Keegan Quarries Limited

Tromman Quarry

Tromman, Rathmolyon, Co. Meath

Planning Application for Substitute Consent for Unauthorised development on lands at Tromman Quarry

Hydrogeological and Hydrological Impact Assessment

December 2023

BCL HYDRO
Consultant Hydrogeologists Limited

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Report Prepared By	Report Checked By
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Contents Page Number

Figures

Appendices

BCL CONSULTANT HYDROGEOLOGISTS' EXPERIENCE & QUALIFICATIONS

BCL is an independent consultancy specialising in various aspects of hydrogeology and hydrology as they relate to minerals extraction, waste disposal, water supply and related industries.

Henry Lister (the author of this report) holds a joint honours Bachelor of Science Degree (Applied Geology B.Sc.) conferred by Plymouth University, Devon, United Kingdom (UK) in 1992 and a Master of Science Degree (Groundwater Engineering M.Sc.) received in 1994 from the Civil Engineering Department of Newcastle University, Newcastle upon Tyne, UK.

BCL has provided specialist services, advice and reporting to the extractive, waste and related industries since 1990. During this time, 25+ years of experience has been earned from involvement with wide variety of assignments. BCL's work has included:

- Installation and management of hydrometric data collection systems;
- Data interpretation;
- Conceptualisation of hydrogeological systems;
- Identification of potential impacts;
- Formulation of mitigation measures;
- Management and undertaking of operational impact monitoring and impact assessment;
- Review and auditing of contingency mitigation schemes;
- Reporting in connection with proposed developments within varying hydrogeological terrains at over 250 quarries throughout the United Kingdom and Republic of Ireland, and;
- Client representation at Planning Committee and Public Inquiry regarding hydrological and hydrogeological matters connected with proposed quarry developments, including prospective hard-rock quarries within green-field sites.

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1 INTRODUCTION

1.1 Background

1.1.1 This Hydrogeological and Hydrological Impact Assessment (HHIA) forms part of the remedial Environmental Impact Assessment Report (rEIAR) that has been prepared to accompany the planning application for substitute consent (SC), seeking to regularise the unauthorised development on lands at Tromman Quarry, which includes the unauthorised structures erected in the manufacturing (northern) part of the Site since 2013, and the unauthorised quarrying operations undertaken at the quarry since 5th August 2018.

1.1.2 The Application has been coordinated by Quarryplan Limited (Quarryplan), a specialist planning consultancy.

1.1.3 BCL Consultant Hydrogeologists Limited (BCL) has assessed the potential Hydrological and Hydrogeological Impacts associated with the unauthorised development.

1.2 Overview

1.2.1 The Site is located in the Townland of Tromman 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 (hereafter referred to as Kilsaran Quarry); to the south by the regional road R156; and to the north and east by agricultural fields.

1.2.2 The overall SC planning application area extends to some 22.5 hectares (Ha) in extent; and the application boundary incorporates the totality of the Applicant's operations.

1.2.3 Sequential historical imagery from Google Earth has been used to inform:

- The chronology of the construction of the unauthorised structures within the established footprint of the concrete manufacturing area of the Site. It is considered that this verifies the introduction of each element during the period from 2013 to present day; and,
- The progression of the quarry faces from 5th August 2018 to present day.

1.2.4 Full details are given at *section 3*.

1.2.5 *Figure 1* overleaf illustrates the existing sub-divisions within the Site, which can be described in a north-south progression as follows:

- Concrete product manufacturing activities in the northern extent of the Site;
- Historical overburden storage immediately to the south of this area;
- The extraction area (quarry void); and,
- The 'buffer zone' between extraction activities and the public highway, which contains the head office car-parking and tree-planted landscaping.

1.2.6 The operation is a mature, well-defined development, with a concealed extraction operation and a sophisticated and distinct manufacturing area.

	Tromman Quarry.
	Hydrogeological and Hydrological Impact **Assessment**
BCL HYDRO	**Figure 1 Orthophotograph of Site taken on 17th August 2023**
	Drawn By: HTL / Scale:
	Ref: / Date: Dec-23

1.3 Aim, Scope and Methodology of Assessment

1.3.1 This report presents the findings of the Baseline Study and Impact Assessment that is intended to inform consultations both prior to submission of the SC Planning Application and during its determination.

1.3.2 The collection and interpretation of baseline data has facilitated a detailed understanding of the nature of, and interactions between, the groundwater and surface water systems operating in and around the Site.

1.3.3 The understanding of hydrological and hydrogeological conditions has been applied to assess the direct and indirect significant effects of the Development upon the water environment. This includes:

- Impacts that "Have occurred": In terms of the legislative requirements with respect to SC, it is considered that with reference to the assessment of the environmental impacts that have occurred, the appropriate period for consideration is from 2013 to present. This is the period when the precast manufacturing structures in the northern part of the Site and other ancillary developments were erected. Within this period, it is also necessary to consider the period from 5th August 2018 onwards, when quarrying became unauthorised;
- Impacts that "Are occurring": This stage of the assessment considers impacts that are currently being experienced at the Site. This allows for a description of the relevant aspects of the current state of the water environment at the quarry and its surrounds at the time of writing in 2023; and,
- Impacts that can be "Reasonably expected to occur": The final stage of the assessment is to consider the effects that can reasonably be expected to occur as a result of the development for which SC is required.

1.3.4 With regard to the third bullet point, it is considered that two scenarios can be "Reasonably expected to occur":

- "*Scenario 1*" would be that this SC application and the accompanying s.37L application are not granted. In this instance, all quarrying and associated manufacturing operations at the Site would cease. The existing manufacturing buildings and structures would be removed, all plant and equipment associated with the same would be removed, and the Site would be remediated and restored. Existing water management practices would cease, and de-watering pumps would be turned off and removed. The remediation and restoration efforts would likely involve the movement and placement of limited volumes of overburden material and the natural formation of a waterbody within the quarry void; and,
- "*Scenario 2*" is that this SC application and the accompanying s.37L applications are granted. This would result in development at the Site to date becoming regularised; and a continuation and extension of quarrying operations and associated manufacturing and ancillary operations at the Site.

1.3.5 The predicted impacts associated with the continuation of operations and the extension of the existing quarry ("*Scenario 2*") are detailed in a separate EIAR submitted as part of the s.37L planning application package. It is not intended to duplicate the s.37L application and its associated EIAR in this document, however reference will be drawn to the information contained within the same, in order to allow for an adequate assessment of impacts "reasonably expected to occur" within this rEIAR, as required by the legislation.

1.4 Data Sources, Policy & Guidance

1.4.1 Site specific data include the following:

- Topographic surveying by QPL on 17th August 2023 (*Figure 3.2 Quarry Development Plan Current Survey*);
- Water features survey and walk over inspection of the Site, which was completed by BCL on 31st October 2018;
- Groundwater level data collected at Site piezometers and local water supply boreholes/wells, as supplied by the Applicant;
- Dewatering discharge data supplied by the Applicant;
- Regular sampling of surface water and groundwater for laboratory analysis;
- 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*;
- 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*;
- Discharge Licence 04/2, issued by Meath County Council (MCC) in 2004. Hereafter *Reference 3*;
- 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*;
- 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*;
- 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*;
- Planning application ref: TA 900976. Response to request for Further Information, DBC. Dated 2nd November 2009. Hereafter referred to as *Reference 7*;
- 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*;

- 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*;
- 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*;
- Planning application ref: TA-70175, EIS for Castletown Quarry, completed by Golders Associates Ireland, April 2007. Hereafter referred to as *Reference 11*;
- 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*; and,
- Planning application ref: TA 170519. 1st Party Appeal of Conditions 2 & 36, SLR. Dated 10th April 2018. Hereafter referred to as *Reference 13*.

1.4.2 The following published and unpublished documents and other sources of information have been examined:

- Mapping published by the Ordnance Survey of Ireland (OSI), Geological Survey of Ireland (GSI) and Environmental Protection Agency (EPA);
- GSI Well Records;
- "Longwood Groundwater Body (GWB): Summary of Initial Characterisation", published by GSI;
- "Trim GWB: Summary of Initial Characterisation", published by GSI;
- "County Meath Groundwater Protection Scheme", commissioned by Meath County Council (MCC) and prepared in the Groundwater Section of the GSI, dated 1996;
- "Ballivor Water Supply: Groundwater Source Protection Zones", prepared by MCC/GSI, June 2004;
- "Establishment of Groundwater Source Protection Zones: Enfield Water Supply Scheme: Enfield Borehole", prepared by EPA/GSI/MCC, May 2010;
- "Establishment of Groundwater Source Protection Zones: Trim Water Supply Scheme: Trim Borehole", prepared by EPA/GSI/MCC, September 2010;
- "Establishment of Groundwater Source Protection Zones: Longwood Water Supply Scheme: Longwood Borehole", prepared by EPA/GSI/MCC, September 2010;
- EPA water quality data;
- Water Framework Directive (WFD) river basin management planning report: "WFD 3rd Cycle Draft, Boyne Catchment Report (HA 07)" completed by the Catchment Science & Management Unit at the EPA, with the assistance of the Local Authority Waters Programme (LAWPRO), local authorities and RPS consultants, dated August 2021, Version no. 1;
- Flood Mapping published by the Office of Public Works (OPW);
- National Parks and Wildlife Service (NPWS): Spatial mapping & citation information for Designated Sites of ecological interest;
- Met Éireann: Rainfall data;
- Geological information and quarry layout plans provided by the Applicant;

- 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;
- Working Group on Groundwater (2004) Guidance document GW8: Methodology for risk characterisation of Ireland's groundwater;
- 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;
- Storm event data from the Flood Estimation Handbook (FEH), with online Web Service at the Centre for Ecology & Hydrology (CEH), developed by Wallingford HydroSolutions;
- Defra & Environment Agency, Flood and Coastal Defence R&D Programme: "Preliminary rainfall runoff management for developments" (Technical Report W5-074A/TR/1);
- "Improving the FEH Statistical Method", published in July 2008 by the CEH at the Natural Environment Research Council (NERC); and,
- "Revitalised Flood Hydrograph Model (ReFH 2.3)", Wallingford HydroSolutions Limited, 2019.

1.5 Report Structure

1.5.1 Baseline data concerning the topography, geology, hydrology and hydrogeology of the study area are presented at *section 2*.

1.5.2 An account of the Unauthorised Development is given in *section 3*, including chronology of the construction of the unauthorised structures (2013-present); progression of the quarry faces (5th August 2018 to present day); and description of water management measures.

1.5.3 *Section 4* provides details of the direct and indirect significant effects of the Proposed Development upon the water environment; and describes mitigation measures that have been implemented to ameliorate such impacts during the specified time periods.

1.5.4 A summary of the findings of the Hydrogeological and Hydrological Impact Assessment, together with report conclusions and recommendations, are given in *section 5*.

2 BASELINE CONDITIONS

2.1 Location

2.1.1 The Irish Grid Reference (IGR) for the centre of the existing quarry is easting [2]77700, northing [2]50100.

2.1.2 The totality of the Operational Site has a well-established planning history dating back to the original consent for the 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.

2.1.3 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; 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, with a sump at 15-16 maOD.

2.1.4 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.

2.1.5 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 21.64 Ha 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.

2.1.6 Going forward, "*Scenario 2*" (*section 1.3.4*) involves the extraction of limestone from an area of 14.3 Ha using conventional drilling and blasting techniques; and mineral reduction using mobile crushing and screening to a depth of 13 maOD; and the restoration and rehabilitation of the whole quarry site. This includes 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.

2.1.7 The "*Scenario 2*" development proposals do not involve any deepening below 13 maOD, which is the previously approved depth permitted under PL17.206702 (PA ref. TA/30334).

2.1.8 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.

2.2 Protected Sites/Designated Areas

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 the neighbouring Kilsaran 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 Waste Facilities and Sustainable Economy (EPA Mapping)

2.3.1 Mapping published by the EPA has been consulted to check for IPPC (Integrated Pollution Prevention Control), IPC (Integrated Pollution Control), IEL (Industrial Emissions Licensing) facilities in the vicinity of the Application Area.

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

2.3.3 The closest is Basketstown Landfill Facility, near Summerhill, which is about 7.2 km to the east of the Quarry.

2.3.4 Local authorities license smaller discharges of trade effluent and wastewater to ground or surface waters ("Section 4 Discharges").

2.3.5 The Applicant's consented discharge point ("Section 4 Discharge") is at the northern end of the Site, as covered by Trade Effluent Discharge Licence Ref. 04/2. The trade effluent is directed into a drainage ditch, which flows northwest to join Rathmolyon Stream (*section 2.4.6*).

2.3.6 The closest third-party Section 4 Discharge is at Kilsaran Quarry; the licence holder is Cemex (ROI) Limited. Trade effluent is discharged under Licence Ref. 14/04, issued June 2014. Kilsaran's discharge point, which goes directly into Rathmolyon Stream, is approximately 500 m downstream from the Applicant's outfall.

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 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 a drainage ditch that connects with Rathmolyon Stream, as outlined at *section 2.3*. Local to the Site, the base of the drainage ditch is at 68 maOD (some 2-3 m below ground level in the yard).

2.4.7 The ditch flows from southeast to northwest, passing alongside the northern end of the landholding and continuing alongside the northern boundary of Kilsaran Quarry. At the mid-point on this boundary, which is 200 m from the Applicant's discharge point, the ditch reaches 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 1.4.1 and 1.4.2*.

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 dip 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 "*Scenario 2*" Development (the subject of the s.37L 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 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 Rainfall

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 55.8 mm. This data is taken from Met Éireann's Depth Duration Frequency (DDF) Model.

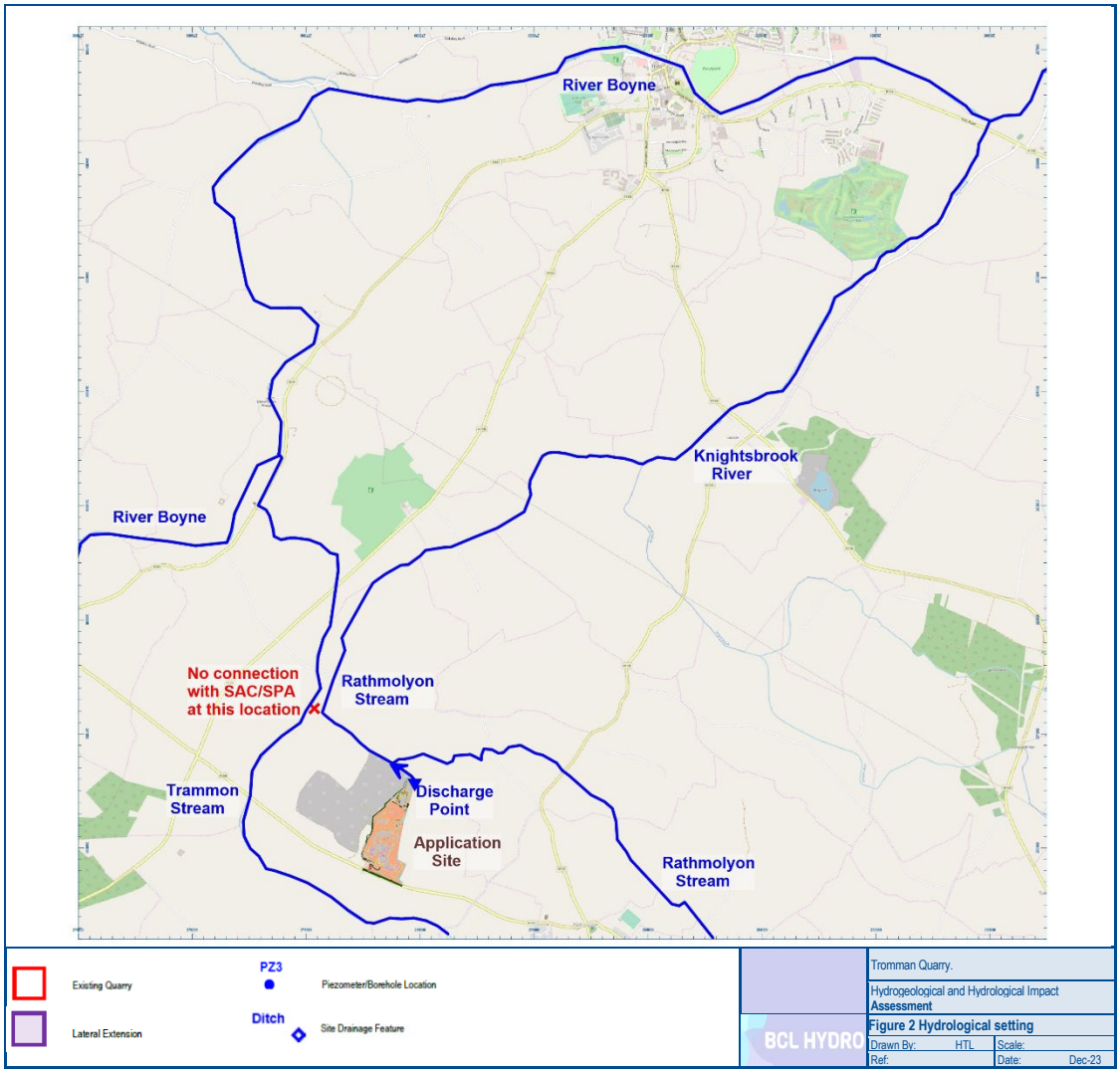
2.7 Hydrology

2.7.1 Rathmolyon Stream

2.7.1.1 The surface watercourses of the area are illustrated upon *figure 2*. 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 *Reference 12* presents flow duration percentiles for the Rathmolyon Stream on the stretch local to Kilsaran 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

2.7.1.5 The same report includes the results of a survey of channel capacity on Rathmolyon Stream. Along the 500 m stretch immediately downstream from Kilsaran 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.

2.7.1.6 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.

2.7.1.7 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

2.7.1.8 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.

2.7.2 Tromman Stream

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

2.7.2.2 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 Quarry, it enters the uppermost section of the River Boyne & River Blackwater SAC-SPA.

2.7.2.3 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.

2.7.2.4 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.

2.7.2.5 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**

2.7.2.6 On this basis, the evidence presented above conflicts 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.

2.7.3 Site Drainage

2.7.3.1 The dewatering sump at the Applicant's quarry is currently located at the northwest corner of the quarry floor (27 maOD). This sump is excavated to a depth of 10-12 m below the quarry floor, such that the base of the sump is at *circa* 15-16 maOD. The sump has a surface area of approximately 2,700 m^2, with water level being suppressed at 16-17 maOD by means of an electro-submersible pump. "*Scenario 2*" would see this sump being widened out to form the new quarry floor.

2.7.3.2 In "*Scenario 2*", a secondary sump will be maintained alongside the primary sump throughout the operational life of the quarry. The secondary sump will have a surface area of 225 m^2 and depth of 6 m (providing a storage volume of 1,350 m^3).

2.7.3.3 Throughout the SC period, the exact location of these sumps has depended upon the configuration of the quarry floor and the position of the working face during each phase of the development; at present day, the secondary sump is 15 m to the east of the primary sump.

2.7.3.4 After initial settlement for suspended solids within these sumps on the quarry floor, the ingress water is pumped up to the drainage infrastructure (seven-stage settlement tanks) at the northern end of the landholding. Four of the settlement tanks are sited to the east of the overburden storage area; and the final three tanks are situated alongside the southeast corner of the pre-cast manufacturing structure.

2.7.3.5 The tanks have a total surface area of 422 m^2 and they provide a storage volume of 1,324 m^3. The water is discharged from these tanks into a concrete culvert (0.77 m in width by 1.0 m in depth).

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

2.7.3.7 The culvert connects with an open drainage channel (40 m in length, 3 m in width and 2 m in depth) leading to the consented discharge point, as covered by Trade Effluent Discharge Licence Ref. 04/2 (*appendix 1*).

2.7.3.8 The layout of the drainage system is illustrated below:

Tromman Quarry.
Hydrogeological and Hydrological Impact Assessment
Figure 3 Drainage layout
BCL HYDRO
Drawn By: HTL | Scale:
Ref: | Date: Dec-23

2.7.3.9 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.

2.7.3.10 The complete record of flow rate is presented as a series of hydrographs in *appendix 2*.

2.7.3.11 For the monitoring period 8th April 2019 to 14th November 2023, the average daily rate equates to 1,335 m^3/day, with a standard deviation of 640 m^3/day.

2.7.3.12 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.

2.7.3.13 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.

2.7.3.14 The peak readings in the dataset are recorded on 25th February 2020 (3,532 m^3/day); 7th March 2021 (3,675 m^3/day); and 29th March 2022 (3,861 m^3/day); regressing on the following day to 2,018 m^3/day; 2,095 m^3/day; and 1,725 m^3/day respectively. 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.

2.7.3.15 In "*Scenario 2*" (where the SC application and the accompanying s.37L applications are granted as outlined in *section 1.3.4*), the Applicant will need to lodge an application to vary the licence in order to allow for an increased rate of dewatering. 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).

2.7.3.16 Water samples have been collected from the discharge point on a regular basis and submitted for laboratory analysis in order to check for compliance with the limits specified in the consent. The most recent results (28th September 2023) are presented below:

Parameter	Measured Value 17.07.23	Limit Value
BOD mg/l	0.7	2
COD mg/l	<5	15
Ammonium as NH3 mg/l	0.02	3
Nitrate mg/l	5.27	35
Orthophosphate mg/l	0.01	0.03
Mineral Oils ug/l	<.2.5	<10
Colour	<5	10
Suspended Solids	**14**	1
pH	7.58	6 - 9
DRO ug/l	<1.0	<10

< = Less than laboratory limit of detection

BCL HYDRO

Tromman Quarry.
Hydrogeological and Hydrological Impact **Assessment**
Figure 4 Water quality at Discharge Point on 28th September 2023
Drawn By: HTL | Scale:
Ref: | Date: Dec-23

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

2.7.3.18 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 the neighbouring Kilsaran Quarry.

2.7.3.19 "Environmental Management Guidelines: Environmental Management in the Extractive Industry (Non-Scheduled Minerals)", published by the EPA in 2006, is promoted by Government, Planners and the EPA as the lead guidance for good environmental practice in the quarrying industry; and it includes recommendations for emission limit values (ELVs), where appropriate.

2.7.3.20 Where there are discharges of treated effluent from quarry developments to surface watercourses, the following ELVs are recommended in the above guidance:

- pH less than 9;
- Biochemical oxygen demand (BOD): 25 mg/l;
- Total suspended solids (TSS): 35 mg/l;
- Nitrate (NO_3) 50 mg/l;
- Chemical oxygen demand (COD): 100 mg/l O_2; and,
- Total hydrocarbons: 1 mg/l.

2.7.3.21 When varying the Applicant's licence, the limit for suspended solids should be brought into line with the guidance *i.e.* a practical limit that can be achieved in a limestone quarry setting using industry-standard methodology, without incurring excessive costs; and which is appropriate for the location and hydrological setting, as per the limits stated in the discharge licence for the adjacent Kilsaran Quarry.

2.7.4 Waterbodies

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

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

2.7.5 Flood Risk

2.7.5.1 National Indicative Fluvial Mapping (NIFM) showing River Flood Extents at Present Day is published on the OPW Rivers website (https://www.floodinfo.ie/map/floodmaps/#).

		Tromman Quarry.
		Hydrogeological and Hydrological Impact Assessment
	BCL HYDRO	Figure 5 Extract from NIFM mapping
		Drawn By: HTL / Scale:
		Ref: / Date: Dec-23

2.7.5.2 The Site does not overlap any floodplain. The closest area shown to be at risk of fluvial flooding is the narrow strip of land immediately adjacent to the banks of the Rathmolyon Stream. The standoff between the Site and closest stretch of "floodplain" equates to 100 m.

2.7.5.3 The Tromman Stream has a wider floodplain; but this is c.250 m standoff to the south the Site entrance.

2.7.5.4 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 Background

2.8.1.1 The hydrogeological regime of the Site and its surrounding areas has been elucidated on the basis of:

- Review of published and site-specific geological data including mineral evaluation borehole and piezometer borehole logs;
- The occurrence and elevation of local water features;
- Groundwater level measurements at piezometer boreholes; and,
- Experience of similar hydrogeological terrains within Ireland and the UK.

2.8.2 Regional Setting

2.8.2.1 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).

2.8.2.2 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.

2.8.2.3 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.

2.8.2.4 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"; and,
- "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".

2.8.2.5 Transmissivity data for the Waulsortian strata encountered at Kilsaran 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".

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

2.8.2.7 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.

2.8.2.8 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.

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

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

2.8.2.11 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; and,
- "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).

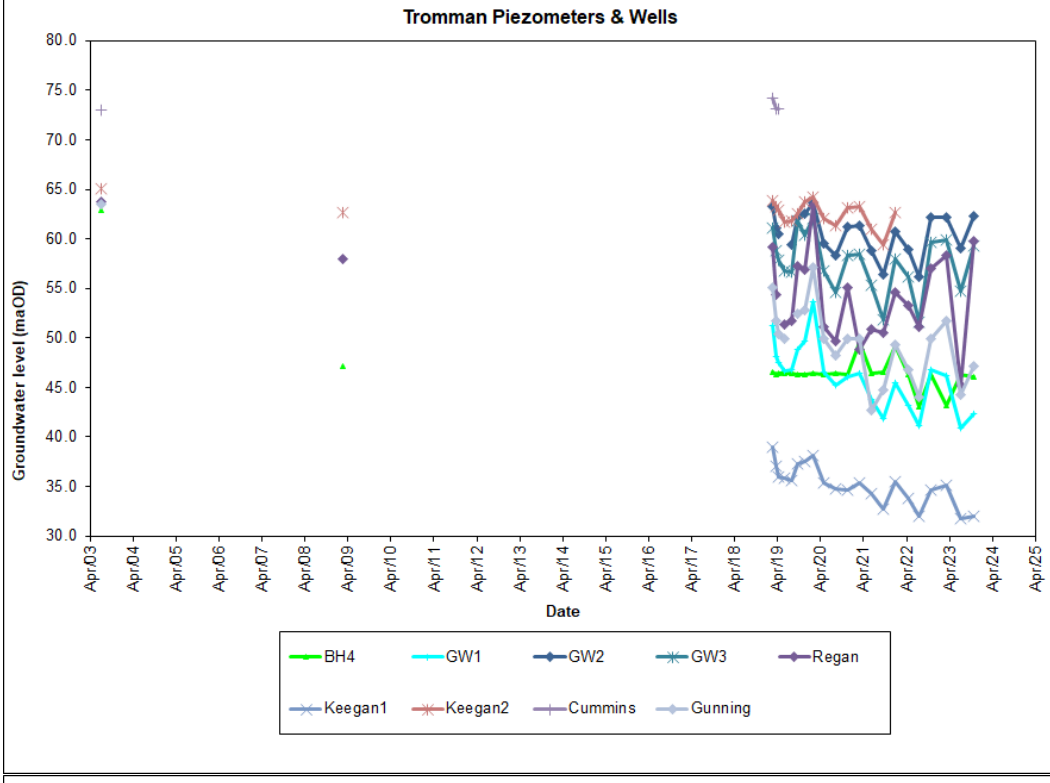
2.8.2.12 *Reference 12* (SLR, 2017) includes site-specific data for Kilsaran Quarry: "Tests carried out in 2003 focused on the Lucan Formation; at a pumping rate of 100 m^3/d, groundwater levels were noted to drawdown rapidly, but also recover rapidly and at a greater rate than that of the Waulsortian 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".

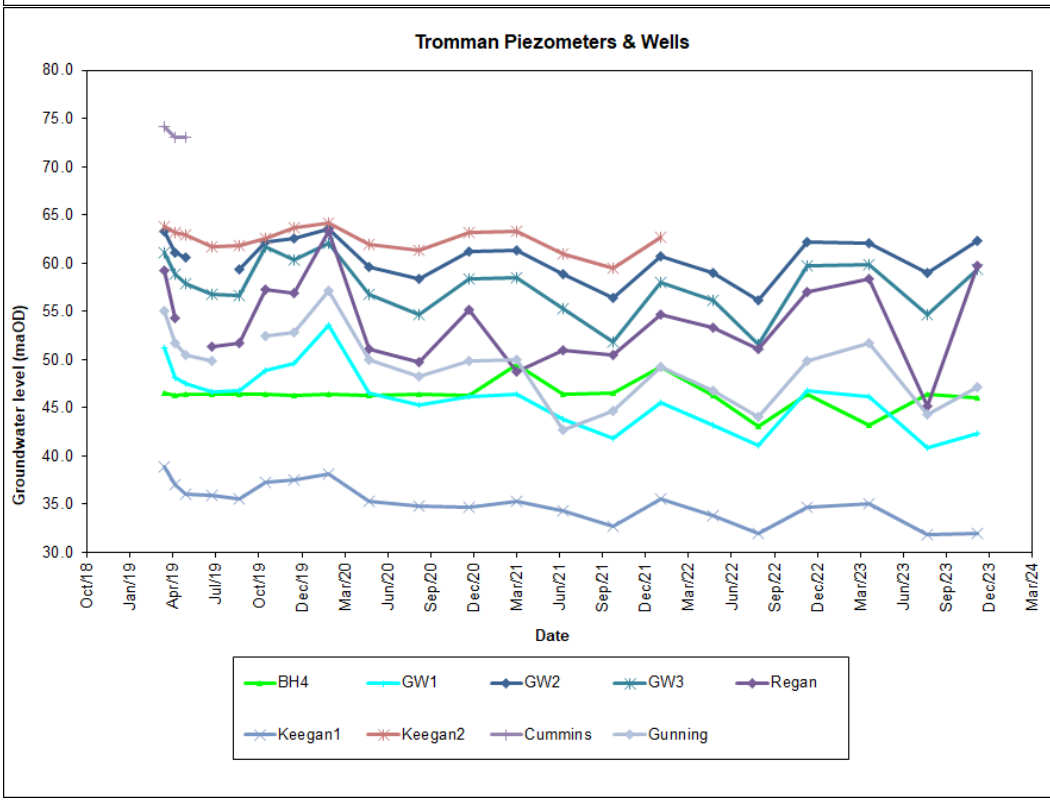
2.8.3 Groundwater Levels

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

2.8.3.2 The groundwater level readings collected from March 2019 (with the sump at 27 maOD) to November 2023 (with the sump at 15-16 maOD) have been compared with historic data, collected in July-August 2003 (with the sump at 52 maOD) and March 2009 (with the sump at 36 maOD). The results are presented as a series of hydrographs at *figure 7*.

2.8.3.3 The borehole in the pumphouse at the Brogan property is no longer accessible. The borehole feeds a shallow chamber (Brogan SC), and the latter is being monitored to check for any visible sign of reduced yield. The water level data at Brogan SC is not representative of the groundwater system; therefore, the hydrograph for the shallow chamber is not included at *figure 7*.





BCL HYDRO	Tromman Quarry.
	Hydrogeological and Hydrological Impact **Assessment**
	Figure 7 Piezometer hydrographs
	Drawn By: HTL Scale:
	Ref: Date: Dec-23

2.8.3.4 The groundwater level data collected at Kilsaran Quarry by SLR, May 2017 (*Reference 12*) has been merged with the Applicant's dataset, as recorded in the spring of 2019 (this date being closest to the commencement of unauthorised quarrying operations on 5th August 2018). The merged dataset informs 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	277962	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

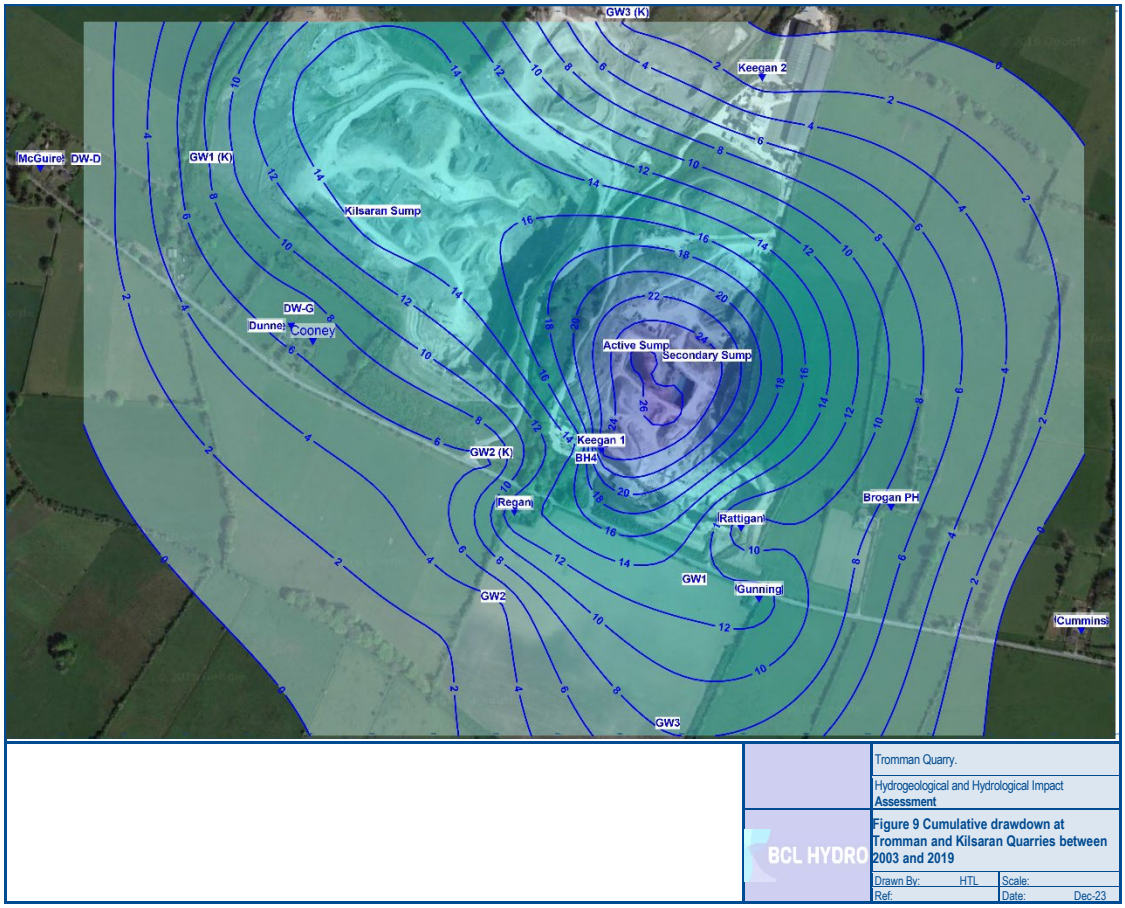
Tromman Quarry.
Hydrogeological and Hydrological Impact Assessment
BCL HYDRO
Figure 8 Kilsaran dataset (SLR, May 2017) merged with Applicant's data (May 2019)
Drawn By: HTL | Scale:
Ref: | Date: Dec-23

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

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

2.8.3.7 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 2.8.2*), 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.

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



2.8.3.9 The drawdown profile in *figure 9* is exacerbated at the production borehole (Keegan 1); and the indicative drawdown contours are pinched at the southeast corner of the Site, because the quarry face was advanced in this direction between 2003 and 2019 (and the Rattigan borehole was quarried out).

2.8.3.10 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.

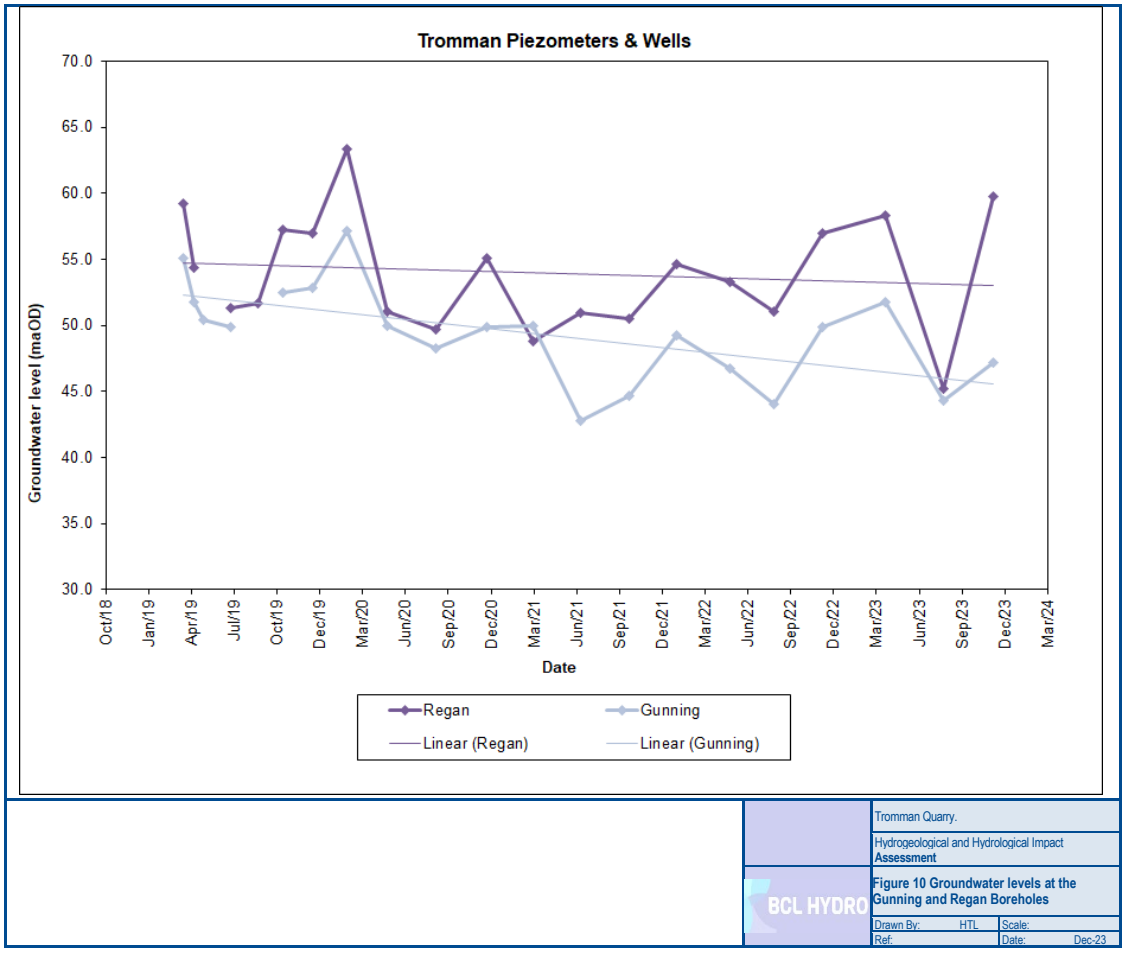
2.8.3.11 Most importantly, the cumulative cone of depression that developed at the two quarries between 2003 and 2019 resulted in:

- 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 borehole 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;

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

2.8.3.12 Between March 2019 and November 2023, the quarry sump has been lowered from 27 maOD down to 15-16 maOD.

2.8.3.13 In terms of 3rd-party supplies, monitoring has continued at the Gunning and Regan boreholes as part of the Applicant's scheme.



2.8.3.14 A linear best-fit line has been drawn through each hydrograph. The Regan borehole has shown about 2 m drawdown in the period 2019-2023. The total drawdown is 18 m since 2003.

2.8.3.15 The Gunning borehole has experienced closer to 6 m drawdown in the period 2019-2023. The total drawdown is 19 m since 2003.

2.8.3.16 In "*Scenario 2*" (*section 1.3.4*), it is recommended that the radius of influence of dewatering drawdown continues to be monitored by checking groundwater level (on a quarterly basis) at the Site piezometers and third-party water supplies (subject to access permission).

2.8.3.17 All monitoring boreholes will be deepened to at least 15 m below the final agreed depth of the quarry, once the extent and depth of s.37L development has been approved by the Planning Authority.

2.9 Groundwater Quality

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

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

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)

BCL HYDRO

Tromman Quarry.
Hydrogeological and Hydrological Impact **Assessment**
Figure 11 Groundwater Quality Data (pt.1)
Drawn By: HTL | Scale:
Ref: | Date: Dec-23

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

Water
Metals

Analysed as Water

				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

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Tromman Quarry.
Hydrogeological and Hydrological Impact **Assessment**
Figure 12 Groundwater Quality Data (pt.2)
Drawn By: HTL | Scale:
Ref: | Date: Dec-23

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

2.9.4 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).

2.9.5 In "*Scenario 2*" (*section 1.3.4*), 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.

2.10 Dwellings within 550 m Radius of Quarry

2.10.1 A Further Information Request (FIR) was issued by Meath County Council on 29th April 2020 relating to Planning Application at Tromman Quarry (ref: TA/200151).

2.10.2 Question 4c of the FIR states that "*The Applicant shall provide a map indicating the location of all dwellings within 550m radius of the quarry and indicating their source of domestic water. This shall include a schedule of neighbouring wells and a programme for monitoring these wells for the duration of extraction activities at the quarry.*"

2.10.3 Figure FIR 6.20: "Tromman Quarry – 550m Application Buffer Zone" was produced in response to the FIR; this drawing is reproduced overleaf. It has been annotated with cyan circles pinpointing each dwelling within the buffer zone; and giving details of the water supply to these properties, including the extent of the mains water network.

2.10.4 The ongoing hydrometric monitoring programme at the Site currently includes the following commitments:

- Stage measurements by data logger (15-minute interval) at the V-Notch weir leading to the Consented Discharge Point (Trade Effluent Discharge Licence Ref. 04/2). For the monitoring period 8th April 2019 to 14th November 2023, the average daily rate equates to 1,335 m^3/day, with a standard deviation of 640 m^3/day;
- Measurement of groundwater levels on a quarterly basis at Site Piezometers: BH4, GW1, GW2, GW3, Keegan1 and Keegan2;
- Measurement of groundwater levels on a quarterly basis at Domestic properties: Regan, Gunning and Brogan Shallow Chamber (SC), which is fed by the adjacent Brogan Pump House Borehole. Subject to permission from the owner, it is recommended that a dip tube be installed at the Brogan borehole; and,
- Water sampling at the following locations: Regan, Cummins, Brogan SC, Keegan1, Keegan2, GW1 and GW3. Going forward, this should be conducted on an annual basis. The samples will be subject to laboratory analysis as detailed at *section 2.9*.

2.10.5 In "*Scenario 2*" (*section 1.3.4*), the hydrometric monitoring programme should be expanded to include:

- Quarterly monitoring of groundwater level at Domestic properties PW1 and PW2 should be added to the schedule, subject to owner's permission;

- Likewise, Domestic properties LD1 and LD2 are expected to be served by private wells, given that the mains water distribution network does not reach these properties. Again, subject to owner's permission, there would be a requirement for quarterly monitoring of groundwater level at these water supplies. The Applicant is awaiting a reply from the owners following a letter drop at each property;
- As well as quarterly monitoring of water level, the above supplies should be sampled on an annual basis and submitted for laboratory analysis, using the schedule outlined at *section 2.9*;
- Cummins domestic borehole is excluded from the schedule on the instructions of the Owner; and,
- Kilsaran Quarry has a guard borehole (DW-G) adjacent to the pair of Domestic properties (Dunne and Cooney), which are situated to the west of the Application Area. Furthermore, these properties are served by mains water network.

3 THE UNAUTHORISED DEVELOPMENT

3.1 Construction of the Unauthorised Structures

3.1.1 The potential for impacts from the unauthorised structures has been considered for the period from 2013 to present day.

3.1.2 Sequential historical images from Google Earth (as presented in Chapter 1 of the rEIAR) have been annotated to clearly mark up the introduction of a ready mixed concrete batching plant in the southeast corner of the manufacturing area, and the upgrading of the ESB substation on the western boundary at the beginning of the unauthorised period.

3.1.3 The aerial image from July 2016 confirms that, at this time, the concrete manufacturing yard including the recently erected limestone fines plant, and the concrete batching plant, blockyard and pre-cast manufacturing structure is evident with a paved surface throughout the entirety of the northern extent of the Site. The storage of concrete blocks on the open yard, immediately to the east of the permitted building, is also evident.

3.1.4 In 2017, the layout of the Manufacturing part of the Site, as it currently is, is evident with the erection of the portal frame extension to the pre-cast manufacturing unit on the eastern part of the concrete yard and the internal arrangement of the concrete block making yard and associated storage area, reverting to the central location.

3.1.5 The Google image from July 2018 illustrates that there has been no further alteration to the manufacturing area within the northern part of the Site.

3.2 Mineral Extraction

3.2.1 Quarrying has occurred on the Site in accordance with environmentally assessed development control protocols since the first grant of planning permission in December 1998. The general approach to operations has not varied substantially since this first approval, with activities having been confined to the main quarry sinking and storage of overburden in the central part of the Site and along the southern boundary to create a landform for tree planting. Therefore, activities have been confined to the disturbed footprint of the Site and the activities have continued to be operated in accordance with previous environmentally impact assessed parameters.

3.2.2 The aerial imagery from the quarry void for the period 5th August 2018 to present day shows that the faces have been developing in a generally southerly direction. An additional small sinking in the quarry floor is evident, along with a ramp along the eastern boundary of the Site, providing access to the quarry benches from the upper benches. A new improved water settlement system is also evident in lands to the east of the overburden tip. The system has been constructed from pre-cast concrete tanks and has been developed in order to further enhance the settlement facilities at the quarry.

3.2.3 The "*Scenario 2*" development proposals do not involve any deepening below 13 maOD, which is the previously approved depth permitted under PL17.206702 (PA ref. TA/30334).

3.3 Water Management

3.3.1 In "*Scenario 2*" (where the SC application and the accompanying s.37L applications are granted as outlined in *section 1.3.4*), it is proposed that the water management system at the Site will continue to be operated in the same fashion as detailed in *section 2.7.3*.

3.3.2 The Site dewatering and drainage operations are covered by Trade Effluent Discharge Licence Ref. 04/2; and the discharge water will continue to pass through the existing infrastructure in the northeast corner of the Site, which includes improvements made in 2023.

3.3.3 The efficacy of this facility is discussed in greater detail in *section 4.4*.

3.3.4 In "*Scenario 1*", the 'no development option' would involve the removal of all plant and machinery, allowing the void to flood and the faces and remaining benches to naturally regenerate.

3.3.5 An assessment of the potential impacts associated with "*Scenario 1*" is given at *section 4.10*.

4 IMPACT ASSESSMENT & MITIGATION MEASURES

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 direct and indirect significant effects upon the water environment that "Have occurred", "Are occurring", and can be "Reasonably expected to occur" as a result of the Development. The assessment includes a description of the mitigation measures that have been implemented to ameliorate such impacts during the SC time period.

4.1.2 In common with other quarrying operations of this type and scale, it is considered appropriate to examine the following list of likely significant effects upon the water environment:

- Interception of groundwater causing a modification of groundwater levels and flow rates within and surrounding the area from which mineral has been extracted;
- Derogation of existing groundwater quality;
- Derogation of surface water quantity and quality;
- Potential for impact upon water supplies;
- Potential for impact upon Designated Sites; and,
- Modification of existing flooding characteristics.

4.2 Ingress Rates and Radius of Influence of Dewatering Drawdown

4.2.1 Impacts that "Have occurred":

4.2.2 As explained in *section 2.8.3*, the groundwater level data collected at Kilsaran Quarry by SLR, May 2017 (*Reference 12*) has been merged with the Applicant's dataset, as recorded in the spring of 2019 (this date being closest to the commencement of unauthorised quarrying operations on 5th August 2018).

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

4.2.4 The bulk of the drawdown is considered to have occurred between 2003 and 2009. This is consistent with the conceptual understanding of the limestone formations at this location (*section 2.8.2*), 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.

4.2.5 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 Quarry), both of which are judged to be outside the cumulative cone of depression.

4.2.6 In spring 2019, the void had progressed 40 m (maximum) below the pre-development groundwater level.

4.2.7 To aid quantification of the degree of risk posed to potential receptors as a result of the current and future predicted lowering of groundwater levels in "*Scenario 2*", calculations have been undertaken to determine likely ingress rates and the radius of influence of dewatering drawdown.

4.2.8 The methodology has been tested using input data that is representative of the quarry in its 2019 configuration (floor level at 27 maOD) *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.

Tromman, Development to 27 maOD in spring 2019							
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

BCL HYDRO

Tromman Quarry.
Hydrogeological and Hydrological Impact Assessment
Figure 14 Ingress Rates and Cone of Depression at 27 maOD
Drawn By: HTL Scale:
Ref: Date: Dec-23

4.2.9 The ingress rate calculated above (1,588 m^3/day) is in line with the dewatering requirements in spring 2019, as measured at the V-notch weir. Averaged across the monitoring period 8th April to 16th December 2019, the daily rate equated to 1,370 m^3/day, with a standard deviation of 280 m^3/day.

4.2.10 The radius of influence of dewatering drawdown in spring 2019 is calculated to have been 204 m (taking the Applicant's quarry in isolation).

4.2.11 The cumulative radius of influence, with the two quarries taken together, was shown to be *circa* 400 m (*figure 9*). It works out as roughly double what was calculated for Tromman Quarry in isolation. This was based upon actual observed distance-drawdown readings, as measured at Site piezometers and local boreholes in spring 2019. At this date, the Applicant's quarry floor was at 27 maOD; and Kilsaran's quarry floor was at 35 maOD.

4.2.12 Between 2019 and 2023, the quarry sump has been deepened and water level is being suppressed at 16-17 maOD. Correcting for outliers, the peak discharge rates are currently in the region of 2,000-2,100 m^3/day (*section 2.7.3*). This is close to what is predicted by the model for the current scenario (*figure 15*), thus lending confidence to using the same approach for the final development ("*Scenario 2*").

4.2.13 Using the IGI guidance, the aquifer is shown to be of '**Medium**' importance. The unauthorised quarrying operations (commencing 5th August 2018) have only involved the removal of a small proportion of aquifer, with minor change to the extant configuration of the aquifer (bearing in mind that the bulk of the drawdown had already been established between 2003 and 2009). Given the above factors, the magnitude of impact on the Hydrogeology Attribute is '**Small Adverse**', therefore the significance of impact is within acceptable range, being rated as **'Slight'**.

Tromman, Current Dewatering to 16-17 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)	50
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	255	169	424	2136	25

Distance Drawdown

			metres from face				
		Ro	25	50	100	175	255
Percentage distance from face	Site experience	255.155	9.80%	19.60%	39.19%	68.59%	99.94%
%age drawdown (from lookup)	Site experience		60.64%	41.35%	24.02%	10.36%	0.61%
Absolute drawdown (m)	Site experience		30.32	20.68	12.01	5.18	0.30

Tromman Quarry.
Hydrogeological and Hydrological Impact Assessment
BCL HYDRO
Figure 15 Ingress Rates and Cone of Depression at 13 maOD
Drawn By: HTL Scale:
Ref: Date: Dec-23

4.2.14 **Impacts that "Are occurring":**

4.2.15 The radius of influence of dewatering drawdown at present day is calculated to be around 255 m (taking the Applicant's quarry in isolation). This is doubled to 510 m to allow for the cumulative impact of Tromman and Kilsaran Quarries.

4.2.16 This explains why the Regan borehole has shown about 2 m drawdown in the period 2019-2023; and the Gunning borehole has experienced closer to 6 m drawdown (*section 2.8.3*).

4.2.17 As above, the magnitude of impact on the Hydrogeology Attribute is '**Small Adverse**', therefore the significance of impact is within acceptable range, being rated as **'Slight'**.

4.2.18 **Impacts that can be "Reasonably expected to occur" in "*Scenario 1*":**

4.2.19 "*Scenario 1*" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake.

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

4.2.21 In this scenario, the pumps would be turned off and all impacts associated with drawdown would therefore cease.

4.2.22 **Impacts that can be "Reasonably expected to occur" in "*Scenario 2*":**

4.2.23 In "*Scenario 2*", the final depth in the Applicant's Tromman Quarry would be 13 maOD, which is the previously approved depth permitted under PL17.206702 (PA ref. TA/30334). This means that the void would be progressed to 54 m (maximum) below the pre-development groundwater level.

4.2.24 The lateral extension at the northern end of the existing workings would lengthen the void by 100-110 m. In addition, the quarry face would be advanced some 20-25 m along the bulk of the western margin.

4.2.25 The calculations have been repeated to provide an estimate of the potential groundwater ingress rate associated with the final development in "*Scenario 2*".

Tromman, 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	260	300
Percentage distance from face	Site experience	275.568	9.07%	18.14%	36.29%	94.35%	108.87%
%age drawdown (from lookup)	Site experience		60.64%	41.35%	27.05%	3.00%	0.61%
Absolute drawdown (m)	Site experience		32.75	22.33	14.61	1.62	0.33

BCL HYDRO

Tromman Quarry.
Hydrogeological and Hydrological Impact Assessment
Figure 16 Ingress Rates and Cone of Depression at 13 maOD
Drawn By: HTL | Scale:
Ref: | Date: Dec-23

4.2.26 The estimated ingress rate at the final development ("*Scenario 2*") is in the region of 2,750 m^3/day. The cumulative radius of influence for Tromman and Kilsaran Quarries 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).

4.2.27 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.

4.2.28 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.

4.2.29 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 outside the Site.

4.2.30 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.

4.2.31 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.

4.2.32 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 in the event that the SC application and the accompanying s.37L applications are granted ("*Scenario 2*").

4.3 Storm Balancing

4.3.1 Impacts that "Have occurred":

4.3.2 Total rainfall occurring on Site during the design storm (6-hour duration and 100-year return period) is 55.8 mm. Given the catchment area of the development (*circa* 22.5 hectares), this equates to some 12,555 m^3 input of rainfall.

4.3.3 Since commencement of unauthorised activities, all ingress water would have drained under gravity into the primary sump, which has a volume of approximately 27,000 m^3 *i.e.* with sufficient capacity for the design storm.

4.3.4 Following abatement of the storm, water would have been pumped from the quarry to the settlement system at the licensed rate, based upon the requirement to maintain dry workings under average conditions ("*Scenario 2*").

4.3.5 There is no record or indication of overtopping/ runoff during the assessment period; and therefore storm balancing is considered to have been adequate over this period.

4.3.6 Impacts that "Are occurring":

4.3.7 No change from what is described above.

[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).

4.3.8 Current arrangements for storm balancing are considered to be adequate.

4.3.9 **Impacts that can be "Reasonably expected to occur" in "*Scenario 1*":**

4.3.10 "*Scenario 1*" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake.

4.3.11 It is considered that a lake level of some 65 maOD +/-2m (subject to seasonal variation) would be established within the abandoned workings; and the storm balancing would occur within the +/-2m zone of fluctuation.

4.3.12 Pre-quarrying ground level would have equated to 70-85 maOD. Therefore, there is considered to be no risk of overtopping. There is no risk of runoff from the quarry void to neighbouring land.

4.3.13 **Impacts that can be "Reasonably expected to occur" in "*Scenario 2*":**

4.3.14 No change from the impacts what is described that "Have occurred" and that "Are occurring".

4.4 Settlement System

4.4.1 Design of Settlement Lagoons

4.4.1.1 The design of the updated settlement system is based upon the EPA's Environmental Management Guidelines Environmental Management in the Extractive Industry (Non-Scheduled Minerals).

4.4.1.2 Practical experience indicates that the application of Stokes Law provides a reasonable basis for sizing settlement lagoons. Stokes Law defines the critical settling velocity with which suspended solids in a fluid fall under gravity.

4.4.1.3 For practical values of water temperature and particle specific gravity (density), and a settlement lagoon depth of 1 m, the following theoretical retention times are calculated:

- 11 hours to settle out particles of 0.006 mm (medium silt) or greater; and,
- 24 hours to settle out particles of 0.004 mm (fine silt) or greater.

4.4.1.4 The depth of water in the settlement lagoons is not a variable in the equation relating capacity flow rate to minimum settling velocity (*i.e.* making lagoons deeper does not improve their efficiency or performance). In practice, it has been shown that settlement lagoons are efficient if the water depth in the lagoon is not less than 1 m.

4.4.1.5 The overall depth of the lagoons takes into account the maximum depth of sediment that will be allowed to collect before removal (typically 0.5–1.0 m) and the provision of freeboard (typically 0.5 m between maximum water level in the lagoon and the crest of the lagoon).

4.4.2 Construction of Settlement Lagoons

4.4.2.1 The size, shape and layout are limited by the areas available on the Site. The dimensions of the system are dictated by the requirement to allow digging out by long reach excavator.

4.4.2.2 The primary consideration is the maintenance of uniform horizontal flow. For this, the lagoons are rectangular in shape with parallel sides in the directions of flow. The floor and sides of the lagoon will be maintained as smooth as practicable to minimise turbulent flow. Where turbulence is created, currents can create scour conditions and negate the settlement process.

4.4.2.3 The final settlement lagoons are concrete-lined to eliminate any seepage into the underlying strata.

4.4.3 Operational Practice

4.4.3.1 The lack of maintenance is the primary cause of poor efficiency of settlement lagoons. Typical problems arising include instability of lagoon side slopes, blocked pipes that can affect flows, and reduction in efficiency arising from settled materials forming shallows within the lagoon.

4.4.3.2 Typically, settled materials will need to be removed from primary lagoons every 3–6 months. Regular maintenance can prevent these types of problems occurring. Provision should be made to allow settlement lagoons to be cleaned/maintained without affecting the overall settling process (*i.e.* by using over-pumping or installing pipes to bypass individual lagoons).

4.4.3.3 The most difficult suspended solids to remove from drainage waters are clay-size particles. These often originate from excavated topsoil and overburden materials/stockpiles. Minimising surface water run-off from these materials through shaping, optimising locations, and re-vegetation of stockpiles can reduce the generation of suspended solids at source.

4.4.4 Site Drainage - Impacts that "Have occurred"

4.4.4.1 Throughout this period, the exact location of the dewatering and primary settlement sumps has depended upon the configuration of the quarry floor and the position of the working face during each phase of the development.

4.4.4.2 Since commencement of unauthorised activities, all ingress waters (groundwater and rainfall runoff) at the Applicant's landholding have been directed through settlement tanks and discharged into the ditch at the consented discharge point, as covered by Trade Effluent Discharge Licence Ref. 04/2 (*appendix 1*). This ditch gently descends to the northwest to its confluence with the Rathmolyon Stream.

4.4.4.3 Water samples have been collected from the discharge point on a regular basis and submitted for laboratory analysis in order to check for compliance with the limits specified in the consent.

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

4.4.4.5 As shown in the Discharge Effluent Quality Reports, there has been broad compliance with prescribed standards over the assessment period. This suggest that drainage arrangements and settlement infrastructure at the Site over the assessment period have been adequate.

4.4.5 Site Drainage - Impacts that "Are occurring"

4.4.5.1 The layout of the drainage infrastructure is outlined at *section 2.7.3*.

4.4.5.2 The overall surface area of the primary, secondary and tertiary settlement system equates to 3,347 m^2.

4.4.5.3 Correcting for outliers, the peak discharge rates are currently in the region of 2,000-2,100 m^3/day.

4.4.5.4 Therefore, the settlement area (3,347 m^2) exceeds present day requirements; and therefore, in combination with the most recent Discharge Effluent Quality Reports, the system is shown to be adequate in continuing to meet the current discharge standards/ emission limit values (EPA, 2006); and therefore no adverse impacts are currently occurring.

4.4.6 Site Drainage - Impacts that can be "Reasonably expected to occur" in "*Scenario 1*"

4.4.6.1 "*Scenario 1*" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake.

4.4.6.2 Water would not be discharged off Site. No silt settlement would be required and therefore no impacts would occur.

4.4.7 Site Drainage - Impacts that can be "Reasonably expected to occur" in "*Scenario 2*"

4.4.7.1 The layout of the drainage infrastructure is outlined at *section 2.7.3*.

4.4.7.2 The estimated ingress rate at the final development ("*Scenario 2*") is in the region of 2,750 m^3/day.

4.4.7.3 The overall surface area of the primary, secondary and tertiary settlement system equates to 3,347 m^2.

4.4.7.4 In "*Scenario 2*", each settlement stage will continue to be maintained with a minimum operational depth of 1 m.

4.4.7.5 Therefore, the settlement storage provision exceeds what is required under the EPA's Environmental Management Guidelines Environmental Management in the Extractive Industry (Non-Scheduled Minerals).

4.4.7.6 This is a precautionary approach – it allows 24 hours to settle out particles of 0.004 mm (fine silt) or greater.

4.4.7.7 In reality, the grading data for silt samples taken from the settlement system shows that the site-specific fines material is more coarse-grained. The relevant grading data is presented in *appendix 3* ("Week_37_ SILT_Grading", where the 0.020 mm sieve was sufficient for the finest grade).

4.4.7.8 It is noteworthy that the storage requirement of 2750 m^3 is not an instantaneous figure and is progressive as the quarry develops and increases in size, therefore it is a sliding scale requirement, and the full volume will only be required when the void is at maximum proposed extent in "*Scenario 2*". Irrespective of this, the system is already in place, thus delivering excess capacity from an early stage.

4.4.7.9 The water is discharged from the final settlement tanks into a concrete culvert, which connects with an open drainage channel (40 m in length, 3 m in width and 2 m in depth) leading to the consented discharge point, as covered by Trade Effluent Discharge Licence Ref. 04/2 (*appendix 1*).

4.4.7.10 The licence states that all effluent will go through a Klargester Interceptor type NS 15 Class 1 (full retention), unless otherwise agreed in writing with the Licensing Authority. The Applicant has confirmed that the interceptor will be installed within 3 months of receipt of planning consent. Further details are provided in the accompanying s.37L application.

4.5 Risk of Flow Derogation in Surface Watercourses

4.5.1 Tromman Stream

4.5.1.1 Impacts that "Have occurred":

4.5.1.2 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*):

4.5.1.3 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"*.

4.5.1.4 *"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"*.

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

4.5.1.6 Given the lack of any pathway, the development has not posed any risk to the Tromman Stream.

4.5.1.7 Impacts that "Are occurring":

4.5.1.8 No change from what is described above.

4.5.1.9 Impacts that can be "Reasonably expected to occur" in "*Scenario 1*":

4.5.1.10 "*Scenario 1*" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake.

4.5.1.11 Given the lack of any pathway, there would be no risk to Tromman Stream.

4.5.1.12 Impacts that can be "Reasonably expected to occur" in "*Scenario 2*":

4.5.1.13 No change from the impacts what is described that "Have occurred" and that "Are occurring".

4.5.2 Rathmolyon Stream

4.5.2.1 Impacts that "Have occurred":

4.5.2.2 Any ingress waters encountered in the quarry have been discharged into the drainage ditch leading to Rathmolyon Stream (under licence). The impacts of the same are discussed at *section 4.6*.

4.5.2.3 This has provided protection against the risk of drawdown-related impact upon the surface water regime of this watercourse. As such, the development is not considered to have resulted in any drawdown-related impacts at the stream.

4.5.2.4 Impacts that "Are occurring":

4.5.2.5 No change from what is described above.

4.5.2.6 Impacts that can be "Reasonably expected to occur" in "*Scenario 1*":

4.5.2.7 "*Scenario 1*" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake.

4.5.2.8 All de-watering and associated drawdown would cease; and therefore there would be no risk to Rathmolyon Stream.

4.5.2.9 Impacts that can be "Reasonably expected to occur" in "*Scenario 2*":

4.5.2.10 In "*Scenario 2*" (where the SC application and the accompanying s.37L applications are granted as outlined in *section 1.3.4*), the quarry operator will need to lodge an application to vary the licence in order to allow for an increased rate of dewatering. The current licensed rate is 1,400 m^3/day (equivalent to 60 m^3/hr); the estimated ingress rate in "*Scenario 2*" is in the region of 2,750 m^3/day (115 m^3/hr).

4.5.2.11 It is noteworthy that this is comparable with the discharge rates required at Kilsaran 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) at Kilsaran Quarry, "*and therefore an updated discharge licence will be applied for*".

4.5.2.12 *Section 2.7.1* 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.

4.5.2.13 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.

4.5.2.14 The stream has sufficient receiving capacity for the combined discharge rate from Kilsaran Quarry and the Applicant's 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).

4.5.2.15 Given the above, no adverse impact upon the stream is anticipated for this scenario.

4.6 Quality of Water Discharged Off Site

4.6.1 Impacts that "Have occurred":

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

4.6.3 Water samples have been collected from the discharge point on a regular basis and submitted for laboratory analysis in order to check for compliance with the limits specified in the consent.

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

4.6.5 As shown in the above reports, there has been broad compliance with prescribed standards over the assessment period; and therefore no adverse impacts on water quality have been occurring.

4.6.6 Impacts that "Are occurring":

4.6.7 No change from what is described above.

4.6.8 The most recent Discharge Effluent Quality Reports demonstrate that drainage arrangements and settlement infrastructure at the Site are adequate in meeting the current discharge standards/ emission limit values (EPA, 2006); and therefore no adverse impacts on water quality are currently occurring.

4.6.9 Impacts that can be "Reasonably expected to occur" in "*Scenario 1*":

4.6.10 "*Scenario 1*" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake.

4.6.11 There would be no further discharge of trade effluent to Rathmolyon Stream; and therefore, there would be no potential for impacts to occur.

4.6.12 Impacts that can be "Reasonably expected to occur" in "*Scenario 2*":

4.6.13 As outlined previously, 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 Quarry.

4.6.14 "Environmental Management Guidelines: Environmental Management in the Extractive Industry (Non-Scheduled Minerals)", published by the EPA in 2006, is promoted by Government, Planners and the EPA as the lead guidance for good environmental practice in the quarrying industry; and it includes recommendations for emission limit values (ELVs), where appropriate.

4.6.15 Where there are discharges of treated effluent from quarry developments to surface watercourses, the following ELVs are recommended in the above guidance:

- pH less than 9;
- Biochemical oxygen demand (BOD): 25 mg/l;
- Total suspended solids (TSS): 35 mg/l;
- Nitrate (NO_3) 50 mg/l;
- Chemical oxygen demand (COD): 100 mg/l O_2; and,
- Total hydrocarbons: 1 mg/l.

4.6.16 When varying the Applicant's licence ("*Scenario 2*"), the limit for suspended solids should be brought into line with the guidance *i.e.* a practical limit that can be achieved in a limestone quarry setting using industry-standard methodology, without incurring excessive costs; and which is appropriate for the location and hydrological setting, as per the limits stated in the discharge licence for the adjacent Kilsaran Quarry.

4.6.17 In "*Scenario 2*", silt fencing will be erected at the toe of the outer slope of any screening bund when it is under construction. On each new section of screening bund, this silt fencing would be left in place until the slope was seeded and fully-vegetated.

4.7 Protecting Groundwater Quality

4.7.1 Fluids Handling Protocol

4.7.1.1 Impacts that "Have occurred":

4.7.1.2 The operation of mobile and fixed plant presents a risk that pollutants may enter groundwater as a result of hydrocarbon spillage or leakage on Site. Such sources are identified as fuel, lubricating and hydraulic oils.

4.7.1.3 Experience has demonstrated that the risk of such a pollution incident may be minimised by continued adherence to the following measures:

- A code of practice for the refuelling of machinery;
- Operators shall 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) shall be available on Site to cope with a loss equal to the total fluid content of the largest item of plant;
- Following the use of such oil sorbant material, any contaminated materials shall be disposed from Site in accordance with current tipping legislation; and,
- Adequate containment should be provided for all oils stored on the Site, to be equipped with bunds to the relevant regulatory standard.

4.7.1.4 The foregoing measures have been incorporated within the fluids handling protocol that is included here at *appendix 4*.

4.7.1.5 There are no reports or evidence of significant spillages during the assessment period.

4.7.1.6 Impacts that "Are occurring":

4.7.1.7 No change from what is described above.

4.7.1.8 No accidents/ spillages are reported to have occurred; and the quarry has operated in accordance with handling procedures.

4.7.1.9 Impacts that can be "Reasonably expected to occur" in "*Scenario 1*":

4.7.1.10 "*Scenario 1*" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake.

4.7.1.11 There would be no further operation of mobile and fixed plant; and therefore no potential for spillage/ leakage to occur.

4.7.1.12 Impacts that can be "Reasonably expected to occur" in "*Scenario 2*":

4.7.1.13 It is considered that continued adherence to the above measures will provide appropriate mitigation against the potential for derogation of groundwater quality as a result of quarry operations continuing.

4.7.2 Refuelling Process

4.7.2.1 Impacts that "Have occurred":

4.7.2.2 With respect to fuel storage, the Site has operated a two-tier system with road-going vehicles being fuelled from the fully-bunded and enclosed double-skin tanks within the quarry workshop adjacent to the quarry offices.

4.7.2.3 The mobile plant within the void has been fuelled from a mobile fuel tanker. All the remaining machinery in the quarry void is of a mobile nature. Fuel has only been within the perimeter of the Site during the process of refuelling.

4.7.2.4 The fuel for the face excavators and primary crusher has been held and delivered via this double-skinned tanker system. The operatives have been trained in best practice for refuelling of machinery and also in emergency procedures.

4.7.2.5 As above, there are no reports or evidence of significant spillages during the assessment period.

4.7.2.6 Impacts that "Are occurring":

4.7.2.7 No change from what is described above.

4.7.2.8 Refuelling continues to be undertaken in accordance with the above.

4.7.2.9 Impacts that can be "Reasonably expected to occur" in "*Scenario 1*":

4.7.2.10 "*Scenario 1*" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake.

4.7.2.11 There would be no further operation of mobile and fixed plant; therefore, no refuelling, and no associated risk.

4.7.2.12 Impacts that can be "Reasonably expected to occur" in "*Scenario 2*":

4.7.2.13 It is proposed that the Site will continue to be operated in accordance with these systems and procedures.

4.7.3 Concrete Manufacturing Impacts

4.7.3.1 Impacts that "Have occurred":

4.7.3.2 Inspecting historical images from Google Earth (as presented in Chapter 1 of the rEIAR), it is evident that the entirety of the northern extent of the Site had already been fully paved (100% impermeable) prior to April 2009. Surface type and gradient is unchanged by the introduction of the concrete batching plant and ESB substation. Therefore, these new structures do not impact upon the principal factors influencing rainfall runoff; and the drainage characteristics of the yard in July 2013 are consistent with what would "have occurred" previously.

4.7.3.3 The aerial image from July 2016 confirms that, at this time, the concrete manufacturing yard included the concrete batching plant, blockyard and pre-cast manufacturing structure. The yard provided for a paved surface throughout the entirety of the northern extent of the Site, with the storage of concrete blocks occurring on the open yard, immediately to the east of the dominant building.

4.7.3.4 However, only some 8 months later, the aerial image from March 2017 shows that the present layout is in place with the erection of the portal frame extension to the pre-cast manufacturing unit on the eastern element of the concrete yard.

4.7.3.5 Thus, as outlined previously, the concrete manufacturing area of the Site was fully paved (100% impermeable) prior to constructing the new shed.

4.7.3.6 The erection of the portal frame extension has made negligible difference to the rainfall runoff characteristics of the yard. The catchment area of the yard has not expanded; the slope of the yard is unchanged; and the surface material remains 100% impermeable (previously paved area, now rooftop).

4.7.3.7 In fact, a brief qualitative assessment would highlight the following improvements:

- The rate of runoff from the rooftop is throttled by the gutters and downpipes, thus improving the overall attenuation capacity of the water management system; and,
- Runoff from the rooftop is less likely to mobilise suspended solids compared with drainage from the floor of the yard.

4.7.3.8 As such, the development of the elements in the concrete manufacturing part of the Site is not considered to have resulted in any adverse impacts.

4.7.3.9 Impacts that "Are occurring":

4.7.3.10 No change from what is described above.

4.7.3.11 Impacts that can be "Reasonably expected to occur" in "*Scenario 1*":

4.7.3.12 The structures and plant and machinery would be dismantled, and the remediation completed by the removal of the concrete yard; this would involve rock breaking the yard and removal from Site. It is maintained that this remediation would be sufficient to comply with the requirements of the consents to "all plant etc. shall be removed off Site and the area shall be made good."

4.7.3.13 The remediation and restoration are not considered likely to result in any adverse impacts.

4.7.3.14 Impacts that can be "Reasonably expected to occur" in "*Scenario 2*":

4.7.3.15 No change from the impacts what is described that "Have occurred" and that "Are occurring".

4.8 Potential for Impact upon Water Supplies

4.8.1 Impacts that "Have occurred":

4.8.2 The cumulative cone of depression, which developed at Tromman and Kilsaran Quarries between 2003 and 2019, was shown to be *circa* 400 m and 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;
- Zero drawdown at the Cummins borehole, which is some 550 m to the southeast and on the hydraulic up-gradient side of the Site; and,
- 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.

4.8.3 The owners of the above boreholes have not reported any issue with required yield; therefore, there has been no unacceptable impact on the supplies.

4.8.4 Impacts that "Are occurring":

4.8.5 In terms of 3rd-party supplies, monitoring has continued at the Gunning and Regan boreholes as part of the Applicant's scheme.

4.8.6 Cummins borehole is excluded from the schedule on the instructions of the Owner.

4.8.7 The cumulative radius of influence of dewatering drawdown at Tromman and Kilsaran Quarries has enlarged from *circa* 400 m in 2019 (floor level at 27 maOD) to an estimated 510 m in 2023 (sump level at 15-16 maOD).

4.8.8 The Regan borehole has shown about 2 m drawdown in the period 2019-2023. The total drawdown in worst-case conditions (prolonged dry periods) is 18 m since 2003.

4.8.9 The Gunning borehole has experienced closer to 6 m drawdown in the period 2019-2023. The total drawdown in worst-case conditions is 19 m since 2003.

4.8.10 The owners of the Regan and Gunning boreholes have not reported any issue with required yield; therefore, there are currently no unacceptable impact on the supplies.

4.8.11 Impacts that can be "Reasonably expected to occur" in "*Scenario 1*":

4.8.12 "*Scenario 1*" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake.

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

4.8.14 Water levels would rebound in the 3rd-party supplies, returning close to what would have been seen pre-development; and therefore there would be no potential for adverse impacts.

4.8.15 Impacts that can be "Reasonably expected to occur" in "*Scenario 2*":

4.8.16 In "*Scenario 2*" (where the SC application and the accompanying s.37L applications are granted as outlined in *section 1.3.4*), the cumulative radius of influence of dewatering drawdown at Tromman and Kilsaran Quarries would be expected to increase from 510 m in 2023 (sump level at 15-16 maOD) to *circa* 550 m at the final development (floor level at 13 maOD).

4.8.17 Minimum standoff from the final deepest (13-maOD) sinking would equate to 260 m at the Regan borehole; and 330 m at the Gunning borehole. Calculations show that the final drawdown at the Regan borehole in worst-case conditions would result in an additional 3.0-3.5 m cumulative drawdown (with the provision that there should be continued monitoring in view of the heterogeneity of the limestone formations). Taking a precautionary approach, a similar impact might be expected at the Gunning borehole.

4.8.18 Cummins domestic borehole is some 550 m to the southeast and on the hydraulic up-gradient side of the Site, which would be at the outer limit of the predicted radius of influence; therefore, negligible drawdown would be anticipated at this location.

4.8.19 Throughout the operational life of the development ("*Scenario 2*"), the Applicant would continue to check groundwater level in Site piezometers and third-party boreholes on a quarterly basis, subject to agreeing access arrangements.

4.8.20 This would provide early warning in the event that any 3rd party borehole should show signs of an unacceptable decline in yield. To date, the owners of the Regan and Gunning boreholes have not reported any issue with required yield despite the specified drawdown.

4.8.21 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*, revised 2013.

4.8.22 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.

4.8.23 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).

4.8.24 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.

4.8.25 In the eventuality that a shortfall in yield is confirmed post-monitoring, 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.

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

4.8.27 The fall-back position would be the provision of a replacement supply *e.g.* mains water. The quarry operators (Applicant and Kilsaran) would have to cover the costs for mains water usage at any property where the water supply is affected by the cumulative quarry development. *Appendix 5* includes an extract from the Irish Water Web Map, showing the extent of the mains water distribution network.

4.8.28 If a borehole supply has been derogated by quarry dewatering, it is envisaged that the supply would 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.

4.8.29 Water quality at local abstractions would 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 2.8.3* and *4.2.5*).

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.

4.9.5 Subject to the continuation of the control measures specified in this report (*e.g.* ongoing monitoring of water quality and levels, provision and maintenance of the settlement system, continued adherence to fuel handling protocols *etc*), it is considered that no adverse impacts have occurred or are occurring.

4.10 "*Scenario 1*" (SC and s.37L applications are not granted)

4.10.1 "*Scenario 1*" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake.

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

4.10.3 In this scenario, all impacts associated with dewatering drawdown and discharge activities would therefore cease.

4.11 Summary Impact & Mitigation Schedule

Feature	*Origin of impact*	*Impact*	*Significance and duration of impact*	*Probability (in absence of mitigation)*	*Proposed mitigation / surveillance monitoring*	*Residual impact*
Groundwater-Dependent Features	Increase in quarry dewatering.	**"Have occurred"**: Averaged across the monitoring period 8th April to 16th December 2019, the daily rate of dewatering equated to 1,370 m^3/day. The cumulative radius of influence for Tromman and Kilsaran Quarries was *circa* 400 m. **"Are occurring"**: The peak discharge rates are currently in the region of 2,000-2,100 m^3/day. The cumulative radius of influence for Tromman and Kilsaran Quarries is around 510 m. **"Reasonably expected to occur"**: The total discharge requirement at the final development ("*Scenario 2*") is estimated at 2,750 m^3/day. The cumulative radius of influence for Tromman and Kilsaran Quarries is likely to be in the region of 550 m.	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 has not been impacted by the drawdown of the groundwater table in the limestone bedrock at depth. Any drawdown-related impact upon Rathmolyon Stream is being counterbalanced by the consented discharge process, whereby water from the quarry sump is directed into the at-risk section of stream in accordance with the Discharge Licence. The closest 3rd party water supplies are the Regan borehole (which has experienced 18 m drawdown in worst-case conditions since 2003); and the Gunning borehole (19 m drawdown in worst-case conditions since 2003). In **"*Scenario 1*"**, water levels would rebound in the 3rd-party supplies, returning close to what would have been seen pre-development. In **"*Scenario 2*"**, these boreholes are at risk of an additional 3.0-3.5 m cumulative drawdown. This will last for the duration of quarrying activities.	Probable increase in drawdown at the Regan and Gunning boreholes.	**"*Scenario 1*"** would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake. It is considered that a lake level of some 65 maOD +/-2m (subject to seasonal variation) would be established within the abandoned workings. In **"*Scenario 2*"**, the Applicant would continue to check groundwater level in Site piezometers and third-party boreholes on a quarterly basis, subject to agreeing access arrangements. In the eventuality that a shortfall in required yield is confirmed post-monitoring, 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. The fall-back position would be the provision of a replacement supply *e.g.* mains water.	In **"*Scenario 1*"** and **"*Scenario 2*"**: At the time of restoration, quarry dewatering operations would be terminated, and the quarry void would fill with water to form a lake. It is considered that a lake level of some 65 maOD +/-2m (subject to seasonal variation) would be established within the abandoned workings. It is envisaged that any drawdown at third-party borehole supplies will be reversed when the quarry is allowed to flood with water at the cessation of extraction.

	Continued operation of mobile and fixed plant.	**"Have occurred", "Are occurring" and "Reasonably expected to occur":** The operation of mobile and fixed plant presents a risk that pollutants may enter groundwater as a result of hydrocarbon spillage or leakage on Site.	The likely significant effect (scale / likelihood of occurrence) or consequences of groundwater contamination will not be materially increased in "***Scenario 1***" or "***Scenario 2***". This will last for the duration of quarrying activities.	Possible derogation of groundwater quality resulting from accidental spillages and / or undetected long-term leakage.	Precautionary procedures have been implemented for the protection of groundwater quality; by minimising the likelihood of occurrence in the first instance, and specification of reactive measures for the management of accidental spillage and / or long-term leakage of fuel, lubricating or hydraulic oils should this occur.	In "***Scenario 1***" and "***Scenario 2***": Upon the completion of extraction, all mobile and fixed plant will be removed from site.
Surface Water Features	Increase in dewatering discharge rate.	**"Have occurred":** The total discharge requirement has increased from 1,370 m^3/day in 2019 up to 2,000-2,100 m^3/day at present day. **"Are occurring":** The total discharge requirement is up to 2,000-2,100 m^3/day at present day. **"Reasonably expected to occur":** "***Scenario 1***" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake. In "***Scenario 2***", the estimated rate would be 2,750 m^3/day (115 m^3/hr). This is comparable with the discharge rates required at Kilsaran Quarry. *Reference 12* (SLR 2017) allows for an average rate of 121 m^3/hr.	Rathmolyon Stream has sufficient receiving capacity for the combined discharge rate from Kilsaran Quarry and the Applicant's development. The combined rate is *circa* 250 m^3/hr, equivalent to 0.070 m^3/s. Added to Q5 in the stream (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). This will last for the duration of quarrying activities.	In ***"Scenario 1"***, water would not be discharged off Site. No silt settlement would be required. In ***"Scenario 2"***, quarry ingress waters (having been attenuated in the sump) will be directed into the pre-existing water management system in a continuation of current practice; and will be discharged in accordance with the standards specified in the Discharge Licence 04/2, dated 2004, issued by Meath County Council.	The current licensed rate is 1,400 m^3/day. In "*Scenario 2*", this would need to be varied to accommodate the total discharge requirement at the final development, which is estimated at 2,750 m^3/day. The current limit for suspended solids is 1 mg/l, whereas Licence 14/04 (issued June 2014) allows for 20 mg/l at Kilsaran Quarry (and national guidance for quarries is 35 mg/l). This would need to be addressed when the licence is varied.	In "***Scenario 1***" and "***Scenario 2***": Upon the completion of extraction, the dewatering pumps will be turned off and the discharge of trade effluent will cease.
	Construction of screening bunds.	**"Have occurred", "Are occurring" and "Reasonably expected to occur":** Creation of any bund on the margins of the Application Area for screening or soils/overburden storage.	In ***"Scenario 1"***: no new bunds would be erected. In "***Scenario 2***": When the bund is under construction, there would be a risk that suspended solids would become entrained within runoff going onto peripheral lands. This would last until the outer slope of the bund is seeded and fully-vegetated.	Possible	In ***"Scenario 1"***: no new bunds would be erected. In "***Scenario 2***": Silt fencing would be erected at the toe of the outer slope of any screening bund when it is under construction. On each new section of screening bund, this silt fencing would be left in place until the slope is seeded and fully-vegetated.	In ***"Scenario 1"***: no new bunds would be erected. In "***Scenario 2***": Use of silt fencing means there would be negligible likelihood of surface water quality derogation resulting from fugitive suspended solids entrained within runoff onto peripheral lands.

	Drainage at the concrete manufacturing yard	**"Have occurred", "Are occurring" and "Reasonably expected to occur":** The entirety of the northern extent of the Site had already been fully paved (100% impermeable) prior to April 2009	**"Have occurred", "Are occurring" and "Reasonably expected to occur":** Surface type and gradient is unchanged by the introduction of the concrete batching plant and ESB substation	**"Have occurred", "Are occurring" and "Reasonably expected to occur":** The drainage characteristics of the yard in July 2013 are consistent with what would "have occurred" previously.	The rate of runoff from the rooftop is throttled by the gutters and downpipes, thus improving the overall attenuation capacity of the water management system. Runoff from the rooftop is less likely to mobilise suspended solids compared with drainage from the floor of the yard.	In "*Scenario 1*" and "*Scenario 2*": At restoration, the structures and plant and machinery can be dismantled, and the remediation completed by the removal of the concrete yard. This would be sufficient to comply with the requirements of the consents whereby "all plant etc. shall be removed off site and the area shall be made good."
	Flood risk posed to Site	**"Have occurred", "Are occurring" and "Reasonably expected to occur":** Risk of fluvial or surface water flooding.	**"Have occurred", "Are occurring" and "Reasonably expected to occur":** The application area is not vulnerable to either fluvial or surface water flooding applying either present-day or anticipated climate-change scenarios.	There is no risk of fluvial flooding. There is a very limited risk of surface water flooding in the Application Area. During the 100-year storm event, all ingress water would drain under gravity into the primary sump, which has a volume of approximately 27,000 m^3 (sufficient for the design storm). The development is classed as Water-Compatible in terms of fluvial flooding and is equally applicable to the risk posed by storm runoff.	In *"Scenario 1"*, water would not be discharged off Site. In "*Scenario 2*": Quarry ingress waters (having been attenuated in the sump) would continue be directed into the pre-existing water management system in a continuation of current practice; and would be discharged in accordance with the standards specified in the Discharge Licence 04/2.	In "*Scenario 1*" and "*Scenario 2*": At the time of restoration, quarry dewatering operations would be terminated, and the quarry void would fill with water to form a lake. A lake level of some 65 maOD +/-2m (subject to seasonal variation) would be established within the abandoned workings.
	Off-Site flood risk posed by Site	**"Have occurred", "Are occurring" and "Reasonably expected to occur":** Risk of uncontrolled runoff from quarry.	**"Have occurred", "Are occurring" and "Reasonably expected to occur":** Storm runoff will continue to be detained upon the quarry floor. Due to its morphology as a closed depression within the landscape, there is no uncontrolled run-off entering any surface watercourse or impacting upon neighbouring land.	"*Scenario 1*" would involve the cessation of quarry dewatering operations, and the quarry void would fill with water to form a lake. It is considered that a lake level of some 65 maOD +/-2m (subject to seasonal variation) would be established within the abandoned workings; and the storm balancing would occur within the +/-2m zone of fluctuation. In "*Scenario 2*": During intense and prolonged rainfall, storm runoff will continue to collect in the sump on the quarry floor, be settled out and discharged in accordance with the standards specified in the Discharge Licence 04/2.	In *"Scenario 1"*, water would not be discharged off Site. In "*Scenario 2*": The quality of the water being discharged off site will continue to comply with the limits specified by Discharge Licence 04/2. The licence would be varied to accommodate the total discharge requirement at the final development, which is estimated at 2,750 m^3/day. The current limit for suspended solids is 1 mg/l, whereas Licence 14/04 (issued June 2014) allows for 20 mg/l at Kilsaran Quarry (and national guidance for quarries is 35 mg/l). This would need to be addressed when the licence is varied.	In "*Scenario 1*" and "*Scenario 2*": Upon the completion of extraction, the dewatering pumps will be turned off and the discharge of trade effluent will cease.

5 CONCLUSIONS

5.1 Published guidance[2], which details the criteria for ranking the importance of hydrological and hydrogeological features (low / medium / high / very high / extreme) and assessing the magnitude of impact (negligible / small / moderate / large adverse), has allowed for judging the significance of impact (imperceptible / slight / moderate / significant / profound).

5.2 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).

5.3 The Waulsortian Limestone is a Locally important aquifer, moderately productive only in local zones" (Ll). The quarry does not overlap with any Source Protection Areas. Using the IGI guidance, the aquifer is shown to be of 'Medium' importance.

5.4 Impacts that "Have occurred":

5.5 Looking at the cumulative cone of depression that has developed at the existing quarry complex (*i.e.* the Applicant's quarry and Kilsaran Quarry, taken together), the bulk of the drawdown is considered to have been established between 2003 and 2009 *i.e.* during previous phases of quarrying, when working the upper benches ("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").

5.6 Impacts that "Are occurring":

5.7 The current radius of influence (based upon actual observed distance-drawdown readings) is shown to equate to *circa* 510 m. This is the cumulative impact of the two existing quarries.

5.8 Impacts that "Reasonably expected to occur":

5.9 At the final development ("*Scenario 2*"), the cumulative radius of influence would be expected to increase to 550 m.

5.10 The Waulsortian Limestone belongs to the Longwood Groundwater Body (GWB), which covers an area of 50 km^2. Thus, the development has only involved the removal of a small proportion of aquifer, with minor change to the extant configuration of the aquifer (bearing in mind that the unsaturated zone has already been removed by the pre-existing development).

5.11 Given the above factors, the magnitude of impact on the Hydrogeology Attribute is 'Small Adverse', therefore the significance of impact is within acceptable range, being rated as 'Slight'.

5.12 In *"Scenario 1"*, water would not be discharged off Site.

[2] Institute of Geologists of Ireland (IGI 2013) 'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements'.

5.13 In "*Scenario 2*", the quarry operator would need to lodge an application to vary the existing licence (Discharge Licence 04/2) in order to allow for an increased rate of dewatering. The current licensed rate is 1,400 m^3/day (equivalent to 60 m^3/hr); the estimated ingress rate at the final development would 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.

5.14 The current limit for suspended solids is 1 mg/l, whereas Licence 14/04 (issued June 2014) allows for 20 mg/l at Kilsaran Quarry (and national guidance for quarries is 35 mg/l). This would need to be addressed when the licence is varied.

5.15 In terms of potential hydrological receptors, there is no hydraulic continuity between the groundwater in the bedrock as encountered at the quarry, and the Tromman Stream. Therefore, with respect to the Tromman Stream and associated SAC, no impacts **"Have occurred", "Are occurring"** and no impacts are **"Reasonably expected to occur"** due to the drawdown of the groundwater table in the limestone bedrock at depth.

5.16 Any drawdown-related impact upon Rathmolyon Stream is counterbalanced by the consented discharge process, whereby water from the quarry sump is directed into the at-risk section of stream in accordance with the Discharge Licence. This applies when considering impacts that **"Have occurred", "Are occurring"** and are **"Reasonably expected to occur".**

5.17 **Impacts that "Have occurred" and "Are occurring":** The closest 3rd party water supplies are the Regan borehole (with 18 m drawdown in worst-case conditions since 2003); and the Gunning borehole (19 m drawdown in worst-case conditions since 2003).

5.18 **"Reasonably expected to occur":**

5.19 In "*Scenario 1*", water levels would rebound in the 3rd-party supplies, returning close to what would have been seen pre-development.

5.20 At the final development ("*Scenario 2*"), these boreholes are at risk of an additional 3.0-3.5 m cumulative drawdown.

5.21 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) would mean that these findings can be reviewed and refined in the event that the SC application and the accompanying s.37L applications are granted ("*Scenario 2*").

5.22 In the eventuality that a shortfall in yield is confirmed post-monitoring, the first step towards tackling a shortfall in the required yield would be to pump at a lower rate but for longer hours; and provide a larger storage tank.

5.23 The fall-back position would be the provision of a replacement supply *e.g.* mains water.

5.24 At the time of restoration ("*Scenario 1*" and "*Scenario 2*"), quarry dewatering operations would be terminated, and the quarry void would fill with water to form a lake. It is considered that a lake level of some 65 maOD +/-2m (subject to seasonal variation) would be established within the abandoned workings.

5.25 In view of the findings of assessment and the planned approach to future development, which includes specific measures for the continued protection of the water environment, there are considered to be no over-riding hydrogeological or hydrological reasons for not granting Substitute Consent.

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Keegan Quarries Limited

Tromman Quarry

Tromman, Rathmolyon, Co. Meath

Planning Application for Substitute Consent for Unauthorised development on lands at Tromman Quarry

Hydrogeological and Hydrological Impact Assessment

December 2023

Appendix 1 Trade Effluent Discharge Licence Ref. 04/2

BCL HYDRO
Consultant Hydrogeologists Limited

Technology Centre, Wolverhampton Science Park, Glashier Drive, Wolverhampton
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email: info@bclhydro.co.uk, web: http://www.bclhydro.co.uk
Registered Office: 33, Wolverhampton Road, Cannock, West Midlands, WV11 1AP
Registered in England & Wales. Company Registration Number: 4043373

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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

Planning Application for Substitute Consent for Unauthorised development on lands at Tromman Quarry

Hydrogeological and Hydrological Impact Assessment

December 2023

Appendix 2 Flow Rate Data at Discharge Point

BCL HYDRO
Consultant Hydrogeologists Limited

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email: info@bclhydro.co.uk, web: http://www.bclhydro.co.uk
Registered Office: 33, Wolverhampton Road, Cannock, West Midlands, WV11 1AP
Registered in England & Wales. Company Registration Number: 4043373

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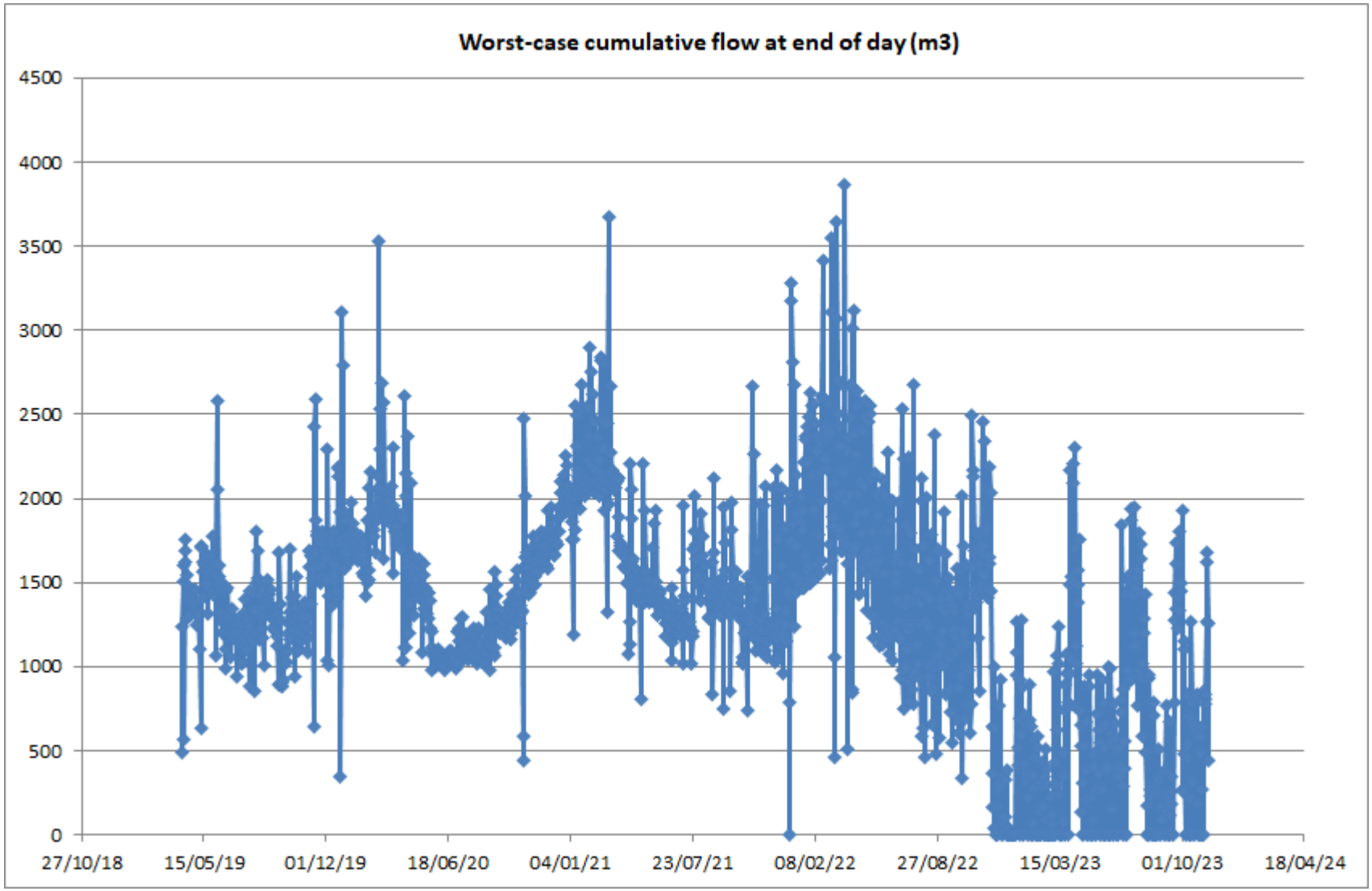
Worst-case cumulative flow at end of day (m3)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
27/10/18
15/05/19
01/12/19
18/06/20
04/01/21
23/07/21
08/02/22
27/08/22
15/03/23
01/10/23
18/04/24

Keegan Quarries Limited

Tromman Quarry

Tromman, Rathmolyon, Co. Meath

Planning Application for Substitute Consent for Unauthorised development on lands at Tromman Quarry

Hydrogeological and Hydrological Impact Assessment

December 2023

Appendix 3 Grading Data for Silt Samples taken from the Settlement System

BCL HYDRO
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email: info@bclhydro.co.uk, web: http://www.bclhydro.co.uk
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Registered in England & Wales. Company Registration Number: 4043373

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KEEGAN QUARRIES LTD
CONCRETE, STONE & PRE-CAST PRODUCTS

Grading of Fine Aggregates by washing and sieving method

Week No. 37

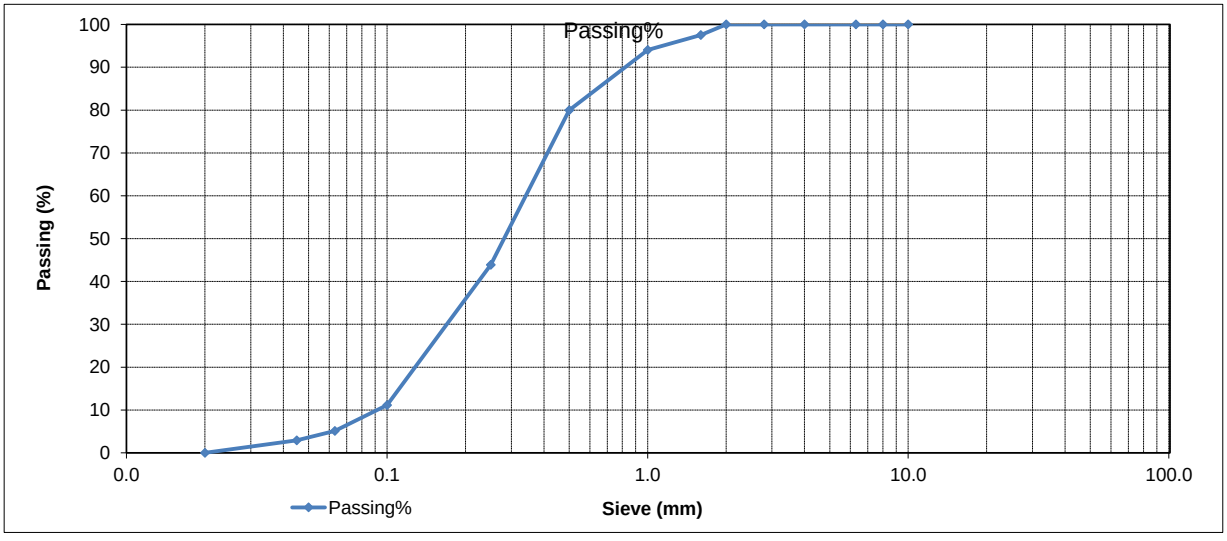
Sample No. AG134

Material:	***SILT***	Standard testing:	*IS EN 933-1*
Sampling date:	*09 September 2020*	Standard Specification:	
Testing date:	*10 September 2020*	Source of material:	*Trammon Quarry*
Sample location:	*Quarry Tank*		

Wet w. of sample - a	(g)	
Dry w. of sample - b	(g)	241.3
Washed Dry Weight of sample - c	(g)	121.0

Fineness Modulus	**3.43**
Moisture content	

Sieve (mm)	Retained (g)	Cumulative Retained (%)	Cumulative Passing (%)	Specification limits Table 5 S.R. 16:2016	
				min%	max%
10	0.0	0.0	**100.0**		
8.0	0.0	0.0	**100.0**		
6.3	0.0	0.0	**100.0**		
4	0.0	0.0	**100.0**		
2.8	0.0	0.0	**100.0**		
2.0	0.0	0.0	**100.0**		
1.6	3.0	2.5	**97.5**		
1.0	4.2	6.0	**94.0**		
0.500	17.0	20.0	**80.0**		
0.250	43.7	56.1	**43.9**		
0.100	39.6	88.8	**11.2**		
0.063	7.3	94.9	**5.1**		
0.045	2.7	97.1	**2.9**		
0.020	3.5	100.0	**0.0**		
PAN < 0.020	0.0	100.0			



Remarks:

Tested by: **J.K.** *(LT)* Date: 10/09/2020

Checked by: **J.K.** *(QM)* Date: 10/09/2020

Keegan Quarries Limited

Tromman Quarry

Tromman, Rathmolyon, Co. Meath

Planning Application for Substitute Consent for Unauthorised development on lands at Tromman Quarry

Hydrogeological and Hydrological Impact Assessment

December 2023

Appendix 4 Fluids Handling Protocol

BCL HYDRO
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Registered in England & Wales. Company Registration Number: 4043373

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Introduction
Inappropriate storage and handling of fuels and oils can result in contamination of ground, groundwater and surface water.

This procedure covers:
Bulk storage of fuels and oils, including waste oil
Filling of bulk storage tanks
Storage and handling of drums
Refuelling operations
Procedure for emptying bunded areas
Fuel and oil spills

Bulk storage of fuels and oils, including waste oil
1. All fuels and oils in bulk shall be kept in bunded storage, the location of which shall be identified on a site plan.
2. The walls and floor of storage bunds must be impervious to oil.
3. Tank filling points shall be inside the bunded area.
4. Delivery lines shall be overhead or, if underground, sleeved.
5. Delivery nozzles shall be stored inside the bund and locked when not in use.
6. Bund drain valves, where fitted, shall be designed so that they can only be removed by key or handheld tool, except when emptying the bund under controlled conditions.
7. All bulk storage tanks shall be appropriately labelled with contents and capacity.
8. Spill kits shall be provided close to hand.
9. Bunded areas shall be checked weekly for build-up of oil residues, rainwater or debris.
10. The inside of the bund shall have a line painted to identify when 10% of the capacity has been filled by rainwater etc.

Filling of bulk storage tanks
1. A member of site staff must supervise all tank filling operations.
2. Storage tank levels must be checked to gauge spare capacity before starting filling operations.
3. Check delivery hoses and hose connections for leaks.
4. Report spillages and leaks and clean them up promptly, disposing of waste correctly according to the requirements of prevailing regulation(s).

Storage and handling of drums
1. All drums and containers used for the storage of fuels and oils, including waste oil, shall be appropriately labelled and kept in designated areas identified on a site plan. This will include temporary storage areas.
2. All drums or containers will be kept in bunded storage or on bund trays. This will include temporary storage.
3. Where drum taps are fitted these should be secure. The tap should be positioned over a bund tray to collect drips and spillage.
4. No drum shall be stored in the open without a drum cap fitted.
5. Drums shall be secured when moving them about the site.
6. Report spillages and leaks and clean them up promptly.
7. Spill kits shall be provided.
8. Drum storage areas shall be checked weekly for evidence of poor practice.

Refuelling operations

1. The person refuelling the vehicle must be present throughout the entire refuelling operation.
2. Check vehicle fuel tank level before starting refuelling operations to gauge how much fuel is required.
3. Check delivery hose from the pump / tank to the nozzle for leaks.
4. All delivery nozzles shall be fitted with an automatic cut-out to prevent over-filling.
5. Ensure the delivery nozzle is held upright when moving between storage tank and vehicle.
6. Operatives should be prepared to react to any gas oil splashing out whilst re-fuelling.
7. Fuel delivery nozzles shall be locked or similarly disabled when not in use.
8. Report spillages and leaks and clean them up promptly.

Procedure for emptying bunded areas

1. Authority of site management is required before emptying a bund.
2. Details of bund emptying shall be recorded and maintained on site.
3. If the contents of the bund include floating oil, then the water underneath this oil should be carefully pumped out through the hydrocarbon interceptor. The remaining oil coated water should be collected and disposed of through a licensed contractor.
4. The reason for bund contamination shall be investigated.

Fuel and oil spills

1. Any spillage that cannot be cleaned up promptly with a rag or use of a shovel full of absorbent material must be reported to the site manager or his designated deputy who will co-ordinate the response and investigate the cause.
2. Spills to ground shall be absorbed and prevented from spreading by using absorbent materials such as sand, fines, absorbent mats, paper or cloth.
3. Halt the movement of fuel or oil towards a watercourse by creating a barrier in front of it by sand bagging, deployment of absorbent boom or use of 3mm or finer dust.
4. If oil enters a watercourse, prevent it spreading by deploying an absorbent boom.
5. If spilt oil or fuel leaves the site the Quarry Manager must inform the NIEA.
6. Contaminated materials from clean-up should be put in an appropriately labelled container and disposed of through a licensed contractor in line with regulatory requirements.

Keegan Quarries Limited

Tromman Quarry

Tromman, Rathmolyon, Co. Meath

Planning Application for Substitute Consent for Unauthorised development on lands at Tromman Quarry

Hydrogeological and Hydrological Impact Assessment

December 2023

Appendix 5 Extract from Irish Water Web Map

BCL HYDRO
Consultant Hydrogeologists Limited

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Registered Office: 33, Wolverhampton Road, Cannock, West Midlands, WV11 1AP
Registered in England & Wales. Company Registration Number: 4043373

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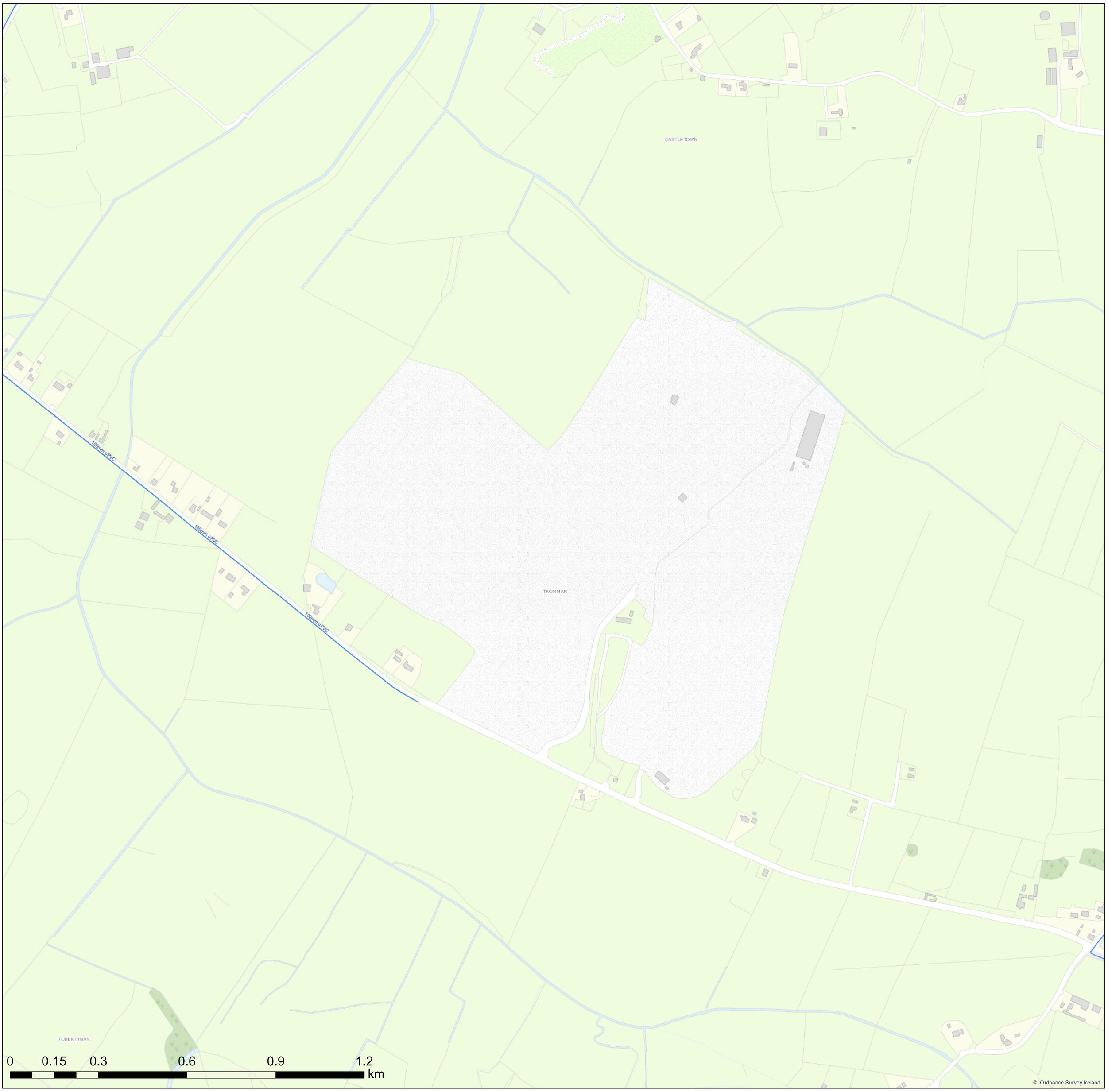
Irish Water Web Map



Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

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