deepening below 13 maOD, which is the previously approved depth permitted under PL17.206702 (PA ref. TA/30334).

2.1.10 Associated ancillary facilities/operations occupy the northern end of the landholding (outside the proposed extraction area). This includes the concrete batching plant, blockyard and pre-cast manufacturing structure. The drainage infrastructure (three-stage settlement tank system) is situated alongside the southeast corner of the pre-cast manufacturing structure.

2.2 Designated Sites

2.2.1 NPWS mapping has been consulted to check for sites with the following status: Special Area of Conservation (SAC), Special Protection Area (SPA), Natural Heritage Area (NHA) and proposed Natural Heritage Area (pNHA).

2.2.2 The Site is not covered under any statutory nature conservation designations.

2.2.3 The closest section of the River Boyne & River Blackwater SAC-SPA is at 950 m standoff to the northwest of the Applicant's quarry; they are separated by Kilsaran's Tromman Quarry.

2.2.4 The SAC comprises the freshwater element of the River Boyne as far as the Boyne Aqueduct, the Blackwater as far as Lough Ramor and the Boyne tributaries including the Deel, Stoneyford and Tremblestown Rivers.

2.2.5 The SAC has been selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive: Alkaline Fens; Alluvial Forests; River Lamprey; Atlantic Salmon; and Otter.

2.2.6 The SPA status is awarded as a result of the high ornithological importance of the river system, because it supports a nationally important population of Kingfisher.

2.2.7 Rathmolyon Esker pNHA is *circa* 2 km to the southeast of the Application Area. This is "one of the type-sites for Francis Synge's theory of esker bead formation as fans. Most of the feature has been quarried out, leaving only the 3 faces topped by mature broadleaf woodland at the southeast extreme".

2.3 Landfill Sites

2.3.1 There are no landfill sites within 5 km radius of the Application Area.

2.3.2 The closest is Basketstown Landfill Facility, near Summerhill, which is about 7 km to the east of the Quarry.

2.3.3 Other sites covered by the EPA's waste licensing & permitting regime include Kiernan Sand & Gravel Limited in Foxtown (8 km ENE); and Lyndon Douglas in Moynalvey (10 km E).

2.4 Topography

2.4.1 The Application Area and the adjoining third-party quarry (Kilsaran) are situated within a gently undulating landscape.

2.4.2 Pre-quarrying ground level would have equated to 70-85 maOD.

2.4.3 The land drops away gently on the southern and western margins of the quarried areas, sloping down towards a small watercourse, Tromman Stream.

2.4.4 This stream passes 400 m to the south of the Application Area, at closest approach. Ground level on this stretch of stream is at around 65-66 maOD, which is roughly 10 m below the nearest section of the Site boundary.

2.4.5 The watercourse makes a very gentle descent westwards then northwards, maintaining 400-450 m standoff from the quarries. As it passes to the northwest of Kilsaran's Tromman Quarry, ground level on the watercourse is at *circa* 63 maOD (roughly 5 m below the Kilsaran boundary). Thus, this 1 km stretch of stream loses only 2-3 m in elevation as it loops around the quarry complex.

2.4.6 At the northern end of the Applicant's landholding, the ground slopes gently down towards the Rathmolyon Stream, which flows from east to west, passing 150 m standoff to the north of the Application Site.

2.4.7 The northern margin of the concrete products yard is delimited by a drainage ditch, the base of which is at 68 maOD (some 2-3 m below ground level in the yard). This ditch extends 200 m to the northwest to reach its confluence with the Rathmolyon Stream. Ground level at the confluence is 67 maOD. In the 750 m stretch below the confluence, the Rathmolyon Stream only loses about 4 m in elevation.

2.4.8 On the eastern side of the quarry, ground levels are at 80-85 maOD, which is slightly raised above the surrounding countryside. This demarcates the watershed between the Tromman Stream and Rathmolyon Stream.

2.5 Geology

2.5.1 The geology within and surrounding the Site has been characterised by reference to the mapping and literature cited in *sections 1.2.1 and 1.2.2*.

2.5.2 The quarry is developed within a sequence of limestone beds of Lower Carboniferous age. According to published GSI mapping, the southeast half of the quarry void extracts from the Lucan Formation; the northwest half is working a block of Waulsortian Limestones, which is in faulted contact with the Lucan Formation.

2.5.3 The Project Geologist (current application) and Minerex (planning application ref: TA 900976) found no evidence in the quarry void of the contact between the two formations.

2.5.4 The Project Geologist concludes that the Site operates within the Waulsortian Limestone formation. Waulsortian Limestone typically comprises pale-grey and very fine-grained carbonates, which display mudstone to wackestone depositional textures. The pale colouration reflects the relative purity of the carbonate matrix, which contains very little to no argillite and is essentially composed of lime mud. The strata at Site generally dips at a low angle to the west, although can be locally steep.

2.5.5 The GSI describes the Lucan Formation as comprising dark grey, well bedded, cherty limestones and calcareous shales.

2.5.6 As outlined previously, the Proposed Development (the subject of the current planning application) involves a lateral extension to encompass the overburden landform abutting the northern end of the existing void. In addition, the quarry face will be advanced some 20-25 m along the bulk of the western margin.

2.5.7 In advancing westwards and northwards, these extension areas would be confined to the Waulsortian Limestones.

2.5.8 In terms of drift deposits, the farmland to the south and east of the Application Area (and the fields to the west of Kilsaran's quarry) are typically underlain by limestone-derived till: described as slightly gravelly sandy Silt with occasional cobbles and boulders; locally grading to slightly gravelly sandy Clay/Silt and very silty gravelly Sand.

2.5.9 There is an expanse of glacial sand and gravel on the land to the north of the quarry.

2.5.10 A pocket of lacustrine deposits is shown to have accumulated on the valley floor alongside Tromman Stream, where it passes to the south of the Site.

2.5.11 Further upstream and downstream, ribbons of alluvium occupy significant sections of the valley floor.

2.6 Meteorology

2.6.1 The following information has been obtained from Met Éireann:

2.6.2 The closest weather station is located in Castletown (Rathmolyon).

2.6.3 The average annual rainfall (for the period 1981 to 2010) is *circa* 845 millimetres per year (mm/yr). Corrected for evapotranspiration, the effective rainfall rate is calculated to be 441 mm/yr (*Reference 12*).

2.6.4 Total rainfall occurring on Site during the design storm (6-hour duration and 100-year return period) is 53.6 mm. This data is taken from Met Éireann's Depth Duration Frequency (DDF) Model.

2.7 Hydrology

2.7.1 Surface Watercourses - Overview

2.7.1.1 The surface watercourses of the area are illustrated upon the drawing at *section 2.7.1.6*. The Water Features Survey (WFS) was conducted by BCL on 31st October 2018 to inspect the status of each watercourse and to make a visual estimate of flow rate.

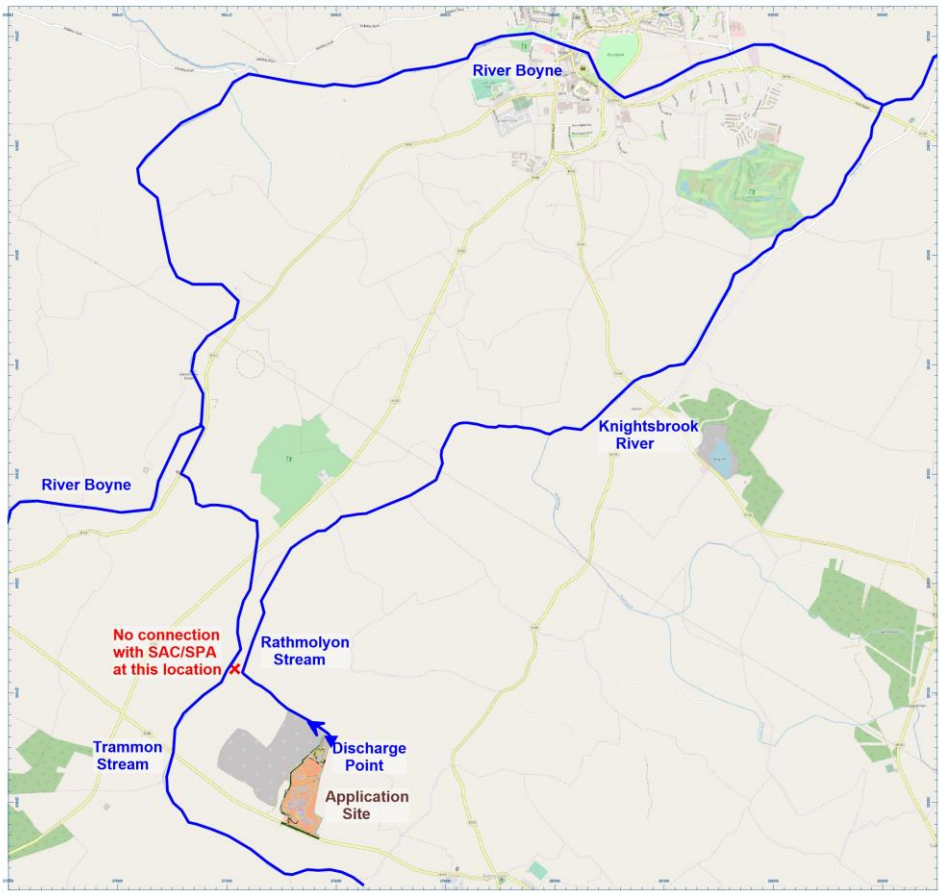
2.7.1.2 All ingress waters (groundwater and rainfall runoff) at the Applicant's landholding are directed through settlement tanks and discharged into a ditch upon the northern margin of the concrete products yard. This ditch gently descends to the northwest to its confluence with the Rathmolyon Stream, which is 200 m downstream from the quarry discharge point.

2.7.1.3 The Rathmolyon Stream flows from east to northwest, passing 150 m standoff to the north of the Site and then running alongside the northern boundary of Kilsaran's quarry. Some 550 m downstream from the northwest limit of Kilsaran's quarry, the stream turns to the north and follows this direction to its confluence with the Knightsbrook River (5-6 km downstream from the Site) and onwards to the River Boyne.

2.7.1.4 At the opposite/southern end of the Site, the land drops away gently towards a second watercourse, Tromman Stream.

2.7.1.5 Tromman Stream passes 400 m to the south of the Application Area, at closest approach. The watercourse makes a very gentle descent westwards then northwards, maintaining 400-450 m standoff from the quarries. As it passes to the northwest of Kilsaran's quarry, it enters the uppermost section of the River Boyne & River Blackwater SAC-SPA.

2.7.1.6 The protected section of the Tromman Stream is some 950 m standoff to the northwest of the Applicant's quarry. At this point, the two streams (Tromman and Rathmolyon) run parallel to each other, separated by a strip of farmland (less than 100 m in width). This stretch of the Rathmolyon Stream was inspected during the water features survey; there was no evidence of any connection between the two watercourses.



2.7.1.7 Likewise, SLR Consulting Ireland inspected the same two streams in 2017 and reported that "there is no surface water connection between the two". Please refer to the following documents: Planning application seeking permission for continued use of the previously permitted development at Castletown Quarry (Kilsaran Concrete), TA-170519, May 2017, EIS including "Surface Water and Groundwater" (Chapter 6) completed by SLR Consulting Ireland. First Party Appeal of Conditions 2 & 36, SLR. Dated April 2018.

2.7.1.8 Furthermore, please refer to An Bord Pleanála (ABP) report, reference number 17.QV.0182:

(j) the apparent error made by the planning authority's advisors with respect to the existence of a proximate hydrological link between the receiving waters of the surface and ground waters discharged from the site and the nearby River Boyne and River Blackwater Special Area of Conservation, site code 002299, (no such link exists),

(k) the actual hydrological distance to the River Boyne and River Blackwater Special Area of Conservation, site code 002299, which is in excess of nine kilometres from the site,

17.QV.0182 **An Bord Pleanála** **Page 3 of 5**

2.7.1.9 The Office for Public Works (OPW) flood mapping provides further confirmation that there is no surface water link between the Rathmolyon Stream and the Tromman Stream (http://www.floodinfo.ie/map/floodmaps/).

2.7.1.10 On this basis, the evidence presented above is in conflict with Point 7.3.2 in the Inspector's Report ABP-303334-19, dated 14th March 2019. It is argued that Point 7.3.2 should be withdrawn from the ABP report.

2.7.2 Rathmolyon Stream

2.7.2.1 *Reference 12* presents flow duration percentiles for the Rathmolyon Stream on the stretch local to Kilsaran's quarry, calculated using the EPA's online tool for flow estimation in ungauged catchments:

Flows equalled or exceeded for the given percentage of time (m^3/sec)										
5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%
0.266	0.208	0.153	0.125	0.102	0.085	0.072	0.057	0.043	0.033	0.029

2.7.2.2 The same report includes the results of a survey of channel capacity on Rathmolyon Stream. Along the 500 m stretch immediately downstream from Kilsaran's quarry, where the stream flows from east to northwest, the stream was surveyed at 7 locations. The channel capacity was reported to range from 0.470-0.800 m^3/s.

2.7.2.3 Thus, it has been demonstrated that the stream channel can readily accommodate the Q5 (or 5 percentile) flow rate; as would be expected, given that the channel has been deepened and straightened to facilitate land drainage.

2.7.2.4 The water quality data in *Reference 12* gives an indication of the assimilative capacity of Rathmolyon Stream on the stretch where it is joined by the drainage ditch coming from the quarry (*i.e.* downstream from the Applicant's consented discharge point).

Date:	Units	15/11/2016	29/11/2016	13/12/2016	04/01/2017	18/01/2017	03/02/2017
Sample:		US S1	US S1	US S1	US S1	US S1	US S1
Ammonia	mg/l	0.03	0.015	0.165	0.02	0.044	0.028
Benzene	ug/l		<0.42	<0.42	<0.42	<0.42	<0.42
BOD	mg/l	<2	<2	<2	<2	<2	<2
BTEX Total	ug/l		<0.75	<0.75	<0.75	<0.75	<0.75
COD	mg/l		13	12	<5	<5	9
Ethylbenzene	ug/l		<0.42	<0.42	<0.42	<0.42	<0.42
m & p-Xylene	ug/l		<0.73	<0.73	<0.73	<0.73	<0.73
Nitrate	mg/l as N	<0.11	4.28	1.29	5.46	4.07	1.68
Nitrate as NO3	mg/l as NO3	<0.49		1.566	24.18	18.024	7.44
o-Xylene	ug/l			<0.18	<0.18	<0.18	<0.18
pH	pH units	7.5	8	7.9	7.7	7.8	8
Phosphate	mg/l as P			0.025	0.018	<0.005	0.012
OrthoPhosphat	mg/l as P	0.02	0.022	0.008	0.006	<0.006	<0.006
Suspended Sol	mg/l	<2	54	<2	<2	3	17
Toluene	ug/l		<0.53	<0.53	<0.53	<0.53	<0.53
TPH	mg/l	<1	<1	<1	<1	<1	<1
Xylene Total	ug/l			<1	<0.73	<0.73	<0.73

2.7.2.5 The only reading that exceeds regulatory standards is an outlier for suspended solids: 54 mg/l on 29th November 2016. The water quality dataset collected at the quarry's discharge point is examined in *section 2.7.3* to check whether the stream is being impacted by the trade effluent from the quarry.

2.7.3 Site Drainage

2.7.3.1 The dewatering sump is currently located at the northwest corner of the deepest sinking (27 maOD). This sump has a surface area of approximately 400 m^2, with water level being suppressed by means of a six-inch electro-submersible pump.

2.7.3.2 At the time the most recent topographic survey in October 2018, there was some shallow standing water in the southeast half of the deepest sinking (derived from storm waters). This would drain into the secondary sump (200 m^2), which is situated at the northeast corner of the same sinking. The pump can be re-located to this secondary sump as and when required.

2.7.3.3 The water filters through fractured/broken rock into the active dewatering sump and, after primary settlement for suspended solids, it is pumped up to the drainage infrastructure (three-stage settlement tanks) in the concrete products yard at the northern end of the landholding. The settlement tanks are situated alongside the southeast corner of the pre-cast manufacturing structure.

2.7.3.4 Each tank is 8.5 m in length by 7 m in width; and 3 m in depth. The water is discharged from these tanks into a concrete culvert (0.77 m in width by 1.0 m in depth).

2.7.3.5 The culvert channel incorporates a V-Notch weir, now fitted with data logger that has been in operation since 8th April 2019, taking head measurements every 15 minutes.

2.7.3.6 The channel leads to the consented discharge point, as covered by Trade Effluent Discharge Licence Ref. 04/2 (*appendix 1*).

2.7.3.7 There is no natural baseflow in this drainage channel. It was excavated for the sole purpose of conveying water from the settlement tanks to the discharge point. The flow rate was and continues to be entirely dependent upon the discharge rate at the settlement tanks.

2.7.3.8 The complete record of flow rate is presented as a hydrograph in *appendix 2*.

2.7.3.9 Averaged across the monitoring period 8th April to 23rd August 2019, the daily rate equates to 1,350 m^3/day, with a standard deviation of 260 m^3/day.

2.7.3.10 This is a worst-case estimation of flow rate because the V-notch comprises a broad concrete weir, which would have a higher roughness coefficient than a thin-plate weir; and therefore the head measurements would be more elevated.

2.7.3.11 With this in mind, the bulk of the data is expected to be broadly consistent with the licensed rate (1,400 m^3/day), which was set in 2004. This is likely to have been selected by reference to the rating curve of the pump being used at that time.

2.7.3.12 The peak reading in the dataset is 2,585 m^3/day, as recorded on 5th June, regressing to 2,050 m^3/day the following day. These outlier data should be treated with caution: they could be caused by a temporary blockage at the V-notch; the rate of dewatering/pumping would not be expected to spike in this manner unless a new or additional pump was installed.

2.7.3.13 Notwithstanding this, the Applicant will need to lodge an application to vary the licence in order to allow for an increased rate of dewatering in line with the Proposed Development. This is subject to the findings of the impact assessment herein (*section 4*), checking that the dewatering operation does not present an unacceptable risk to local receptors (*e.g.* water supplies and streams).

2.7.3.14 Water samples have been collected from the discharge point on a regular basis and submitted for laboratory analysis in order to demonstrate compliance with the limits specified in the consent. The most recent results are presented below:

Parameter	Measured Value 03.02.18	Limit Value
BOD mg/l	<3	2
COD mg/l	9	15
Ammonia as NH3 mg/l	0.28	3
Nitrate mg/l	20	35
Orthophosphate mg/l	<0.5	0.03
Diesel Range Organics mg/l	<0.1	<10
Petrol Range Organics ug/l	<0.1	<10
Mineral Range Organics ug/l	<0.1	<10
Colour (Hazen)	7	10
Suspended Solids	<10	1
pH	7.4	6 - 9
TPH ug/l	<0.1	<10

2.7.3.15 The datasets are presented in the Discharge Effluent Quality Reports prepared by Byrne Environmental Consulting Limited.

2.7.4 Waterbodies

2.7.4.1 The quarry sump(s) and settlement system are described above.

2.7.4.2 The surrounding countryside is well-drained and characterised by a scarcity of surface waterbodies.

2.7.4.3 The closest pond is in the vicinity of Rathmolyon; over 1 km standoff to the east of the Application Area.

2.7.5 Flooding

2.7.5.1 Reference has been made to the National Flood Hazard Mapping conducted by the OPW.

2.7.5.2 There is no risk of fluvial flooding at the Site. There are no mapped flood points (or areas of flooding) associated with the Rathmolyon Stream or Tromman Stream.

2.7.5.3 The R156 Rathmolyon to Cherryvalley Road is prone to flooding at a point lying over 0.5 km to the east of the Site.

2.8 Hydrogeology

2.8.1 Regional Hydrogeology

2.8.1.1 As explained in *section 2.5*, the Project Geologist has indicated that the Site operates within the Waulsortian Limestone formation, having found no evidence in the quarry void of the faulted contact with the Lucan Formation (as shown on GSI mapping). Minerex reached the same conclusion (planning application ref: TA 900976).

2.8.1.2 The groundwater level assessment (focussing on historic, present day and predicted drawdown) has been conducted on the basis that there is no hydraulic barrier between the two formations, irrespective of the precise location of the faulted contact.

2.8.1.3 The Waulsortian Limestone is a "Locally important aquifer, moderately productive only in local zones" (Ll), belonging to the Longwood Groundwater Body (GWB), covering an area of 50 km^2.

2.8.1.4 The Longwood GWB is conceptualised as follows:

- "In general, the majority of groundwater flow will occur in the upper 10 m, comprising a weathered zone of a few metres and a connected fractured zone below this. However, deepwater strikes in more isolated faults/ fractures can be encountered at 50-70 mbgl. Flow path lengths are relatively short, and in general are between 30 and 300 m".

- "The regional groundwater flow direction is to the northwest although on a local scale groundwater will follow the local hydraulic gradient towards rivers in the area".

2.8.1.5 Transmissivity data for the Waulsortian strata encountered at Kilsaran's quarry (*Reference 12*) are reported to range from "0.068 to 10.9 m^2/d". "The recovery rate for groundwater levels at the testing locations was noted as very slow".

2.8.1.6 A review of the GSI karst mapping for the Longwood GWB indicates that the closest such feature is a spring emerging in a field at 2 km standoff to the southeast of the Application Area.

2.8.1.7 Transmissivity values of 30 to 40 m^2/d are reported for wells in the Longwood GWB at Summerhill (6 km east of the Site) and Longwood (6.5 km southwest). The Longwood well is fed by a major fissure encountered at 55 to 57 mbGL.

2.8.1.8 GSI mapping indicates that the Lucan Formation (part of the Dinantian Upper Impure Limestone Group) falls within the Trim GWB, which is part of a "Locally important aquifer which is generally moderately productive" (Lm), covering an area of 640 km^2.

2.8.1.9 This GWB extends from northeast Offaly through Meath and narrows towards Navan and Slane.

2.8.1.10 Karst features (such as springs and swallow holes) are generally concentrated in the highly fractured area between Slane and Navan.

2.8.1.11 The Lucan Formation is best described by the following statements from the Trim GWB report:

- "Where the limestone is less karstified, the flow systems will be shallower and more diffuse. Although groundwater will still flow mainly along fractures, there will not have been the large-scale dissolution of the rocks to convert these into large conduits that concentrate flow deep underground".

- "An example of this can be seen at Dunshaughlin where a 300 metre deep well was drilled for the Council adjacent to the Tower in Dunshaughlin and encountered 296 metres of dark gray to black limestones, intermittently shaly. Calcite veining occurred through the sequence and the abundance of shale and veining increased with depth. The rock was competent indicating no significant fracturing in this area".

- Transmissivity values of 50 to 60 m^2/d are reported for the Dunshaughlin well.

- "Where the karstic system is less developed, the occurrence of large springs is less likely as the GWB discharges as baseflow to the overlying rivers" (River Boyne and its tributaries).

2.8.1.12 *Reference 12* (SLR, 2017) includes site-specific data for Kilsaran's quarry: "Tests carried out in 2003 focused on the Lucan Formation; at a pumping rate of 100 m^3/d, groundwater levels were noted to drawdown rapidly, but also recover rapidly and at a greater rate than that of the Waulsortian Limestones. It is interpreted that this is due to the well-bedded and fractured nature of the Lucan Formation. Fractures are expected to diminish with depth and therefore lower inflows to the quarry would be expected when deepening the quarry in future phases".

2.8.2 Groundwater Levels

2.8.2.1 The ongoing hydrometric monitoring programme at the Site includes measurement of groundwater levels on a monthly basis at the locations highlighted below.

2.8.2.2 The groundwater level readings collected in March-August 2019 have been compared with historic data, where available:

Monitoring point	Ground Level	Jul-Aug 2003 with sump at 52maOD	March 2009 with sump at 36maOD	19/03/2019 with sump at 27maOD	10/04/2019 with sump at 27maOD	01/05/2019 with sump at 27maOD	24/05/2019 with sump at 27maOD	26/06/2019 with sump at 27maOD	23/08/2019 with sump at 27maOD
BH4	79.31	62.86	47.11	46.57	46.34	46.37	46.39	46.38	46.4
GW1	74.92			51.25	48.14	47.49	47.07	46.659	46.779
GW2	64.51			63.31	61.06	60.55	60.04	No access	59.408
GW3	65.50			61.14	58.85	57.89	57.30	56.789	56.619
Regan	72.43	63.80	58.03	59.19	54.34	No access	47.06	51.297	51.677
Keegan 1	79.49			38.93	37.02	35.98	36.20	35.869	35.559
Keegan 2	68.76	65.09	62.66	63.86	63.24	62.96	62.01	61.7	61.78
Cummins	83.37	73.02		74.17	73.07	73.08	72.83	72.538	No access
Brogan Shallow Chamber	86.95			86.30	86.47	86.60	No access	86.557	86.547
Brogan Pump House	87.68	79.26		No access	No access	No access	No access	No access	No access
Gunning	75.59	63.52		55.09	51.73	50.44	50.37	49.877	No access

2.8.2.3 The dataset has been merged with that collected by SLR, 2017 (*Reference 12*) in order to provide a wider assessment to encompass both quarries (the Applicant and Kilsaran):

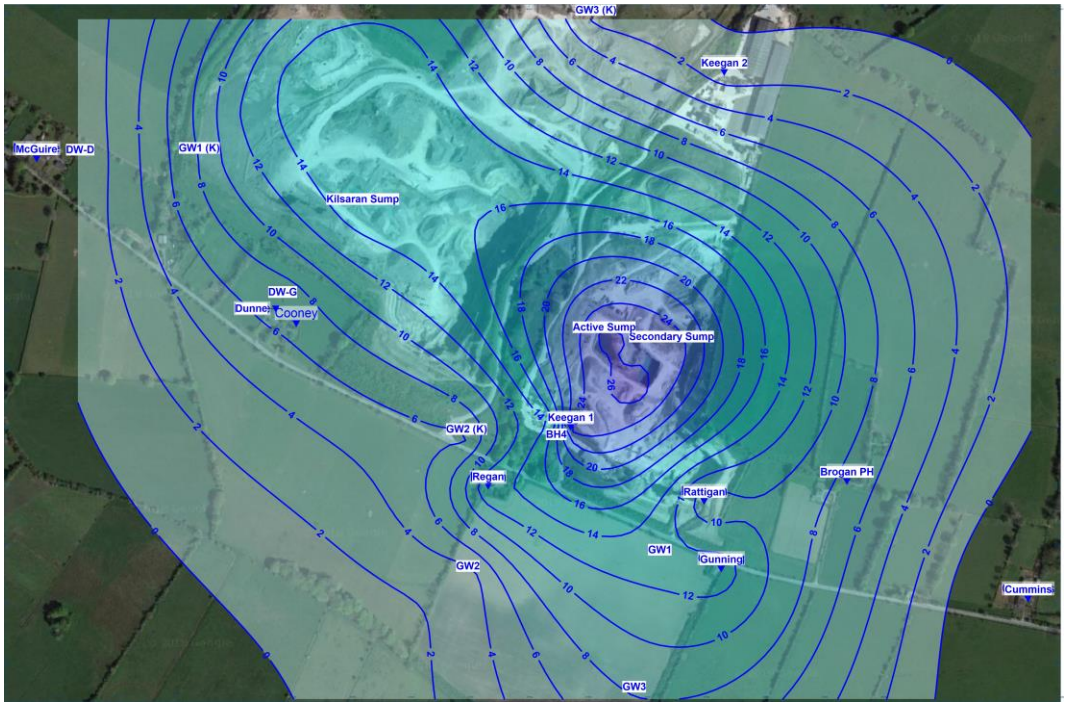
Monitoring point	Easting	Northing	Jul-Aug 2003 with sump at 52maOD	March 2009 with sump at 36maOD	2017 SLR & 05.2019 BCL
BH4	277539	249905	62.86	47.11	46.39
GW1	277721	249676			47.07
GW2	277396	249649			60.04
GW3	277678	249445			57.30
Regan	277430	249800	63.80	58.03	59.19
Keegan 1	277570	249900			36.20
Keegan 2	277830	250500	65.09	62.66	62.01
Cummins	278345	249609	73.02		72.83
Brogan Shallow Chamber	277982	249789			86.3
Brogan Pump House	278038	249808	79.26		No access
Gunning	277825	249660	63.52		50.37
Secondary Sump	277741	250037	52		27
Active Sump	277627	250053	52		27
GW1 (K)	276941	250356			58.08
GW2 (K)	277393	249880			55
GW3 (K)	277613	250590			61.43
DW-D	276739	250353			64.22
DW-G	277082	250111			58.72
Kilsaran Sump	277218	250270	50-51		35
Dunne	277070	250100	66		58.72
McGuire	276665	250354	64		64.22
Rattigan	277796	249774	51.02		Quarried

2.8.2.4 The above table allows for a quantitative analysis of the cumulative drawdown that has occurred in the vicinity of the two quarries during the period 2003 to 2019.

2.8.2.5 This coincides with the Applicant's quarry being lowered from 52 maOD to 27 maOD; and Kilsaran's quarry is deepened from 50 maOD to 35 maOD.

2.8.2.6 There is very limited data for 2009 but, from what is available, it would indicate that the bulk of the drawdown had occurred by this time. This is consistent with the conceptual understanding of the limestone formations at this location (*section 2.8.1*), where "the majority of groundwater flow will occur in the upper 10 m, comprising a weathered zone of a few metres and a connected fractured zone below this. Where the limestone is less karstified, the flow systems will be shallower and more diffuse". Thus, the more extensive drawdown would be expected to have occurred when working the upper benches.

2.8.2.7 The groundwater level data has been utilised to provide an indicative illustration of the cone of depression / amount of drawdown (m) that has occurred between 2003 and 2019 as a cumulative consequence of the widening and deepening of the two quarries (and the associated dewatering operations).



2.8.2.8 The drawdown profile is exacerbated at the production borehole (Keegan 1); and the indicative drawdown contours are pinched at the southeast corner of the Site, where the quarry face has been advanced in this direction (and the Rattigan borehole has been quarried out).

2.8.2.9 The contour plan has been extended beneath the fields to the northeast and southwest of the quarry complex; but this part of the plan should be viewed with caution because of the extrapolation involved.

2.8.2.10 Most importantly, the cumulative cone of depression that has developed at the two quarries between 2003 and 2019 has resulted in:

- 8-13 m drawdown at the Gunning borehole, allowing for seasonal variation observed in the 2019 dataset;
- 5-16 m drawdown at the Regan borehole (seasonal variation as above);
- 7 m drawdown in the vicinity of the Dunne and Cooney boreholes;
- Unquantified drawdown at the Brogan property. The supply at the pumphouse is no longer accessible; but the reading taken in 2003 was some 15 m higher than would be expected in this section of limestone aquifer (based upon observations at nearby boreholes: Gunning, Cummins and GW3). Therefore, it is considered that the Brogan borehole is abstracting from a perched groundwater unit. The shallow chamber (fed by the borehole) is being monitored to check for any visible sign of reduced yield;
- Zero drawdown at the Cummins borehole, which is some 550 m to the southeast and on the hydraulic up-gradient side of the Site;
- Zero drawdown at the McGuire borehole, which is some 400 m to the west and on the hydraulic down-gradient side of Kilsaran's quarry.

2.8.2.11 It is recommended that the radius of influence of dewatering drawdown continues to be monitored by checking groundwater level (on a monthly basis) at the Site piezometers and third-party water supplies (subject to access permission).

2.8.3 Groundwater Quality

2.8.3.1 Groundwater quality samples were collected on 10th April 2019 at the following locations: Regan, Cummins, Brogan Shallow Chamber, Keegan 1, Keegan 2, GW1 and GW3.

Concept Reference: 815797
Project Site: Keegan GW April
Customer Reference:

Water Analysed as Water
Miscellaneous

				Concept Reference	815797 001	815797 002	815797 003	815797 004	815797 005
				Customer Sample Reference	Regan	Cummins	Brogan	Keegan 1	Keegan 2
				Date Sampled	10-APR-2019	10-APR-2019	10-APR-2019	10-APR-2019	10-APR-2019
				Sample Received (ml)	2250	2250	2250	2250	2250
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Ammoniacal nitrogen	T686	F	0.05	mg/l	0.07	0.07	0.07	0.06	0.19
Bicarbonate	T22	F	10	mg/l	430	450	380	390	260
Biochemical Oxygen Demand	T7	AR	3	mg/l	<3	<3	<3	<3	<3
Carbonate	T22	F	10	mg/l	<10	<10	<10	<10	<10
Chemical Oxygen Demand	T4	AR	5	mg/l	<5	9	9	7	9
Chloride	T686	F	1	mg/l	71	19	160	47	17
Diss Oxygen	T7	AR	1.0	mg/l	11	11	11	12	11
Electrical Conductivity	T7	AR	10	µS/cm	890	840	1100	890	850
Nitrogen (Total)	T319	AR	0.1	mg/l	3.9	1.9	2.1	12	1.6
Nitrogen(Kjeldahl)	T116	AR	10	mg/l	<10	<10	<10	<10	<10
orthophosphate	T686	F	0.5	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5
pH	T7	AR			7.1	7.1	7.0	7.1	7.4
Sulphate	T686	F	0.5	mg/l	31	72	14	53	220
Suspended Solids (Total)	T2	AR	10	mg/l	<10	<10	<10	<10	<10
Total Organic Carbon	T21	F	1	mg/l	1	2	2	2	3
Total Oxidised Nitrogen	T686	F	0.1	mg/l	3.6	1.7	1.9	9.8	1.2
TPH (C10-C40)	T8	AR	0.1	mg/l	<0.1(13)	<0.1(13)	<0.1(13)	<0.1(13)	<0.1(13)
Nitrate	T686	F	0.5	mg/l	16	7.4	8.6	44	5.5

Concept Reference: 815797
Project Site: Keegan GW April
Customer Reference:

Water Analysed as Water
Miscellaneous

				Concept Reference	**815797 006**	**815797 007**
				Customer Sample Reference	**GW1**	**GW3**
				Date Sampled	**10-APR-2019**	**10-APR-2019**
				Sample Received (ml)	**2250**	**2250**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
Ammoniacal nitrogen	T686	F	0.05	mg/l	0.30	5.5
Bicarbonate	T22	F	10	mg/l	460	110
Biochemical Oxygen Demand	T7	AR	3	mg/l	<3	<3
Carbonate	T22	F	10	mg/l	<10	<10
Chemical Oxygen Demand	T4	AR	5	mg/l	7	15
Chloride	T686	F	1	mg/l	36	21
Diss Oxygen	T7	AR	1.0	mg/l	11	8.2
Electrical Conductivity	T7	AR	10	µS/cm	840	250
Nitrogen (Total)	T319	AR	0.1	mg/l	9.5	6.1
Nitrogen(Kjeldahl)	T116	AR	10	mg/l	<10	<10
orthophosphate	T686	F	0.5	mg/l	<0.5	<0.5
pH	T7	AR			7.0	7.8
Sulphate	T686	F	0.5	mg/l	27	6.9
Suspended Solids (Total)	T2	AR	10	mg/l	<10	24
Total Organic Carbon	T21	F	1	mg/l	1	3
Total Oxidised Nitrogen	T686	F	0.1	mg/l	9.0	0.2
TPH (C10-C40)	T8	AR	0.1	mg/l	<0.1(13)	<0.1(13)
Nitrate	T686	F	0.5	mg/l	40	1.0

Concept Reference: 815797
Project Site: Keegan GW April
Customer Reference:

Water Analysed as Water
Metals

				Concept Reference	**815797 001**	**815797 002**	**815797 003**	**815797 004**	**815797 005**
				Customer Sample Reference	**Regan**	**Cummins**	**Brogan**	**Keegan 1**	**Keegan 2**
				Date Sampled	**10-APR-2019**	**10-APR-2019**	**10-APR-2019**	**10-APR-2019**	**10-APR-2019**
				Sample Received (ml)	**2250**	**2250**	**2250**	**2250**	**2250**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Sb (Dissolved)	T281	F	1	µg/l	<1	<1	<1	<1	1
As (Dissolved)	T281	F	0.2	µg/l	<0.2	0.2	<0.2	<0.2	<0.2
Cd (Dissolved)	T281	F	0.02	µg/l	0.09	0.04	0.08	0.03	0.16
Ca (Dissolved)	T373	F	1	mg/l	160	140	170	180	170
Cr (Dissolved)	T281	F	1	µg/l	<1	<1	<1	<1	<1
Cu (Dissolved)	T281	F	0.5	µg/l	5.3	15	39	1.2	31
Fe (Dissolved)	T373	F	0.01	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
Pb (Dissolved)	T281	F	0.3	µg/l	<0.3	0.4	0.5	<0.3	<0.3
Mg (Dissolved)	T373	F	1	mg/l	6	17	8	8	11
Mn (Dissolved)	T281	F	1	µg/l	<1	1	<1	<1	71
Hg (Dissolved)	T281	F	0.05	µg/l	<0.05	<0.05	<0.05	<0.05	<0.05
K (Dissolved)	T373	F	1	mg/l	1	17	<1	<1	13
Ag (Dissolved)	T373	AR	0.01	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
Na (Dissolved)	T373	F	1	mg/l	34	24	65	18	16

Concept Reference: 815797
Project Site: Keegan GW April
Customer Reference:

Water
Metals

Analysed as Water

				Concept Reference	815797 006	815797 007
				Customer Sample Reference	GW1	GW3
				Date Sampled	10-APR-2019	10-APR-2019
				Sample Received (ml)	2250	2250
Determinand	Method	Test Sample	LOD	Units		
Sb (Dissolved)	T281	F	1	µg/l	<1	<1
As (Dissolved)	T281	F	0.2	µg/l	<0.2	<0.2
Cd (Dissolved)	T281	F	0.02	µg/l	0.03	0.06
Ca (Dissolved)	T373	F	1	mg/l	180	21
Cr (Dissolved)	T281	F	1	µg/l	<1	<1
Cu (Dissolved)	T281	F	0.5	µg/l	<0.5	<0.5
Fe (Dissolved)	T373	F	0.01	mg/l	<0.01	<0.01
Pb (Dissolved)	T281	F	0.3	µg/l	<0.3	<0.3
Mg (Dissolved)	T373	F	1	mg/l	8	5
Mn (Dissolved)	T281	F	1	µg/l	<1	150
Hg (Dissolved)	T281	F	0.05	µg/l	<0.05	<0.05
K (Dissolved)	T373	F	1	mg/l	<1	6
Ag (Dissolved)	T373	AR	0.01	mg/l	<0.01	<0.01
Na (Dissolved)	T373	F	1	mg/l	13	11

2.8.3.2 No samples were retrieved at BH4 (which is adjacent to Keegan 1) and Gunning (which is in close proximity to GW1).

2.8.3.3 There is no evidence of any quarry-related impact upon groundwater quality.

2.8.3.4 The elevated reading for ammoniacal nitrogen at GW3 is attributed runoff from agricultural land; as are the high potassium results *e.g.* at the Cummins borehole. Potassium is an essential constituent of many artificial fertiliser formulations, but "there are no implications of toxicity" (Parameters of Water Quality: Interpretation and Standards, EPA guidance, 2001).

2.8.3.5 It is recommended that the sampling programme is repeated on an annual basis in order to confirm that the quarry development is not impacting upon groundwater quality at local water supplies.

3 SITE ACTIVITIES

3.1 Current Development

3.1.1 In 2004, under PL17.206702 (PA ref. TA/30334), approval was provided for the bulk of what is now the operational quarry, some 13.94 Ha. This allowed for extraction across the quarry void to a level of 13 maOD.

3.1.2 Under PL17.235960 (and PA ref. TA/900976), the extraction area of the quarry was enlarged by *circa* 2.85 Ha, extending on to land towards the southern extent and to the east of the original quarry. The depth limit in the extension area was set at 50 maOD.

3.1.3 In July 2019, under PL17.305049, a substitute consent application was submitted to seek authorisation for the unauthorised development of ancillary plant and structures at the quarry site totalling some 21.64Ha in extent, from a baseline date of 2013. In addition, the application also covered unauthorised continuation of extraction and associated mineral processing activities and the continued use and or operation of previously authorised structures beyond the expiry of extraction consents on 5th August 2018.

3.2 Proposed Development

3.2.1 The Proposed Development (the subject of the current planning application) involves a lateral extension to encompass the overburden landform abutting the northern end of the existing void. In addition, the quarry face will be advanced some 20-25 m along the bulk of the western margin to its previously approved extent. In this way, the extraction area would be enlarged by some 2.55 Ha.

3.2.2 In advancing westwards and northwards, these extension areas would be confined to the Waulsortian Limestones. This aquifer is classed as less productive than the Lucan Formation.

3.2.3 The development proposals do not involve any deepening below 13 maOD, which is the previously approved depth permitted under PL17.206702 (PA ref. TA/30334).

3.2.4 There will be no lateral extension to the south or east beyond what is already permitted under PL17.235960 (and PA ref. TA/900976).

3.2.5 In proposing to advance westwards by 20-25 m, this will be working into the narrow spine of land separating the two quarries, where the limestone strata will have already been dewatered as a result of being sandwiched between the deepest sinking in each quarry.

3.2.6 In terms of potential hydrological receptors, the northerly extension will involve working in closer proximity to Rathmolyon Stream. Any drawdown-related impact upon this stream would be counterbalanced by the consented discharge process, whereby water from the quarry sump is directed into the at-risk section of stream.

3.2.7 The hydrological and hydrogeological risks associated with the proposed development are the subject of more detailed assessment in *section 4*.

4 IMPACT ASSESSMENT & RECOMMENDATIONS FOR MITIGATION

4.1 Background

4.1.1 Baseline assessment has facilitated a conceptual understanding of the extant groundwater and surface water regimes operating within and around the Site. This understanding has been applied to assess the potential impacts posed by the Proposed Development upon the water environment.

4.1.2 In common with other quarrying operations of this type and scale, it is considered that the Proposed Development has potential to impact upon the water environment in the following ways:

- Interception of groundwater causing a modification of groundwater levels and flow rates within and surrounding the area from which mineral is to be extracted, both during and following workings.
- Derogation of existing groundwater quality.
- Derogation of surface water quantity and quality.
- Risk to local water supplies and floral/faunal habitats.
- Modification of existing flooding characteristics.

4.2 Ingress Rates and Radius of Influence of Dewatering Drawdown

4.2.1 Looking at the cumulative cone of depression that has developed at the quarry complex (*i.e.* the Applicant's quarry and Kilsaran's quarry, taken together), the bulk of the drawdown is considered to have occurred between 2003 and 2009, as explained in *section 2.8.2*.

4.2.2 This is consistent with the conceptual understanding of the limestone formations at this location (*section 2.8.1*), where "the majority of groundwater flow will occur in the upper 10 m, comprising a weathered zone of a few metres and a connected fractured zone below this. Where the limestone is less karstified, the flow systems will be shallower and more diffuse". Thus, the more extensive drawdown would be expected to have occurred when working the upper benches.

4.2.3 As discussed previously, the quarry floor will be deepened in one further sinking from the current level of 27 maOD down to the final permitted depth of 13 maOD. The lateral extension at the northern end of the existing workings will lengthen the void by 100-110 m. In addition, the quarry face will be advanced some 20-25 m along the bulk of the western margin.

4.2.4 Pre-development groundwater level at the Site is considered to have been at *circa* 65 maOD +/-2m. This is derived by interpolating between the Cummins borehole (550 m to the southeast and on the hydraulic up-gradient side of the Site) and the McGuire borehole (400 m to the west and on the hydraulic down-gradient side of Kilsaran's quarry), both of which are judged to be outwith the cumulative cone of depression.

4.2.5 Thus, the current void has progressed 40 m (maximum) below the pre-development groundwater level; and the final sinking will involve an additional 14 m depth of dewatering.

4.2.6 To aid quantification of the degree of risk posed to potential receptors as a result of the current and predicted lowering of groundwater levels, calculations have been undertaken to determine likely ingress rates and the radius of influence of dewatering drawdown.

4.2.7 The methodology has been tested using input data that is representative of the quarry in its current configuration *i.e.* the dimensions of the extraction void; the discharge rates recorded at the V-notch weir; and the distance-drawdown relationship being observed at Site piezometers and local boreholes. The hydraulic conductivity for this model is set at 0.25 m/day; this is the best-fit value whereby the model output is consistent with Site experience.

Trammon, Current Development to 27 maOD							
Radius of Influence	CIRIA Ro= C x S x sqrt(K)						
Discharge	Modified Todd - Impermeable base						
Distance Drawdown	CIRIA "Percentage" method						
Input Variables	Red text						
Representing extraction area by well							
Ro & Q							
Required drawdown in void, S (m)	40						
length of void	300						
width of void	300						
C	3000						
	K (m/s)	K (m/d)	Ro	r	R	Q(m3/d)	Q(l/s)
Site experience	2.894E-06	0.25	204	169	373	1588	18
Distance Drawdown			metres from face				
		Ro	10	20	50	100	200
Percentage distance from face	Site experience	204.124	4.90%	9.80%	24.49%	48.99%	97.98%
%age drawdown (from lookup)	Site experience		71.81%	60.64%	35.50%	18.38%	1.91%
Absolute drawdown (m)	Site experience		28.72	24.26	14.20	7.35	0.76

4.2.8 The ingress rate calculated above (1,588 m^3/day) is in line with current dewatering requirements, as measured at the V-notch weir. Averaged across the monitoring period 8th April to 23rd August 2019, the daily rate equates to 1,350 m^3/day, with a standard deviation of 260 m^3/day.

4.2.9 The radius of influence of dewatering drawdown is calculated to be 204 m (taking the Applicant's quarry in isolation).

4.2.10 The cumulative radius of influence, where the two quarries are taken together, is *circa* 400 m. This is based upon actual observed distance-drawdown readings, as measured at Site piezometers and local boreholes. It works out as roughly double what is calculated for the quarry in isolation.

4.2.11 The process has been repeated to provide an estimate of the potential groundwater ingress rate associated with the final development.

Trammon, Final Development to 13 maOD							
Radius of Influence	CIRIA Ro= C x S x sqrt(K)						
Discharge	Modified Todd - Impermeable base						
Distance Drawdown	CIRIA "Percentage" method						
Input Variables	Red text						
Representing extraction area by well							
Ro & Q							
Required drawdown in void, S (m)	54						
length of void	460						
width of void	300						
C	3000						
	K (m/s)	K (m/d)	Ro	r	R	Q(m3/d)	Q(l/s)
Site experience	2.894E-06	0.25	276	210	485	2729	32
Distance Drawdown			metres from face				
		Ro	25	50	100	200	300
Percentage distance from face	Site experience	275.568	9.07%	18.14%	36.29%	72.58%	108.87%
%age drawdown (from lookup)	Site experience		60.64%	41.35%	27.05%	8.95%	0.61%
Absolute drawdown (m)	Site experience		32.75	22.33	14.61	4.83	0.33

4.2.12 The estimated ingress rate at the final development is in the region of 2,750 m^3/day. The radius of influence is likely to be in the region of 550 m (where the calculated value of 275 m has been doubled to allow for the cumulative impact of the two quarries; as was the case for the present-day model).

4.2.13 It should be noted that the adopted analysis method was devised for use in intergranular flow systems. Thus, its application here is reliant upon the generalising assumption that the joint and fracture system of the limestone strata may, *en-masse*, be thought to operate analogously to an intergranular system.

4.2.14 The assessment methodology takes no account of hydraulic head loss due to turbulent flow that will inevitably occur within the first few metres of rock immediately behind the seepage faces of the quarry. As postulated for limestone quarries[1] within the UK (that have for many years extracted from depths below the pre-development groundwater level), these head losses are thought to represent a significant component in the amelioration of distance-drawdown and groundwater ingress rates.

[1] *e.g.*: Tarmac Ltd: Bankfield Quarry, Lancashire (extended to 80-85m below pre-quarrying groundwater levels, with planning permission to extract to 120m below pre-quarrying groundwater levels); Tarmac Ltd: Halecombe Quarry, Somerset (currently operational at 40m below pre-quarrying groundwater levels); Hanson Ltd: Whatley Quarry, Somerset (currently operational at some 80m below pre-quarrying groundwater levels).

4.2.15 Further to the above, experience of both quarries and well drilling operations strongly suggests that the hydraulic conductivity of the rock mass will reduce with increased depth. This will have a proportionate decelerating effect upon the increase of both the rates of groundwater ingress and propagation of groundwater drawdown outwith the Site.

4.2.16 Evidence gained from surface mapping, and inspection of exposed sections of limestone within the existing quarry void, have not elucidated the presence of significant active karstic development (which would give potential for conduit flow) within or surrounding the Site. The likelihood of intercepting such conduit flow is considered low.

4.2.17 The necessary adoption of simplifying assumptions dictates that the analysis results should be taken only as indicative of the likely general hydraulic response to the dewatering operation.

4.2.18 Given the hydrogeological characteristics of the Limestone Formations, the collection of further monitoring data (groundwater levels in the piezometer network and flow readings at the V-notch weir) will mean that these calculations can be reviewed and refined as the development progresses.

4.3 Storm Balancing

4.3.1 Total rainfall occurring on Site during the design storm (6-hour duration and 100-year return period) is 53.6 mm. Given the catchment area of the final development (*circa* 17 hectares), this equates to some 9,150 m^3 input of rainfall.

4.3.2 All ingress water drains under gravity into the active and secondary sumps, which have a combined surface area of approximately 600 m^2.

4.3.3 The operational solution (when rainfall exceeds the capacity of the sump) is to allow temporary and shallow ponding across the final sinking (approximately 4 hectares). Given that the quarry floor is relatively flat, the water would spread across a large part of the floor without exceeding 20-25 cm depth, although there would be local deepening at the sump.

4.3.4 Following abatement of the storm, water would be pumped from the quarry to the settlement system at the licensed rate, based upon the requirement to maintain dry workings under average conditions.

4.3.5 There is no risk of runoff from the quarry void to neighbouring land.

4.4 Risk of Flow Derogation in Surface Watercourses

4.4.1 *Tromman Stream*

4.4.2 The surface hydrology and ecology of the closest section of Tromman Stream (leading into the SAC-SPA) is not considered to be in continuity with the limestone aquifer. Full detail of the hydrological status of Tromman Stream is presented in the SLR 2017 Appeal Submission to ABP (*Reference 13*):

4.4.3 The geological profile recorded at Kilsaran's borehole DW-H demonstrates that "the Tromman Stream is underlain by glacial till, which in turn is underlain by unsaturated Shale bedrock. The watertable in the limestone bedrock is at depth and does not contribute to the baseflow of the Stream".

4.4.4 "There is no hydraulic continuity between the groundwater in the bedrock as encountered at the quarry, and the Tromman Stream. Therefore, the Tromman Stream and associated SAC will not be impacted by the drawdown of the groundwater table in the limestone bedrock at depth".

4.4.5 "Newly installed groundwater monitoring borehole DW-H will be included in the groundwater monitoring programme carried out by Kilsaran".

4.4.6 *Rathmolyon Stream*

4.4.7 Any ingress waters encountered in the quarry are discharged into the Rathmolyon Stream (under licence).

4.4.8 This provides protection against the risk of drawdown-related impact upon the surface water regime of this watercourse.

4.4.9 The quarry operator will need to lodge an application to vary the licence in order to allow for an increased rate of dewatering in line with the Proposed Development. The current licensed rate is 1,400 m^3/day (equivalent to 60 m^3/hr); the estimated ingress rate at the final development is in the region of 2,750 m^3/day (115 m^3/hr).

4.4.10 It is noteworthy that this is comparable with the discharge rates required at Kilsaran's quarry. *Reference 12* (SLR 2017) allows for "an average rate of 121 m^3/hr. This is in exceedance of the discharge licence" (22 m^3/hr), "and therefore an updated discharge licence will be applied for".

4.4.11 *Section 2.7.2* reproduces the results of a survey of channel capacity on Rathmolyon Stream. Along the 500 m stretch immediately downstream from the quarries, where the stream flows from east to northwest, the stream was surveyed at 7 locations. The channel capacity was reported to range from 0.470-0.800 m^3/s.

4.4.12 The Q50 flow rate is 0.085 m^3/s; Q30 is 0.125 m^3/s; and the Q5 flow rate is 0.266 m^3/s (Q5 is only exceeded under extreme conditions). The stream channel can readily accommodate these flow rates, as would be expected, given that the channel has been deepened and straightened to facilitate land drainage.

4.4.13 The stream has sufficient receiving capacity for the combined discharge rate from Kilsaran's quarry and the Applicant's proposed development. The combined rate is circa 250 m^3/hr, equivalent to 0.070 m^3/s. Added to Q5 (0.266 m^3/s), the total flow rate would be 0.336 m^3/s, which would not overwhelm the most restricted section on the surveyed stretch of stream channel (0.470 m^3/s).

4.5 Quality of Water Discharged Off Site

4.5.1 In order to protect the receiving watercourse, the quality of the trade effluent must accord with the standards specified in the Discharge Licence 04/2, dated 2004, issued by Meath County Council.

4.5.2 It is noteworthy that the current limit for suspended solids is 1 mg/l, whereas Licence 14/04 (issued June 2014) allows for 20 mg/l at Kilsaran's quarry. When varying the Applicant's licence, this parameter should be brought into line with Kilsaran's 20 mg/l *i.e.* a more practical limit that can be achieved in a quarry setting using industry-standard methodology, without incurring excessive costs.

4.5.3 As noted previously, the current licensed rate is 1,400 m^3/day (equivalent to 60 m^3/hr); the estimated ingress rate at the final development is in the region of 2,750 m^3/day (115 m^3/hr).

4.6 Refuelling Process

4.6.1 The following details are given for the refuelling process.

4.6.2 Although the crushing and screening plant is periodically moved about the quarry floor, it is not practicable or time/cost effective to move the plant to a fixed location for refuelling.

4.6.3 All plant is refuelled by mobile bowser (similar to the type of bowser delivering home heating oil and adhering to the same environmental standards). The storage vessel (mounted on the back of the delivery vehicle) is double-skinned and housed upon a drip tray. This practice has been ongoing for more than two decades; when tested, there have been no hydrocarbons detected in the water samples collected at the discharge point.

4.6.4 The refuelling operation is completed in accordance with the procedure described within the Oil Care Code (*section 4.7*).

4.6.5 As a further safeguard, it should be noted that any hydrocarbons would be drawn towards the quarry sump (because of the dewatering process) and then passed through the settlement system, at which point any polluted water could be directed into a hydrocarbon interceptor.

4.7 Oil Care Code

4.7.1 As in the historic and current workings, the operation of mobile and fixed plant presents a risk of pollutants entering groundwater as a result of hydrocarbon spillage or leakage on Site. Experience has demonstrated that the risk of such a pollution incident can be minimised by adhering to the following measures.

- A code of practice for the refuelling of machinery.
- Operators will check their vehicles on a daily basis before starting work to confirm that leakages are not present. Operators will report any defect to ensure that repairs are undertaken to that vehicle before it enters the working area.
- Sufficient oil sorbant material (*3M Oil-Sorb* or similar) will be available on Site to cope with a loss equal to the total fluid content of the largest item of plant.
- In the event of the use of such oil sorbant material, any contaminated materials will be disposed from Site in accordance with prevailing tipping legislation.
- Adequate containment will be provided for all oils stored on the Site, equipped with bunds to the relevant standard.

4.7.2 It is considered that the correct adoption of these measures will continue to provide appropriate mitigation against the potential for derogation of groundwater quality as a result of quarry operations.

4.8 Risk of Derogation at Local Water Supplies

4.8.1 The cumulative cone of depression that has developed at the two quarries between 2003 and 2019 has resulted in:

- 8-13 m drawdown at the Gunning borehole, allowing for seasonal variation observed in the last quarter;
- 5-16 m drawdown at the Regan borehole (seasonal variation as above);
- 7 m drawdown in the vicinity of the Dunne and Cooney boreholes;

- Unquantified drawdown at the Brogan property. The supply at the pumphouse is no longer accessible; but the reading taken in 2003 was some 15 m higher than would be expected in this section of limestone aquifer (based upon observations at nearby boreholes: Gunning, Cummins and GW3). Therefore, it is considered that the Brogan borehole is abstracting from a perched groundwater unit. The shallow chamber (fed by the borehole) is being monitored to check for any visible sign of reduced yield;

- Zero drawdown at the Cummins borehole, which is some 550 m to the southeast and on the hydraulic up-gradient side of the Site;

- Zero drawdown at the McGuire borehole, which is some 400 m to the west and on the hydraulic down-gradient side of Kilsaran's quarry.

4.8.2 On average, water usage in a typical household equates to 150 litres/day per person. Full details are given in a report prepared by British Water: *Code of practice, Flows and Loads – 4, Sizing criteria, treatment capacity for sewage treatment systems,* first edition published 2004, revised 2013. The flows and loads values given in the above document represent current best knowledge within the UK and Ireland but may change with time in line with per capita water use.

4.8.3 The same guidance suggests that water usage in a house with 4 bedrooms should be calculated on the basis that it will be occupied by a population (P) of 6 people *i.e.* water usage in a 4-bed house will equate to 900 litres/day (*circa* 0.01 litres/second).

4.8.4 As detailed in *section 4.2*, the best estimate of the predicted radius of influence at the proposed development is likely to be in the region of 550 m, which is about 150 m greater than that observed in the current quarry setting.

4.8.5 It is not possible to provide a more accurate quantification of the likely increase in drawdown at local water supplies because of the heterogeneity of the limestone formations. The following strategy is proposed in the event that a borehole is not meeting demand:

4.8.6 If the pump is currently operated at 0.1 litres/second (for example), a daily total of 900 litres would be abstracted in 2.5 hours. With this relatively low level of demand, the first step towards tackling a shortfall in yield would be to pump at a lower rate but for longer hours; and provide a larger storage tank.

4.8.7 Another option would be to lower the pump depth or drill a replacement (deeper) borehole.

4.8.8 The fall-back position would be the provision of a replacement supply *e.g.* mains water; or a group scheme, with the option of installing a reservoir tank filled by quarry abstraction (subject to requisite treatment). The quarry operators would have to cover the costs for mains water usage at any property where the water supply is affected by the cumulative quarry development.

4.8.9 If a borehole supply has been derogated by quarry dewatering, it is envisaged that the supply will be restored when the quarry is allowed to flood with water at the cessation of extraction. At this time, the quarry operators would no longer be responsible for the costs of supplying water to these properties.

4.8.10 Water quality at local abstractions will be safeguarded against quarry-related impact by the same measures adopted to protect groundwater quality and to control the discharge of trade effluent.

4.9 Residual Impact

4.9.1 The pre-quarrying groundwater level is taken to be *circa* 65 maOD +/-2m (based upon the piezometer data presented in *sections 2.8.2* and *4.2.4*).

4.9.2 At the time of restoration, quarry dewatering operations would be terminated and the quarry void would fill with water to form a lake.

4.9.3 It is considered that a lake level of some 65 maOD +/-2m (subject to seasonal variation) would be established within the abandoned workings.

4.9.4 The above assessment has been undertaken without the benefit of any pre-development groundwater level data.

4.10 Monitoring Schedule

4.10.1 Examining the Inspector's Reports (ABP) relating to previous planning submissions at the Application Site and Kilsaran's Quarry, it is evident that the findings of the risk assessment need to be verified by committing to a comprehensive programme of hydrometric monitoring, which will be conducted throughout the operational life of the quarry.

4.10.2 Any shortfalls, highlighted by the previous ABP reports, have been addressed by expanding the hydrometric monitoring scheme that is now in operation.

4.10.3 The ongoing hydrometric monitoring programme at the Site includes measurement of groundwater levels on a monthly basis at the locations highlighted below:

Monitoring point	Easting	Northing
BH4	277539	249905
GW1	277721	249676
GW2	277396	249649
GW3	277678	249445
Regan	277430	249800
Keegan 1	277570	249900
Keegan 2	277830	250500
Cummins	278345	249609
Brogan Shallow Chamber	277982	249789
Gunning	277825	249660

4.10.4 It is recommended that the radius of influence of dewatering drawdown continues to be monitored by checking groundwater level (on a monthly basis) at the Site piezometers and third-party water supplies (subject to access permission).

4.10.5 Subject to permission from the owner, it is recommended that a dip tube be installed at the Brogan Pump House Borehole. As an interim measure, the Applicant will continue to monitor the water level in the Brogan Shallow Chamber (which is fed by the borehole) in order to check for any visible sign of reduced yield.

4.10.6 Groundwater quality samples were collected on 10th April 2019 at the following locations: Regan, Cummins, Brogan Shallow Chamber, Keegan 1, Keegan 2, GW1 and GW3. No samples were retrieved at BH4 (which is adjacent to Keegan 1) and Gunning (which is in close proximity to GW1).

4.10.7 The sampling programme will be repeated on an annual basis in order to confirm that the quarry development is not impacting upon groundwater quality at local water supplies.

4.10.8 The discharge channel incorporates a V-Notch weir, now fitted with data logger that has been in operation since 8th April 2019, taking head measurements every 15 minutes; thus providing a record of off-site discharge rates. Going forward, this logger data will be uploaded and processed on a monthly basis in order to confirm that discharge rates are in line with the licensed quantities.

4.10.9 Water samples will continue to be collected from the discharge point on a regular basis and submitted for laboratory analysis in order to demonstrate compliance with the limits specified in the Discharge Licence.

5 CONCLUSIONS

5.1 The Proposed Development (the subject of the current planning application) involves a lateral extension to encompass the overburden landform abutting the northern end of the existing void. In addition, the quarry face will be advanced some 20-25 m along the bulk of the western margin. In this way, the extraction area would be enlarged by some 2.55 Ha.

5.2 The development proposals do not involve any deepening below 13 maOD, which is the approved depth permitted under PL17.206702 (PA ref. TA/30334).

5.3 There will be no lateral extension to the south or east beyond what is already permitted under PL17.235960 (and PA ref. TA/900976).

5.4 In proposing to advance westwards by 20-25 m, this will be working into the narrow spine of land separating the two quarries, where the limestone strata will have already been dewatered as a result of being sandwiched between the deepest sinking in each quarry.

5.5 In terms of potential hydrological receptors, the northerly extension will involve working in closer proximity to Rathmolyon Stream. Any drawdown-related impact upon this stream would be counterbalanced by the consented discharge process, whereby (in a continuation of existing practice) water from the quarry sump will be directed into the at-risk section of stream in accordance with the Discharge Licence.

5.6 The quarry operator will need to lodge an application to vary the existing licence in order to allow for an increased rate of dewatering in line with the Proposed Development. The current licensed rate is 1,400 m^3/day (equivalent to 60 m^3/hr); the estimated ingress rate at the final development is in the region of 2,750 m^3/day (115 m^3/hr). The stream has been subject to appropriate assessment to confirm that it has sufficient capacity.

5.7 The current dewatering operation has involved suppressing groundwater level in the quarry void by some 40 m. The Proposed Development will involve an additional 14 m depth of dewatering at the quarry sump.

5.8 The cumulative radius of influence at Present Day, where the two quarries are taken together, is *circa* 400 m. This is based upon actual observed distance-drawdown readings, as measured at Site piezometers and local boreholes.

5.9 The best estimate of the predicted radius of influence at the proposed development is likely to be in the region of 550 m, which is about 150 m greater than that observed in the current quarry setting.

5.10 Given the hydrogeological characteristics of the Limestone Formations, the collection of further monitoring data (groundwater levels in the Site piezometers and local boreholes; and flow readings at the V-notch weir) will mean that these findings can be reviewed and refined as the development progresses.

5.11 It is not possible to provide a more accurate quantification of the likely increase in drawdown at local water supplies because of the heterogeneity of the limestone formations.

5.12 In the event that a borehole is not meeting demand, the fall-back position would be the provision of a replacement supply *e.g.* mains water; or a group scheme, with the option of installing a reservoir tank filled by quarry abstraction (subject to requisite treatment). The quarry operators would have to cover the costs for mains water usage at any property where the water supply is affected by the cumulative quarry development.

5.13 There is no hydraulic continuity between the groundwater in the bedrock as encountered at the quarry, and the Tromman Stream. Therefore, the Tromman Stream and associated SAC will not be impacted by the drawdown of the groundwater table in the limestone bedrock at depth.

5.14 The protected section of the Tromman Stream is some 950 m standoff to the northwest of the Applicant's quarry. At this point, the two streams (Tromman and Rathmolyon) run parallel to each other, separated by a strip of farmland (less than

100 m in width). There is no evidence of any connection between the two watercourses. The water being discharged from the quarries into Rathmolyon Stream does not merge with the protected section of Tromman Stream.

5.15 During storm events (if rainfall exceeds the capacity of the sump), there is temporary and shallow ponding across the deepest sinking. In the design storm (6-hour duration and 100-year return period) with the quarry at its maximum extent, the water would spread across a large part of the floor without exceeding 20-25 cm depth, although there would be local deepening at the sump. There is no risk of runoff from the quarry void escaping on to neighbouring land.

5.16 The operation of mobile and fixed plant presents a risk of pollutants entering groundwater as a result of hydrocarbon spillage or leakage on Site. Experience has demonstrated that the risk of such a pollution incident will continue to be minimised by adhering to the Oil Care Code described in this report.

5.17 The implementation of the treatment systems, engineering measures and monitoring protocol advanced to protect groundwater quality will, in turn, serve to safeguard the surface water environment and water supplies.

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Keegan Quarries Limited

TROMMAN QUARRY

Tromman, Rathmolyon, Co. Meath

Environmental Impact Assessment Report
for Recommencement of Quarry Operations

Hydrogeological and Hydrological Assessment

August 2019

APPENDIX I

Discharge Licence and Supporting Information

Consultant Hydrogeologists Limited

Technology Centre
Wolverhampton Science Park, Wolverhampton, WV10 9RU
Tel: 01902 824111, Fax: 01902 824112
email: info@bclhydro.co.uk www: http://www.bclhydro.co.uk

Company Registration Number: 4043373
Registered in England & Wales. Registered Office: 33 Wolverhampton Road, Cannock.

MEATH COUNTY COUNCIL

Local Government (Water Pollution) Acts, 1977 and 1990. Local Government (Water Pollution) Regulations 1978 and 1992.

Licence to Discharge Trade Effluent to Waters

Ref. No. in Register 04/2

To:/ **Keegan Quarries**
Tromman
Rathmolyon
Co. Meath

Meath County Council in exercise of the powers conferred on it by the Local Government (Water Pollution) Acts 1977 and 1990 and the Local Government (Water Pollution) Regulations 1978 and 1992, hereby grants a licence to Keegan Quarries, in respect of discharge of trade effluent to waters subject to the following conditions:

1. **General Layout and Operations:**

1.1 This licence shall be in respect of the discharge of treated effluent from quarry de-watering operations only, at Keegans Quarry Ltd., Tromman, Rathmolyon, Co. Meath.

1.2 In the event of pollution of any waters arising from the Licensee's activities, whether due to accidental discharge or discharge other than in accordance with the terms and conditions of this licence, the Licensee shall make good all damage resulting from such pollution, including, if necessary:
(i) the replacement of fish stocks,
(ii) the restoration of spawning grounds,
(iii) the removal of polluting matter from waters
(iv) the modification of its discharge regime to prevent re-occurrence,
(v) or such other measures as may be directed by the Licensing Authority.

1.3 All effluent shall be directed through settlement lagoons with a minimum capacity of 3600m³ and then through a Klargester Interceptor *type* NS 15 Class 1 (full retention), which accepts a nominal flow of 14 litres/second, unless otherwise agreed in writing with the Licensing Authority.

1.4 Water from the interceptor shall pass through a 30m section of 10-50mm crushed rock berm. Treated water will finally discharge through a V-notch weir to the receiving waters.

1.5 The Licensee shall ensure that the interceptor is serviced regularly to ensure that the interceptor does not become overloaded. Records of such services are to be maintained on site for inspection by Officers of the Licensing Authority.

1.6 No contaminated water arising from the interceptor shall be taken off-site for disposal or treatment, until the name of the waste contractor and details of the waste contractor's licence or permit to dispose of such waste has been submitted to and agreed in writing with the Licensing Authority.

1.7 A visual examination of the surface water discharge shall be carried out daily. A log of such examinations shall be maintained on the site.

1.8 In the event that any observations made on the quality or appearance of the surface water discharge indicates that contamination has taken place, the licensee shall:

(i) carry out an immediate investigation to identify and isolate the source of contamination,

(ii) put in place measures to prevent further contamination and to minimise the effects of any contamination on the environment, and

(iii) notify the Local Authority and the Eastern Regional Fisheries Board as soon as practicable.

1.9 The licensee's site shall be laid out, operated and maintained in accordance with the plans and particulars submitted within the licence application.

1.10 The Licensee shall install an on-line flow-measuring device. Records of daily flow rates shall be maintained and submitted to the Licensing Authority on a quarterly basis.

2. Effluent Characteristics:

2.1 Oils and grease shall not be present in the effluent in such quantities as to:

(i) form visible films on the surface of the water;

(ii) form coatings on the river bed, benthic biota or food resources,

(iii) cause deleterious effects on aquatic life; or

(iv) impart a detectable taste or odour or edible aquatic species.

2.2 The total volume of treated effluent to be discharged shall not exceed 58m³ per hour or 1400m³ on any one day.

2.3 Effluent as discharged shall comply with the quality standards set out hereunder in respect of the following determinants:

Parameter	Units	Maximum Limit Value:
BOD_5	mg/l	2
COD	mg/l	15
Suspended Solids	mg/l	1
PH	pH units	6.0 – 9.0
Ortho-phosphate, as P	mg/l	0.03
Nitrates, as NO_3	mg/l	35
Ammonium, as NH_4	mg/l	3
Colour	° Hazen	10
Petrol Range Organics (C_4-C_{10})	µg/l	<10
Petrol Range Organics (C_{10+})	µg/l	<10

Diesel Range Organics	µg/l	<10
BTEX Compounds	µg/l	<10
Mineral Oils	µg/l	<10

3. Monitoring Regime:

3.1 The licensee shall arrange for monitoring of the discharge every 2 months, during periods of discharge, for the determinants listed in Condition 2.3 above.

3.2 The discharge sampling point shall be located at Grid Reference E277914, N250468, unless otherwise agreed in writing with the Licensing Authority.

3.3 Copies of results in respect of condition 3.1 above shall be submitted to the Licensing Authority every quarter.

3.4 On the basis of results submitted over time, the Licensing Authority may amend the frequency of monitoring or the parameters to be monitored.

4. Access by Authorised Personnel:

4.1 Details of emergency contact personnel, including addresses and telephone numbers, shall be made available to the Licensing Authority within one month of the date of grant of this licence. At least one such person shall be available for contact at all reasonable times, having due authorisation from the Licensee to expedite emergency measures as may be required.

4.2 Authorised Officers of the Licensing Authority, or its agents, or any other person authorised under Section 28 of the Local Government (Water Pollution) Act, 1977 shall have access to the site at all reasonable times, including if necessary, times other than normal working hours.

5. Change of Use of the Development:

5.1 The Licensee shall notify the Licensing Authority of any proposed change in the operation of the premises, which would cause, or be likely to cause, a material alteration in the nature, or increase in the volume of effluent discharged.

5.2 No changes in relation to the discharge (flow rates, effluent concentrations) shall take place without the prior written agreement of the Licensing Authority.

5.3 The Licensing Authority shall interpret whether any such change is material or not, and whether a review of the Licence is required as a result.

6. Contributions to the Licensing Authority:

6.1 The Licensee shall pay to the Licensing Authority an annual contribution of €1,010 or such sum as the Licensing Authority from time to time determines, towards the costs incurred by the Licensing Authority in monitoring the

discharge. The Licensee shall in **2005** and subsequent years, not later than the 31st of January of each year, pay to the Licensing Authority this amount updated annually in accordance with Table 5 of the All Items Index (base at November 1975=100) published by the Central Statistics Office. The Licensing Authority shall notify the updated amount to the Licensee. For **2004**, the Licensee shall pay a *pro rata* amount from the date of this licence to the 31st of December 2004. This amount shall be paid to the Licensing Authority within one month of the date of grant of this licence.

6.2 The Licensee shall pay the Licensing Authority such additional fees, as the Licensing Authority considers necessary for the carrying out of any confirmatory or specialist testing during the life of this Licence.

SIGNED: _____

DIRECTOR OF SERVICES

Dated this the _____, 2004

See Schedule No 1 (attached) for appeal procedure.

SCHEDULE NO. 1

APPEAL

An appeal under Section 8 of the Local Government (Water Pollution) Act, 1977 as amended by the Local Government (Water Pollution) (Amendment) Act 1990 may be made to An Bord Pleanala by any person within the prescribed period, i.e. one month beginning on the date of the decision on the Licence and shall be accompanied by a fee of €127 and shall:-

a) Be made in writing
b) State the name and address of the appellant
c) State the subject matter of the appeal and
d) State IN FULL the grounds of the appeal and the reasons, considerations and arguments on which they are based.

And shall specify

e) Whether any condition of the Licence, the subject of the review, has been deleted.
f) Whether and in what way any condition of the Licence has been amended.
g) Any conditions or additional conditions which have been attached to the Licence.
h) In the event of revocation of the Licence, the reasons for such revocation and the date of the decision of the Local Authority.

Without prejudice to Article 19 of the Local Government (Water Pollution) Regulations, 1992, an appellant shall not be entitled to elaborate in writing upon, or make further submissions in writing in relation to the grounds of appeal stated in the appeal or to submit further grounds of appeal and any such elaboration, submission or further grounds of appeal that is or are received by the Board shall not be considered by it.

A person, other than a party to an appeal, may make submissions or observations, in writing, to the Board in relation to the appeal on payment of a fee of €38.

Keegan Quarries Limited

TROMMAN QUARRY

Tromman, Rathmolyon, Co. Meath

Environmental Impact Assessment Report
for Recommencement of Quarry Operations

Hydrogeological and Hydrological Assessment

August 2019

APPENDIX II

Daily Discharge Data

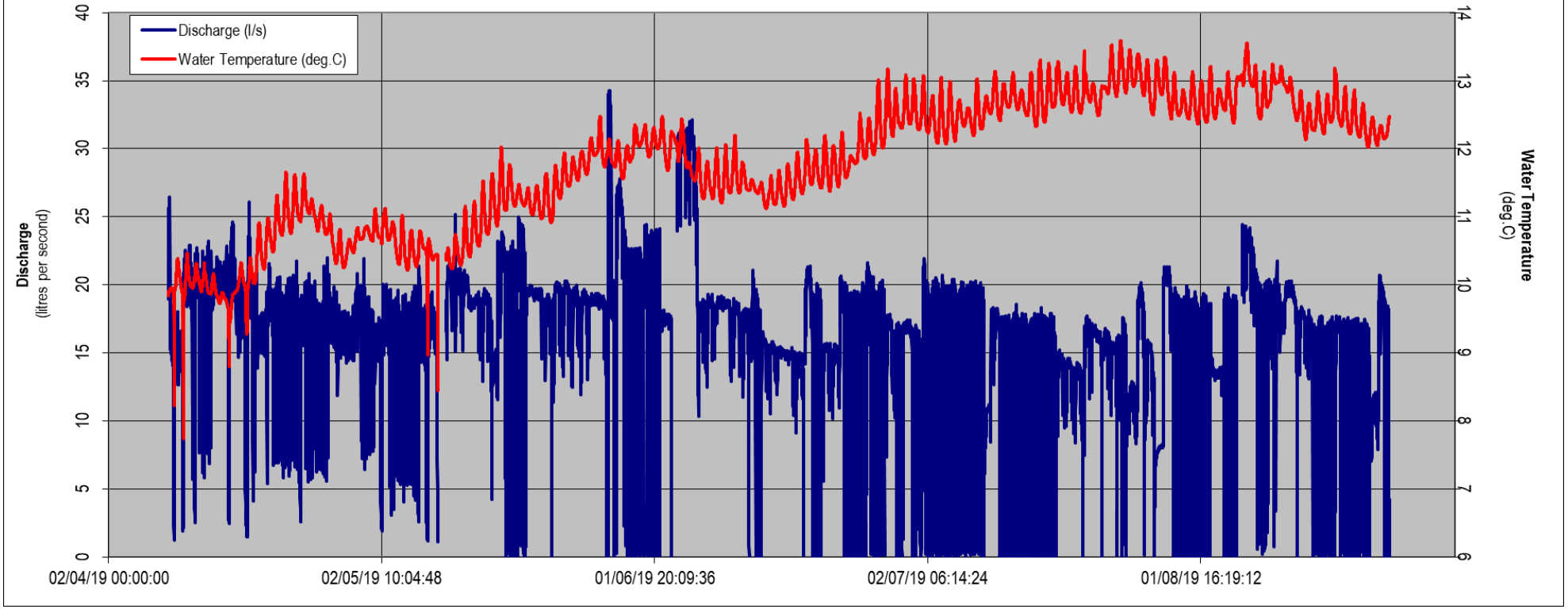
Consultant Hydrogeologists Limited

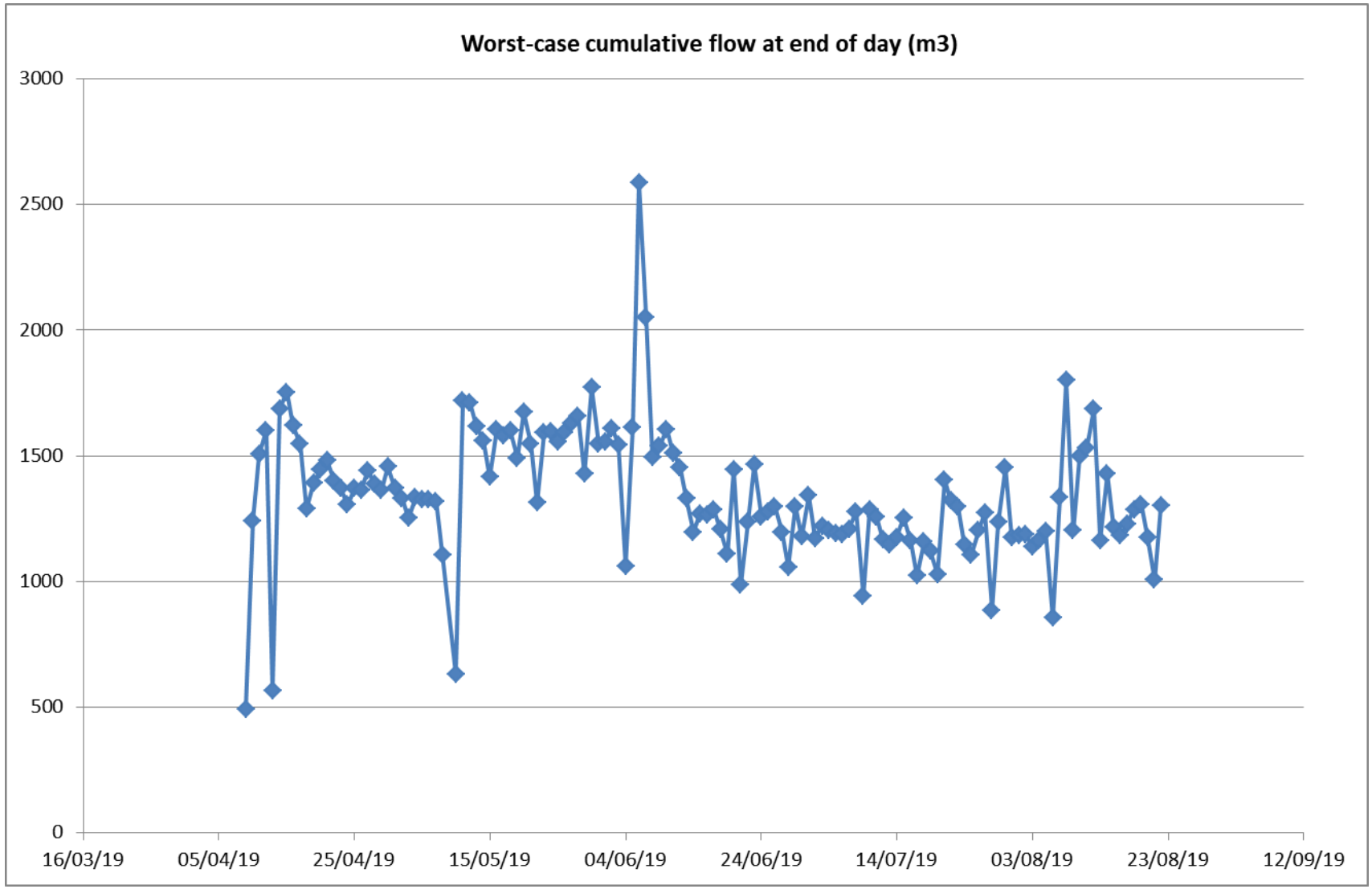
Technology Centre
Wolverhampton Science Park, Wolverhampton, WV10 9RU
Tel: 01902 824111, Fax: 01902 824112
email: info@bclhydro.co.uk www: http://www.bclhydro.co.uk

Company Registration Number: 4043373
Registered in England & Wales. Registered Office: 33 Wolverhampton Road, Cannock.

Tromman Quarry: Worst-Case Off-Site Discharge Rate

Note: Till 8th May 2019: Stage measured over v-notch weir of c.55-degree angle.
From 9th May 2019: Stage measured over rough broad concrete weir of 90-degree angle.




Worst-case cumulative flow at end of day (m3)
3000
2500
2000
1500
1000
500
0
16/03/19
05/04/19
25/04/19
15/05/19
04/06/19
24/06/19
14/07/19
03/08/19
23/08/19
12/09/19