



Appropriate Assessment Screening & Natura Impact Statement Report

Cam Quarry Continuance of Use

Roadstone Ltd.

Cam Quarry, Brideswell, Co. Roscommon

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Basis of Report

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Table of Contents

Basis of Report	i
Acronyms and Abbreviations	vi
1.0 Introduction	1
1.1 Background	1
1.2 Project Overview	1
1.3 Site Description	1
1.4 Report Purpose	2
1.5 Relevant Legislation and Policy	2
1.6 Statement of Authority	2
2.0 Methodology	4
2.1 General Approach	4
2.2 Baseline Information	4
2.2.1 Ecological Desk Study	4
2.2.2 Field Survey	4
2.3 AA Screening Methodology	5
2.4 Sources of Information	6
2.4.1 For the Project Alone	6
2.4.2 For the Project in Combination	6
3.0 AA Screening	7
3.1 Management of any European Site	7
3.2 Project Description	7
3.2.1 The Project	7
3.2.2 The Project Site	19
3.3 Potential Impact Factors	20
3.4 Identification of Relevant European sites	21
3.5 Likely Significant Effects	36
3.5.1 For the Project Alone	36
3.5.2 For the Project in Combination	37
3.6 AA Screening Conclusion	38
4.0 Natura Impact Assessment	39
4.1 Introduction	39
4.2 Information on the Project	39
4.2.1 The Project	39
4.2.2 The Project Site	39
4.3 Information on European Sites	41



4.3.1 Lough Croan Turlough SAC (000610)	42
4.3.2 Castlesampson Esker SAC (001625)	42
4.3.3 Lough Croan Turlough SPA (004139)	43
4.3.4 River Suck Callows SPA (004097)	44
4.4 Potential for Adverse Effects on the Integrity of European Sites	46
4.4.1 Relevant Groundwater Information	46
4.4.2 Summary of Known Threats and Pressures	47
4.4.3 Summary of the Assessment	47
4.5 Mitigation and Monitoring Measures	48
4.5.1 Mitigation by Design	48
4.5.2 Additional Mitigation Measures	48
4.5.3 Monitoring Measures	51
4.5.4 Mitigation and Monitoring Summary	53
4.5.5 Residual Effects on the Integrity of European Sites	55
5.0 Conclusion	55
6.0 References	56
Figures	58

Tables in Text

Table 3-1: Positive and High-Quality Indicator Species for Annex I Semi-Natural Dry Grassland on Calcareous Substrates Present in the Southern Area of the Site	20
Table 3-2: Description of European sites with Potential S-P-R Links	22
Table 4-1: Positive and High-Quality Indicator Species for Annex I Semi-Natural Dry Grassland on Calcareous Substrates Present in the Southern Area of the Site	39
Table 4-2: Indicative Schedule of Environmental Monitoring for Water	52
Table 4-3: Summary of mitigation measures to be implemented for the proposed project ...	53
Table 6-1: European Sites with Threats and Pressures	C-1
Table 6-2: Qualifying Interests of SACs that have undergone assessment including summaries of current threats and sensitivities	C-4
Table 6-3: Conservation objectives and targets for relevant QI with potential for adverse effects on the integrity of Lough Croan Turlough SAC [000610]	C-7
Table 6-4: Conservation objectives and targets for relevant QI with potential for adverse effects on the integrity of Castlesampson Esker SAC [001625]	C-9
Table 6-5: Conservation objectives and targets for relevant QI with potential for adverse effects on the integrity of Lough Croan Turlough SPA (004139)	C-12
Table 6-6: Conservation objectives and targets for relevant QI with potential for adverse effects on the integrity of River Suck Callows SPA (004097)	C-15
Table 6-7: Ecological pathways for each Qualifying Interests and the associated rationale as supported by relevant literature	D-24



Table 6-8: Ecological pathways for each Special Conservation Interest species and the associated rationale as supported by relevant literature	D-25
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Appendices

Appendix A Relevant Legislation and Policy

A.1 Relevant Legislation and Policy

A.1.1 Habitats and Birds Directives

A.1.2 European Communities (Birds and Natural Habitats) Regulations 2011

A.1.3 Planning and Development Act 2000 (as amended)

A.1.4 National Planning Framework

Appendix B Appropriate Assessment Process

B.1 Appropriate Assessment Process

B.1.1 Stage One: AA Screening

B.1.2 Stage Two: Appropriate Assessment

Appendix C European Sites Data

C.1 European Site Information

C.1.1 Site Synopses Sheets for each European Site

C.1.2 SSSCOs for each European Site

C.2 Further information on the SACs and SPAs that have undergone assessment

C.3 Further information on the Qualifying Interests of SACs and SPAs that have undergone assessment

C.3.1 Further information on the Qualifying Interests of SACs

C.3.2 Further information on the Qualifying Interests of SPAs

C.4 Potential Effects to the COs of Screened In European Sites

C.4.1 Lough Croan Turlough SAC

C.4.2 Castleampson Esker SAC

C.4.3 Lough Croan Turlough SPA

C.4.4 River Suck Callows SPA

Appendix D Relevant Information

D.1 Pathway Considerations to inform the Zone of Influence for each of the Qualifying interests and Special Conservation Interests

D.2 Relevant Figures

D.3 EIAR Chapter 2 – Project Description

D.4 EIAR Chapter 7 – Water (Hydrology & Hydrogeology Information)

D.4.1 GSI Groundwater Vulnerability Rating (Table 7-4 from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))

D.4.2 Summary of groundwater level logger data (August 2023 – April 2025)

D.4.3 Summary of manual groundwater levels (August 2023 – April 2025)



- D.4.4 Groundwater levels at on-site boreholes and on-site rainfall (chart 7-1 from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))
- D.4.5 Groundwater quality 05/08/2023 (extracted from Table 7-16 from from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))
- D.4.6 Groundwater quality 11/01/2024 (extracted from Table 7-17 from from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))
- D.4.7 Groundwater quality 08/10/2024 (extracted from Table 7-18 from from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))
- D.4.8 Surface water quality results screened (extracted from Table 7-22 from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))
- D.4.9 Significance of Impacts extracted from Table 7-15 from the EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology)
- D.5 EIAR Water Chapter 7 Addendum



Acronyms and Abbreviations

AA	Appropriate Assessment
ABP	An Bord Pleanála
AOD	Above Ordnance Datum
CIEEM	Chartered Institute of Ecology and Environmental Management
CO	Conservation Objectives
db	Decibels
DoEHLG	Department of Housing, Local Government and Heritage
EclA	Ecological Impact Assessment
EIAR	Ecological Impact Assessment Report
EMS	Environmental Management System
EPA	Environmental Protection Agency
EWMP	Extractive Waste Management Plan
GSI	Geological Survey Ireland
GWB	Groundwater body
ha	Hectares
HGV	Heavy Goods Vehicle
ICR	Irish Concrete Federation
ITM	Irish Transverse Mercator
LSE	Likely Significant Effect(s)
m	Metres
NIS	Natura Impact Statement
NPWS	National Parks and Wildlife Service
QF	Qualifying Feature
QI	Qualifying Interest
SAC	Special Area of Conservation
SCI	Special Conservation Interest
SLR	SLR Environmental Consulting (Ireland) Ltd
SPA	Special Protection Area
S-P-R	Source-Pathway-Receptor
SSCO	Site-specific Conservation Objectives
WFD	Water Framework Directive
WWTS	Waste Water Treatment System



1.0 Introduction

1.1 Background

SLR Environmental Consulting (Ireland) Ltd (SLR) was commissioned by the Roadstone Limited, to prepare an Appropriate Assessment (AA) Screening / Natural Impact Statement (NIS) report to accompany a planning application for the continuance of use of Cam Quarry, Brideswell, Co. Roscommon, hereafter referred to as “the Site”.

1.2 Project Overview

With respect to the proposed design amendments, the proposed development will consist of:

- Permission for continued use of the existing quarry development currently permitted by P. Ref. 04/1479 and ABP PL20.215417 for a further period of 10 years, within an application area of c. 66.3 hectares (ha), with an extraction area of c. 12.9 ha and permanent overburden storage area of c. 2.9 ha.
- Permission for continued use of the permitted facilities consisting of: ESB substation (26m²), portacabin office facilities including canteen and washroom facilities (91m²), bunded fuel storage, vehicle circulation/access including wheelwash and weighbridge, settlement tanks/hydrocarbon interceptors for treatment of water, construction of overburden and screening mounds, all other associated site works and ancillary activities.
- Permission for continued extraction of limestone using conventional blasting techniques and processing of rock using crushing and screening plant.
- Upgrade of the existing Waste Water Treatment System (WWTS) and percolation area to new Secondary WWTS and constructed soil polishing filter area.
- Provision of the permitted concrete batching plant, truck washdown facility with wash water recycled via a closed settlement tank system, the storage of aggregates; and
- Restoration of the overall application site to a natural habitat including a seasonal waterbody.

No further extraction or development works will be undertaken on areas of currently undisturbed lands within the application site, i.e. all proposed development will be contained within existing disturbed areas where topsoils have already been removed, with the result that no grasslands, including any potential Annex I grassland habitat, will be affected.

1.3 Site Description

The site is located within the townlands of Curry and Cloonacaltry, about 4 km to the west of Brideswell, and c. 12 km west of Athlone, Co. Roscommon. The Site is currently being used as an active limestone quarry, with areas of semi-natural grassland and scrub surrounding the existing quarry and more extensive areas in the southern area of the quarry extension area. Refer to **Drawing FI-5** for the habitat map overlaid with the proposed revised development plan.

The existing quarry extraction area occupies the central part of the site and currently consists of a 2 no. working faces typically 10-15m in height. Current ground levels over the quarry floor range from c. 70-85m Above Ordnance Datum (AOD). The extraction area is currently c. 8.4 ha within an overall permitted extraction area of c. 23.7 ha. Previously stripped soils and overburden have been used to construct perimeter screening berms.

Over the southern portion of the site, an area of c. 2.9 ha is currently covered with stripped overburden from the site with the remainder of the area still in its natural state of a mosaic of



semi-natural grasslands, scrub and gorse. This area is currently permitted under P. Ref. 04/1479 for both rock extraction and overburden storage.

1.4 Report Purpose

The purpose of this report is to provide the information for the Competent Authority, in this case Roscommon County Council, to carry out a screening assessment for likely significant effects on European sites resulting from the proposed continued use of the existing permitted development, in accordance with and fulfillment of the requirements of Article 6 of the Habitats Directive and derived Regulations.

1.5 Relevant Legislation and Policy

The requirement for AA screening and AA is set out in the Habitats Directive (Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, which is transposed into Irish law primarily through the European Communities (Birds and Natural Habitats) Regulations 2011 –21, (S.I. 477 of 2011, as amended) (“Birds and Natural Habitats Regulations”) and the Planning and Development Acts 2000 -22. Further details are provided in **Appendix A**.

1.6 Statement of Authority

SLR Project Ecologist Victoria Molloy prepared this report and SLR Associate Ecologist Michael Bailey carried out the technical review.

Victoria Molloy holds a BSc. in Zoology from the University of Galway. She has three years’ experience as a consultant ecologist and is a Qualifying Member of the Chartered Institute of Ecology and Environmental Management (CIEEM). Victoria has prepared a wide range of impact assessment reports including biodiversity chapters for Environmental Impact Assessment Report (EIAR), Ecological Impact Assessment Reports (EclA), Appropriate Assessment (AA) screening reports, and NIS for a variety of projects including quarries, forestry licence applications, housing, road, and industrial developments.

Michael Bailey holds a BSc (Hons) in Biology and Ecology from the University of Ulster, and an MSc in Quantitative Conservation Biology from the University of the Witwatersrand, Johannesburg, South Africa. Michael is a full member of CIEEM. Michael is an experienced consultant ecologist with over 20 years field and research experience with mammal, bird, bat and invasive species surveys in Ireland, the UK and Africa. He has prepared Appropriate Assessments and Ecological Impact Assessments for a wide range of infrastructure, mining and extractive industry, and renewable energy projects.

Revision edits to this report were made by SLR Senior Ecologist Jake Matthews MSc, BSc (Hons), ACIEEM. Jake has over 6 years’ experience in ecological consultancy across the UK and Ireland and has worked on several large-scale infrastructure project including the preparation of EIAR chapters and AA Screening and NIS reports. He possesses an MSc in Ecology and Environmental Management from Liverpool Hope University and a BSc (Hons) in Wildlife Conservation from the University of Salford. These edits underwent a technical review by Michael Bailey and include the following:

- Additional information of European Sites that have undergone assessment have been included in a new **Appendix C**, this includes information on the Qualifying Features of each European Site; as well as their known threats and pressures.
- Pathway considerations have been provided in **Appendix D.1**, including recommended distances for relevant Qualifying Features.
- Likely Significant Effects (detailed in Section 3.5) have revised the number of European Sites brought forward to Stage Two Assessment.



- Each Qualifying Interest for European Sites that have been screened in for further assessment at Stage Two have been assessed separately and in greater detail in **Table 6-3 - Table 6-6**.
- The proposed mitigation measures have been summarised in **Table 4-3**, with additional information provided about the chances of success, responsibilities, and reporting protocol.
- Further details have been included based on ground water monitoring surveys, which were conducted at the Project Site in August / September 2026. Further details of these surveys have been included in **Appendix D.4**.
- Amendments made to the assessment of European Sites in Section 4.4.
- Minor amendments to the text and subheadings where appropriate.



2.0 Methodology

2.1 General Approach

The methodology used in this report is based on guidance provided by the National Parks and Wildlife Service (NPWS, 2010), the Office of the Planning Regulator (OPR, 2021) and EC Guidance (EC, 2018) (EC, 2020) (EC, 2021) on the application of Article 6 of the Habitats Directive.

The 2021 EC guidance describes a series of stages and steps which should be completed when carrying out the assessment and these are followed here with minor modifications. The assessment applies only to European sites. More specifically, it only applies to the qualifying interest features of such sites i.e. the features which are the reason that the site was designated.

2.2 Baseline Information

2.2.1 Ecological Desk Study

SLR Consulting Ireland undertook an ecological desk study comprising an online search for:

- i. Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) within 15 km of the project site.
- ii. Annex I habitats and Annex II species (of the Habitats Directive) within 10km of the Project site; and
- iii. Annex I bird species (of the Birds Directive) within 15km of the Project site.

The desk study area was extended where possible links to European sites and species populations occurred due to emissions to water, changes to hydrology, or mobile or migratory species populations.

Online resources included ecology data held by the National Biodiversity Data Centre, the NPWS, the Environmental Protection Agency, the Ireland Wetland Bird Survey (IWeBS) and Ordnance Survey Ireland (Geohive).

2.2.2 Field Survey

A preliminary ecological appraisal survey was conducted on 11 June 2024, and follow-up habitat surveys were conducted on 23 July 2024 and 14 May 2025 by SLR Project Ecologist Victoria Molloy to identify the habitats on-site and to determine the baseline ecology of the Site, see **Drawing FI-4**.

A breeding raptor walkover survey was undertaken on the 22nd of April 2026 by SLR Project Ecologist Derbhla Moore. The survey comprised a walkthrough of the site, stopping at suitable VP (vantage point) locations distributed across the quarry. The survey targeted cliff faces and exposed substrates to identify;

1. peregrine falcon activity such as sightings, nesting features, whitewash staining on cliff face and prey remains.
2. any other breeding raptor and bird activity such as sand martin nesting activity evidenced by the presence of burrows within sandy substrate or sand stockpiles.



The approach to the field surveys is based on accepted standard practice and methods. Habitats within the study area were classified after 'A Guide to Habitats in Ireland'¹ and were assessed if they comprise Annex I habitats under the Habitats Directive, habitats which have a supporting function for such habitats, habitats which may support Annex II species of the Habitats Directive and/or habitats which may support Annex I species of the Birds Directive.

2.3 AA Screening Methodology

The methodology for the screening assessment follows that set out in EC (and other) guidelines and be based on the data, surveys and assessments described in **Appendix B**. In summary this will comprise:

- Ascertaining whether the Project is directly connected with or necessary to the management of a European site. Typically, this applies only to a management plan, or parts thereof, which has the purpose of maintaining or restoring the conservation interest of a European site, and which would not have a negative effect on any other European site.
- Identifying the relevant elements of the Project and their likely impacts, which is subdivided into:
- Outlining the description of the Project, including construction, operation and decommissioning, containing enough information for potential impact pathways to be understood, and the Project site and its surroundings, focussing on the habitats and species that may form part of the qualifying interest of a European site.
- An identification of the aspects of the project which have the potential to affect European sites, either alone or in combination with other Projects and Plans. This may include for example emissions to air and water, noise and increases in recreational activity (Sources).
- Identifying which (if any) European sites may be affected, considering the potential effects of the Project alone or in combination with other plans or projects, which is subdivided into:
- Generating an initial list of European sites to be considered in the screening process, which are those which are potentially connected (via a Pathway) to the Project site including (i) any which overlap with the Project site or are close enough to experience increased noise, vibration, light, visible human activity or invasive species; (ii) those that may have downstream connectivity via watercourses or groundwater to the Project site or transport routes; (iii) those that may receive deposition of pollutants as a result of emissions to air from the Project or transport routes; (iv) those which may support migratory or mobile species populations which may also use the Project site or its environs; and (v) those which may receive additional recreational activity once the Project site is inhabited.
- Compiling basic information on the European sites identified in Part 1, including a list of qualifying interest features/special conservation interest (the Receptors), their conservation objective if known (maintain or restore), the distance and direction from the Project site (including transport routes) and how it is or is not connected, using the Source-Pathway-Receptor (S-P-R) model, to the Project site (including transport routes). Likely significant effects can be immediately excluded for any European sites and any qualifying /special conservation interest features which clearly lack a pathway or were it can be demonstrated there is a very weak pathway, such that any effects would not be appreciable.

¹ Fossitt (2000): A Guide to Habitats in Ireland



- Assessing whether likely significant effects (LSE) on all European sites can be ruled out, in view of their Conservation Objectives (CO).
- Assessing LSE for the project alone, determining whether there is a risk that the project could undermine the CO for the qualifying interest features/special conservation interest for those European sites for which a pathway has been identified. This is a scientific determination which considers whether the maintain or restore objective applies and both direct and indirect effects. If there is any uncertainty or detailed investigation or mitigation are required, LSE are assumed.
- Assessing LSE for the project in combination with other Projects and Plans. Along the same lines as Part 1, this considers whether the effects of the Project, if not capable of undermining the CO on their own, could do so cumulatively with other projects and plans. It also considers whether the risk of undermining conservation objective is elevated when cumulative effects are considered.
- Concluding whether likely significant effects arising from the Project, alone and in combination with projects and plans, on European sites can be excluded, and if they cannot, which European sites and which qualifying interest features/special conservation interest are at risk from significant effects, and the relevant impact sources and pathways. If the latter, an AA will be required. The conclusion will not consider any mitigation measures designed to avoid likely significant effects on a European site.

2.4 Sources of Information

2.4.1 For the Project Alone

Sources of information for the assessment of the Project 'alone' include:

- Article 17 and Article 12 reports completed by the NPWS²;
- Site Synopses, CO and Standard Data Forms for the Natura 2000 sites³;
- Environmental Protection Agency (EPA) Maps⁴.

2.4.2 For the Project in Combination

Sources of information for the plans and projects for the 'in-combination' assessment were as above and also include:

- Roscommon County Development Plan 2022-2028
- Roscommon County Council planning portal⁵ and myplan.ie⁶ were accessed for information on other projects and plans.

² <https://www.npws.ie/publications/article-17-reports?msclkid=0c19d260b00a11ecaf5a935da63f219b> (last accessed April 2025)

³ <https://www.npws.ie/protected-sites> (last accessed April 2025)

⁴ <http://gis.epa.ie/> (last accessed April 2025)

⁵ <https://www.eplanning.ie/RoscommonCC/searchtypes> (last accessed April 2025)

⁶ <https://myplan.ie/> (last accessed April 2025)



3.0 AA Screening

3.1 Management of any European Site

The proposed project consists of the continuance of use of the existing quarry on the Site. Therefore, it is not connected with, or necessary for, the management of a European site.

3.2 Project Description

3.2.1 The Project

3.2.1.1 Construction & Operational Phase

As this application primarily relates to continued use of the existing permitted development, the construction and operational phases are effectively considered the same. The quarry will be further developed laterally and at depth over the proposed development life of 10 years. The existing extraction and processing operations currently carried out at the site will be maintained and continued over the operational phase of the development.

The permitted quarry extraction area under P. Ref. 04/1479 (ABP PL20.215417) is 23.7 ha. As noted above, this will reduce to 12.9 ha. This reduction will eliminate the development from encroaching any further into existing grassland areas within the site over the life of the planning permission (i.e. all development will be carried out within existing areas of disturbed ground where topsoils have already been removed), as shown on **Figure 1**.

The permitted quarry extraction depth under P. Ref. 04/1479 (ABP PL20.215417) is c. 40m AOD. It is proposed to reduce the depth of extraction by 25 metres (m), changing the previously permitted depth from 40m AOD to 65m AOD. This reduction will eliminate the requirement to dewater and discharge water off site to the Ballyglass River. The existing extraction and processing operations currently carried out at the site will be maintained and continued over the operational phase of the development.

There are some elements of the existing permitted development that have not been constructed or carried out to-date that will be required at a future date during the life of the development. These items include:

- The concrete batching plant and truck washdown facility which have not been constructed to date. The batching plant is permitted to produce 50,000m³/annum and 5 million concrete blocks.

3.2.1.2 Restoration Phase (Seasonal Lake Feature)

Most restoration works will be carried out on permanent completion of extraction works. As the majority of the site is used for extraction and processing purposes it is not feasible to restore any significant parts of the rock quarry void at an earlier stage. However, it is proposed that all existing grass and scrub areas which have established along the site boundaries will be protected and retained, as much as possible.

Upon the cessation of extraction operations, it is proposed to return the worked-out areas to a beneficial ecological after-use. Following extraction, vegetation through natural colonisation on the redundant quarry benches will occur.

The proposed extraction scheme and associated elements were reduced to restrict all works to the currently disturbed areas and thereby prevent the removal of / impact on any grassland and scrub habitats within the site. The restoration scheme proposes to leave all disturbed areas for natural regeneration. This will ensure that these areas are colonised by locally occurring grass, wildflower and scrub species, rather than introducing such species through



wildflower / grass seeding. The restoration areas will therefore provide an opportunity for the expansion of surrounding habitats.

The quarry void will also be left for natural regeneration. Some parts of the quarry floor are likely to seasonally flood, which will create a mosaic of different habitats.

3.2.1.3 Duration of Extraction

The duration of quarrying activities at the application site will largely be dictated by the rate at which the rock is extracted from the site. There are many factors which will influence this, including, but not limited to the prevailing economic climate and related construction industry demand and distance of construction projects from the facility (and scale of activity). The extracted rock will be used to primarily supply concrete and asphalt plants at other locations, with the remainder supplied directly to the market.

The site is currently permitted to extract up to 500,000 tonnes of rock per annum.

The reduced quarry extraction area (in both area and depth) will consequently shorten the overall development life. Planning permission is now sought for a 10-year timeframe, reflecting the revised scale of the scheme. It is considered that planning permission for the proposed quarry development should be commensurate with the life of the reserves. An adequate quarry life is required to secure an acceptable return on investment, when the costs of continued investment in the site development, mobile crushing / screening plant and the on-going operational costs are considered

A planning permission duration of 10 years is considered reasonable and is sought for the development; rock extraction, processing and restoration works.

3.2.1.4 Site Screening and Boundary Treatment

The quarry has been largely screened from views from adjacent roads and residences by screen planting, screening berms and field boundary hedgerows.

The entrance itself is splayed with stone wing walls and pillars with the gates set back c. 20m from the edge of the carriageway. The access road has sweeping curves to prevent any visibility of the site facilities from the site entrance or public road.

3.2.1.5 Removal of Topsoil & Overburden Soils

Previously stripped overburden and topsoil material has been used for the construction of the existing perimeter screening berms and placed within the overburden storage area. Given the reduction in the proposed quarry extraction footprint area, there will be no requirement for development into existing grassland areas over the life of the planning permission. All development will be carried out within existing areas of disturbed ground so there will be no requirement for topsoil / overburden removal.

The existing overburden storage area located to the southwest of the quarry void will retain its current footprint of c. 2.9 ha. The final footprint and the placement of overburden within, will not impact any of the Marsh Fritillary butterfly web sites and suitable habitat, i.e., Devil's Bit Scabious *Succisa pratensis*, identified during ecological surveys carried out in 2024.

3.2.1.6 Hedgerows / Tree lines

The lands comprise unimproved pasture, scrub and boulder strewn land with field walls and sporadic boundary hedgerows / trees.

The existing stonewalls, trees and hedgerows on the site perimeter were retained as part of the original development and will continue to be permanently retained as part of this planning application, and if necessary reinforced, for the duration of the workings. Any gaps in the



existing boundary which would provide uncontrolled access to the quarry will be blocked by a suitable means and reinforced with further planting as necessary and / or fenced.

Any hedges and trees planted as part of the proposed landscaping and restoration plans will be comprised of native and typically occurring species present in the local vegetation and/or hedgerows in Co. Roscommon.

3.2.1.7 Site Drainage

There are no streams or surface water drainage channels within the immediate vicinity of the site.

Site drainage from the overall quarry is currently managed within the site by Roadstone. The quarry is currently worked without the need to discharge water off-site and will remain as such. Any rainfall or water ingress within the current quarry void is managed within the void where water accumulates in the lowest level of the quarry floor allowing the remainder of the quarry to remain dry for extraction operations.

It is proposed to reduce the depth of extraction by 25 m, changing the previously permitted depth from 40m AOD to 65m AOD. This reduction will eliminate the requirement to dewater and discharge water off site to the Ballyglass River.

A hydrological / hydrogeological assessment has been carried out taking into consideration the existing water regime at the quarry site and to determine what the requirements are for the proposed development. It addresses mitigation measures to eliminate and/or minimise the potential impacts, if any, on surface water and groundwater. These measures will be incorporated into the quarry design and operation.

3.2.1.8 Extraction and Blasting

Industry standard blasting techniques have been used to fragment the stone prior to processing (crushing and screening). This technique will continue to be utilised at the site. On average, c. 45,000 to 50,000 tonnes are typically produced per blast at the quarry.

The drilling pattern is typically 110mm diameter vertical holes drilled at c. 4m burden and spacing to full face height. Bulk emission explosives are used to charge the holes. Delivery and placement of explosives is carried out by Irish Industrial Explosives and Roadstone under supervision of a blast engineer. There is no proposed change in the blast design and blast methods employed in further developing the quarry laterally and at depth below the existing quarry floor.

Ground vibration and air-overpressure associated with blasting at the quarry is controlled/limited by condition nos. 10, 11 & 12 of planning ref. ABP PL20.215417 (P. Ref. 04/1479). Every blast at the quarry has been monitored since Roadstone commenced extraction operations the quarry in 2006/2007. The actual blast monitoring results for the period 2022 to 2024 show there were:

- 6 no. blasts in 2022;
- 7 no. blasts in 2023; and
- 11 no. blasts in 2024.

It is proposed that the scheme of blast monitoring be continued should permission be granted for the further development of the quarry.

All rock extracted from the application area will be processed on site to produce a range of aggregates for use in concrete and asphalt production (off-site), site development works, for road construction, and supply to the market generally.



3.2.1.9 Method of Extraction

It is proposed that the existing method of extraction will continue to be implemented at the site as follows:

- where required, overburden will be stripped in advance of rock blasting in accordance with the quarry development plan. Stripped overburden will be placed at the permanent storage area to the southwest of the extraction void or used to further enhance existing perimeter screening berms;
- rock material will be extracted using conventional blasting techniques. Prior to drilling, the quarry face will be surveyed in order to ensure safe and efficient blasting. Drilling will be carried out in accordance with the blast design. Finally, the holes will be filled with bulk emulsion explosives and the blast carried out. All blasting is and will be carried out in accordance with the health & safety regulations, and environmental guidelines for the sector;
- the fragmented rock will be processed using mobile crushing and screening plant located at the blasted quarry face within the quarry void area; and
- the aggregate products will be stored in stockpiles located within the quarry site, as is the current practice.

3.2.1.10 Processing Methods

Extracted Rock Processing Method

The processing methods currently used at the quarry constitute size reduction through crushing and sizing by screening using mobile plant.

An excavator is used to directly feed a mobile crushing / screening plant at the working face. The mobile plant will be relocated after every blast during the life of the quarry development as operational requirements dictate.

Once screened, the aggregate is stored in various stockpiles on the quarry floor and at surface level to await transported off site.

It is proposed that the same processing methods will be utilised going forward. There is no requirement for any additional processing plant as part of this planning application.

Readymix Concrete Operations (when implemented)

It was noted above that the concrete batching plant and truck washdown facility, permitted under ABP PL20.215417 (P. Ref. 04/1479) have not been constructed to date. The batching plant is permitted to produce 50,000m³/annum. When operational, the following processes will be carried out.

A combination of sand & gravels, crushed chips and cement will be utilised in the concrete manufacturing process. A dust control system will be used to control any fugitive emissions from the cement silos (2 x 80 tonne capacity). The batching unit will be clad to further eliminate fugitive dust. The silos will be filled from ground level, under pressure, through a cement fill pipe.

Concrete lorries will reverse into a partially enclosed loading bay at the base of the batch house (mixer), wherein batched concrete will be discharged from the base of the mixer via a chute into the lorry mixer drums.

The concrete will be produced using the following components:

- Stone aggregates: will be sourced from the existing rock quarry area on site;
- Sand: will be sourced locally from a third party site in Co. Roscommon;



- Water: will be sourced from the water management system within the quarry;
- Cement & Admixtures: These materials will be transported to the site as demand requires.

The concrete manufacturing process will be as follows:

- The aggregates will be loaded into 6 x 60 tonne storage bins;
- The aggregates will then be weighed out from the storage bins (hoppers) into batch sizes depending on the volume of concrete required;
- The aggregates will be transported from the hoppers to the mixer by conveyor;
- Cement, water and admixtures will then be added to the aggregates in the mixer.
- The mixer will agitate the mix and then transfer the mixed material into a concrete truck for despatch off-site.

The weight of water, admixture, cement and the batching cycles will be controlled by computer. Admixtures are compounds which are added to concrete in small amounts in order to change the properties of the concrete. A typical admixture is added at a rate of 1 litre per cubic metre of concrete.

All admixtures will be stored in suitably bunded tanks. Water will be stored in a water tank (c. 3,000-gallon capacity) adjacent to the Concrete Batching Plant. This will be topped up as required.

Concrete trucks will be washed out in a washing bay adjacent to the Concrete Batching Plant. The wash water will be pumped from the trucks for recycle through a closed series of settlement ponds.

The production level of the plant will be c. 50,000m³ per annum of concrete.

3.2.1.11 Dispatch of Aggregate Product

Aggregate from the screened stockpiles will be loaded by means of a mechanical loading shovel directly to incoming Heavy Goods Vehicles (HGV). Trucks leaving the site will be directed through the weighbridge where loads dispatched off-site will be weighed and recorded. The dispatch office will monitor the movement of incoming and outgoing road trucks and will also be responsible for the issuing of dispatch dockets.

Prior to leaving the site, all road trucks will pass through a wheel wash, which is currently in place, to minimise dust / mud nuisance on the public carriageway. The site access road is hard surfaced from the exit of the wheelwash facility to its junction with the public road.

3.2.1.12 Site Infrastructure

Site Access and Security

The existing quarry entrance is located on the regional road (R363) to the north of the application site and has good, splayed visibility in both directions. There is a low stone wall with pillars on either side of the entrance. The entrance consists of two metal gates which are recessed back (c. 20m) from the road verge to allow vehicles to pull in off the road when the gates are locked. The quarry entrance and internal access road are hard surfaced for a distance of c. 175m to where the weighbridge is located.

In the unlikely event of material being spilled on the public road the operator will ensure that spilled material is removed from the road surface in a safe and timely manner, as soon as they notice or are notified that a spillage has arisen.



Parking & Hardstanding Areas

Internal access roads are provided within the site, running from the site entrance southwards to the existing weighbridge and the main site office.

All HGVs utilising the existing site are confined within the application area. There is adequate provision for HGV parking to ensure that there is no queueing of HGVs on the public road outside the quarry.

Adequate car parking provision for employees, contractors and visitors is already provided in a dedicated area on a hardcore surface to the east of the weighbridge office. Additional parking with a pedestrian access walkway is provided to the west of the weighbridge office. A hardstanding area and hydrocarbon interceptor is provided around the bunded fuel storage tank.

Weighbridge

In compliance with condition no. 14 of ABP PL20.215417 (P. Ref. 04/1479), all HGVs accessing the site are required to pass over the existing weighbridge which is located adjacent to the site office.

The weighbridge is utilised to establish a weight for each truck used for hauling stone. All loaded trucks pass over the weighbridge before exiting the quarry so that a record of each load can be made. Apart from keeping a record of the quarry's productivity, the weighbridge is also used to ensure all loads exiting the site do not exceed the legal weight limit.

It is proposed that the weighbridge will be utilised and maintained for the life of the proposed development.

Wheelwash

In compliance with condition no. 15 of ABP PL20.215417 (P. Ref. 04/1479), all HGVs existing the site are required to pass through the existing wheelwash which is located adjacent to the site office. The section of internal road between the wheelwash and the site entrance is hard-surfaced.

It is proposed that the weighbridge will be utilised and maintained for the life of the proposed development.

Offices and Ancillary Facilities

An existing prefabricated portacabin structure acts as site offices, and canteen / cloakroom / toilet for staff use. Surface water run-off from the roof directly percolates to ground.

A garage / workshop is permitted under planning permission ABP PL20.215417 (P. Ref. 04/1479) but has also not been constructed to date. The previously permitted workshop building has been removed from the current application.

Utilities and Services

The site is served by on-site water supply and mains electricity. An ESB power line feeds directly into the quarry site to service the offices and weighbridge. An existing on-site generator supplies the fixed processing plant.

Site based staff at the application site are contactable by mobile phone, landline and email and broadband connections to the site office as provided via a mobile network.

Water for drinking and to service the toilet facilities (located within the site office) is supplied from the mains water supply.

Effluent from toilet facilities is treated using an existing WWTS.



As part of this planning application, it is proposed to decommission the existing WWTS and replace it with a new proprietary wastewater treatment system and constructed percolation area. The existing WWTS will be decommissioned, and the contents of the tank will be taken off site for appropriate treatment by a licenced contractor.

Lighting

Lighting is provided at the site as necessary, which includes fixed downlights outside the office / welfare facilities and processing plant; and mobile lighting on the machinery used within the quarry void.

All lighting is only in use for wintertime operations, when darkness has fallen, within the proposed site operating hours of 07.00 hours until 20.00 hours Monday to Friday and until 14.00 hours on Saturdays. There are therefore periods where such lighting is required for up to 1 hour in the morning and up to 2.5 hours in the evening, during periods in winter. As most quarry activity is below surrounding ground level light pollution from site activity is considered to be minimal and not significant.

Fuel and Oil Storage

Bunded fuel storage tanks are located at the site. Oil and lubricants for plant and machinery are stored on spill pallets in designated storage areas.

A Hydrocarbon interceptor is in place at the refuelling station.

Spill Kits and spill training has been provided. All new employees are given an induction which includes spill kit training and how to respond to a fuel spill.

3.2.1.13 Waste Management

General Waste Management

Roadstone as a member of the Irish Concrete Federation (ICF) commits themselves to the principles of the Federations Environmental Code. The code states:

“ICF members will minimise production of waste and where appropriate consider its beneficial use including recycling. They will deal with all waste in accordance with the relevant legislation and other controls in place, including using waste contractors with valid Waste Collection Permits”

Potential waste produced and the proposed measures used to control it are described as follows:

- Scrap metal – these materials are chiefly produced from the maintenance of the processing plant and equipment and can cause a nuisance if allowed to build up in an uncontrolled manner. A designated scrap metal area will be demarcated on site, and the build-up of scrap will be controlled by the regular removal by licensed scrap metal contractors.
- Used oil and oil filters – any waste oil / oil filters that may arise from servicing of processing plant will be removed from the site by a licensed waste contractor.
- Used batteries – similarly all used batteries will be removed from site for collection and recycling by a licensed waste contractor in accordance with the Waste Management Regulations.
- Domestic waste (canteen waste) – domestic waste generated at the offices and employee’s facility will be collected by a licensed waste collection contractor.



Extractive Waste Management

Almost all products and by-products arising from the aggregate processing have commercial value. Any waste materials from the site are stored, collected, recycled and/or disposed of in accordance with any requirements of Roscommon County Council.

In Ireland, the management of extractive waste is regulated by the Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 (SI No. 566 of 2009). Under these Regulations, quarry operators are required to prepare an Extractive Waste Management Plan (EWMP) which outline the plans and procedures for minimisation, treatment, recovery and disposal of extractive wastes, having regard to the principle of sustainable development.

Description of the Waste Generating Operation

There is no intention on behalf of Roadstone to discard, where possible, any material extracted from the quarry at Cam. The principal aim of the extractive waste management plan for the site is to prevent waste production which is in accordance with Section 5(2)(a) of the 2009 Regulations. Given the reduction in the proposed quarry extraction footprint to within existing areas of disturbed ground, there will be no topsoil removal and associated waste management.

3.2.1.14 Environmental Controls

General

Extraction, processing and ultimately restoration activities at the application site require a number of environmental controls to eliminate or minimise the potential nuisance to the public arising from the extraction and processing operations. The environmental control measures in place at the existing site are outlined in the following sections.

The existing operations at the site are currently regulated by conditions attached to the current planning permission: ABP PL20.215417 (P. Ref. 04/1479).

Any additional control measures, over and above those outlined below, which may be instructed on foot of this planning application, will also be implemented.

Odour Control

As the rock extraction activities at the site are not biodegradable and do not therefore emit odorous gases, site activities will not give rise to odour nuisance. No odour control has been required for the existing quarry or will be required for the proposed continued development.

Dust Generation and Control

In dry, windy weather conditions, site activities may give rise to dust blows across and beyond the existing or planned development site areas.

The incidence of fugitive dust outside of the operation is reduced by the mobile crushing and screening plant located within the quarry void. Generation of fugitive dust is generally limited to periods of very low rainfall. Dust generation occurs from three main sources:

- Point sources – such as operating plant and machinery;
- Line sources – such as roads and conveyors; and
- Dispersed sources– such as the quarry floor and stockpiles.

In order to control dust emissions, the following measures are / will be implemented:



- Water sprayed from a tractor drawn bowser on dry exposed surfaces and stockpiles (paved roads, unsealed haul roads and hardstand areas) as required;
- Fixed sprinkler system on the hard surface site access road between the site entrance and the weighbridge;
- Areas of bare or exposed soils will, insofar as practicable, be kept to a minimum through the phased extraction proposals;
- Dust blows at the existing site are largely screened by the side walls of the existing quarry and the vegetated screening berms and existing boundary hedgerows;
- All HGV's exiting the site routed through the existing wheelwash. This minimises the transport of fines by HGVs over the access / egress road and the public road network;
- Periodic sweeping of the internal paved site access road and surrounding public roads carried out as required by a mechanical road sweeper;

These dust mitigation and management measures are in accordance with the Department of Housing, Local Government and Heritage (DoEHLG) (2004) and EPA (2006) guidelines for the sector.

Noise Generation and Control

Potential noise generating sources arising from the operation of the quarry are from the crushing and screening plant, mobile plant such as the loading shovels and from the haulage fleet both within and outside the quarry.

The potential for noise generation from the application area is reduced by locating the processing plant within the quarry floor void. This means that the potential for noise generation from activities associated with the operation of the plant such as movement of vehicles and maintenance is reduced.

In addition to the above the following good house-keeping measures are in place in order to reduce noise emitted from plant and machinery as much as possible:

- all machinery used to be CE certified for compliance with EU noise control limits;
- the machinery regularly maintained, with regular checking of any muffler systems and servicing or replacing as required, and any loose or damaged panels or covers that suppress noise are fixed or replaced immediately;
- if there are further noise-reducing modifications available for any machinery, they will be fitted wherever practical (e.g. rubber-decked screens, rubber chute linings etc.);
- haul road grades to be kept as low as possible ($\leq 1:10$) to reduce engine / brake noise from heavy vehicles.

These noise mitigation and management measures are provided in accordance with the DoEHLG (2004) and EPA (2006) guidelines for the sector.

3.2.1.15 Environmental Monitoring

Environmental Management System (EMS)

As part of the environmental management system (EMS), Roadstone has implemented a comprehensive environmental monitoring programme at Cam Quarry in compliance with condition no. 6 of planning permission ABP PL20.215417 (P. Ref. 04/1479) on the operation of the quarry. Environmental noise, ground/surface water, blast, and dust monitoring, carried out on a regular basis, has demonstrated that the quarry has not had any significant adverse effects on the surrounding environment.



Limit values for environmental emissions arising from the site activities are identified by the existing consent from the planning authority. Environmental sampling, monitoring and testing is generally undertaken by the Roadstone in-house environmental team (or by external consultants) as and when required. Records of environmental monitoring and testing are held by Roadstone and submitted to the Local Authority on a quarterly basis.

Environmental noise, blast, dust and water monitoring carried out on a regular basis, has demonstrated that the quarry has not had any significant adverse effects on the surrounding environment.

Dust Monitoring

A comprehensive dust monitoring programme has been and will continue to be implemented at Cam Quarry, in compliance with the current planning permission ABP PL20.215417 (P. Ref. 04/1479) - condition 13.

The dust monitoring gauges are located close to emission sources or potentially sensitive receptors located beyond the site boundary. Monitoring is carried out at 5 no. locations around the site boundary with continuous monitoring over the 12-month period. Monitoring point D5 is a new dust monitoring location which was installed 27th March 2026, with monitoring commencing 20th April 2026. It is proposed that the existing dust monitoring stations will remain in place for the duration of extraction and processing operations at the site.

Previous dust deposition monitoring carried out at the site boundaries at D1 – D4 indicates that the current quarry operations have for the most part complied with the recommended dust deposition emission limit value of 350 mg/m²/day (averaged over 30 days) as set out in condition no. 13, with the exception of 1 exceedance (D1 – June), out of 48 results in 2022; 2 exceedances (D1 – May & June) in 2023, 2 exceedances (D4 – May & June) in 2024, 4 exceedances (D1 and D3 – February, D4 – February and June) in 2025. There have been no exceedances to date in 2026. The dust monitoring to-date has shown that the existing site can operate within the permitted limit of 350 mg/m²/day (averaged over 30 days).

It is proposed that the existing dust monitoring stations will remain in place for the duration of extraction and processing operations at the site. As part of the Further Information submitted to the Planning Authority, an additional monitoring location (**D5**) was proposed on the eastern boundary of the Site, to further assess the impact on any receptors to the east of the Site, in particular the potential for impacts on the nearest sensitive receptors to the east of the site (in the direction of Athlone). Monitoring at D5 will be carried out as a regular monitoring location in line with the sites overall air quality monitoring programme. The addition of location D5 will provide for 2 monitoring locations along the eastern site boundary. Monitoring will continue to be undertaken monthly using the industry standard Bergerhoff method of monitoring to ensure the development complies with the DoEHLG (2004) / EPA (2006) recommended total dust deposition threshold of 350 milligrams per day (averaged over a 30-day period).

Noise Monitoring

An annual noise monitoring programme has been and will continue to be implemented at Cam Quarry, in compliance with the current planning permission ABP PL20.215417 (P. Ref. 04/1479) - condition 9.

The noise monitoring position is located close to sensitive receptors located beyond the northern site boundary. Monitoring is carried out for a 4-hour period once per year. It is proposed that the existing noise monitoring location will remain in place for the duration of extraction and processing operations at the site.

Previous noise monitoring carried out at the nearest noise sensitive receptors to the quarry operations has shown compliance with the recommended daytime noise emission limit value of 55 decibels (db) (A), as set out in condition no. 9. The noise monitoring to-date has shown



that the existing site can operate within the permitted limit of 55 dB (A) over a continuous four-hour period between the hours of 07:00 and 20:00, Monday to Friday and between 07:00 and 14:00 on Saturdays when measured outside any dwelling house in the vicinity of the site.

It is proposed that the noise monitoring location will remain in place for the duration of extraction and processing operations at the site. Monitoring will continue to be undertaken on an annual basis to ensure the development complies with the current ABP PL20.215417 (P. Ref. 04/1479) - condition 9; and the noise threshold limit of 55 dB (A) recommended in the EPA (2006) environmental management guidelines for the sector.

Water Monitoring (Groundwater / Surface Water)

The following monitoring activities will continue to be carried out to demonstrate that the development is not having an adverse impact on the surrounding environment and will document any changes in water quality:

- Monitoring of ground and surface water quality, levels and discharges - Condition 6 (g);
- Groundwater levels in all boreholes monitored on a monthly basis for the duration of the proposed development - Condition 7 (d);
- Recording of any breaches over the previous year for water quality monitoring to be provided in the annual environmental audit - Condition 7 (e);
- Submission of quarterly reports with full monitoring records of surface water quality monitoring and groundwater monitoring - Condition 7;

3.2.1.16 Proposed Landscape Management & Final Restoration

Proposed Landscape Management Measures

The principal landscaping aims are:

- the physical and visual integration of the existing site and associated features into the surrounding landscape; and
- screening to minimise visual intrusion and to reduce any significant negative aspects regarding the visual impact of the proposed development on adjacent sensitive receptors.

Site Screening Measures

- it is proposed to complete a screening berm to the north of the quarry extraction footprint to provide further screening of noise and dust to the nearest residences to the northern side of the R363 regional road.
- the screening berm will then be planted with a native mix of hedgerow species to tie into existing berm and vegetation along the northern boundary in the vicinity of the site entrance and internal access road. This planting will be carried out as early as possible following completion of the berm construction;
- the planting will be carried out in 2 staggered rows, with the rows 50cm apart and plants within each row 50cm apart (i.e. 4 plants per m);
- the tree stock will be made up from transplants and container grown stock at 40-90cm height, as these are known to establish more successfully;
- 4 Hawthorn, 4 Blackthorn, 1 Hazel and 1 Holly to be planted in random succession every 2.5m;



- all plant handling, planting and establishment works will be carried out in accordance with current best practice;
- works are to take place in the appropriate planting season (e.g. bareroot planting: November to March only) and in favourable weather conditions;
- planting will be carried out by a suitably qualified landscape contractor; and
- establishment maintenance will be carried out for 2 years following the planting works. This will include weed control, replacement planting, watering (if required) and the adjustment of spiral guards.

In addition to the above, existing boundary vegetation is to be retained to keep the site secure. The boundary vegetation will be checked annually; dead trees will be removed and any gaps will be filled with new native planting.

Siting of Facilities (not constructed to-date)

The permitted concrete batching plant, when constructed, will be located within the existing development area at a distance of c. 450m from the nearest residence, located to the north of the R363 regional road. The existing perimeter berm and planting at the site entrance will afford maximum screening of the structure to the residence and passing traffic along the R363.

3.2.1.17 Proposed Restoration Scheme

The principal activity which will be undertaken at the application site is the extraction of the in-situ rock with ultimate restoration of the overall application site to a natural habitat including lake, which is one of the beneficial after uses listed in the EPA Guidelines: 'Environmental Management in the Extractive Industry' (2006).

The proposed restoration scheme will be achieved by the following measures:

- the extraction void will be left for natural regeneration by locally occurring tree and shrub species. Some parts of the quarry floor are likely to seasonally flood, which will create a mosaic of different habitats. The rebound water level will typically be around 60-65m AOD.
- on completion of all extraction works, all of the plant and machinery within the site will be removed. All hard standing areas will be deep ripped, levelled, and covered with any available overburden / topsoil and left for natural regeneration.
- the settlement lagoons will be left to naturally develop into further wetland habitats on site.
- all existing boundary fences and hedgerows will be retained to ensure that the site is secure. The existing gates at the site entrance will be retained and kept locked at all times, except for maintenance access.

The majority of restoration works will be carried out on permanent completion of the extraction works. As the majority of the site is used for extraction and processing purposes it is not feasible to restore any parts of the quarry void at an earlier stage. However, it is proposed that all existing grass and scrub areas which have established along the site boundaries will be protected and retained, as much as possible.

The restoration works will be carried out in accordance with the EPA Guidelines (2006). Ecological advice will also be incorporated into the restoration process to facilitate future habitat value in the area for biodiversity.

As the applicant is a long-established mineral extraction operator, it has ample experience and expertise in implementing mineral restoration programmes.



Site Management and Supervision

The applicant will clearly define the management responsibility for the site restoration work and will ensure that this person has the necessary information (from the planning application) and authority to manage the whole restoration process. Relevant staff will be briefed on the scheme and will be adequately supervised / controlled. A system of record keeping for the key restoration activities will be put in place.

Long Term Surface Water and Groundwater

The surface water will percolate to ground. There is no requirement for any active long term surface water or groundwater management at the site.

Decommissioning of Plant and Machinery

Redundant structures, plant equipment and stockpiles will be removed from site on permanent cessation of extraction activity. Machinery and buildings will either be utilised by the applicant on other sites or be sold as working machinery or scrap.

As part of the overall decommissioning process, all fuel and oil storage tanks within the existing site will be removed from the site by a licensed waste contractor. Therefore, there will be no potential for fuel, oil or sewage to cause long-term water pollution following completion of extraction activities.

Aftercare and Monitoring

There will be no on-going requirement for monitoring noise or dust after extraction and processing and manufacturing operations have ceased.

A final site inspection 6 months after formal site closure will be carried out to confirm the final site restoration as implemented is functioning.

3.2.2 The Project Site

3.2.2.1 Habitats (Annex I) Summary

The semi-natural grasslands on-site and in the fields surrounding the Site have been identified as Annex I [6210] orchid-rich calcareous grassland according to the data held by NPWS on Annex I grasslands⁷. The grasslands are classified as being of bad quality according to this data.

During the field surveys, the semi-natural grasslands in the northern part of the Site were identified as non-Annex I grassland due to a lack of indicator species present within the habitat. The semi-natural grasslands in the southern, unmanaged area of the Site were identified as potentially good quality Annex I semi-natural dry grassland on calcareous substrate [6210] due to the presence of six positive indicator species and ten high-quality indicator species were identified within this area, as listed in **Table 3-1**⁸.

This Annex I habitat is listed as a QI for the following European sites located within 15 km of the Site: Killeglan Grassland SAC, Castlesampson Esker SAC, and Lough Ree SAC.

No other Annex I habitats were identified on-site or in the immediate vicinity of the Site.

⁷ <https://www.npws.ie/maps-and-data/habitat-and-species-data/article-17/2019/habitats/grasslands>

⁸ https://bsbi.org/wp-content/uploads/dlm_uploads/Semi_Natural_Calcareous_Grasslands_6210.pdf



Table 3-1: Positive and High-Quality Indicator Species for Annex I Semi-Natural Dry Grassland on Calcareous Substrates Present in the Southern Area of the Site

High-Quality Indicator Species	Positive Indicator Species
Mountain Everlasting <i>Antennaria dioica</i>	Lady's Bedstraw <i>Galium verum</i>
Kidney Vetch <i>Anthyllis vulneraria</i>	Hawkbit spp. <i>Leontodon</i> spp.
Yellow-wort <i>Blackstonia perfoliata</i>	Common Bird's Foot Trefoil <i>Lotus corniculatus</i>
Quaking-grass <i>Briza media</i>	Mouse-ear Hawkweed <i>Pilosella officinarum</i>
Carlina Thistle <i>Carlina vulgaris</i>	Bulbous Buttercup <i>Ranunculus bulbosus</i>
Field Scabious <i>Knautia arvensis</i>	Wild Thyme <i>Thymus polytrichus</i>
Marsh Orchids <i>Dactylorhiza</i> sp.	
Lesser Twayblade <i>Neottia cordata</i>	
Early Purple Orchid <i>Orchis mascula</i>	
Fragrant Orchids <i>Gymnadenia</i> sp.	

3.2.2.2 Species (Annex I birds and Annex II others) Summary

A marsh fritillary larval web survey and habitat condition assessment was conducted on 26th and 27th August 2024. This report concluded that the areas surveyed were utilised by marsh fritillary for breeding and are classified as suitable (under-grazed) for marsh fritillary.

Peregrine falcons were recorded on-site during the site visits on 11th June 2024 and 23rd July 2024. No nests were observed during these field surveys; however, the quarry cliff faces are potentially suitable for nesting peregrine.

On 22nd April 2026, a single peregrine falcon was observed in flight over the central sector of the quarry as shown in Drawing FI-3. It was determined that this behaviour was indicating potential territorial, foraging and/or breeding behaviour. A potential peregrine nesting location was identified on a cliff face in the southwest corner of the existing quarry site; this site was characterised by suitable ledges and evidence of frequent use indicated by whitewash stains on cliff face just below the ledge.

Marsh fritillary and peregrine falcon are not listed as QIs for any European site within 15 km of the Site.

3.2.2.3 Environmental Connections Summary

There are no surface water hydrological connections between the Site and any European site.

There is potential for a groundwater connection between the Site and Lough Croan Turlough SAC, Killeglan Grassland SAC, Castlesampson Esker SAC, Lough Croan Turlough SPA, and River Suck Callows SPA.

3.3 Potential Impact Factors

The proposed development has the potential to result in the following effects:

- Disturbance due to machinery usage and presence of construction workers;
- Dust emissions during the operational phase;
- Noise and vibration during the operational phase;



- Introduction of suspended solids into surface waterways; and
- Contamination of and groundwater bodies.

The habitats and species listed as features of interest of any European sites with a S-P-R link to the project must therefore be assessed for affects from potential impact factors listed above, and these effects are considered further below.

3.4 Identification of Relevant European sites

The first step in identification of relevant European sites for further assessment is to identify those that will be at risk from likely significant effects where a S-P-R link exists between the proposed development and the European site.

The relevant European sites are identified through a review of the nature and scale of the project, the project location relative to European sites, presence of ecological (including mobile and migratory species) and landscape connectivity, such as along waterways, hedgerows and treelines between the Site and the European sites, known impacts and effects likely to arise as a result of this type of project, distance from European sites and the qualifying interests of the European sites.

Table 3-2 provides a list of European sites which were selected for initial consideration of S-P-R links (**Figure 2**); a description of each site; their qualifying interests; and any S-P-R Receptor links.



Table 3-2: Description of European sites with Potential S-P-R Links

European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
SACs				
Ballynamona Bog and Corkip Lough SAC (002339)	2 km southeast	• Turloughs [3180] • Active raised bogs [7110] • Degraded raised bogs still capable of natural regeneration [7120] • Depressions on peat substrates of the Rhynchosporion [7150] • Bog woodland [91D0] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002339.pdf	Disturbance: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to indirect disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to disturbance as a result of noise and vibration. Groundwater contamination: The Site is located in the Suck South groundwater body (GWB) (IE_SH_G_225) but this European site is in a different GWB – Funshinagh (IE_SH_G_091). Therefore, there is no pathway for potential groundwater contamination.	N

⁹ When measured in a straight line over the shortest distance between the site and European site.

¹⁰ For SPAs, the bird species that are the reason for designation are Species of Conservation Interest (SCIs) and for SACs the habitats and species that are the reason for designation are its Qualifying Interests (QIs). For convenience, the term qualifying interest or QI is used here for both SPAs and SACs.

⁹ Protected Sites in Ireland | National Parks & Wildlife Service ([npws.ie](https://www.npws.ie))



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
Lough Croan Turlough SAC (000610)	3.1 km north	Turloughs [3180] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000610.pdf	Disturbance: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to indirect disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to disturbance as a result of noise and vibration. Groundwater contamination: The Site is located on the same GWB, Suck South (IE_SH_G_225), as the European site. Therefore, there is a potential pathway for groundwater contamination of the European site.	Y
Killeglan Grassland SAC (002214)	3.25 km southwest	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002214.pdf	Disturbance: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to indirect disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: There are no species QIs designated for this European site. The habitat QIs for which the European site is	Y



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
			designated are not sensitive to disturbance as a result of noise and vibration. Groundwater contamination: The Site is located on the same GWB, Suck South (IE_SH_G_225), as this European site. Therefore, there is a potential pathway for groundwater contamination of the European site.	
Castlesampson Esker SAC (001625)	3.6 km south	- Turloughs [3180] - Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO001625.pdf	Disturbance: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to indirect disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to disturbance as a result of noise and vibration.. Groundwater contamination: The Site is located on the same GWB, Suck South (IE_SH_G_225), as this European site. Therefore, there is a potential pathway for groundwater contamination of the European site.	Y
Lough Funshinagh SAC (000611)	5.3 km northeast	Turloughs [3180]	Disturbance: There are no species QIs designated for this European site. The habitat	N



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
		Rivers with muddy banks with <i>Chenopodium rubri</i> p.p. and <i>Bidention</i> p.p. vegetation [3270] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000611.pdf	QIs for which the European site is designated are not sensitive to indirect disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to disturbance as a result of noise and vibration. Groundwater contamination: Groundwater contamination: The Site is located in the Suck South GWB (IE_SH_G_225) but this European site is in a different GWB – Funshinagh (IE_SH_G_091). Therefore, there is no pathway for potential groundwater contamination.	
Four Roads Turlough SAC (001637)	7.15 km northwest	Turloughs [3180] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO001637.pdf	Disturbance: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to indirect disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: There are no species QIs designated for this European site. The habitat QIs for which the European site is	Y



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
			designated are not sensitive to disturbance as a result of noise and vibration. Groundwater contamination: Groundwater contamination: The Site is located on the same GWB, Suck South (IE_SH_G_225), as this European site. Therefore, there is a potential pathway for groundwater contamination of the European site.	
Lough Ree SAC (000440)	9.4 km east	- Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation [3150] - Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] - Active raised bogs [7110] - Degraded raised bogs still capable of natural regeneration [7120] - Alkaline fens [7230] - Limestone pavements [8240] - Bog woodland [91D0] - Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae) [91E0] <i>Lutra lutra</i> (Otter) [1355] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000440.pdf	Disturbance: The European site is considered to be sufficiently distant from the Site to exclude the possibility of significant effects as a result of disturbance. There are no suitable habitats for otter on-site or in the vicinity of the Site. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: The European site is considered to be sufficiently distant from the Site to exclude the possibility of significant effects as a result of noise and vibration. There are no suitable habitats for otter on-site or in the vicinity of the Site. Groundwater contamination: Groundwater contamination: The Site is located in the Suck South GWB (IE_SH_G_225) but this European site is in a different GWB – Funshinagh (IE_SH_G_091). Therefore, there is no pathway for potential groundwater contamination.	N



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
Lisduff Turlough SAC (000609)	10.8 km northwest	Turloughs [3180] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000609.pdf	Disturbance: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to indirect disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to disturbance as a result of noise and vibration. Groundwater contamination: The Site is located on the same GWB, Suck South (IE_SH_G_225), as this European site. Therefore, there is a potential pathway for groundwater contamination of the European site.	Y
River Shannon Callows SAC (000216)	12.9 km southwest	<i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinia caerulea</i>) [6410] - Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) [6510] - Alkaline fens [7230] - Limestone pavements [8240] - Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae) [91E0]	Disturbance: The European site is considered to be sufficiently distant from the Site to exclude the possibility of significant effects as a result of disturbance. There are no suitable habitats for otter on-site or in the vicinity of the Site. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016).	N



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
		<i>Lutra lutra</i> (Otter) [1355] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000216.pdf	Noise and vibration: The European site is considered to be sufficiently distant from the Site to exclude the possibility of significant effects as a result of noise and vibration. There are no suitable habitats for otter on-site or in the vicinity of the Site. Groundwater contamination: Groundwater contamination: The Site is located in the Suck South GWB (IE_SH_G_225) but this European site is in a different GWB – Funshinagh (IE_SH_G_091). Therefore, there is no pathway for potential groundwater contamination.	
Ballinturly Turlough SAC (000588)	14.55 km northeast	Turloughs [3180] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000588.pdf	Disturbance: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to indirect disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to disturbance as a result of noise and vibration. Groundwater contamination: Groundwater contamination: The Site is located in the Suck South GWB (IE_SH_G_225) but this European site is in a different GWB – Funshinagh (IE_SH_G_091). Therefore, there is no	N



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
			pathway for potential groundwater contamination.	
Aughrim (Aghrane) Bog SAC (002200)	14.7 km northwest	Degraded raised bogs still capable of natural regeneration [7120] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002200.pdf	Disturbance: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to indirect disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to disturbance as a result of noise and vibration. Surface water contamination: There is no surface water hydrological connection between the Site and this European site. Therefore, there is no pathway for potential surface water contamination. Groundwater contamination: Groundwater contamination: While the Site is located in the same GWB as this European site, they are separated by the Suck River and therefore groundwater from the Site will not reach the SAC and so there is no pathway for potential groundwater contamination.	N
Ballygar (Aghrane) Bog SAC (002199)	15 km northwest	- Active raised bogs [7110] - Degraded raised bogs still capable of natural regeneration [7120]	Disturbance: There are no species QIs designated for this European site. The habitat	N



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
		https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002199.pdf	QIs for which the European site is designated are not sensitive to indirect disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: There are no species QIs designated for this European site. The habitat QIs for which the European site is designated are not sensitive to disturbance as a result of noise and vibration. Groundwater contamination: Groundwater contamination: The Site is located in the Suck South GWB (IE_SH_G_225) but this European site is in a different GWB – Ballygar (IE_SH_G_028). Therefore, there is no pathway for potential groundwater contamination.	
SPAs				
Lough Croan Turlough SPA (004139)	3.1 km north	- Shoveler (<i>Anas clypeata</i>) [A056] - Golden Plover (<i>Pluvialis apricaria</i>) [A140] - Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] - Wetland and Waterbirds [A999] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004139.pdf	Disturbance: The Site is located over 1km from the European site. This is the largest recommended buffer zone for preventing disturbance to bird species (Goodship and Furness, 2022). Therefore, the Site is considered to be sufficiently distant from the European site to exclude the possibility of significant impacts from disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope	Y



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
			out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: The Site is located over 1km from the European site. This is the largest recommended buffer zone for preventing disturbance to bird species (Goodship and Furness, 2022). Therefore, the Site is considered to be sufficiently distant from the European site to exclude the possibility of significant impacts from disturbance as a result of noise and vibration. Groundwater contamination: The Site is located on the same GWB, Suck South (IE_SH_G_225), as this European site. Therefore, there is a potential pathway for groundwater contamination of the European site.	
River Suck Callows SPA (004097)	4.6 km west	- Whooper Swan (<i>Cygnus cygnus</i>) [A038] - Wigeon (<i>Anas penelope</i>) [A050] - Golden Plover (<i>Pluvialis apricaria</i>) [A140] - Lapwing (<i>Vanellus vanellus</i>) [A142] - Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] - Wetland and Waterbirds [A999] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004097.pdf	Disturbance: The Site is located over 1km from the European site. This is the largest recommended buffer zone for preventing disturbance to bird species (Goodship and Furness, 2022). Therefore, the Site is considered to be sufficiently distant from the European site to exclude the possibility of significant impacts from disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: The Site is located over 1km from the European site. This is the largest	Y



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
			recommended buffer zone for preventing disturbance to bird species (Goodship and Furness, 2022). Therefore, the Site is considered to be sufficiently distant from the European site to exclude the possibility of significant impacts from disturbance as a result of noise and vibration. Surface water contamination: Groundwater contamination: The Site is located on the same GWB, Suck South (IE_SH_G_225), as this European site. Therefore, there is a potential pathway for groundwater contamination of the European site.	
Four Roads Turlough SPA (004140)	7.15 km northeast	- Golden Plover (<i>Pluvialis apricaria</i>) [A140] - Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] - Wetland and Waterbirds [A999] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004140.pdf	Disturbance: The Site is located over 1km from the European site. This is the largest recommended buffer zone for preventing disturbance to bird species (Goodship and Furness, 2022). Therefore, the Site is considered to be sufficiently distant from the European site to exclude the possibility of significant impacts from disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: The Site is located over 1km from the European site. This is the largest recommended buffer zone for preventing disturbance to bird species (Goodship and Furness, 2022). Therefore, the Site is	Y



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
			considered to be sufficiently distant from the European site to exclude the possibility of significant impacts from disturbance as a result of noise and vibration. Groundwater contamination: The Site is located on the same GWB, Suck South (IE_SH_G_225), as this European site. Therefore, there is a potential pathway for groundwater contamination of the European site.	
Lough Ree SPA (004064)	9.4 km east	• Little Grebe (<i>Tachybaptus ruficollis</i>) [A004] • Whooper Swan (<i>Cygnus cygnus</i>) [A038] • Wigeon (<i>Anas penelope</i>) [A050] • Teal (<i>Anas crecca</i>) [A052] • Mallard (<i>Anas platyrhynchos</i>) [A053] • Shoveler (<i>Anas clypeata</i>) [A056] • Tufted Duck (<i>Aythya fuligula</i>) [A061] • Common Scoter (<i>Melanitta nigra</i>) [A065] • Goldeneye (<i>Bucephala clangula</i>) [A067] • Coot (<i>Fulica atra</i>) [A125] • Golden Plover (<i>Pluvialis apricaria</i>) [A140] • Lapwing (<i>Vanellus vanellus</i>) [A142] • Common Tern (<i>Sterna hirundo</i>) [A193] • Wetland and Waterbirds [A999] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004064.pdf	Disturbance: The Site is located over 1km from the European site. This is the largest recommended buffer zone for preventing disturbance to bird species (Goodship and Furness, 2022). Therefore, the Site is considered to be sufficiently distant from the European site to exclude the possibility of significant impacts from disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: The Site is located over 1km from the European site. This is the largest recommended buffer zone for preventing disturbance to bird species (Goodship and Furness, 2022). Therefore, the Site is considered to be sufficiently distant from the European site to exclude the possibility of significant impacts from disturbance as a result of noise and vibration.	N



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
			Groundwater contamination: The Site is located in the Suck South GWB (IE_SH_G_225) but this European site is in a different GWB – Ballygar (IE_SH_G_028). Therefore, there is no pathway for potential groundwater contamination.	
Middle Shannon Callows SPA	12.9 km southeast	- Whooper Swan (<i>Cygnus cygnus</i>) [A038] - Wigeon (<i>Anas penelope</i>) [A050] - Corncrake (<i>Crex crex</i>) [A122] - Golden Plover (<i>Pluvialis apricaria</i>) [A140] - Lapwing (<i>Vanellus vanellus</i>) [A142] - Black-tailed Godwit (<i>Limosa limosa</i>) [A156] - Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] - Wetland and Waterbirds [A999] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004096.pdf	Disturbance: The Site is located over 1km from the European site. This is the largest recommended buffer zone for preventing disturbance to bird species (Goodship and Furness, 2022). Therefore, the Site is considered to be sufficiently distant from the European site to exclude the possibility of significant impacts from disturbance. Dust emissions: The Site is located over 400m from the European site. Therefore, it is considered to be sufficiently distant to scope out any potential impacts from elevated dust (IAQM, 2016). Noise and vibration: The Site is located over 1km from the European site. This is the largest recommended buffer zone for preventing disturbance to bird species (Goodship and Furness, 2022). Therefore, the Site is considered to be sufficiently distant from the European site to exclude the possibility of significant impacts from disturbance as a result of noise and vibration. Groundwater contamination: : The Site is located in the Suck South GWB (IE_SH_G_225) but this European site is in a different GWB – Ballygar (IE_SH_G_028).	N



European Site	Distance ⁹	Qualifying Interests ¹⁰	Connections (S-P-R)	Considered further in screening (Y/N)
			Therefore, there is no pathway for potential groundwater contamination.	



3.5 Likely Significant Effects

3.5.1 For the Project Alone

The following European sites are located on the same Water Framework Directive (WFD) GWB as the Site:

- Lough Croan Turlough SAC and SPA,
- Killeglan Grassland SAC,
- Castlesampson Esker SAC,
- Lisduff Turlough SAC,
- River Suck Callows SPA, and,
- Four Roads Turlough SAC and SPA.

Therefore, there is a potential pathway for the introduction of contaminated groundwater into the above European sites as a result of the proposed development. Contaminants may enter the groundwater via the following pathways during the construction and operational phases:

- Suspended solids entering groundwater bodies, namely the quarry sump, which could impact on groundwater in the regionally important karstified bedrock aquifer; and
- The accidental leaking or spillage of fuel and/or other petroleum-based products could also impact on groundwater in the regionally important karstified bedrock aquifer.

Such impacts will potentially arise during all phases of the Project. Sediments are likely to accumulate within the sump (i.e., the lowest point of the quarry extraction area) via surface water runoff and dust deposition. This impact will most occur during the operational phase of the development through blasting and general extraction works and will be exacerbated during periods of wet weather through increased runoff or potentially even during dry weather through increased dust creation (or alternatively via increased runoff through dust suppression e.g., water bowsers). Sediments that accumulate within the sump will potentially interact with groundwater and may alter the water chemistry.

Hydrocarbons may enter the groundwater and also alter the water chemistry via accidental spills or leaks during all phases of the project. This risk would be heightened in the event of any plant or vehicles requiring refuelling on the Project Site. Such spills or leaks are anticipated to be small in scale and rare in occurrence, but under the precautionary principle cannot be fully discounted.

These impacts could cause LSE to the QI of the European Sites listed above that are reliant on groundwater interactions (e.g., turloughs and SCI birds that rely on turlough habitats). However, groundwater interactions considered all European Sites within the same GWB from the EPA map viewer data.

Although all European Sites within the same GWB were initially considered, the likelihood of a viable groundwater pathway decreases with distance. Irish aquifer characterisation studies show that for moderate-transmissivity fractured bedrock systems, groundwater flow paths from recharge to discharge zones (including those associated with groundwater-dependent



terrestrial ecosystems or groundwater habitats) are typically within a range of 1 – 5 km^{11,12}. Therefore, a conservative screening radius of 5 km is considered appropriate for identifying potential groundwater pathways (see **Table 6-7**). This 5 km radius was therefore applied when screening for potential effects arising from groundwater interactions, with reference to the potential impact sources outlined in **Table 3-2**; and the following European Sites were screened out for LSE as a result:

- Lisduff Turlough SAC;
- Four Roads Turlough SAC; and
- Four Roads Turlough SPA.

The QI for which Killeglan Grassland SAC is designated will not experience LSE due to impacts relating to groundwater quality. Therefore, the Killeglan Grassland SAC can also be excluded from further consideration in this report.

LSE relating to groundwater impacts are only considered for those European Sites within 5 km of the Site, including:

- Lough Croan Turlough SAC;
- Lough Croan Turlough SPA;
- Castlesampson Esker SAC; and
- River Suck Callows SPA

These four European Sites are therefore screened in for further assessment at Stage Two.

3.5.2 For the Project in Combination

In combination, or cumulative, effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location. Cumulative effects can occur where a proposed development results in individually insignificant impacts that, when considered in-combination with impacts of other proposed or permitted plans and projects, can result in significant effects.

Other plans and projects that should be considered when establishing cumulative effects are:

- proposals for which consent has been applied but which are awaiting determination;
- projects which have been granted consent, but which have not yet been started, or which have been started but are not yet completed (i.e., under construction);
- proposals which have been refused permission, but which are subject to appeal, and the appeal is undetermined;
- constructed developments whose full environmental effects are not yet felt and therefore cannot be accounted for in the baseline; or
- developments specifically referenced in a National Policy Statement, a National Plan or a Local Plan.

¹¹ Williams, N.H. & Lee, M. (2013). Characterisation of the groundwater environment — Irish aquifers. In Groundwater & Sustainable Development, Geological Survey Ireland. (Note: this is a conference/workshop style document, see “Characterisation of the groundwater environment for resource assessment, development, management and protection” by Taly Hunter Williams & Monica Lee).

¹² Gill, L., Bhatnagar, S., Bijkerk, E., Regan, S., Somlai, C., Naughton, O., Ghosh, B., Waldren, S., Coxon, C. & Johnston, P. (2022). EcoMetrics – Environmental Supporting Conditions for Groundwater-dependent Terrestrial Ecosystems. EPA Research Report No. 403. Environmental Protection Agency, Ireland. ISBN 978-1-80009-030-9.



A search of recent (within the last five years) planning applications was carried out for applications that may give rise to in combination effects with the project. The majority of the recent planning applications in the vicinity of the Site are for small-scale domestic and agricultural projects that will not result in any cumulative effects with the proposed development. One planning application (ABP Ref. 313750-22¹³) was considered to be of sufficient significance to warrant further consideration for cumulative effects.

A 17-turbine wind farm (Seven Hills Wind Farm) surrounding the quarry to the south, east and west (with the closest infrastructure c. 100m from the site boundary) has been granted planning permission by An Bord Pleanála in November 2023 (ABP Ref. 313750-22). The Biodiversity Chapter of the EIAR accompanying this application concluded that there would be no significant effects on biodiversity, provided the proposed wind farm is installed and decommissioned in accordance with the mitigation measures outlined in the application. Therefore, there is no potential pathways for cumulative effects on biodiversity with the proposed continuance of use at Cam Quarry.

Therefore, the risk of significant effects on European sites as a result of the proposed development can be excluded for the project when considered in-combination with other proposed or permitted plans and projects.

3.6 AA Screening Conclusion

Based on the Source–Pathway–Receptor assessment and on the basis of objective scientific information, one or more credible pathways for significant effects on European Sites have been identified. The analysis has taken account of the characteristics of the proposed project, the ecological sensitivities of the qualifying interests and special conservation interests, the relevant site-specific CO, the known threats and pressures identified in Article 17 and Article 12 reporting, and potential in-combination effects with other plans and projects.

Having regard to the identified pathways for effect, and applying the precautionary principle in accordance with Article 6(3) of the Habitats Directive, it cannot be excluded that the proposed project, individually or in combination with other plans or projects, is likely to have a significant effect on the following European site(s) in view of their CO:

- Lough Croan Turlough SAC (000610)
- Lough Croan Turlough SPA (004139)
- Castlesampson Esker SAC (001625)
- River Suck Callows SPA (004097)

A NIS has been completed for these European Sites.

¹³ MKO (2022). Proposed Seven Hills Wind Farm, Co Roscommon – Natura Impact Statement (NIS) Report. NIS – F – 2022.06.03 – 190907



4.0 Natura Impact Assessment

4.1 Introduction

This NIS presents information on the project and on the European Sites for which LSEs have been identified at Stage One Screening, for the competent authority to carry out a Stage Two NIS.

The purpose of the Stage Two NIS is to determine whether the proposed project would lead to any adverse effects on the integrity of any European site identified at Stage One. In this case the following European sites were identified as potentially at risk of LSE by the proposed project:

- 1 Lough Croan Turlough SAC (000610)
- 2 Lough Croan Turlough SPA (004139)
- 3 Castlesampson Esker SAC (001625)
- 4 River Suck Callows SPA (004097)

4.2 Information on the Project

4.2.1 The Project

A detailed description of the proposed development is outlined in Section 3.2 above and provided in EIAR Chapter 2 - Project Description (included in Appendix D.3).

4.2.2 The Project Site

4.2.2.1 Habitats (Annex I) Summary

The semi-natural grasslands on-site and in the fields surrounding the Site have been identified as Annex I [6210] orchid-rich calcareous grassland according to the data held by NPWS on Annex I grasslands¹⁴. These grasslands are classified as being of 'bad quality' according to this data.

During the field surveys, the semi-natural grasslands in the northern part of the Site were identified as non-Annex I grassland due to a lack of indicator species present within the habitat.

The semi-natural grasslands in the southern, unmanaged area of the Site were identified as potentially good quality Annex I semi-natural dry grassland on calcareous substrate [6210] due to the presence of six positive indicator species and ten high-quality indicator species were identified within this area, as listed in **Table 4-1**¹⁵.

Table 4-1: Positive and High-Quality Indicator Species for Annex I Semi-Natural Dry Grassland on Calcareous Substrates Present in the Southern Area of the Site

High-Quality Indicator Species	Positive Indicator Species
Mountain Everlasting <i>Antennaria dioica</i>	Lady's Bedstraw <i>Galium verum</i>
Kidney Vetch <i>Anthyllis vulneraria</i>	Hawkbit spp. <i>Leontodon</i> spp.
Yellow-wort <i>Blackstonia perfoliata</i>	Common Bird's Foot Trefoil <i>Lotus corniculatus</i>
Quaking-grass <i>Briza media</i>	Mouse-ear Hawkweed <i>Pilosella officinarum</i>

¹⁴ <https://www.npws.ie/maps-and-data/habitat-and-species-data/article-17/2019/habitats/grasslands> (last accessed April 2025)

¹⁵ https://bsbi.org/wp-content/uploads/dlm_uploads/Semi_Natural_Calcareous_Grasslands_6210.pdf



High-Quality Indicator Species	Positive Indicator Species
Carlina Thistle <i>Carlina vulgaris</i>	Bulbous Buttercup <i>Ranunculus bulbosus</i>
Field Scabious <i>Knautia arvensis</i>	Wild Thyme <i>Thymus polytrichus</i>
Marsh Orchids <i>Dactylorhiza</i> sp.	
Lesser Twayblade <i>Neottia cordata</i>	
Early Purple Orchid <i>Orchis mascula</i>	
Fragrant Orchids <i>Gymnadenia</i> sp.	

This Annex I habitat is listed as a QI for the following European sites located within 15 km of the Site: Killeglan Grassland SAC, Castlesampson Esker SAC, and Lough Ree SAC. However, the Annex I grasslands located within the Site does not form any part of the QI grasslands within these European Sites and this QI has been screened out from any further assessment with regards to the loss of integrity of European Site.

No other Annex I habitats were identified on-site or in the immediate vicinity of the Site.

4.2.2.2 Species (Annex I birds and Annex II others) Summary

A marsh fritillary larval web survey and habitat condition assessment was conducted on 26th and 27th August 2024. This report concluded that the areas surveyed were utilised by marsh fritillary for breeding and are classified as suitable (under-grazed) for marsh fritillary.

Peregrine falcons were recorded on-site during the site visits on 11th June 2024 and 23rd August. No nests were observed during these field surveys; however, the quarry cliff faces are potentially suitable for nesting peregrine.

During an additional peregrine survey on 22nd April 2026, a single peregrine falcon was observed in flight over the central sector of the quarry as shown in **Plate 1**. It was determined that this behaviour was indicating potential territorial, foraging and/or breeding behaviour. A potential peregrine nesting location was identified on a cliff face in the southwest corner of the existing quarry site; this site was characterised by suitable ledges and evidence of frequent use indicated by whitewash stains on cliff face just below the ledge.



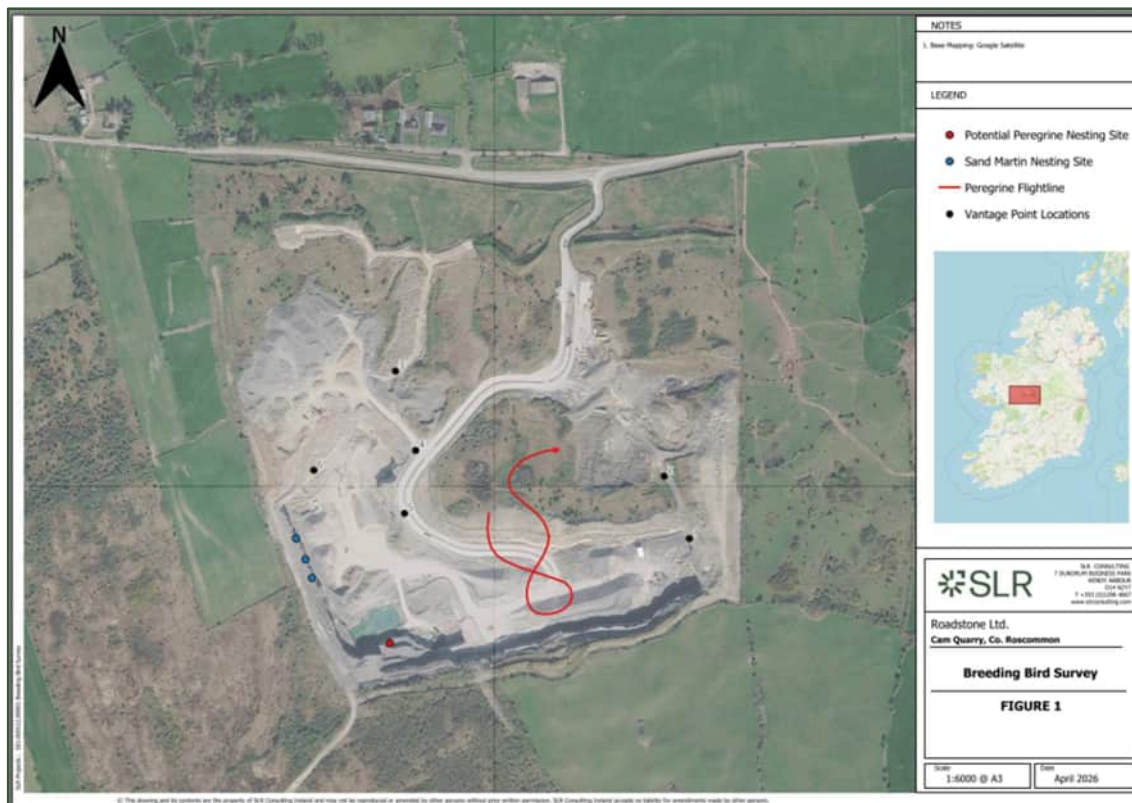


Plate 1 Vantage Point and breeding bird locations in Cam Quarry April 2026

Neither marsh fritillary and peregrine falcon are QI/SCI for any European site within the Zol of the Project and have, therefore, not been considered further in this report.

4.2.2.3 Environmental Connections Summary

There are no surface water hydrological connections between the Site and any European site (see **Figure 7-3** included in **Appendix D.2**).

There is potential for a groundwater connection between the Lough Croan Turlough SAC and SPA, Castlesampson Esker SAC, and River Suck Callows SPA. However, it should be noted that the general groundwater flow direction of north-north-west to south-south-east based on a review of groundwater level data surveyed at the Site and detailed in Chapter 7 – Water (see **Appendix D.4**). This would indicate that impacts to those European Sites located to the north of the Site are unlikely, and would include

- Lough Croan Turlough SAC;
- Lough Croan Turlough SPA

However, given that the surrounding groundwater flow (i.e., that located outside the Site boundary) is unknown, a full assessment of these European Sites has been included in Section 4.4 under the precautionary principle.

4.3 Information on European Sites

In total, four European Sites were screened in for further assessment for Stage Two assessment; all other European Sites were screened out at Stage One AA Screening. These included the following:

- 1 Lough Croan Turlough SAC (000610)



- 2 Castlesampson Esker SAC (001625)
- 3 Lough Croan Turlough SPA (004139)
- 4 River Suck Callows SPA (004097)

The site synopses sheets and Site-specific Conservation Objectives (SSCO) sheets for each of the European Sites screened in for further assessment are provided in **Appendix C.1.1** and **C.1.2**. Further details of each European Site and their Qualifying Features are detailed in the following sections.

4.3.1 Lough Croan Turlough SAC (000610)

4.3.1.1 Brief Description

Lough Croan turlough is located south of the Athlone to Mount Talbot Road in Co. Roscommon. It is a linear wetland, aligned north-west/south-east, which lies in a relatively flat area of glacial till. It is split into two main parts - the east functions as a typical turlough, with a wet area dominated by Common Reed (*Phragmites australis*) at the centre; at the west is a fen, with floating vegetation in places, which also floods in winter. In between there is undulating ground. There is little over-ground flow, but both basins retain some water all year round.

Lough Croan Turlough is an unusual wetland that contains fen, reed swamp and turlough vegetation communities in juxtaposition. The vegetation is highly diverse, with a total of 17 different communities occurring, several of which are rare or unusually large in extent. The site is notable for the presence of the rare, Northern Yellow-cress, which occurs frequently. The wintering waterfowl numbers are large, and the site is especially useful to dabbling duck species. This is an important site because of its overall size, its birdlife and the rare plant communities and species it supports. Turloughs are rare and threatened habitats that are listed, with priority status, on Annex I of the EU Habitats Directive and, as such, are of considerable conservation significance.

According to IE Geological Survey Ireland (GSI) Groundwater Data Ireland Irish Transverse Mercator (ITM) Viewer¹⁶, this SAC is situated at 70m AOD.

4.3.1.2 Qualifying/Special Conservation Interests

The qualifying interests relevant to this NIS are listed below. All other qualifying interests listed for the Lower River Shannon SAC have been scoped out of further consideration in this report as changes in water quality are not considered to have a direct or indirect impact on their CO.

Turlough [3180]

Conservation objective: To restore the favourable conservation condition of turloughs in the Lough Croan Turlough SAC.

4.3.2 Castlesampson Esker SAC (001625)

4.3.2.1 Brief Description

Castlesampson Esker is a complex site with esker, turlough and raised bog all found. The esker is the most westerly of an important group of eskers centred on Adrnacloon Hill in south-east Co. Roscommon, 9 km west of Athlone. It forms a steep-sided, crescent-shaped hill composed of glacial gravels, situated on the south side of a metalled road. Although gravel is

¹⁶ <https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=d333a8a9b6ab44378411fc0d973db4ef>
(Last accessed: 01/09/2026).



being quarried all around the esker and gravel pits occur within the site, the esker ridge itself is largely intact and fairly undisturbed. Lying to the east of the esker is a raised bog, whilst to its west is a turlough.

The Castlesampson Esker site is of high conservation for the proximity and juxtaposition of esker, raised bog and turlough. The esker itself is of high importance for its almost intact structure (something which is very rare in Irish eskers), its relatively undisturbed state and for the presence of good quality, species-rich dry calcareous grassland, a habitat that is listed with priority status on Annex I of the EU Habitats Directive. It is also notable for the good variety of rare or unusual vascular plant species that it supports. The transitional area between esker and raised bog vegetation is of interest, and notable for supporting a population of a protected vascular plant species. The raised bog itself is fairly intact and includes areas of active raised bog, degraded raised bog and Rhynchosporion vegetation, all habitats that are listed on Annex I of the EU Habitats Directive. The turlough section of the site contains a wide range of grassland and turlough habitats and includes some areas of excellent quality. Its floristic diversity is high and it is of particular interest for the remarkable contrast shown by the vegetation of grazed and ungrazed areas. The pattern of flooding is also unusual, appearing to come mostly from a few swallow holes in the south. Turlough is a habitat listed with priority status on Annex I of the EU Habitats Directive.

According to IE GSI Groundwater Data Ireland ITM Viewer¹⁶, this SAC is situated at 60m AOD.

4.3.2.2 Qualifying/Special Conservation Interests

Turlough [3180]

Conservation objective: To restore the favourable conservation condition of turloughs in Castlesampson Esker SAC.

4.3.3 Lough Croan Turlough SPA (004139)

4.3.3.1 Brief Description

Situated approximately 6 km east of the River Suck in Co. Roscommon, Lough Croan Turlough is a linear wetland, aligned north-west/south-east, which lies in a flattish area of glacial till. It is split into two main parts - the east functions as a typical turlough, with a wet, reedy centre, while the west is a fen, floating in places, which also floods in winter.

The site is a SPA under the EU Birds Directive, of special conservation interest for the following species: Greenland White-fronted Goose, Shoveler and Golden Plover. The EU Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

Lough Croan Turlough SPA is of high ornithological importance, primarily for its Greenland White-fronted Goose population, but also because of its nationally important Shoveler and Golden Plover populations. The presence of Greenland White-fronted Goose, Golden Plover and Whooper Swan is of particular note as these are listed on Annex I of the EU Birds Directive. Part of the site is a Wildfowl Sanctuary.

According to IE GSI Groundwater Data Ireland ITM Viewer¹⁶, this SPA is situated at 70m AOD.

4.3.3.2 Qualifying/Special Conservation Interests

Shoveler [A056]

Conservation objective: To maintain the favourable conservation condition of shoveler at Lough Croan Turlough SPA.



- Attributes and targets relevant to this NIS: forage spatial distribution, extent and abundance.
- The quality of foraging habitat may be impacted by potential groundwater pollution as a result of the proposed development.

Golden Plover [A140]

Conservation objective: To restore the favourable conservation condition of golden plover at Lough Croan Turlough SPA.

- Attributes and targets relevant to this NIS: forage spatial distribution, extent and abundance.
- The quality of foraging habitat may be impacted by potential groundwater pollution as a result of the proposed development.

Greenland White-fronted Goose [A395]

Conservation objective: To restore the favourable conservation condition of Greenland white-fronted goose at Lough Croan Turlough SPA.

- Attributes and targets relevant to this NIS: forage spatial distribution, extent and abundance.
- The quality of foraging habitat may be impacted by potential groundwater pollution as a result of the proposed development.

Wetlands [A999]

Conservation objective: To maintain the Favourable conservation condition of wetland habitats at the Lough Croan Turlough SPA as a resource for the regularly occurring migratory waterbirds that utilise these areas.

- Attributes and targets relevant to this NIS: wetland habitat quality and functioning.

4.3.4 River Suck Callows SPA (004097)

4.3.4.1 Brief Description

The River Suck Callows SPA is a linear, sinuous site comprising a section of the River Suck from Castlecoote, Co. Roscommon to its confluence with the River Shannon close to Shannonbridge, a distance of approximately 70km along the course of the river. The river forms part of the boundary between Counties Galway and Roscommon. The site includes the River Suck itself and the adjacent areas of seasonally flooded semi-natural lowland wet callow grassland. The River Suck is the largest tributary of the River Shannon.

The site is a SPA under the EU Birds Directive, of special conservation interest for the following species: Whooper Swan, Greenland White fronted Goose, Wigeon, Golden Plover and Lapwing. The EU Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

The River Suck Callows SPA is of considerable ornithological importance, in particular for the presence of nationally important populations of five species. Of note is that three of the species that occur regularly, i.e. Whooper Swan, Greenland White-fronted Goose and Golden Plover, are listed on Annex I of the EU Birds Directive. Part of the River Suck Callows SPA is a Wildfowl Sanctuary.

According to IE GSI Groundwater Data Ireland ITM Viewer¹⁶, this SPA is situated at 50m AOD.



4.3.4.2 Qualifying/Special Conservation Interests

Whooper Swan [A038]

Conservation objective: To maintain the favourable conservation condition of whooper swan in River Suck Callows SPA.

- Attributes and targets relevant to this NIS: forage spatial distribution, extent and abundance.
- The quality of foraging habitat may be impacted by potential groundwater pollution as a result of the proposed development.

Wigeon [A050]

Conservation objective: To restore the favourable conservation condition of wigeon in River Suck Callows SPA.

- Attributes and targets relevant to this NIS: forage spatial distribution, extent and abundance.
- The quality of foraging habitat may be impacted by potential groundwater pollution as a result of the proposed development.

Golden Plover [A140]

Conservation objective: To restore the favourable conservation condition of golden plover in River Suck Callows SPA.

- Attributes and targets relevant to this NIS: forage spatial distribution, extent and abundance.
- The quality of foraging habitat may be impacted by potential groundwater pollution as a result of the proposed development.

Lapwing [A142]

Conservation objective: To restore the favourable conservation condition of lapwing in River Suck Callows SPA.

- Attributes and targets relevant to this NIS: forage spatial distribution, extent and abundance.
- The quality of foraging habitat may be impacted by potential groundwater pollution as a result of the proposed development.

Greenland White-fronted Goose [A395]

Conservation objective: To restore the favourable conservation condition of Greenland white-fronted goose in River Suck Callows SPA.

- Attributes and targets relevant to this NIS: forage spatial distribution, extent and abundance.
- The quality of foraging habitat may be impacted by potential groundwater pollution as a result of the proposed development.

Wetlands [A999]

Conservation objective: To maintain the wetland habitats at River Suck Callows SPA as a resource for the regularly occurring migratory waterbirds that utilise these areas.

- Attributes and targets relevant to this NIS: wetland habitat quality and functioning.



- The quality of foraging habitat may be impacted by potential groundwater pollution as a result of the proposed development.

4.4 Potential for Adverse Effects on the Integrity of European Sites

NPWS, in their Article 17 reporting (NPWS, 2019) define the favourable conservation status of an Annex I habitat or Annex II species as achieved when:

- its natural range, and area it covers within that range, are stable or increasing;
- the specific structure and functions which are necessary for its long-term maintenance;
- exist and are likely to continue to exist for the foreseeable future; and
- the conservation status of its typical species is favourable.

The favourable conservation status of an Annex II species (Habitats Directive) and Annex I species (Birds Directive) is achieved through the maintenance or restoration of conservation status according to the CO of the site.

The Stage One AA Screening process showed that the elements of the project alone were identified as having the potential for LSEs on the European Sites detailed above.

The LSE that may occur to these European Sites from the proposed project were limited to groundwater interactions, namely the following:

- LSE 1 - Suspended solids entering groundwater bodies, namely the quarry sump, which could impact on groundwater in the regionally important karstified bedrock aquifer; and
- LSE 2 - The accidental leaking or spillage of fuel and/or other petroleum-based products could also impact on groundwater in the regionally important karstified bedrock aquifer.

4.4.1 Relevant Groundwater Information

The EIAR Chapter 7 – Water details the groundwater baseline conditions, vulnerability, and an assessment of potential impacts to groundwater at the Project Site.

The proposed development is located within the Suck South Groundwater Body (GWB), which has an area of 1,099km² and is bordered by twelve other GWBs. A description of the GWB is published by the GSI and is summarised below and refers to the karst limestone bedrock underlying the limestone till deposits at the site. The Funshinagh GWB is located to the east of the site. Groundwater bodies are shown in **Figure 7-6 (Appendix D)**.

The Suck South GWB received a Good WFD status during the 2016-2021 period. The Suck South GWB is considered to be “Not at Risk”. Most of the surrounding GWBs are also considered “Not at Risk of deteriorating in quality” except for the GWDTE-Rahasane Turlough (SAC000322) GWB (located on the southwest border of the Suck South GWB) which is considered “At Risk”. Further details of the baseline GWB conditions are provided in **Appendix D**.

Overall, the EIAR Chapter 7 - Water concluded that the construction and operational phases of the proposed Project (in the absence of mitigation) had a ‘medium – low’ impact rating for LSE 1 providing a ‘moderate to slight’ impact significance; and a ‘medium’ impact rating for LSE 2, providing a ‘moderate’ impact significance (see **Appendix D**). There was no risk of groundwater impacts during the decommissioning/restoration phase.



4.4.2 Summary of Known Threats and Pressures

The known threats and pressures of each European Site are presented in **Table 6-1**; the known threats and pressures for QI are presented in **Table 6-2**. A summary is provided in the Sections below.

4.4.2.1 Known Threats and Pressures to QI Turloughs for Lough Croan Turlough SAC and Castlesampson Esker SAC

The known threats and pressures for this QI is related to agricultural activities generating diffuse pollution to surface or ground waters, as well as intensive grazing or overgrazing by livestock and drainage for use as agricultural land. This QI is groundwater dependant and is highly sensitive to hydrological changes and pollution.

With regards to Lough Croan Turlough SAC, agricultural activities, including grazing, are listed under the known threats and pressures. Similarly, agricultural activities comprise the known threats and pressures turloughs at Castlesampson Esker SAC, with the addition of insufficient fertilisation.

The proposed Project will not contribute to any site-specific threats but will contribute to groundwater impacts for which this QI is dependent.

4.4.2.2 Known Threats and Pressures to SCI Birds for Lough Croan Turlough SPA

The known threats and pressures for the SCI birds for Lough Croan Turlough SPA (i.e., wetland and waterbirds, shoveler, Greenland white-fronted goose, and golden plover) comprises mixed source pollution mainly from agricultural and forestry activities, and grazing activities.

The proposed Project is not related to any agriculture or forestry and will not contribute to of the site-specific threats, pressures and activities directly. However, groundwater pollution from the proposed Project may create contribute to the existing pressure from these sources.

4.4.2.3 Known Threats and Pressures to SCI Birds for River Suck Callows SPA

The known threats and pressures to the SCI birds for the River Suck Callows SPA (i.e., wetland and waterbirds, wigeon, lapwing, Greenland white-fronted goose, golden plover, whooper swan) comprises mowing or cutting of grassland, mixed source pollution from agricultural and forestry activities, and grazing.

The proposed Project is not related to any agriculture or forestry and will not contribute to of the site-specific threats, pressures and activities directly. However, groundwater pollution from the proposed Project may create contribute to the existing pressure from these sources.

4.4.3 Summary of the Assessment

Table 6-3 – Table 6-6 (Appendix C) details the assessment of the LSE to the CO for each QI of the European Sites considered for further assessment considered (listed above) caused by the project alone and in-combination with other projects in the absence of appropriate mitigation.

Taking a precautionary approach, the proposed works have the potential to cause deterioration in water quality and alteration of local hydrology via groundwater pathways through accumulation of suspended sediments and hydrocarbons during the construction and operational phases in the absence of mitigation. However, it should be noted that this is unlikely to significantly increase from the baseline levels. No other effects will occur as a result of the proposed Project.



Under a precautionary approach, groundwater impacts may undermine the COs for the four European Sites:

- Lough Croan Turlough SAC;
- Castlesampson Esker SAC;
- Lough Croan Turlough SPA; and
- River Suck Callows SPA

Such effects could be impacted further through cumulative effects with nearby developments, namely the adjacent Seven Hills Wind Farm (313750-22). However, it should be noted that an NIS for this development was completed and included appropriate mitigation measures to prevent or minimise groundwater impacts. The effective implementation of this mitigation, along with the mitigation measures provided in Section 4.5, will prevent undermining the CO for these European Sites.

4.5 Mitigation and Monitoring Measures

The following mitigation and monitoring measures that are proposed during the construction and operational phases to avoid adverse impacts on the CO of the QIs/SCIs identified in Section 4.3.

Note that only mitigation measures that are relevant to the Project's LSE to nearby European Sites (as identified in Section 3.5) have been detailed in this report (i.e., potential impacts affecting groundwater). Additional mitigation measures for unrelated impacts are included in the adjoining EIAR.

4.5.1 Mitigation by Design

Site drainage from the overall quarry is currently managed within the site by Roadstone. The quarry is currently worked without the need to discharge water off-site and will remain as such with the proposed reduction of extraction depth. Any rainfall or water ingress within the current quarry void is managed within the void where water accumulates in the lowest level of the quarry floor allowing the remainder of the quarry to remain dry for extraction operations.

4.5.2 Additional Mitigation Measures

4.5.2.1 Surface Water Management System

An updated project design includes a surface water management system at the quarry as set out in the Proposed Quarry Water Management Infrastructure and Mitigation Measures (see **Figures ACP-5 & ACP 6 – Appendix D.2** and the EIAR Water Chapter Addendum in **Appendix Error! Reference source not found.**). This document details the proposed new surface water infrastructure to treat surface water prior to discharge to ground and provides surface water storage to use for on-site activities including dust control and wheel washing.

The proposals include for:

1. Construction of a Barrier Berm

A barrier berm will be constructed at the base of the access ramp leading to the lowest extraction bench, adjacent to the groundwater discharge area in the south-western corner of the quarry.

The purpose of the berm is to prevent surface water runoff potentially containing suspended solids from entering the sump / infiltration area directly.



Similarly, a 20 m-wide block of in situ rock will be retained along the northern boundary of the sump / infiltration area to provide an additional barrier against surface water runoff entering the area during quarry extraction at the proposed final level of 65 m AOD.

These design measures will create a dedicated enclosure around the groundwater discharge area, effectively separating it from the operational quarry. As a result, only treated, clean water will be permitted to enter the sump / infiltration area.

2. Collection of Runoff in Lagoon 1

Surface water runoff generated within the active extraction area will be directed to Lagoon 1, which will function as the primary collection and containment pond. Lagoon 1 will be lined, refer to sections below and **Drawing ACP-5 / ACP-6** for detailed design.

The lagoon will allow the initial settlement of coarse suspended solids and provide temporary storage of runoff generated within the quarry workings before being pumped to Lagoon 2 for treatment.

3. Transfer to Lagoon 2 for Secondary Treatment

Water collected within Lagoon 1 will be pumped via pipeline to Lagoon 2, located at surface level. Two pumps will be employed at Lagoon 1, one acting as the duty pump and one as a stand-by. The pumps, along with the associated generator and bunded fuel storage tank will be housed on a sealed concrete pad with bunded kerb to direct any rainfall over the pad to the lined Lagoon 1.

Lagoon 2 will be lined, and function as a secondary settlement lagoon and will provide additional retention time to facilitate the removal of sediment prior to reuse or discharge, refer to sections below and **Drawings ACP-5 / ACP-6** for detailed design.

4. Water Reuse within Quarry Operations

Lagoon 2 will serve as the principal water storage reservoir for the quarry. Stored water will be reused within site operations for the following purposes:

a. Wheelwash Supply

Water stored within Lagoon 2 will be used to supply the existing wheelwash facility. This will minimise the requirement to use water from the mains supply for wheelwash operations.

b. Dust Suppression

Stored water will provide a reliable year-round source of water for dust suppression activities throughout the quarry. This will minimise the requirement to use water from the mains supply during periods of dry weather when water is not naturally available within the quarry void.

5. Controlled Discharge of Treated Water

A water level monitoring system and automated control valve will be installed within **Lagoon 2**. When water levels exceed a predefined operational threshold, surplus water will be discharged under controlled conditions (using a hydrobrake) via a gravity-fed pipeline to the existing Sump / Infiltration Area in the south-western corner of the quarry.

Prior to discharge, the water will pass through a Class 1 hydrocarbon interceptor to ensure the removal of any residual hydrocarbons.

This system **will ensure that only clean, treated water is discharged to ground** in the sump / infiltration area and will provide an additional robust level of environmental protection for the underlying groundwater and any related pathways to European sites.



Under this new management system, all surface water runoff from the quarry base will collect in a lined pond (Lagoon 1) and prevent direct discharge into the infiltration area of all surface runoff except that which falls directly onto the infiltration area. The water collected in Lagoon 1 will then be pumped to a lined settlement lagoon (Lagoon 2) located on the higher ground to the northeast, this lagoon will provide water storage for use on site along with further attenuation of water flows.

Water discharging from the settlement lagoon will be controlled by a hydrobrake and discharged to a class 1 full retention separator. The final discharge will be via gravity to the existing quarry sump / infiltration area. The size of the lagoons is determined from the pump rates and flow controls provided by the drainage infrastructure. The design has been tested for a 1 in 1-, 30-, and 100-year storm events with 20% allowance for climate change included for the 1:100-year event. Further details of the design can be found in **Appendix D.5**.

This mitigation will prevent any contamination surface water runoff from entering the quarry sump and potentially contaminating the groundwater.

Roadstone Ltd. are in the process of submitting a Section 4 discharge licence application to Roscommon County Council based on the water management infrastructure design described above.

4.5.2.2 Water Control Measures

The revised extraction depth removes the need for any off-site water discharge. Therefore, the previously proposed Water Management System, including the hydrocarbon interceptor and all associated discharge pipework along the public road to the Ballyglass River, is no longer required.

Any surface water falling over the site will either infiltrate naturally to the ground or will be directed to the sump on the quarry floor and used for dust suppression at the site, as required.

Roadstone propose to upgrade the overall effluent treatment system by decommissioning the existing WWTS and replacing it with a Secondary WWTS at the site with a constructed soil polishing filter for final treatment. The package WWTS is designed to cater for 30 staff on site with a Population Equivalent of eight persons, based on daily hydraulic load.

In order to mitigate against the risk of pollution to groundwater occurring at the site the following management measures will be implemented:

- There will be no discharge off site to any surface watercourse;
- A double skinned fuel storage tank is located at the site and stands on a concrete pad area. Oil and lubricants for plant and machinery are stored on spill pallets in designated storage areas;
- A hard stand refuelling area with hydrocarbon separator for treating runoff waters is in place at the refuelling station area;
- Spill Kits and spill training has been provided. All new employees are given an induction which includes spill kit training and how to respond to a fuel spill;
- To control dust, water sprayed from a tractor drawn bowser on dry exposed surfaces and stockpiles (paved roads, unsealed haul roads and hardstand areas) will be implemented as required;
- Fixed sprinkler system on the hard surface site access road between the site entrance and the weighbridge;
- Areas of bare or exposed soils will, insofar as practicable, be kept to a minimum through the phased extraction proposals;



- Dust blows at the existing site are largely screened by the side walls of the existing quarry and the vegetated screening berms and existing boundary hedgerows;
- All HGVs exiting the site routed through the existing wheelwash. This minimises the transport of fines by HGVs over the access / egress road and the public road network;
- Periodic sweeping of the internal paved site access road and surrounding public roads carried out as and when required by a mechanical road sweeper;
- When the concrete batching plant is operational, all admixtures will be stored in suitably bunded tanks at the site. Water will be stored in a water tank (c. 3,000 gallon capacity) adjacent to the Concrete Batching Plant. This will be topped up as required; and
- Concrete trucks will be washed out in a washing bay adjacent to the Concrete Batching Plant. The wash water will be pumped from the trucks for recycling through a closed series of settlement ponds.

Implementation of these measures at the application site will further reduce the potential impacts identified above.

4.5.3 Monitoring Measures

The EIAR Chapter 7 – Water details the following monitoring activities will continue to be carried out (where required) to demonstrate that the development is not having an adverse impact on the surrounding environment and will document any changes in water quality:

- Monitoring of ground and surface water quality;
- Groundwater levels in all boreholes monitored on a quarterly basis for the duration of the proposed development;
- Recording of any breaches over the previous year for water quality monitoring to be provided in the annual environmental audit; and
- Submission of quarterly reports with full monitoring records of surface water quality monitoring and groundwater monitoring.

The results of these monitoring activities will be reported to the relevant authorities (in this case, An Coimisiún Pleanála).

These measures will be continued throughout the operational lifespan of the Project. It is proposed that they are conducted every three months.

The following water monitoring schedule is proposed for the site as outlined in **Table 4-2**. However, the previously proposed surface water monitoring at the discharge point to the Ballyglass River will be replaced by monitoring of treated water at the discharge point to the quarry sump / infiltration area, following treatment through Lagoons 1 and 2 and the hydrocarbon interceptor.



Table 4-2: Indicative Schedule of Environmental Monitoring for Water

ACTIVITY (RESPONSIBILITY)	Q1			Q2			Q3			Q4		
	J	F	M	A	M	J	J	A	S	O	N	D
Continual Groundwater Level in 4 boreholes MW3, MW4, MW5, MW6 with loggers (Contracted Consultant)	logger	logger	logger	logger	logger	logger	logger	logger	logger	logger	logger	Logger
Quarterly Groundwater Quality in 4 boreholes MW3, MW4, MW5, MW6 (Contracted Consultant)												
Monthly surface water run-off quality at location between hydrocarbon interceptor and water entering the infiltration area in the SE corner of quarry – location of discharge to ground (Contracted Consultant) Note - only when discharge water off-site is occurring												



4.5.4 Mitigation and Monitoring Summary

A summary of the above mitigation measures is provided in **Table 4-3**, below.

Table 4-3: Summary of mitigation measures to be implemented for the proposed project

Mitigation measure	Relevant phase(s) of the development	How measure will avoid / reduce adverse effects	Implementation of mitigation measure and level of success	Monitoring scheme to prevent mitigation failure
Surface water management system and creation of lined settlement lagoons.	Operational phase	This measure will ensure that surface waters potentially carrying suspended sediments and hydrocarbons do not accumulate in the quarry sump and are pumped to the upper lagoon for treatment prior to discharge to ground via a hydrocarbon interceptor. This system will ensure that only clean, treated water is discharged to ground and will provide an additional robust level of environmental protection for the underlying groundwater pathway and the associated European sites.	Mitigation measures will be implemented by the Client. High probability of success.	Routine inspection schedule and maintenance logs retained on site. Groundwater monitoring (detailed in Section 4.5.3) will ensure that the system is effective. Groundwater monitoring results will be provided every three months to the relevant authority for the lifespan of the project.
Double skinned fuel storage tank is located at the site and stands on a concrete pad area. Oil and lubricants for plant and machinery are stored on spill pallets in designated storage areas. All refuelling will be undertaken within the same designated area.	All phases	The double skinned fuel storage tank will minimise the risk of fuel leaks. Refuelling will be undertaken only in the designated refuelling area. The concrete pad will ensure that leaks and spillages are contained in the designated area.	Mitigation measures will be implemented by the Client. High effectiveness	
A hard stand refuelling area with hydrocarbon separator for treating runoff waters is in place at the refuelling station area.	All phases	Removes hydrocarbons from surface water runoff prior to discharge to ground, preventing contamination of underlying groundwaters.	Installed on drainage lines serving hardstanding areas, and refuelling zones. Sized to appropriate design standards and regularly maintained. High effectiveness.	
Designated fuel and oil storage as well as spill measures including overflow pipe and hydrocarbon interceptor and spill kits will be provided on site and periodic spill kit training will be provided to staff.	Operational	Prevents contamination of soil and water from accidental spills or leaks of hydrocarbons.	Fuel stored within impermeable bunded area designed to 110% of tank capacity. Refuelling in designated controlled area only. Very high effectiveness.	Weekly inspections of bund integrity and fuel storage records; spill response equipment maintained on site.
To control dust, water sprayed from a tractor drawn bowser on dry exposed surfaces and stockpiles (paved roads, unsealed haul roads and hardstand areas) will be implemented as required.	All phases	Reduces airborne particulate emissions and associated deposition that will be then managed through the surface water management system (detailed above).	Measures include the appropriate use of water bowsters, regular damping down of haul roads and stockpiles, and speed restrictions. High effectiveness under active management.	Dust monitoring will be carried out at the site at dust monitoring locations.
Fixed sprinkler system on the hard surface site access road between the site entrance and the weighbridge.	All phases	Sediments will be retained within the Site and then managed through the surface water management system (detailed above).		Groundwater monitoring (detailed in Section 4.5.3) will ensure that the system is effective. Groundwater monitoring results will be provided every three months to the relevant authority for the lifespan of the project.
Wheel wash facility.	All phases		Installed at site facilities compound area on impermeable hardstanding with closed-loop or controlled drainage. Mandatory use for all exiting vehicles. High success rate when enforced.	Regular compliance inspections.
Periodic sweeping of the internal paved site access road and surrounding public roads carried out as and when required by a mechanical road sweeper.	Construction and operational phases		Mitigation measures will be implemented by the Client.	



Mitigation measure	Relevant phase(s) of the development	How measure will avoid / reduce adverse effects	Implementation of mitigation measure and level of success	Monitoring scheme to prevent mitigation failure
All admixtures will be stored in suitably bunded tanks at the site. Water will be stored in a water tank (c. 3,000 gallon capacity) adjacent to the Concrete Batching Plant.	Construction and operational phases	This measure will ensure that potential sources of pollution that may otherwise enter groundwaters are appropriately contained and minimise the risk of accidental spills / leaks.	High probability of success.	
Concrete trucks will be washed out in a washing bay adjacent to the Concrete Batching Plant. The wash water will be pumped from the trucks for recycling through a closed series of settlement ponds.	Construction and operational phases	Sediments will be retained within the Site and then managed through the surface water management system (detailed above).		Groundwater monitoring (detailed in Section 4.5.3) will ensure that the system is effective. Groundwater monitoring results will be provided every three months to the relevant authority for the lifespan of the project.



4.5.5 Residual Effects on the Integrity of European Sites

As detailed above in **Table 4-3**, the identified mitigation measures are embedded within the project design and are capable of being implemented in full throughout the construction and operational works. Following implementation of these measures, any residual effects are expected to be negligible and not ecologically significant. Accordingly, no likely significant effects on any European site have been identified, either alone or in combination with other plans or projects.

5.0 Conclusion

The NIS concludes that, based on the best available scientific information, and provided that the works are undertaken in accordance with the proposed design and mitigation measures that are outlined in this report, and these are properly implemented, the proposed development will not have an adverse effect on the integrity of, or pose a risk of likely significant effects on any European site.



6.0 References

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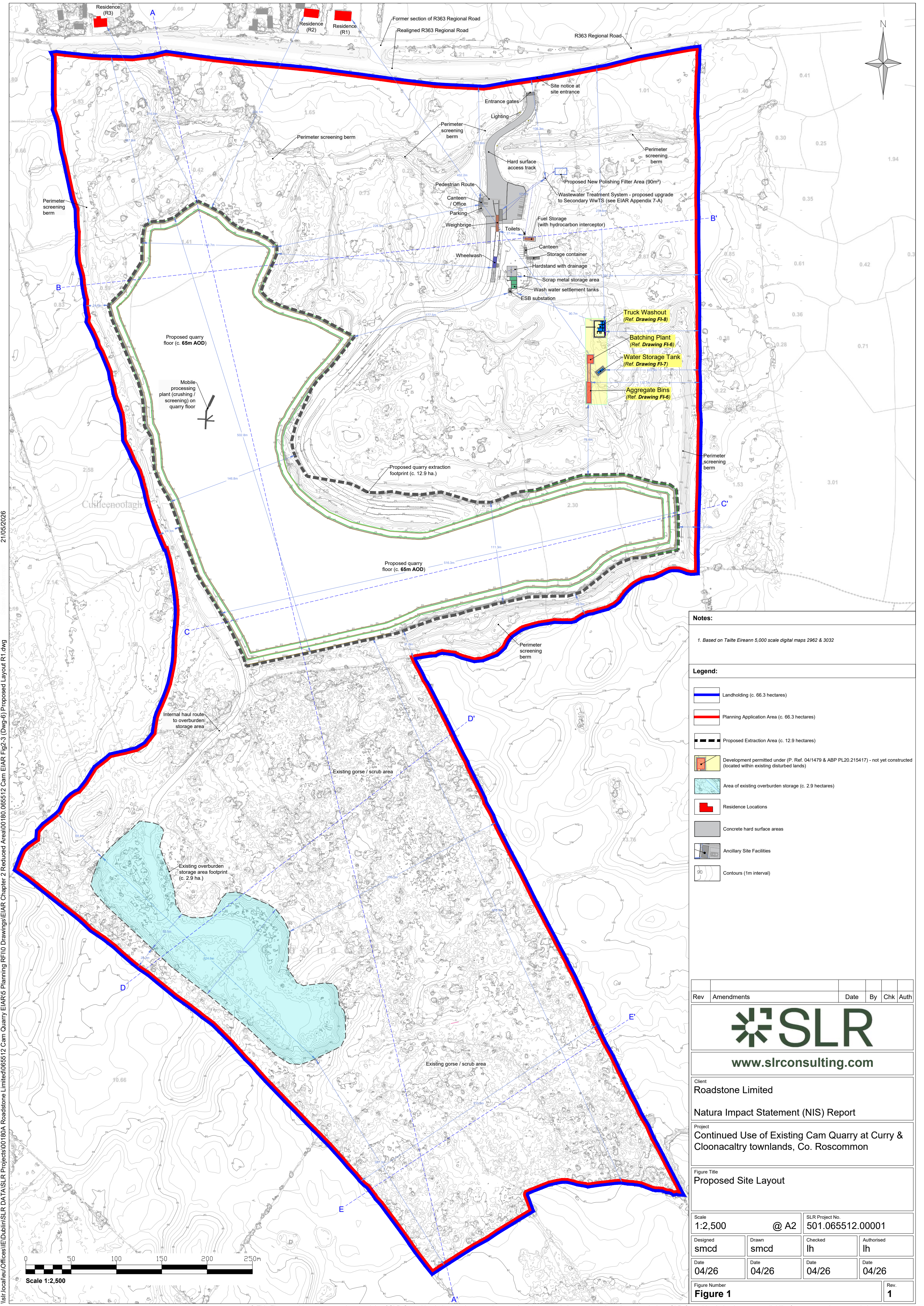


Figures

Figure 1: Site Layout

Figure 2: Location of The Site Relative to European sites

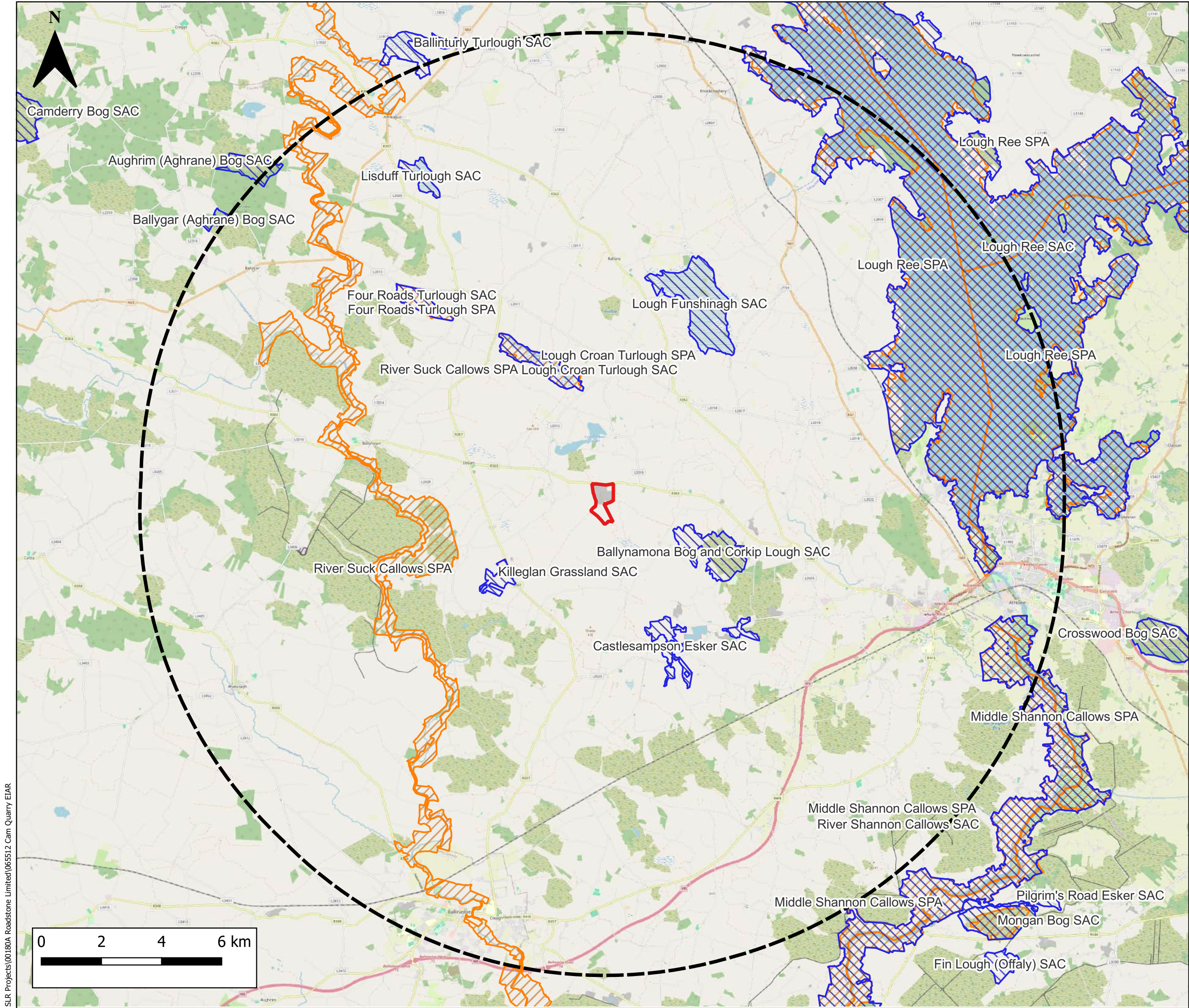




21/05/2026

\\slr.local\au\offices\IE\Dublin\SLR DATA\SLR Projects\00180A Roadstone Limited\065512 Cam Quarry EIA\5 Planning RFI\0 Drawings\EIAR Chapter 2 Reduced Area\00180.065512 Cam Quarry EIA\2 Fig2-3 (Dwg-6) Proposed Layout R1.dwg

SLR Projects\00180A Roadstone Limited\065512 Cam Quarry EIAR



NOTES

1. Base Mapping: OpenStreetMap ©
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LEGEND

- Application Site
- 15 km Buffer
- Special Areas of Conservation (SAC)
- Special Protection Areas (SPA)



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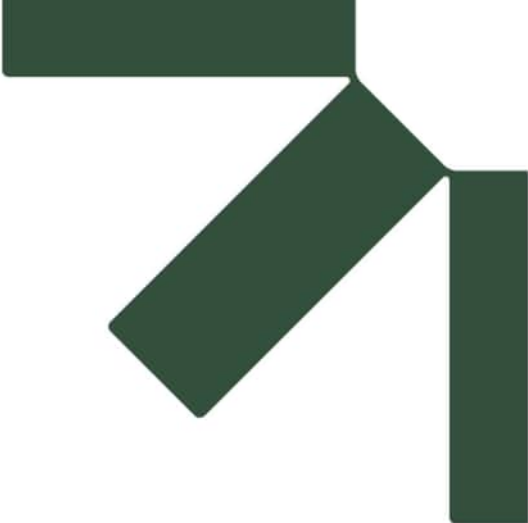
ROADSTONE LTD.
NATURA IMPACT STATEMENT (NIS) REPORT

Cam Quarry
Brideswell, Co. Roscommon
European Sites

FIGURE 2

Scale
1:120000 @ A3

Date
Nov 2025



Appendix A Relevant Legislation and Policy

Appropriate Assessment Screening & Natura Impact Statement Report

Cam Quarry Continuance of Use

Roadstone Ltd.

SLR Project No.: 501.065512.00001

14 September 2026

A.1 Relevant Legislation and Policy

A.1.1 Habitats and Birds Directives

The Habitats Directive (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora) forms the basis for the designation of SACs and a precursor designation SCI. Similarly, SPAs are classified under the Birds Directive (Council Directive 2009/147/EEC on the Conservation of Wild Birds). Collectively, SACs, SCIs and SPAs are referred to as the Natura 2000 network. The Natura 2000 Network is the minimum required to conserve certain habitats and species which are listed in the Directives.

Under Article 6(3) of the Habitats Directive, an Appropriate Assessment (AA) must be undertaken for any plan or project that is not directly connected with or necessary to the management of a Natura 2000 site but is likely to have a significant effect thereon, either alone or in combination with other plans or projects. An AA is an evaluation of the adverse effects of a plan or project, alone or in combination with other plans or projects, on the integrity of a Natura 2000 site, and the identification, where necessary, of avoidance or mitigation measures to preclude adverse effects on the integrity of the site.

Article 6, paragraph 3 the Habitats Directive states that:-

“Any plan or project not directly connected with or necessary to the management of the [Natura 2000] site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the [Natura 2000] site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public”.

Article 6, paragraph 4 goes on to deal with the special circumstances for the granting of consent for plans and projects which would have an adverse effect the integrity of the site(s) concerned.

A.1.2 European Communities (Birds and Natural Habitats) Regulations 2011

Pursuant to the Habitats Directive, Part 5 of the European Communities (Birds and Natural Habitats) Regulations 2011, as amended, similarly sets out the requirements for screening assessments, the circumstances under which an AA is required and the further implementation of Article 6(3) and 6(4) of the Habitats Directive.

It defines a “European Site” as (a) a candidate site of Community importance, (b) a site of Community importance, (c) a candidate special area of conservation, (d) a special area of conservation, (e) a candidate special protection area, or (f) a special protection area. European sites may therefore include sites which may intended to become part of the Natura 2000 network as well as those already within that network.

Regulation 42 has 22 paragraphs, with selected text provided below.

Regulation 42(1) requires that ‘a screening for Appropriate Assessment of a plan or project for which an application for consent is received, or which a public authority wishes to undertake or adopt, and which is not directly connected with or necessary to the management of the site as a European Site, shall be carried out by the public authority to assess, in view of best scientific knowledge and in view of the conservation objectives of the site, if that plan or project, individually or in combination with other plans or projects is likely to have a significant effect on the European site.’



Regulation 42(2) expands on this, stipulating that a public authority must carry out a screening for AA before consent for a plan or project is given, or a decision to undertake or adopt a plan or project is taken.

Regulation 42(6) requires that *'the public authority shall determine that an Appropriate Assessment of a plan or project is required where the plan or project is not directly connected with or necessary to the management of the site as a European Site and if it cannot be excluded, on the basis of objective scientific information following screening under this Regulation, that the plan or project, individually or in combination with other plans or projects, will have a significant effect on a European site'*.

Regulation 42(3)(a) gives the public authority the power to direct a third party to provide a Natura Impact Statement (NIS) and Regulation 42(3)(b) allows it to request any additional information that it needs to complete the screening assessment or AA. Regulation 42(5) goes on to make clear that the NIS should include such information as the public authority considers necessary to enable it to undertake the AA and to ascertain if a project or plan will affect the integrity of a Natura 2000 site. In addition to the information, Regulation 2(1) provides a definition of a Natura Impact Statement as *"a report comprising the scientific examination of a plan or project and the relevant European Site or European Sites, to identify and characterise any possible implications of the plan or project individually or in combination with other plans or projects in view of the conservation objectives of the site or sites, and any further information including, but not limited to, any plans, maps or drawings, scientific information or data required to enable the carrying out of an Appropriate Assessment"*.

Regulation 42(11) makes clear that the AA must be carried out by the public authority and that it must include its conclusion as to whether the project or plan would adversely affect the integrity of a Natura 2000 site, and that this must be done prior to consenting the project. Regulation 42 (12) makes clear that the competent authority should, *inter alia*, consider the Natura Impact Statement when undertaking the AA.

Regulations 43 and 45 then go on to deal with Article 6(4) of the Habitats Directive.

A.1.3 Planning and Development Act 2000 (as amended)

These processes have been further enshrined in the Planning and Development Act 2000 (as amended), in sections 177T, 177U and 177V.

177T states that:

(1) (a) A Natura impact report means a statement for the purposes of Article 6 of the Habitats Directive, of the implications of a Land use plan, on its own or in combination with other plans or projects, for one or more than one European site, in view of the conservation objectives of the site or sites.

(b) A Natura impact statement means a statement, for the purposes of Article 6 of the Habitats Directive, of the implications of a proposed development, on its own or in combination with other plans or projects, for one or more than one European site, in view of the conservation objectives of the site or sites.

(2) Without prejudice to the generality of subsection (1), a Natura impact report or a Natura impact statement, as the case may be, shall include a report of a scientific examination of evidence and data, carried out by competent persons to identify and classify any implications for one or more than one European site in view of the conservation objectives of the site or sites.

(3)



(4) The applicant for consent for proposed development may, or if directed in accordance with subsection (5) by a competent authority, shall furnish a Natura impact statement to the competent authority in relation to the proposed development.

(5) At any time following an application for consent for proposed development a competent authority may give a notice in writing to the applicant concerned, directing him or her to furnish a Natura impact statement.

(6)

(7) a) a Natura impact report or a Natura impact statement shall include all information prescribed by regulations under section 177AD.

(b) Where appropriate, a Natura impact report or a Natura impact statement shall include such other information or data as the competent authority considers necessary to enable it to ascertain if the draft Land use plan or proposed development will not affect the integrity of the site.

177U states that:

(1) A screening for appropriate assessment of a draft Land use plan or application for consent for proposed development shall be carried out by the competent authority to assess, in view of best scientific knowledge, if that Land use plan or proposed development, individually or in combination with another plan or project is likely to have a significant effect on the European site.

(2)

(3) in carrying out screening for appropriate assessment of a proposed development a competent authority may request such information from the applicant as it may consider necessary to enable it to carry out that screening....

(4) The competent authority shall determine that an appropriate assessment of a draft Land use plan or a proposed development, as the case may be, is required if it cannot be excluded, on the basis of objective information, that the draft Land use plan or proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site.

(5) [the vice versa of (4)]

(6)

(7)

(8)

(9)

(10)

177V. states that:

(1) An appropriate assessment carried out under this Part shall include a determination by the competent authority under Article 6.3 of the Habitats Directive as to whether or not a draft Land use plan or proposed development would adversely affect the integrity of a European site and an appropriate assessment shall be carried out by the competent authority, in each case where it has made a determination under section 177U(4) that an appropriate assessment is required, before — ...

(a) the draft Land use plan is made including, where appropriate, before a decision on appeal in relation to a draft strategic development zone is made, or

(b) consent is given for the proposed development



(2) In carrying out an appropriate assessment under subsection (1) the competent authority shall take into account each of the following matters:

(a) the Natura impact report or Natura impact statement, as appropriate

(b)....

(3)a competent authority shall make a Land use plan or give consent for proposed development only after having determined that the Land use plan or proposed development shall not adversely affect the integrity of a European site

(4)

(5)

(6)

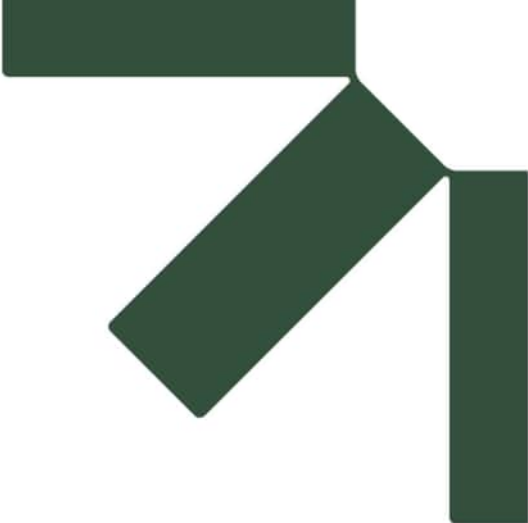
The Act then goes on to deal with Article 6(4) of the Habitats Directive.

A.1.4 National Planning Framework

National Policy Objective 59 Enhance the conservation status and improve the management of protected areas and protected species by

- Implementing relevant EU Directives to protect Ireland's environment and wildlife;
- Integrating policies and objectives for the protection and restoration of biodiversity in statutory development plans;
- Developing and utilising licensing and consent systems to facilitate sustainable activities within Natura 2000 sites;
- Continued research, survey programmes and monitoring of habitats and species.





Appendix B Appropriate Assessment Process

Appropriate Assessment Screening & Natura Impact Statement Report

Cam Quarry Continuance of Use

Roadstone Ltd.

SLR Project No.: 501.065512.00001

14 September 2026

B.1 Appropriate Assessment Process

B.1.1 Stage One: AA Screening

Stage One is a preliminary assessment, the purpose of which is to determine whether a plan or project requires more detailed assessment including the identification of mitigation measures.

There are two principal tests. The first considers whether the plan or project is needed for the management of a European site for the purpose of maintaining or restoring its conservation interest. Any such plans or projects can usually be screened out of further assessment.

The second test considers whether the plan or project, without specific mitigation measures, would be likely to have a significant effect on any European Site. This requires consideration of the project on its own and in combination with other plans or projects. A project can only be screened out of further assessment if it is certain (beyond reasonable scientific doubt and on the basis of the best scientific knowledge) that there would be no significant effects on any European site without detailed scientific investigation or mitigation designed specifically to address potential impacts on the qualifying interest of such sites. Significant effects in this assessment are those which could undermine the conservation objective(s) of a qualifying interest feature of a European site and therefore of the site itself. The process is used to determine which European Sites should be included in the later stages of the assessment. It can also be used to determine which qualifying interest features require further assessment.

The objective of the screening stage is to determine, on the basis of a preliminary assessment and objective criteria, whether a plan or project, alone and in-combination with other plans or projects, could have significant effects on a European site in view of the site's conservation objectives.

There is no necessity to establish such an effect; it is merely necessary for the competent authority to determine that there may be such an effect. The need to apply the precautionary principle in making any key decisions in relation to the tests of Appropriate Assessment (AA) has been confirmed by the case law of the Court of Justice of the European Union (CJEU). Plans or projects that have no appreciable effect on a European site may be excluded. The threshold at this first stage is a very low one and operates as a trigger in order to determine whether a Stage Two AA must be undertaken by the competent authority on the implications of the proposed development for the conservation objectives of a European site. Therefore, where significant effects are likely, uncertain or unknown at screening stage, a second stage AA will be required.

Since the screening assessment must be completed by the competent authority, this report is intended to provide the competent authority the information it requires following the same steps.

Measures intended to avoid or reduce the harmful effects of the proposed development on European sites (i.e. "mitigation measures") or best practice measures have not been taken into account in the screening stage appraisal.

B.1.2 Stage Two: Appropriate Assessment

Stage Two is a more detailed assessment, known as an "Appropriate Assessment" due to the terminology in the legislation. This essentially repeats the second test of the screening assessment but in more detail and considering mitigation measures before reaching a conclusion.

At this stage, the test is whether the project or plan will have an adverse effect on the integrity of any European site. This must be done in the light of the conservation objectives for each of



the sites and qualifying interest features that have been 'screened in' by the earlier stage of assessment. Any effect which could undermine the conservation objectives is considered an adverse effect on the integrity of the site, and vice versa. If the project, with mitigation included, is predicted to lead to adverse effects upon the integrity of the site, further stages of assessment are required before the project can be authorised.

A Stage Two AA is a focused and detailed examination, analysis and evaluation carried out by the competent authority of the implications of the plan or project, alone and in-combination with other plans and projects, on the integrity of a European site in view of that site's conservation objectives. Case law has established that such an Appropriate Assessment, to be lawfully conducted, in summary:

(i) must identify, in the light of the best scientific knowledge in the field, all aspects of the proposed development which can, by itself or in-combination with other plans or projects, affect the conservation objectives of the European site;

(ii) must contain complete, precise and definitive findings and conclusions and may not have lacunae or gaps; and

(iii) may only include a determination that the proposed development will not adversely affect the integrity of any relevant European site where the competent authority decides (on the basis of complete, precise and definitive findings and conclusions) that no reasonable scientific doubt remains as to the absence of the identified potential effects. If adverse impacts can be satisfactorily avoided or successfully mitigated at this stage, so that no reasonable doubt remains as to the absence of the identified potential effects, then the process is complete. If the assessment is negative, i.e. adverse effects on the integrity of a site cannot be excluded, then the process must proceed to stage three and, if necessary, stage four.



Appendix C European Sites Data

Appropriate Assessment Screening & Natura Impact Statement Report

Cam Quarry Continuance of Use

Roadstone Ltd.

SLR Project No.: 501.065512.00001

14 September 2026



C.1 European Site Information

C.1.1 Site Synopses Sheets for each European Site



Site Name: Castlesampson Esker SAC

Site Code: 001625

Castlesampson Esker is a complex site with esker, turlough and raised bog all found. The esker is the most westerly of an important group of eskers centred on Adrnacloon Hill in south-east Co. Roscommon, 9 km west of Athlone. It forms a steep-sided, crescent-shaped hill composed of glacial gravels, situated on the south side of a metalled road. Although gravel is being quarried all around the esker and gravel pits occur within the site, the esker ridge itself is largely intact and fairly undisturbed. Lying to the east of the esker is a raised bog, whilst to its west is a turlough.

The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes):

[3180] Turloughs*

[6210] Orchid-rich Calcareous Grassland*

The vegetation of most of the esker consists of dry grassland, with small amounts of scrub scattered throughout. Some improved grassland is found at the base of the esker. The dry grassland on the site is quite species-rich and the following are commonly found: Mountain Everlasting (*Antennaria dioica*), Wild Thyme (*Thymus praecox*), Common Bird's-foot-trefoil (*Lotus corniculatus*), Carlina Thistle (*Carlina vulgaris*), St. John's-wort species (*Hypericum pulchrum* and *H. perforatum*), Fairy Flax (*Linum catharticum*), Kidney Vetch (*Anthyllis vulneraria*), Crested Hair-grass (*Koeleria cristata*), Glaucous Sedge (*Carex flacca*), Sheep's-fescue (*Festuca ovina*), Hairy Oat-grass (*Avenula pubescens*) and Spring Sedge (*Carex caryophyllea*). The esker grassland supports several species not often seen on eskers, e.g. Goldenrod (*Solidago virgaurea*) and Sea Plantain (*Plantago maritima*), as well as some regional rarities, e.g. Hedge Bedstraw (*Galium mollugo*). The grassland is also notable for the variety of orchids it supports, e.g. Early-purple Orchid (*Orchis mascula*), Pyramidal Orchid (*Anacamptis pyramidalis*), Common Spotted-orchid (*Dactylorhiza fuchsii*) and Fragrant Orchid (*Gymnadenia conopsea*).

Three gravel pits are included within the site. One of these contains a number of fen species, including Black Bog-rush (*Schoenus nigricans*) and Grass-of-parnassus (*Parnassia palustris*). All of the pits contain Blue Fleabane (*Erigeron acer*), a species listed in the Red Data Book, while one pit contains the protected (Flora (Protection) Order, 1999) species Basil Thyme (*Acinos arvensis*).

The raised bog adjacent and to the east of the esker is fairly intact and has a good cover of bog mosses (*Sphagnum* spp). It includes areas of pools and flats with such species as Bogbean (*Menyanthes trifoliata*), Bog Pondweed (*Potamogeton polygonifolius*), Great Sundew (*Drosera anglica*), Carnation Sedge (*Carex panicea*), Bog Asphodel (*Narthecium ossifragum*), Brown Beak-sedge (*Rhynchospora fusca*) and White Beak-sedge (*R. alba*), while hummocks support Bog-rosemary (*Andromeda polifolia*), Hare's-tail Cottongrass (*Eriophorum vaginatum*) and the moss *Racomitrium lanuginosum*. The eastern edge of the bog is notable for supporting a population of the grass Wood Small-reed (*Calamagrostis epigejos*), its only known Co. Roscommon site. This is a rare species in Ireland and is protected under the Flora (Protection) Order, 1999.

The western section of the site comprises an undulating area of glacially-derived mounds and seasonally flooded basins, Corraree turlough. The main turlough basin extends southwards into two arms that are separated by higher ground of glacial sediments. It includes areas dominated by Black Bog-rush and by Purple Moor-grass (*Molinia caerulea*), areas of wet grassland that hold a typical suite of turlough species and areas of marsh and fen. Certain sections of the turlough flood more frequently than others. Flooding appears to emanate largely from a few swallow holes in the south, which fill when the underlying karst limestone aquifer is full from river flooding. However, at least one swallow hole is known in the northern part of the turlough also. A few small areas not connected to the main turlough basin also flood. The areas liable to flooding are surrounded by low mounds covered in dry grassland, which have been improved to a greater or lesser extent.

The Castlesampson Esker site is of high conservation for the proximity and juxtaposition of esker, raised bog and turlough. The esker itself is of high importance for its almost intact structure (something which is very rare in Irish eskers), its relatively undisturbed state and for the presence of good quality, species-rich dry calcareous grassland, a habitat that is listed with priority status on Annex I of the E.U. Habitats Directive. It is also notable for the good variety of rare or unusual vascular plant species that it supports. The transitional area between esker and raised bog vegetation is of interest, and notable for supporting a population of a protected vascular plant species. The raised bog itself is fairly intact and includes areas of active raised bog, degraded raised bog and Rhynchosporion vegetation, all habitats that are listed on Annex I of the E.U. Habitats Directive. The turlough section of the site contains a wide range of grassland and turlough habitats and includes some areas of excellent quality. Its floristic diversity is high and it is of particular interest for the remarkable contrast shown by the vegetation of grazed and ungrazed areas. The pattern of flooding is also unusual, appearing to come mostly from a few swallow holes in the south. Turlough is a habitat listed with priority status on Annex I of the E.U. Habitats Directive.

Site Name: Lough Croan Turlough SAC

Site Code: 000610

Lough Croan turlough is located south of the Athlone to Mount Talbot road in Co. Roscommon. It is a linear wetland, aligned north-west/south-east, which lies in a relatively flat area of glacial till. It is split into two main parts - the east functions as a typical turlough, with a wet area dominated by Common Reed (*Phragmites australis*) at the centre; at the west is a fen, with floating vegetation in places, which also floods in winter. In between there is undulating ground. There is little over-ground flow, but both basins retain some water all year round.

The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes):

[3180] Turloughs*

Lough Croan Turlough is a large, complex site which supports a multitude of vegetation types. The midline of the turlough is generally the wettest ground and, particularly in the western half of the site, there are beds of Common Reed, with Tufted-sedge (*Carex elata*), Bottle Sedge (*Carex rostrata*) and Water Horsetail (*Equisetum fluviatile*). Cowbane (*Cicuta virosa*), Lesser Water-parsnip (*Berula erecta*), Greater Spearwort (*Ranunculus lingua*) and Yellow Iris (*Iris pseudacorus*) are frequent, and there are occasional clumps of Rusty Willow (*Salix cinerea* subsp. *oleifolia*). Drains on the site support aquatic vegetation, with Bogbean (*Menyanthes trifoliata*), Whorled Water-milfoil (*Myriophyllum verticillatum*) and Lesser Pondweed (*Potamogeton pusillus*).

At the eastern end a larger waterbody holds similar vegetation, with substantial areas of Common Club-rush (*Scirpus lacustris*), Tufted-sedge and Bogbean, mixed with Bracted bur-reed (*Sparganium erectum*) and Yellow Iris. On the southern side a distinct band of annual plants follows the edge of the sedges on the whitish mud. Here the rare, Red Data Book species Northern Yellow-cress (*Rorippa islandica*) occurs frequently, along with Marsh Cudweed (*Gnaphalium uliginosum*), Red Goosefoot (*Chenopodium rubrum*) and Toad Rush (*Juncus bufonius*).

Outside of these wet areas the turlough bottom is covered with sedge-dominated vegetation, particularly Common Sedge (*Carex nigra*); the occurrence here of Purple Moor-grass (*Molinia caerulea*), Tufted Hair-grass (*Deschampsia cespitosa*) and Marsh Horsetail (*Equisetum palustre*) reflect the high peat content of the soil. Peat is especially thick at the western end where Blunt-flowered Rush (*Juncus subnodulosus*), Bogbean, Marsh Lousewort (*Pedicularis palustris*) and Water Horsetail are scattered

through vegetation of Common Sedge, Bottle Sedge and Brown Sedge (*Carex disticha*). An area of sedge fen with Devil's-bit Scabious (*Succisa pratensis*), a little Black Bog-rush (*Schoenus nigricans*) and Slender Sedge (*Carex lasiocarpa*) is also found here.

Around the margins grassland is the most common habitat; calcareous grassland at the southern end where the shore rises abruptly, but elsewhere grassland which is more nutrient-enriched and generally species-poor.

Lough Croan is an important ornithological site and is a Wildfowl Sanctuary. The following species use the site (except where indicated, numbers are the average of 11 counts over 3 seasons, 1984/85-1986/87): Shoveler (154), Wigeon (483), Gadwall (10, 1 count), Teal (473), Mallard (32), Pintail (17), Coot (42), Lapwing (445; 2,600 in 1988), Curlew (103), Golden Plover (160; occasionally numbers between 1000 and 3000 are recorded), Whooper Swan (11) and Bewick's Swan (18, 1 count). Pochard (6 breeding pairs in 1991), Shoveler (proved breeding in 1993), Mute Swan and Black-headed Gull also occur at the site and nest, as do Snipe, Curlew and Lapwing. Greenland White-fronted Goose regularly utilise this turlough for feeding and, when water is high, for roosting. These birds are part of the River Suck population. Numbers vary, but in most winters between 150 and 300 individuals are recorded. Short-eared Owl has once been recorded from the site; this species, Whooper Swan, Golden Plover and Greenland White-fronted Goose are listed in the Red Data Book and, along with Bewick's Swan, on Annex I of the E.U. Birds Directive.

Lough Croan Turlough is an unusual wetland that contains fen, reedswamp and turlough vegetation communities in juxtaposition. The vegetation is highly diverse, with a total of 17 different communities occurring, several of which are rare or unusually large in extent. The site is notable for the presence of the rare, Northern Yellow-cress, which occurs frequently. The wintering waterfowl numbers are large and the site is especially useful to dabbling duck species. This is an important site because of its overall size, its birdlife and the rare plant communities and species it supports. Turloughs are rare and threatened habitats that are listed, with priority status, on Annex I of the E.U. Habitats Directive and, as such, are of considerable conservation significance.

SITE SYNOPSIS

SITE NAME: LOUGH CROAN TURLOUGH SPA

SITE CODE: 004139

Situated approximately 6 km east of the River Suck in Co. Roscommon, Lough Croan Turlough is a linear wetland, aligned north-west/south-east, which lies in a flattish area of glacial till. It is split into two main parts - the east functions as a typical turlough, with a wet, reedy centre, while the west is a fen, floating in places, which also floods in winter.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Greenland White-fronted Goose, Shoveler and Golden Plover. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

Lough Croan supports nationally important numbers of Greenland White-fronted Goose (164) - mean peak counts for the period 1994/95 to 1998/99. The geese that utilise this site are part of an internationally important flock that are based along the River Suck. The site also supports nationally important populations of Shoveler (157), and Golden Plover (2,025) - figures are mean peak counts for four of the five winters between 1995/96 and 1999/2000. The Shoveler population is one of the largest in the country. Other species that occur at the site include Whooper Swan (15), Wigeon (392), Gadwall (7), Teal (330), Mallard (56), Pintail (22), Lapwing (661), Curlew (93) and Black-headed Gull (59). Some of these species use the turlough both as a feeding and roost site.

Lough Croan is also a site for breeding birds - Pochard and Shoveler, which are both rare breeding species in Ireland, have bred at the site in recent years and it is considered that they probably attempt to nest every year. Mute Swan also breeds and Black-headed Gull has bred in the past.

Lough Croan Turlough SPA is of high ornithological importance, primarily for its Greenland White-fronted Goose population, but also because of its nationally important Shoveler and Golden Plover populations. The presence of Greenland White-fronted Goose, Golden Plover and Whooper Swan is of particular note as these are listed on Annex I of the E.U. Birds Directive. Part of the site is a Wildfowl Sanctuary.

22.4.2010

SITE SYNOPSIS

SITE NAME: RIVER SUCK CALLOWS SPA

SITE CODE: 004097

The River Suck Callows SPA is a linear, sinuous site comprising a section of the River Suck from Castlecoote, Co. Roscommon to its confluence with the River Shannon close to Shannonbridge, a distance of approximately 70 km along the course of the river. The river forms part of the boundary between Counties Galway and Roscommon. The site includes the River Suck itself and the adjacent areas of seasonally-flooded semi-natural lowland wet callow grassland. The River Suck is the largest tributary of the River Shannon.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Whooper Swan, Greenland White-fronted Goose, Wigeon, Golden Plover and Lapwing. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

The River Suck Callows SPA is an important site for wintering waterfowl. Of particular note is the nationally important Greenland White-fronted Goose flock (293 – five year mean peak for the period 1994/95 to 1998/99) which congregates mainly in the middle reaches of the river. Four other species occur in populations of national importance, i.e. Whooper Swan (164), Wigeon (3,232), Golden Plover (2,241) and Lapwing (3,906) – all figures are five year mean peaks from aerial surveys between 2001/02 and 2005/06. Other species present include Mute Swan (122), Teal (402), Mallard (70), Black-tailed Godwit (24), Curlew (22) and Black-headed Gull (86).

The River Suck Callows SPA is of considerable ornithological importance, in particular for the presence of nationally important populations of five species. Of note is that three of the species that occur regularly, i.e. Whooper Swan, Greenland White-fronted Goose and Golden Plover, are listed on Annex I of the E.U. Birds Directive. Part of the River Suck Callows SPA is a Wildfowl Sanctuary.

C.1.2 SSCOs for each European Site



National Parks and Wildlife Service

Conservation Objectives Series

Castlesampson Esker SAC 001625



An Roinn Tithíochta,
Rialtais Áitiúil agus Oidhreachta
Department of Housing,
Local Government and Heritage

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Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

** indicates a priority habitat under the Habitats Directive*

001625	Castlesampson Esker SAC
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3180	Turloughs*
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6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)
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Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	2007
Title :	Grasslands monitoring project 2006
Author :	Dwyer, R.; Crowley, W.; Wilson, F.
Series :	Unpublished report to NPWS
Year :	2013
Title :	Irish semi-natural grasslands survey 2007-2012
Author :	O'Neill, F.H.; Martin, J.R.; Devaney, F.M.; Perrin, P.M.
Series :	Irish Wildlife Manuals, No. 78
Year :	2017
Title :	Conservation objectives supporting document: Turloughs* and Rivers with muddy banks with <i>Chenopodium rubri</i> p.p. and <i>Bidention</i> p.p. vegetation
Author :	O Connor, Á.
Series :	Conservation objectives supporting document
Year :	2018
Title :	The monitoring and assessment of three EU Habitats Directive Annex I grassland habitats
Author :	Martin, J.R.; O'Neill, F.H.; Daly, O.H.
Series :	Irish Wildlife Manuals, No. 102

Other References

Year :	2009
Title :	Teagasc EPA soil and subsoils mapping project-final report. Volume II
Author :	Fealy, R. M.; Green, S.; Loftus, M.; Meehan, R.; Radford, T.; Cronin, C.; Bulfin, M.
Series :	Teagasc, Dublin
Year :	2014
Title :	Orchid Ireland Survey 2014
Author :	Curtis, T.; Wilson, F.
Series :	Report to National Museums Northern Ireland
Year :	2014
Title :	Interim classification, harmonisation and generalisation of county soil maps of Ireland. Irish soil information system final technical report 1
Author :	Jones, R.J.A.; Hannam, J.A.; Palmer, R.C.; Truckell, I.G.; Creamer, R.E.; McDonald, E.
Series :	Report for the EPA prepared by Teagasc and Cranfield University

Spatial data sources

Year : 2021
Title : Internal NPWS data
GIS Operations : Paper map scanned and georectified. Turlough as outlined on map digitised and clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For : 3180 (map 2)

Year : 2006
Title : Grassland Monitoring Project 2006
GIS Operations : Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For : 6210 (map 3)

Conservation Objectives for : Castlesampson Esker SAC [001625]

3180 Turloughs*

To restore the favourable conservation condition of Turloughs* in Castlesampson Esker SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes. See map 2	The western section of Castlesampson Esker SAC comprises an undulating area of glacially-derived mounds and the seasonally flooded basins of Corralee Turlough. The area of turlough habitat in the SAC has been calculated as 80.7ha from mapping contained in NPWS internal files. Information provided in the notes for this and the following attributes was taken from NPWS internal files, particularly surveys conducted on behalf of NPWS by R. Goodwillie in 2003/4 and 2011 (NPWS internal files). See O Connor (2017) for information on all attributes and targets
Habitat distribution	Occurrence	No decline, subject to natural processes	See map 2. The main turlough basin extends southwards into two arms that are separated by higher ground of glacial sediments. A few small hollows to the north-east of this turlough also flood, but are not connected overground to the main turlough basin. The areas liable to flooding are surrounded by low mounds with dry grassland that has been agriculturally improved to a greater or lesser extent. The glacial mounds lead to an unusual topography, particularly in the northern part of the SAC (NPWS internal files)
Hydrological regime	Various	Maintain/restore appropriate natural hydrological regime necessary to support the natural structure and functioning of the habitat	Hydrological regime is sub-divided into more detailed attributes (groundwater contribution, flood duration, frequency, area and depth, and permanently flooded/wet areas) and targets in O Connor (2017). The turlough basin in Castlesampson Esker SAC has a sinuous shape, and complex topography and shoreline owing to undulating glacial drift. There is a series of five or more possible estavelles in the basin north of the road, and one to the south. Several additional hollows to the north-east of the turlough fill with groundwater but do not connect overground to the turlough. (Semi-)permanent ponds are found to the north of the SAC and on an eastern limb near the quarry. There is a permanent stream from a rising/spring at the south-east. Drainage works were noted in 2003/4, including deepening of a drain from the northern basin to the road (NPWS internal files)
Soil type	Hectares	Maintain variety, area and extent of soil types necessary to support turlough vegetation and other biota	The Teagasc/EPA soil maps of Fealy et al. (2009) classified the soils in the vicinity of the wettest areas of the turlough as lacustrine in origin, with the remainder predominantly deep, well-drained basic mineral soils over limestone tills. Jones et al. (2014) classified the whole area as fine loamy drift with limestones but showed an east-west split in terms of drainage, with soils on the east described as moderately drained, and those to the west, which includes the greater proportion of the turlough, as imperfectly drained
Soil nutrient status: nitrogen and phosphorus	N and P concentration in soil	Restore nutrient status appropriate to soil types and vegetation communities	The turlough is naturally at the oligotrophic end of the scale, but most areas have become mesotrophic because of agricultural use, which includes fertilisation and re-seeding. Spreading of farmyard manure and/or slurry was noted in 2003/4. An area at Esker townland still had oligotrophic vegetation and soil, which was notably stonier and poorer in nutrients than elsewhere at the time of survey (NPWS internal files)
Physical structure: bare ground	Presence	Maintain sufficient wet bare ground, as appropriate	See O Connor (2017) for further details on this and all attributes

Chemical processes: calcium carbonate deposition and concentration	Calcium carbonate deposition rate/soil concentration	Maintain appropriate calcium carbonate deposition rate and concentration in soil	See O Connor (2017) for further details on this and all attributes
Active peat formation	Flood duration	Maintain active peat formation, where appropriate	See O Connor (2017) for further details on this and all attributes
Water quality	Various	Restore appropriate water quality to support the natural structure and functioning of the habitat	Water quality is sub-divided into more detailed attributes (nutrients, colour, phytoplankton and epiphyton biomass) and targets in O Connor (2017). See also The European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019. Corralee Turlough is considered to have been naturally oligotrophic, but is now enriched as a result of high densities of grazing animals (mainly sheep, some cattle) and fertilisation. An interim target of $\leq 20\mu\text{g/l}$ total phosphorus (TP) is suggested for this SAC; however, given the presence of fen communities, it may be necessary to achieve a target of $\leq 10\mu\text{g/l}$ TP to reach favourable condition. Maintaining trace/absent epiphyton as algal mats (<2% cover) should also be met for favourable condition
Vegetation composition: area of vegetation communities	Hectares	Restore area of sensitive and high conservation value vegetation communities/units	In 2003/04, the turlough was noted as having high overall diversity owing to its size, with a broad range of turlough and grassland communities. Oligotrophic communities, extensive beds of <i>Schoenus nigricans</i> , <i>Carex hostiana</i> , <i>C. panicea</i> and <i>Molinia caerulea</i> , with some <i>Nardus stricta</i> , were considered to have become restricted to an area at Esker townland. Other species that occurred in this fen vegetation included <i>C. viridula</i> , <i>Cirsium dissectum</i> and <i>Parnassia palustris</i> , while lower down the slope had <i>Deschampsia cespitosa</i> , <i>Scorzoneroideis autumnalis</i> , <i>Potentilla anserina</i> , <i>Filipendula ulmaria</i> , <i>C. hirta</i> and <i>Mentha aquatica</i> (NPWS internal files). By 2011, quarrying had destroyed the turlough vegetation in part of the north-eastern arm of the turlough basin and excavation had created areas of standing water
Vegetation composition: vegetation zonation	Distribution	Maintain/restore vegetation zonation/mosaic characteristic of the turlough	The vegetation communities of Corralee Turlough and their zonation have not been mapped or described in detail
Vegetation structure: sward height	Centimetres	Maintain sward heights appropriate to the vegetation unit, and a variety of sward heights across the turlough	In 2003/4, the contrast between grazed and ungrazed areas of the turlough was noted to be of high conservation value (NPWS internal files)
Typical species	Presence	Maintain/restore typical species within and across the turlough	Typical species is sub-divided into more detailed attributes (terrestrial, wetland and aquatic plants, invertebrates and birds) and targets in O Connor (2017). In addition to the typical species listed above, common turlough species that have been recorded at Corralee Turlough include: <i>Agrostis stolonifera</i> , <i>Cardamine pratensis</i> , <i>Carex disticha</i> , <i>C. flacca</i> , <i>C. nigra</i> , <i>Eleocharis palustris</i> , <i>Equisetum fluviatile</i> , <i>Glyceria fluitans</i> , <i>Myosotis scorpioides</i> , <i>Oenanthe aquatica</i> , <i>Persicaria amphibia</i> , <i>Phalaris arundinacea</i> , <i>Ranunculus repens</i> , <i>Rumex crispus</i> (NPWS internal files)
Fringing habitats: area	Hectares	Maintain marginal fringing habitats that support turlough vegetation, invertebrate, mammal and/or bird populations	Dry calcareous grassland supporting esker species was noted in places along the margins of Corralee Turlough, some of which may correspond to the Annex I grassland habitat 6210 (NPWS internal files). See also the conservation objective for 6210 in this volume

Vegetation structure: turlough woodland	Species diversity and woodland structure	Maintain appropriate turlough woodland diversity and structure	From an examination of aerial imagery of the turlough, woodland does not appear to be a significant feature of this turlough. Scattered hawthorn (<i>Crataegus monogyna</i>) trees occur throughout the turlough, sometimes merging to form lengths of hedgerow, but these do not coalesce into areas of woodland. The only exception is a broader line of scrub that has established along part of the western edge of the south-western arm of the turlough. This may represent turlough woodland establishing at the upper levels of the turlough
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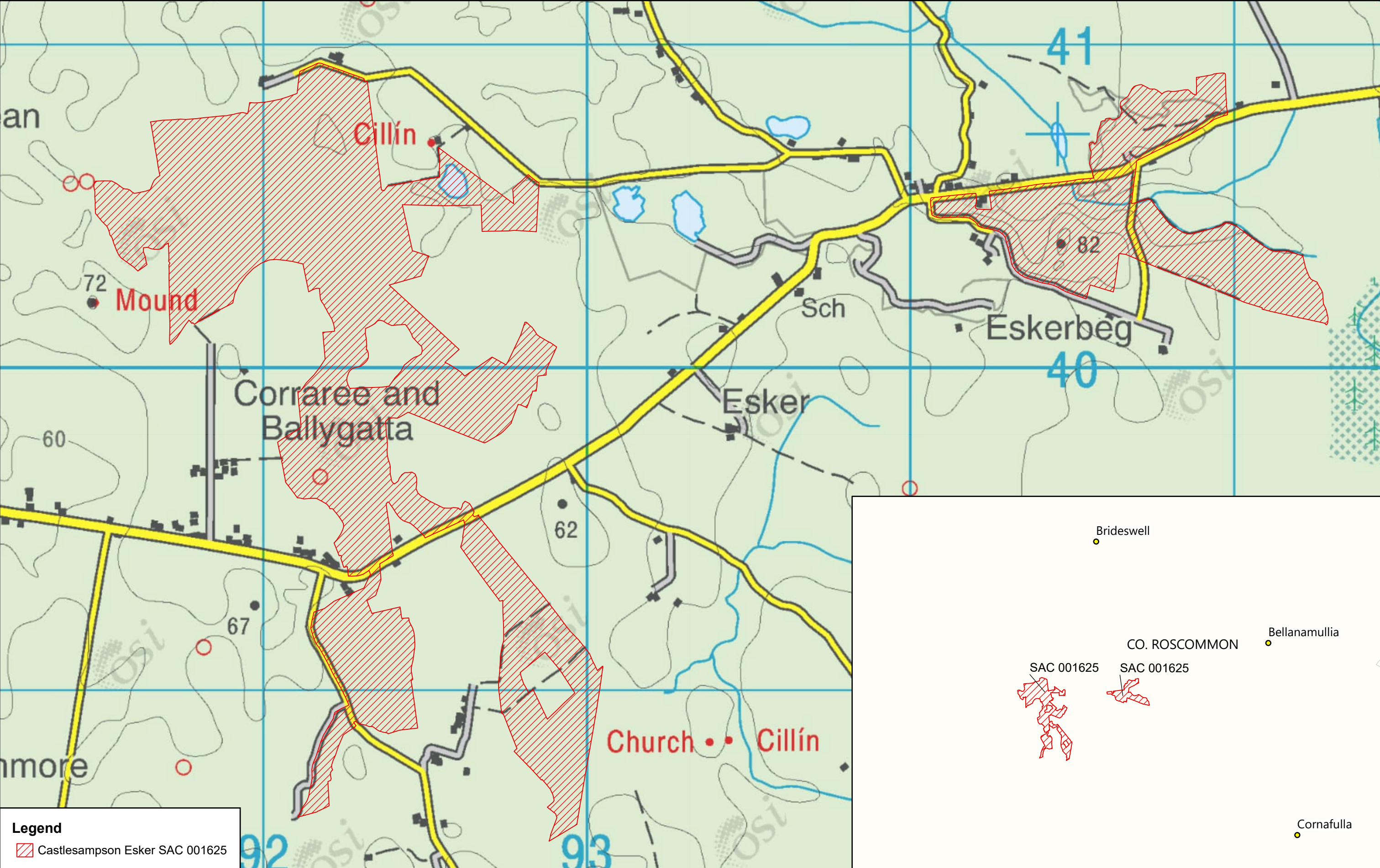
Conservation Objectives for : Castlesampson Esker SAC [001625]

6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)

To restore the favourable conservation condition of Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) in Castlesampson Esker SAC, which is defined by the following list of attributes and targets:

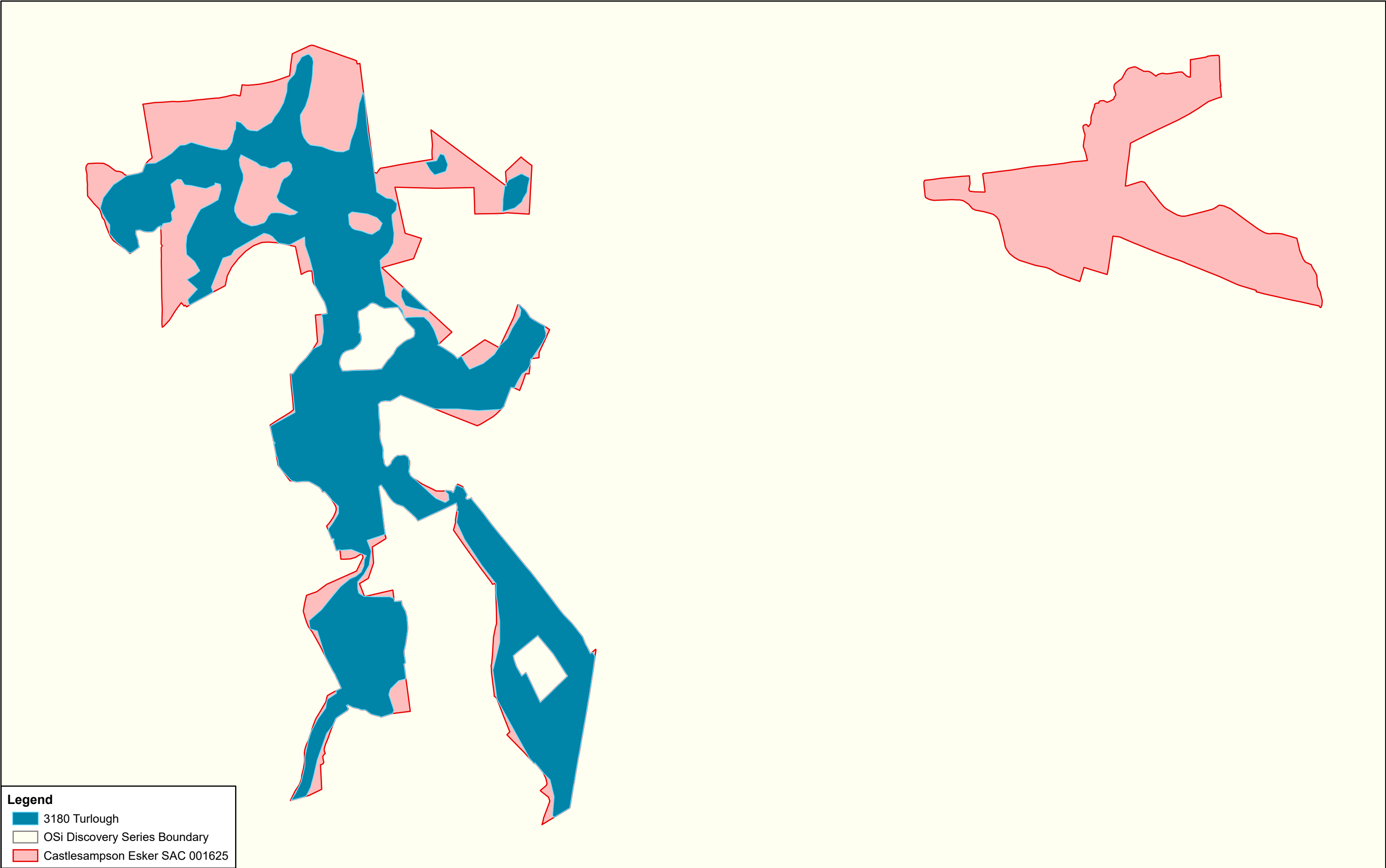
Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	As part of the Grassland Monitoring Project 2006, Dwyer et al. (2007) surveyed the habitat in Castlesampson Esker SAC and stated that it was concentrated on both the north- and south-facing slopes of the well-formed, steep-sided esker in the eastern section of the SAC, and on the hilly landscape directly east of the main esker. An area of the habitat occurring in the low-lying fields at the south-east corner of the main esker was also recorded (Dwyer et al., 2007). The area of the habitat recorded by Dwyer et al. (2007) in the SAC is 9.7ha (see map 2). It is important to note that further unsurveyed areas of the habitat may be present within the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 2 for the habitat surveyed by Dwyer et al. (2007)	Distribution based on Dwyer et al. (2007). Note that further unsurveyed areas of the habitat may be present within the SAC
Vegetation composition: positive indicator species	Number at a representative number of 2m x 2m monitoring stops; within 20m surrounding area of monitoring stops	At least 7 positive indicator species present in monitoring stop or, if 5–6 present in stop, additional species within 20m of stop; this includes at least two 'high quality' indicator species present in stop or within 20m of stop	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the lists of positive indicator species, including high quality indicators, are also presented. High quality indicators recorded in the habitat in the SAC include mountain everlasting (<i>Antennaria dioica</i>), fairy flax (<i>Linum catharticum</i>), kidney vetch (<i>Anthyllis vulneraria</i>), field scabious (<i>Knautia arvensis</i>), cowslip (<i>Primula veris</i>) and quaking-grass (<i>Briza media</i>) and a variety of orchids, including early-purple orchid (<i>Orchis mascula</i>), pyramidal orchid (<i>Anacamptis pyramidalis</i>), fragrant orchid (<i>Gymnadenia conopsea</i>), common spotted-orchid (<i>Dactylorhiza fuchsii</i>), heath spotted-orchid (<i>D. maculata</i> subsp. <i>ericetorum</i>), common twayblade (<i>Neottia ovata</i>) and lesser butterfly orchid (<i>Platanthera bifolia</i>) (Dwyer et al., 2007; Curtis and Wilson, 2014)
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Negative indicator species collectively not more than 20% cover, with cover of an individual species not more than 10%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the lists of negative indicator species are presented
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of non-native species not more than 1%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). The non-native species cotoneaster (<i>Cotoneaster</i> sp.), and also Wilson's honeysuckle (<i>Lonicera nitida</i>), are encroaching on some parts of the habitat in the SAC, particularly on the south- and west-facing slopes of the esker (Dwyer et al., 2007; Curtis and Wilson, 2014). More recent fieldwork confirms that <i>C. cf. integrifolius</i> is an extensive issue on the esker (NPWS internal files)

Vegetation composition: woody species and bracken	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of woody species (except certain listed species) and bracken (<i>Pteridium aquilinum</i>) not more than 5%	Woody species that can occur above 5% cover are juniper (<i>Juniperus communis</i>), burnet rose (<i>Rosa spinosissima</i>), mountain avens (<i>Dryas octopetala</i>) and hoary rock-rose (<i>Helianthemum oelandicum</i>). However, cover of these species above 25% may indicate transition to another Annex I habitat such as Alpine and Boreal heaths (4060) or <i>Juniperus communis</i> formations (5130). Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). Encroachment by blackthorn (<i>Prunus spinosa</i>), hawthorn (<i>Crataegus monogyna</i>), bramble (<i>Rubus fruticosus</i> agg.) and bracken has been reported in some areas of the habitat in the SAC (Dwyer et al., 2007; NPWS internal files)
Vegetation structure: broadleaf herb:grass ratio	Percentage at a representative number of 2m x 2m monitoring stops	Broadleaf herb component of vegetation between 40% and 90%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). Broadleaf herb component of vegetation between 30% and 40% may be allowed to pass on expert judgement (Martin et al., 2018)
Vegetation structure: sward height	Percentage at a representative number of 2m x 2m monitoring stops	At least 30% of sward between 5cm and 40cm tall	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation structure: litter	Percentage cover at a representative number of 2m x 2m monitoring stops	Litter cover not more than 25%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). High litter cover was reported in some parts of the habitat in the SAC by Dwyer et al. (2007)
Physical structure: bare soil	Percentage cover at a representative number of 2m x 2m monitoring stops	Not more than 10% bare soil	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Physical structure: grazing or disturbance	Area in local vicinity of a representative number of monitoring stops	Area of the habitat showing signs of serious grazing or disturbance less than 20m ²	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)



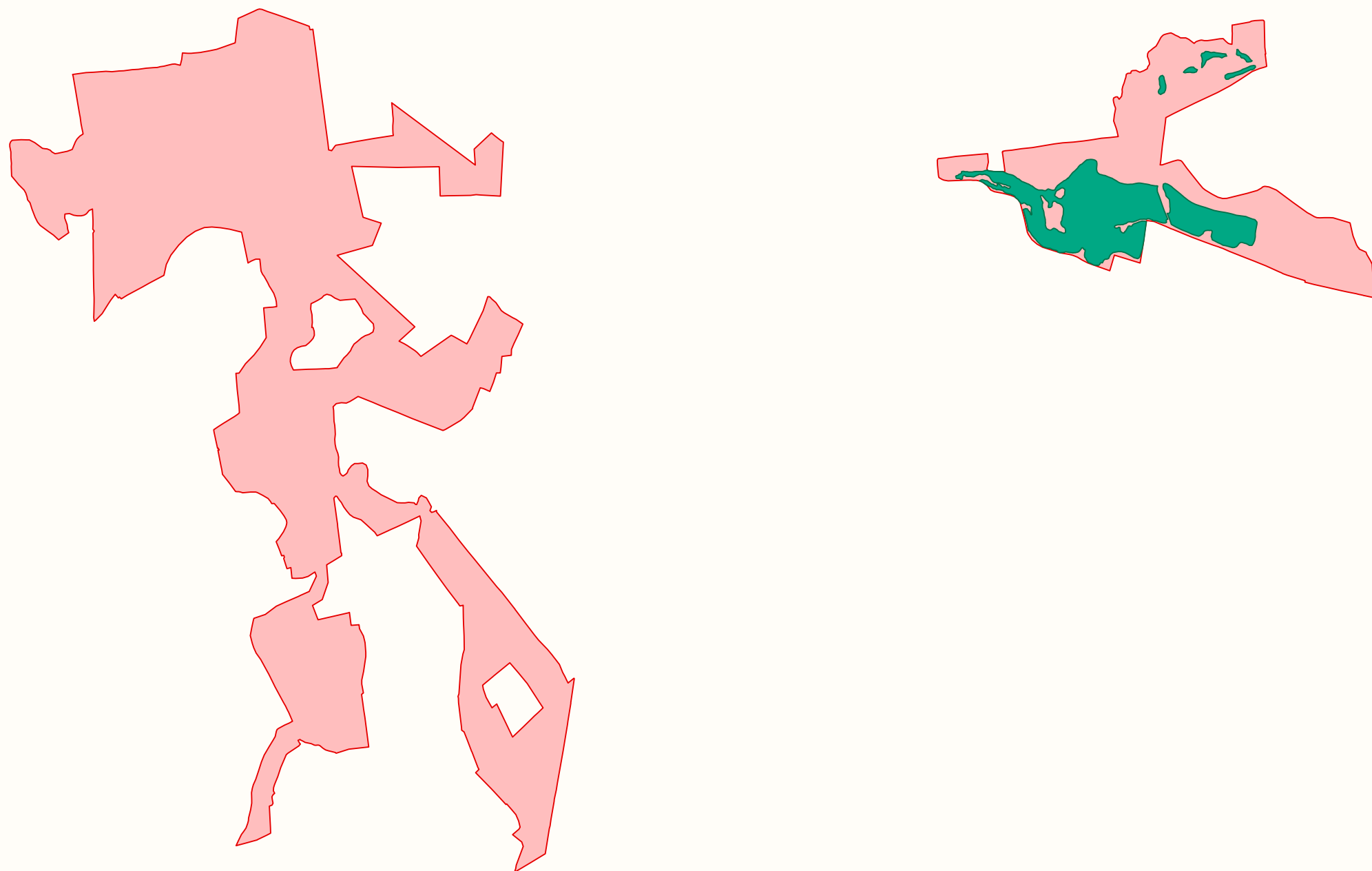
Legend

Castlesampson Esker SAC 001625



Legend

- 3180 Turlough
- OSi Discovery Series Boundary
- Castlesampson Esker SAC 001625



Legend

-  6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)
-  Castlesampson Esker SAC 001625
-  OSi Discovery Series County Boundary



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Rialtais Áitiúil agus Oidhreachta
Department of Housing,
Local Government and Heritage

MAP 3: CASTLESAMPSON ESKER SAC CONSERVATION OBJECTIVES GRASSLAND

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 001625; version 3.09. CO. ROSCOMMON

0 200 400 600 800 Meters

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Map Version 1
Date: September 2021

National Parks and Wildlife Service

Conservation Objectives Series

Lough Croan Turlough SAC 000610



An Roinn
Cultúir, Oidhreacht agus Gaeltachta
Department of
Culture, Heritage and the Gaeltacht



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and the Gaeltacht.**

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ISSN 2009-4086**

Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

** indicates a priority habitat under the Habitats Directive*

000610	Lough Croan Turlough SAC
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3180	Turloughs*
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Please note that this SAC overlaps with Lough Croan Turlough SPA (004139). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping site as appropriate.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	1992
Title :	Turloughs over 10ha - Vegetation survey and evaluation
Author :	Goodwillie, R.N.
Series :	Unpublished report to NPWS
Year :	2009
Title :	Irish Red List No. 1 - Water beetles
Author :	Foster, G.N.; Nelson, B.H.; O Connor, Á.
Series :	Ireland Red List No. 1
Year :	2016
Title :	Ireland Red List No. 10: Vascular Plants
Author :	Wyse Jackson, M.; FitzPatrick, Ú.; Cole, E.; Jebb, M.; McFerran, D.; Sheehy Skeffington, M.; Wright, M.
Series :	Ireland Red Lists series, NPWS
Year :	2017
Title :	Conservation objectives supporting document: Turloughs* and Rivers with muddy banks with <i>Chenopodium rubri</i> p.p. and <i>Bidenton</i> p.p. vegetation
Author :	O Connor, Á.
Series :	Conservation objectives supporting document

Other References

Year :	1986
Title :	A study of the geology, hydrology and geomorphology of turloughs
Author :	Coxon, C.
Series :	Unpublished Ph.D. Thesis, Trinity College Dublin
Year :	1988
Title :	The Cladocera (Crustacea) of Lough Ree and neighbouring waterbodies in Ireland
Author :	Duigan, C.
Series :	Bulletin of the Irish Biogeographical Society, 11: 100-113
Year :	1990
Title :	Records of terrestrial Coleoptera from wetland sites in 1987, including <i>Stenus glabellus</i> Thomson (Staphylinidae) new to the British Isles
Author :	Lott, D.; Foster, G.
Series :	Irish Naturalists' Journal, 23(7): 280-282
Year :	1992
Title :	A classification and evaluation of Irish water beetle assemblages
Author :	Foster, G.N.; Nelson, B.H.; Bilton, D.T.; Lott, D.A.; Merrit, R.; Weyl, R.S.; Eyre, M.D.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems, 2(2): 185-208

Spatial data sources

Year :	2016
Title :	Goodwillie (1992) Turloughs over 10 hectares: Vegetation survey and evaluation
GIS Operations :	Goodwillie map scanned and georectified. Turlough as outlined on map digitised. New turlough dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	3180 (map 3)

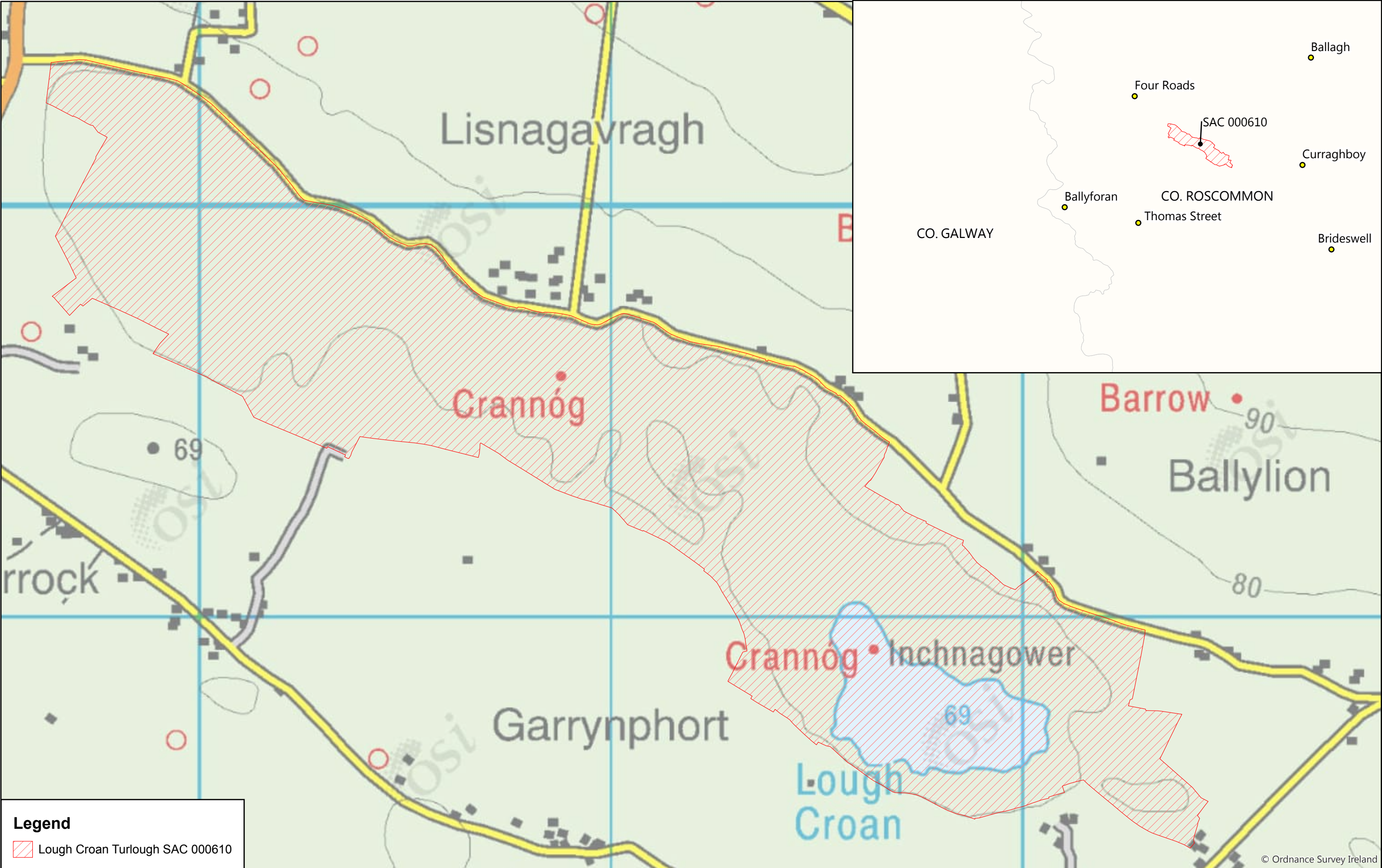
Conservation Objectives for : Lough Croan Turlough SAC [000610]

3180 Turloughs

To restore the favourable conservation condition of Turloughs* in Lough Croan Turlough SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable at c.106ha or increasing, subject to natural processes. See map 3	Based on the approximate area of 106.9ha for Lough Croan turlough from Goodwillie (1992), of which 106.2ha lies within the boundary of Lough Croan Turlough SAC. See map 3 for recorded extent. Goodwillie (1992) stated Lough Croan could be thought of as a 'small turlough contiguous with a large fen'. See also Coxon (1986). See O Connor (2017) for information on all attributes and targets
Habitat distribution	Occurrence	No decline, subject to natural processes	See map 3
Hydrological regime	Various	Maintain/restore appropriate natural hydrological regime necessary to support the natural structure and functioning of the habitat	Hydrological regime is sub-divided into more detailed attributes (groundwater contribution, flood duration, frequency, area and depth, and permanently flooded/wet areas) and targets in O Connor (2017). Lough Croan turlough has a linear basin with flat sections at each end and a more undulating central area, the high points of which become islands at moderate flood levels (Goodwillie, 1992). Goodwillie (1992) found several permanent waterbodies along the central line and south-eastern end; however, he stated that the turlough appeared to be drier than formerly, with annual flooding occurring at the eastern end of the basin, but very rare to the west. Minor springs were noted at the western end, a single spring in the east and a probable swallow hole at the northern side (Coxon, 1986; Goodwillie, 1992)
Soil type	Hectares	Maintain variety, area and extent of soil types necessary to support turlough vegetation and other biota	Goodwillie (1992) found peat below reedbeds, silty deposits in drier areas and (apparently impure) marl in the eastern lake
Soil nutrient status: nitrogen and phosphorus	N and P concentration in soil	Maintain nutrient status appropriate to soil types and vegetation communities	See O Connor (2017) for further details on this and all attributes
Physical structure: bare ground	Presence	Maintain sufficient wet bare ground, as appropriate	See O Connor (2017) for further details on this and all attributes
Chemical processes: calcium carbonate deposition and concentration	Calcium carbonate deposition rate/soil concentration	Maintain appropriate calcium carbonate deposition rate and concentration in soil	Goodwillie (1992) recorded 'apparently rather impure' marl in the eastern lake at Lough Croan
Water quality	Various	Restore appropriate water quality to support the natural structure and functioning of the habitat	Water quality is sub-divided into more detailed attributes (nutrients, colour, phytoplankton and epiphyton biomass) and targets in O Connor (2017). Very abundant epiphyton (filamentous algae) was recorded at Lough Croan in 1984 (Duigan, 1988) and during a field visit in March 2002. An interim target of $\leq 20\mu\text{g/l}$ total phosphorus (TP) is suggested for Lough Croan; however, given the area of fen communities (e.g. wet and peaty common sedge (<i>Carex nigra</i>) communities), it may be necessary to achieve a target of $\leq 10\mu\text{g/l}$ TP to reach favourable condition
Active peat formation	Flood duration	Maintain active peat formation	Goodwillie (1992) found widespread peat at Lough Croan, including deposits of more than 90cm below reedbeds and stated there was some evidence of former peat-cutting at the western end of Lough Croan

Vegetation composition: area of vegetation communities	Hectares	Maintain area of sensitive and high conservation value vegetation communities/units	See Goodwillie (1992) for information on vegetation communities at Lough Croan, which included 'a substantial area of Wet Annuals (8B)' at the south-east, with northern yellow-cress (<i>Rorippa islandica</i>) and red goosefoot (<i>Chenopodium rubrum</i>)
Vegetation composition: vegetation zonation	Distribution	Maintain vegetation zonation/mosaic characteristic of the site	See Goodwillie (1992) for information on vegetation at Lough Croan
Vegetation structure: sward height	Centimetres	Maintain sward heights appropriate to the vegetation unit, and a variety of sward heights across the turlough	See Goodwillie (1992) for information on vegetation at Lough Croan
Typical species	Presence	Maintain typical species within and across the turlough	Typical species is sub-divided into more detailed attributes (terrestrial, wetland and aquatic plants, invertebrates and birds) and targets in O Connor (2017). See Goodwillie (1992) for information on plant species at Lough Croan, which included the Near Threatened slender tufted-sedge (<i>Carex acuta</i>) (Wyse Jackson et al., 2016). For information on invertebrates, see Duigan (1988), Lott and Foster (1990) (<i>Philonthus furcifer</i>) and Foster et al. (1992). Characteristic turlough water beetles recorded by D.A. Lott were <i>Rhantus frontalis</i> , <i>Hygrotus impressopunctatus</i> , the Near Threatened <i>Graptodytes bilineatus</i> (Foster et al., 2009), <i>Helophorus minutus</i> and <i>Ochthebius minimus</i>
Fringing habitats: area	Hectares	Maintain marginal fringing habitats that support turlough vegetation, invertebrate, mammal and/or bird populations	See O Connor (2017) for further details on this and all attributes
Vegetation structure: turlough woodland	Species diversity and woodland structure	Maintain appropriate turlough woodland diversity and structure	See O Connor (2017) for further details on this and all attributes



Legend

 Lough Croan Turlough SAC 000610

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MAP 1:
LOUGH CROAN TURLOUGH SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION

Map to be read in conjunction with the NPWS Conservation Objectives Document.

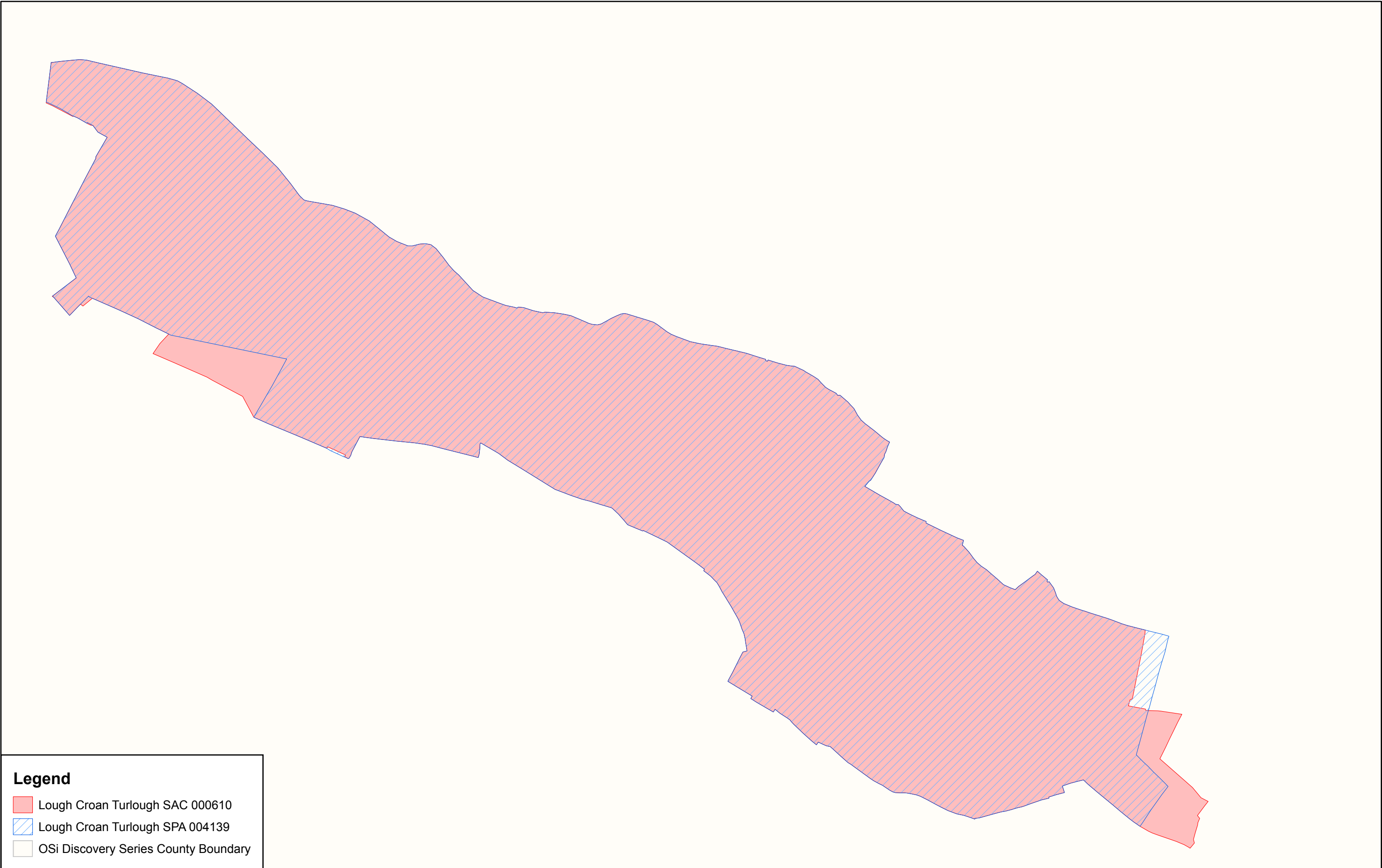
SITE CODE:
SAC 000610; version 3.01. CO. ROSCOMMON

0 90 180 270 360 450 Meters

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Map Version 1
Date: Sept 2017



Legend

-  Lough Croan Turlough SAC 000610
-  Lough Croan Turlough SPA 004139
-  OSi Discovery Series County Boundary



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MAP 2:
LOUGH CROAN TURLOUGH SAC
CONSERVATION OBJECTIVES
OVERLAPPING DESIGNATION

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 000610; version 3.01. SPA 004139; version 3.
CO. ROSCOMMON

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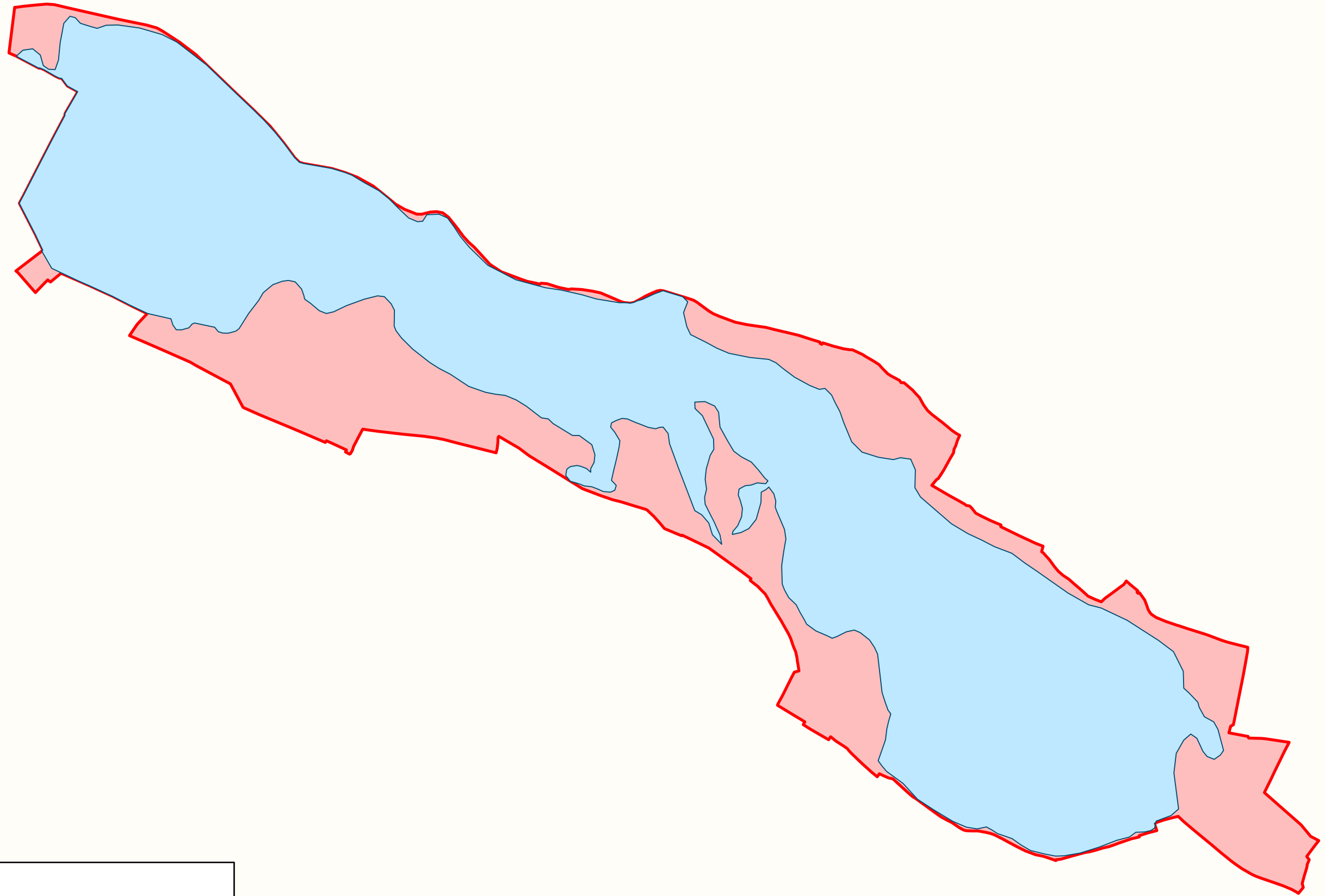


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Map Version 1
Date: Sept 2017



Legend

- 3180 Turloughs
- Lough Croan Turlough SAC 000610
- OSi Discovery Series County Boundary

National Parks and Wildlife Service

Conservation Objectives Series

Lough Croan Turlough SPA 004139



NPWS

An tSeirbhís Páirceanna
Náisiúnta agus Fiadhúlra
National Parks and Wildlife
Service

**National Parks and Wildlife Service,
Department of Housing, Local Government and Heritage,
90 King Street North, Dublin 7, D07 N7CV, Ireland.
Web: www.npws.ie
E-mail: natureconservation@npws.gov.ie**

Citation:

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Version 1. National Parks and Wildlife Service, Department of Housing, Local
Government and Heritage.**

**Series Editors: Maria Long and Colin Heaslip
ISSN 2009-4086**

Introduction

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Qualifying Interests

** indicates a priority habitat under the Habitats Directive*

004139	Lough Croan Turlough SPA
A056	Shoveler <i>Anas clypeata</i>
A140	Golden Plover <i>Pluvialis apricaria</i>
A395	Greenland White-fronted Goose <i>Anser albifrons flavirostris</i>
A999	Wetlands

Please note that this SPA overlaps with Lough Croan Turlough SAC (000610). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping site as appropriate.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year : 2013
Title : A review of the SPA network of sites in the Republic of Ireland
Author : NPWS
Series : Published Report

Other References

Year :	1995
Title :	Impacts of hunting disturbance on waterbirds - a review
Author :	Madsen, J.; Fox, A.D.
Series :	Wildlife Biology 1(4):193-207
Year :	2014
Title :	A review of Greenland white-fronted geese in Ireland 1982/83 – 2011/12
Author :	Burke, B.; Egan, F.; Norriss, D.; Wilson, H.J.; Walsh, A.J.
Series :	Unpublished report
Year :	2016
Title :	Assessing connectivity with Special Protection Areas (SPAs)
Author :	Scottish Natural Heritage
Series :	Guidance Series Version 3 - June 2016
Year :	2019
Title :	Report of the 2018/19 international census of Greenland white-fronted geese
Author :	Fox, T.; Francis, I.; Walsh, A; Norriss, D.
Series :	Unpublished report
Year :	2019
Title :	Report under the Article 12 of the Birds Directive Period 2008-2012
Author :	EEA
Series :	European Environment Agency. European Topic Centre on Biological Diversity. Pp 1-9
Year :	2020
Title :	Report of the 2019/20 international census of Greenland white-fronted geese
Author :	Fox, T.; Francis, I.; Walsh, A.; Norriss, D.
Series :	Unpublished report
Year :	2021
Title :	Report of the 2020/21 international census of Greenland white-fronted geese
Author :	Fox, T.; Francis, I.; Walsh, A.; Norriss, D.; Kelly, S.
Series :	Unpublished report
Year :	2022
Title :	Irish wetland bird survey: I-WeBS national and site trends report 1994/95 – 2019/20
Author :	Kennedy, J.; Burke, B.; Fitzgerald, N.; Kelly, S.B.A.; Walsh, A.J; Lewis, L.J.
Series :	https://birdwatchireland.ie/app/uploads/2022/04/iwebs_trends_report.html
Year :	2022
Title :	Report of the 2021/22 international census of Greenland white-fronted geese
Author :	Fox, T.; Francis, I.; Walsh, A; Norriss, D.; Kelly, S.
Series :	Unpublished report
Year :	2023
Title :	Report of the 2022/23 international census of Greenland white-fronted geese
Author :	Fox, T.; Francis, I.; Walsh, A; Norriss, D.; Kelly, S.
Series :	Unpublished report

Conservation Objectives for : Lough Croan Turlough SPA [004139]

A056 Shoveler *Anas clypeata*

To maintain the Favourable conservation condition of Shoveler at Lough Croan Turlough SPA which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	The national population of wintering Shoveler in Ireland has declined by 11% from 1994/95 to 2019/2000, as monitored via the Irish Wetland Bird Survey (I-WeBS) (Kennedy et al., 2022). During the baseline assessments to inform SPA designation, 157 Shoveler were estimated to be using this SPA (5 year mean of peak counts for baseline period 1995/96 to 1999/2000; see NPWS, 2013). A population of 208 Shoveler were recorded to be using Lough Croan Turlough SPA in recent years (5 year mean of peak counts from I-WeBS data for the period 2016/17 to 2020/21). This represents an estimated population increase of 32% since the baseline period, in contrast to the national trend
Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	Distribution encapsulates the number of locations and area of potentially suitable habitat for the wintering population and its availability for use. The suitability and availability of habitat areas are likely to vary throughout the season, for example, due to variation in land management practices or the abundance of resources available (due to natural variation and other factors). This will affect the spatio-temporal patterns of use of the habitats by the wintering population
Disturbance at wintering site	Intensity, frequency, timing and duration	Disturbance occurs at levels that do not significantly impact the achievement of targets for population trend and spatial distribution	The impact of any significant disturbance (direct or indirect) to the wintering population will ultimately affect the achievement of targets for population trend and/or spatial distribution. Disturbance contributes to increased energetic expenditure which can result in increased likelihood of winter mortality or reduced fitness (if energy expenditure is greater than energy gain) and, in turn, negatively impact population trends (see, for example, Madsen and Fox, 1995). Factors such as intensity, frequency, timing and duration of a (direct or indirect) disturbance source must be taken into account to determine the potential impact upon the targets for population trend and spatial distribution
Barriers to connectivity and site use	Number, location, shape and hectares	Barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA	Barriers limiting the population's access to this SPA or ecologically important sites outside the SPA will ultimately affect the achievement of targets for population trend and/or spatial distribution. Factors such as the number, location, shape and area of potential barriers must be taken into account to determine their potential impact
Forage spatial distribution, extent and abundance	Location, hectares, and forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	Foraging habitats include a range of wetlands, such as marshes, rivers, flood-waters, lakes, reservoirs, lagoons and estuaries, as well as grasslands. Shoveler are omnivorous and primarily forage at the surface (dabbling or up-ending) but also dive. The species demonstrates a highly specialised filter-feeding behaviour which allows it to consume a wide variety of planktonic prey items, including crustaceans, molluscs, insects, larvae and various plant materials. It can also dabble for these prey items

Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	Roosting is a critical ecological requirement for the wintering population. When roosting overnight, Shoveler primarily utilise wetlands (see foraging habitats). Daytime roosting is also a common behaviour, where birds minimise activity levels to conserve energy, while benefitting from the vigilance of other flock members. A lack of sufficient and suitable roosting habitats can result in increased mortality risk, whether indirectly (e.g. via increased energy expenditure travelling to/from roost sites) or directly (e.g. via increased predation risk), or reduction in site use; this would ultimately affect the achievement of targets for population trend and/or spatial distribution
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Conservation Objectives for : Lough Croan Turlough SPA [004139]

A140 Golden Plover *Pluvialis apricaria*

To restore the Favourable conservation condition of Golden Plover at Lough Croan Turlough SPA which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	The national population of wintering Golden Plover in Ireland has declined by 54% from 1994/95 to 2019/2000, as monitored via the Irish Wetland Bird Survey (I-WeBS) (Kennedy et al., 2022). During the baseline assessments to inform SPA designation, 2,025 Golden Plover were estimated to be using this SPA (5 year mean of peak counts for baseline period 1995/96 to 1999/2000; see NPWS, 2013). A population of 560 Golden Plover were recorded to be using Lough Croan Turlough SPA in recent years (5 year mean of peak counts from I-WeBS data for the period 2016/17 to 2020/21). This represents an estimated population decline of 72% since the baseline period which is significantly greater than the national trend
Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	Distribution encapsulates the number of locations and area of potentially suitable habitat for the wintering population and its availability for use. The suitability and availability of habitat areas are likely to vary throughout the season, for example, due to variation in land management practices or the abundance of resources available (due to natural variation and other factors). This will affect the spatio-temporal patterns of use of the habitats by the wintering population
Disturbance at wintering site	Intensity, frequency, timing and duration	Disturbance occurs at levels that do not significantly impact the achievement of targets for population trend and spatial distribution	The impact of any significant disturbance (direct or indirect) to the wintering population will ultimately affect the achievement of targets for population trend and/or spatial distribution. Disturbance contributes to increased energetic expenditure which can result in increased likelihood of winter mortality or reduced fitness (if energy expenditure is greater than energy gain), which can negatively impact population trends (see, for example, Madsen and Fox, 1995). Factors such as intensity, frequency, timing and duration of a (direct or indirect) disturbance source must be taken into account to determine the potential impact upon the targets for population trend and spatial distribution
Barriers to connectivity and site use	Number, location, shape and hectares	Barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA	Barriers limiting the population's access to this SPA or ecologically important sites outside the SPA will ultimately affect the achievement of targets for population trend and/or spatial distribution. Factors such as the number, location, shape and area of potential barriers must be taken into account to determine their potential impact. Access to ecologically important sites outside the SPA must also be considered as a single SPA may not satisfy all the ecological requirements of the wintering population, and it may require access to other SPAs or sites for certain activities, such as foraging when preferred foraging areas are unavailable due to disturbance, extensive flooding, or other factors

Forage spatial distribution, extent and abundance	Location, hectares, and forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	This species forages exclusively at ground level and relies primarily on surface and sub-surface dwelling invertebrate prey, consuming a wide variety of prey items. The species is reliant on open habitats, including a wide range of wetland habitats such as the edges of lakes, turloughs, river floodplains, lagoons, estuaries, intertidal flats and other coastal wetlands, as well as grasslands (wet grassland, semi-improved and improved grasslands), stubble fields and ploughed farmlands. While Golden Plover primarily forage diurnally, the species is also known to feed nocturnally on clear and moonlit nights
Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	Golden Plover roost exclusively at ground level. Roosting is a critical ecological requirement for the wintering population. When roosting overnight, this species typically utilises a similar range of habitats as noted for foraging. Daytime roosting is also a common behaviour, where birds minimise activity levels to conserve energy, while benefitting from the vigilance of other flock members. A lack of sufficient and suitable roosting habitats can result in increased mortality risk, whether indirectly (e.g. via increased energy expenditure travelling to/from roost sites) or directly (e.g. via increased predation risk), or reduction in site use; this would ultimately affect the achievement of targets for population trend and/or spatial distribution
Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	The wintering population can make extensive use of suitable habitats in important areas outside the SPA, for foraging and roosting. The extent, availability and quality of these supporting habitats may be of importance for the resilience of the SPA population. Suitable supporting habitats include those highlighted in the attributes for foraging and roosting habitat

Conservation Objectives for : Lough Croan Turlough SPA [004139]

A395 Greenland White-fronted Goose *Anser albifrons flavirostris*

To restore the Favourable conservation condition of Greenland White-fronted Goose at Lough Croan Turlough SPA which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	The national population of Greenland White-fronted Goose has declined by 13% between 1985 and 2018 (EEA, 2019). It is understood that a single flock of Greenland White-fronted Goose uses the River Suck Callows SPA, Lough Croan Turlough SPA and Four Roads Turlough SPA (see Burke et al., 2014 and NPWS, 2013), referred to as the 'River Suck flock'. During the baseline assessments to inform SPA designation, 293 geese were estimated to be using the River Suck Callows SPA, Lough Croan Turlough SPA and Four Roads Turlough SPA (5 year mean of peak counts for baseline period 1994/95 - 1998/99; see NPWS, 2013). A population of 114 Greenland White-fronted Goose was recorded to be using the River Suck Callows SPA, Lough Croan Turlough SPA and Four Roads Turlough SPA in recent years (5 year mean peak from Fox et al. census reports 2019, 2020, 2021, 2022 and 2023). This represents an estimated population decline of 61% since the baseline period which is significantly greater than the national trend
Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	Distribution encapsulates the number of locations and area of potentially suitable habitat for the wintering population and its availability for use. The suitability and availability of habitat areas are likely to vary throughout the season, for example, due to variation in land management practices or the abundance of resources available (due to natural variation and other factors). This will affect the spatio-temporal patterns of use of the habitats by the wintering population. Movement of the River Suck flock of Greenland White-fronted Goose between the different areas of the River Suck catchment system occurs regularly throughout the winter season depending on where water levels, disturbance levels and other factors render most suitable at any given time (Burke et al., 2014)
Disturbance at wintering site	Intensity, frequency, timing and duration	Disturbance occurs at levels that do not significantly impact the achievement of targets for population trend and spatial distribution	The impact of any significant disturbance (direct or indirect) to the wintering population will ultimately affect the achievement of targets for population trend and/or spatial distribution. Disturbance contributes to increased energetic expenditure which can result in increased likelihood of winter mortality or reduced fitness (if energy expenditure is greater than energy gain) and, in turn, negatively impact population trends (see, for example, Madsen and Fox, 1995). Factors such as intensity, frequency, timing and duration of a (direct or indirect) disturbance source must be taken into account to determine the potential impact upon the targets for population trend and spatial distribution. Part of the Lough Croan Turlough SPA is a wildfowl sanctuary

Barriers to connectivity and site use	Number, location, shape and hectares	Barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA	Barriers limiting the population's access to this SPA or ecologically important sites outside the SPA will ultimately affect the achievement of targets for population trend and/or spatial distribution. Factors such as the number, location, shape and area of potential barriers must be taken into account to determine their potential impact. Access to ecologically important sites outside the SPA must also be considered as a single SPA may not satisfy all the ecological requirements of the wintering population, and it may require access to other SPAs or sites for certain activities, such as foraging when preferred foraging areas are unavailable due to disturbance, extensive flooding, or other factors. Part of the Lough Croan Turlough SPA is a wildfowl sanctuary
Forage spatial distribution, extent and abundance	Location, hectares, and forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	This species is a grazer, feeding on a wide range of vegetation. Key forage materials include roots, tubers (such as potatoes), shoots (such as winter wheat), stolons, rhizomes, leaves (such as grasses), and seed such as (spilled) grain. Key habitats include peat bogs (including raised bogs and blanket bogs), grasslands (such as wet grassland, callows, semi-improved grassland, and intensive grassland), arable stubble, winter cereal fields, coastal grasslands, and occasionally salt marsh. In general, the foraging distance of wintering Greenland white-fronted Goose from night roosts is estimated at 5km to 8km (Scottish Natural Heritage, 2016), although this will vary depending on site and landscape. Lough Croan Turlough SPA has been a consistently important feeding area for the River Suck flock since the early 1990s (Burke et al., 2014)
Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	Overnight roosting habitat mainly consists of permanent waterbodies, such as lakes, estuaries, bays, and other open water. This species may roost on above-water features such as sandbanks. Roosting is a critical ecological requirement for wintering birds. Daytime roosting is also a common behaviour, where birds minimise activity to conserve energy, while benefitting from the vigilance of other flock members. A lack of sufficient and suitable roosting habitats can result in increased mortality risk, whether indirectly (e.g. via increased energy expenditure travelling to/from roost sites) or directly (e.g. via increased predation risk), or reduction in site use; this would ultimately affect the achievement of targets for population trend and/or spatial distribution. Water levels have a significant influence on site use in winter. The species prefers high water levels for roosting and Lough Croan is likely to have been used as a roost site to some extent in the past (Burke et al., 2014)
Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	The wintering population can make extensive use of suitable habitats in important areas outside the SPA, for foraging and roosting. The extent, availability and quality of these supporting habitats may be of importance for the resilience of the SPA population. Suitable supporting habitats include those highlighted in the attributes for foraging and roosting habitat. Movement of the River Suck flock of Greenland White-fronted Goose between the different areas of the River Suck catchment system occurs regularly throughout the winter season depending on where water levels, disturbance levels and other factors render most suitable at any given time (Burke et al., 2014)

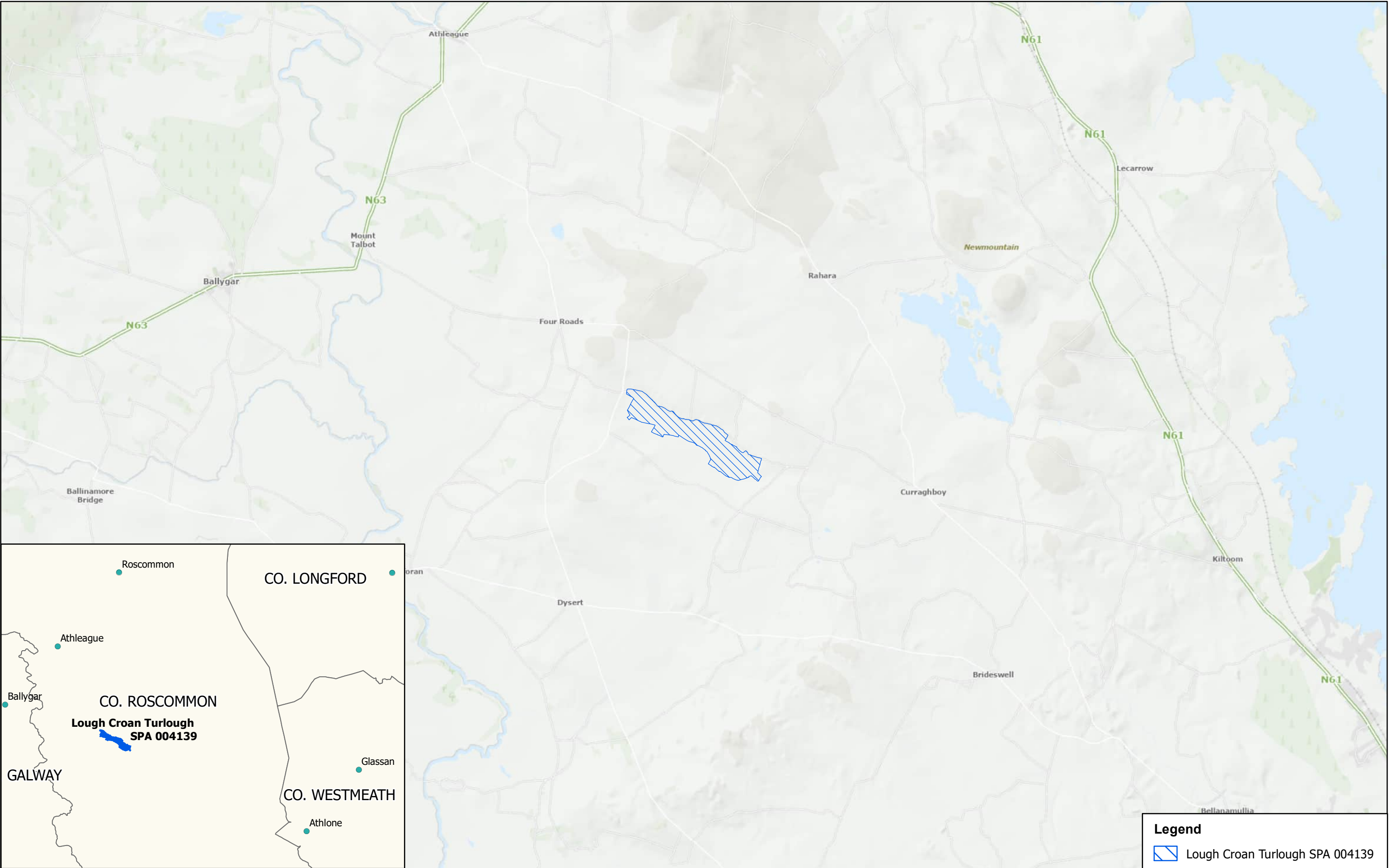
Conservation Objectives for : Lough Croan Turlough SPA [004139]

A999

Wetlands

To maintain the Favourable conservation condition of wetland habitats at the Lough Croan Turlough SPA as a resource for the regularly-occurring migratory waterbirds that utilise these areas. This is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Wetland habitat area	Hectares	No significant loss to wetland habitat within the SPA, other than that occurring from natural patterns of variation	Any significant loss to the wetland habitat within the SPA would likely negatively impact the regularly-occurring migratory waterbirds that utilise this wetland habitat. Such loss of wetland habitat would likely reduce the diversity and abundance of waterbird species that the wetland can support. This, in turn, could negatively impact the Conservation Objectives for waterbird species listed as Special Conservation Interests in the SPA or other regularly-occurring migratory waterbird species
Wetland habitat quality and functioning	Quality and function of the wetland habitat	No significant impact on the quality or functioning of the wetland habitat within the SPA, other than that occurring from natural patterns of variation	Any significant impact on the quality, functioning and accessibility of the wetland habitat within the SPA would likely negatively impact the regularly-occurring migratory waterbirds that utilise this wetland habitat. Impacts on wetland quality, functioning and accessibility would likely reduce the diversity and abundance of waterbird species that the wetland can support. This, in turn, could negatively impact the Conservation Objectives for waterbird species listed as Special Conservation Interests in the SPA or other regularly-occurring migratory waterbird species



Legend

Lough Croan Turlough SPA 004139



National Parks and Wildlife Service

Conservation Objectives Series

River Suck Callows SPA 004097



An Roinn Tithíochta,
Rialtais Áitiúil agus Oidhreachta
Department of Housing,
Local Government and Heritage

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Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

** indicates a priority habitat under the Habitats Directive*

004097	River Suck Callows SPA
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A038	Whooper Swan <i>Cygnus cygnus</i>
A050	Wigeon <i>Anas penelope</i>
A140	Golden Plover <i>Pluvialis apricaria</i>
A142	Lapwing <i>Vanellus vanellus</i>
A395	Greenland White-fronted Goose <i>Anser albifrons flavirostris</i>
A999	Wetlands

Please note that this SPA overlaps with or is adjacent to Ballinturly Turlough SAC (000588), Killeglan Bog Complex SAC (002192), River Shannon Callows SAC (000216), and Middle Shannon Callows SPA (004096). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping sites as appropriate.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	2013
Title :	A review of the SPA network of sites in the Republic of Ireland
Author :	NPWS
Series :	Unpublished report
Year :	2019
Title :	Irish wetland bird survey: waterbird status and distribution 2009/10-2015/16
Author :	Lewis, L. J.; Burke, B.; Fitzgerald, N.; Tierney, T. D.; Kelly, S.
Series :	Irish Wildlife Manuals No. 106
Year :	2020
Title :	Shannon callows waterbird project report
Author :	Edge, R.; Fernández-Bellón, D.; Hayes, W.; Lewis, L. J.; Caffrey, B.; Donaghy, A.
Series :	Unpublished report to NPWS
Year :	2021
Title :	Aerial surveys by NPWS staff: I-WeBS sites (Winter 2020-21) and the international swan census survey (Winter 2019-20)
Author :	NPWS
Series :	Unpublished report
Year :	2022
Title :	Aerial survey data stored centrally in the Irish wetland bird survey (I-WeBS) database
Author :	NPWS
Series :	https://irishwetlandbirds survey.ie/

Other References

Year :	1995
Title :	Impacts of hunting disturbance on waterbirds - a review
Author :	Madsen, J.; Fox, A.D.
Series :	Wildlife Biology 1(4):193-207
Year :	2016
Title :	Assessing connectivity with special protection areas (SPAs)
Author :	Scottish Natural Heritage
Series :	Guidance Series Version 3 - June 2016
Year :	2018
Title :	A review of Greenland white-fronted geese in Ireland 1982/83 – 2011/12
Author :	Burke, B.; Egan, F.; Norriss, D.; Wilson, H.J.
Series :	Unpublished report
Year :	2018
Title :	Report of the 2017/18 international census of Greenland white-fronted geese
Author :	Fox, T.; Francis, I.; Walsh, A; Norriss, D.
Series :	Unpublished report

Year :	2019
Title :	Annex B – Bird species' status and trends report format (Article 12) for the period 2013 – 2018
Author :	NPWS
Series :	Birds Directive - Article 12 Reporting
Year :	2019
Title :	Report of the 2018/19 international census of Greenland white-fronted geese
Author :	Fox, T.; Francis, I.; Walsh, A; Norriss, D.
Series :	Unpublished report
Year :	2020
Title :	Report of the 2019/20 international census of Greenland white-fronted geese
Author :	Fox, T.; Francis, I.; Walsh, A.; Norriss, D.
Series :	Unpublished report
Year :	2021
Title :	Population size, breeding success and habitat use of whooper swan <i>Cygnus cygnus</i> and Bewick's Swan <i>Cygnus columbianus bewickii</i> in Ireland: results of the 2020 international swan census
Author :	Burke, B.; McElwaine, J.G.; Fitzgerald, N.; Kelly, S.B.A.; McCulloch, N.; Walsh, A.J.; Lewis, L.J.
Series :	Irish Birds 43:57-70
Year :	2021
Title :	Report of the 2020/21 international census of Greenland white-fronted geese
Author :	Fox, T.; Francis, I.; Walsh, A.; Norriss, D.; Kelly, S.
Series :	Unpublished report
Year :	2022
Title :	Irish wetland bird survey: I-WeBS national and site trends report 1994/95 – 2019/20
Author :	Kennedy, J.; Burke, B.; Fitzgerald, N.; Kelly, S.B.A.; Walsh, A.J.; Lewis, L.J.
Series :	https://birdwatchireland.ie/app/uploads/2022/04/iwebs_trends_report.html

Conservation Objectives for : River Suck Callows SPA [004097]

A038 Whooper Swan *Cygnus cygnus*

To maintain the favourable conservation condition of whooper swan in River Suck Callows SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	The national population of whooper swan over-wintering in Ireland has increased in the long term, with a 40% population increase from 1991 to 2015 (Lewis et al., 2019). During the baseline assessments to inform SPA designation, 164 whooper swans were estimated to be using this SPA (5 year mean of peak counts from aerial surveys for baseline period 2001/02 to 2005/06; see NPWS, 2013). A population of 234 whooper swan were estimated to be using the River Suck Callows SPA in recent years (3 year mean of peak counts from aerial surveys during winter periods 2018/19 to 2020/21; Edge et al., 2020; NPWS, 2021). This represents a population increase of 43% since the baseline period, which is in line with the recorded increasing national population trend
Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	Distribution encapsulates the number of locations and area of potentially suitable habitat for the wintering population and its availability for use. The suitability and availability of habitat areas is likely to vary throughout the season, for example, due to variation in land management practices or the abundance of resources available (due to natural variation and other factors). This will affect the spatio-temporal patterns of use of the habitats by the wintering population
Disturbance at wintering site	Intensity, frequency, timing and duration	The intensity, frequency, timing and duration of disturbance occurs at levels that do not significantly impact the achievement of targets for population trend and spatial distribution	The impact of any significant disturbance (direct or indirect) to the over-wintering population will ultimately affect the achievement of targets for population trend and/or spatial distribution. Disturbance contributes to increased energetic expenditure which can result in increased likelihood of over-winter mortality or reduced fitness (if energy expenditure is greater than energy gain), which can negatively impact population trends (see, for example, Madsen and Fox, 1995). Factors such as intensity, frequency, timing and duration of a (direct or indirect) disturbance source must be taken into account to determine the potential impact upon the targets for population trend and spatial distribution
Barriers to connectivity and site use	Number, location, shape and hectares	The number, location, shape and area of barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA	Barriers limiting the population's access to this SPA or ecologically important sites outside the SPA will ultimately affect the achievement of targets for population trend and/or spatial distribution. Factors such as the number, location, shape and area of potential barriers must be taken into account to determine their potential impact. Access to ecologically important sites outside the SPA must also be considered as a single SPA may not satisfy all the ecological requirements of the wintering population, and it may require access to other SPAs or sites for certain activities, such as foraging when preferred foraging areas are unavailable due to disturbance, extensive flooding, or other factors

Forage spatial distribution, extent and abundance	Location and hectares, and available forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	This species feeds on a wide range of aquatic and terrestrial vegetation. Key forage materials include: leaves, with significant consumption of grasses; seeds, including spilled grain; roots; tubers, including potatoes; shoots, including those from winter wheat and other cereals. Key foraging habitats are grasslands (including wet grassland, semi-improved grassland, and intensive grassland), arable stubble, winter cereals, rivers, lakes, turloughs and other wetland habitats. In general, the foraging distance of over-wintering whooper swan from night roosts is estimated to be less than 5km (Scottish Natural Heritage, 2016), although this will vary depending on site and landscape
Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	Over-night roosting habitat mainly consists primarily of permanent waterbodies, such as rivers, lakes, turloughs, lagoons and other open waterbodies. Roosting is a critical ecological requirement for the over-wintering population. Day-time roosting is also a common behaviour, where birds minimise activity levels to conserve energy, while benefitting from the vigilance of other flock members. A lack of sufficient and suitable roosting habitats can result in increased mortality risk, whether indirectly (e.g. via increased energy expenditure travelling to/from roost sites) or directly (e.g. via increased predation risk), or reduction in site use; this would ultimately affect the achievement of targets for population trend and/or spatial distribution
Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	The wintering population can make extensive use of suitable habitats in important areas outside the SPA, for foraging and roosting. The extent, availability and quality of these supporting habitats may be of importance for the resilience of the SPA population. Suitable supporting habitats include those highlighted in the attributes for foraging and roosting habitat

Conservation Objectives for : River Suck Callows SPA [004097]

A050 Wigeon *Anas penelope*

To restore the favourable conservation condition of wigeon in River Suck Callows SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	The national population of over-wintering wigeon in Ireland has declined by 18% from 1994/95 to 2019/20, as monitored via the Irish Wetland Bird Survey (Kennedy et al., 2022). During the baseline assessments to inform SPA designation, 3,232 wigeon were estimated to be using this SPA (5 year mean of peak counts from aerial surveys for baseline period 2001/02 to 2005/06; see NPWS, 2013). The most recent available data to assess the population trend is from aerial surveys completed during the period 2008/09 to 2012/13 (NPWS, 2022). A population of 2,857 wigeon was estimated to be using the River Suck Callows SPA during this period (5 year mean of peak counts). This represents a population decline of 12% since the baseline period, which is similar to the recorded decrease in the national population trend
Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	Distribution encapsulates the number of locations and area of potentially suitable habitat for the wintering population and its availability for use. The suitability and availability of habitat areas is likely to vary throughout the season, for example, due to variation in land management practices or the abundance of resources available (due to natural variation and other factors). This will affect the spatio-temporal patterns of use of the habitats by the wintering population
Disturbance at wintering site	Intensity, frequency, timing and duration	The intensity, frequency, timing and duration of disturbance occurs at levels that do not significantly impact the achievement of targets for population trend and spatial distribution	The impact of any significant disturbance (direct or indirect) to the over-wintering population will ultimately affect the achievement of targets for population trend and/or spatial distribution. Disturbance contributes to increased energetic expenditure which can result in increased likelihood of over-winter mortality or reduced fitness (if energy expenditure is greater than energy gain), which can negatively impact population trends (see, for example, Madsen and Fox, 1995). Factors such as intensity, frequency, timing and duration of a (direct or indirect) disturbance source must be taken into account to determine the potential impact upon the targets for population trend and spatial distribution
Barriers to connectivity and site use	Number, location, shape and hectares	The number, location, shape and area of barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA	Barriers limiting the population's access to this SPA or ecologically important sites outside the SPA will ultimately affect the achievement of targets for population trend and/or spatial distribution. Factors such as the number, location, shape and area of potential barriers must be taken into account to determine their potential impact. Access to ecologically important sites outside the SPA must also be considered as a single SPA may not satisfy all the ecological requirements of the wintering population, and it may require access to other SPAs or sites for certain activities, such as foraging when preferred foraging areas are unavailable due to disturbance, extensive flooding, or other factors
Forage spatial distribution, extent and abundance	Location and hectares, and available forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	This dabbling duck feeds primarily on aquatic vegetation, at surface level in waterbodies or at ground level in wetland habitats. Key forage materials include leaves, stems, stolons, roots, rhizomes, and seeds (including cereals). Key over-wintering habitats are marshes, lagoons, estuaries, coastal bays, lakes, rivers and river floodplains, turloughs and other wetland habitats, as well as pastures

Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	Wigeon rely primarily on wetlands or waterbodies for roosting. Roosting is a critical ecological requirement for the over-wintering population. When roosting over-night, this species typically utilises a similar range of habitats as noted for foraging. Day-time roosting is also a common behaviour, where birds minimise activity levels to conserve energy, while benefitting from the vigilance of other flock members. A lack of sufficient and suitable roosting habitats can result in increased mortality risk, whether indirectly (e.g. via increased energy expenditure travelling to/from roost sites) or directly (e.g. via increased predation risk), or reduction in site use; this would ultimately affect the achievement of targets for population trend and/or spatial distribution
Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	The wintering population can make extensive use of suitable habitats in important areas outside the SPA, for foraging and roosting. The extent, availability and quality of these supporting habitats may be of importance for the resilience of the SPA population. Suitable supporting habitats include those highlighted in the attributes for foraging and roosting habitat

Conservation Objectives for : River Suck Callows SPA [004097]

A140 Golden Plover *Pluvialis apricaria*

To restore the favourable conservation condition of golden plover in River Suck Callows SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	The national population of over-wintering golden plover in Ireland has declined by 54% from 1994/95 to 2019/20, as monitored via the Irish Wetland Bird Survey (Kennedy et al., 2022). During the baseline assessments to inform SPA designation, 2,241 golden plover were estimated to be using this SPA (5 year mean of peak counts from aerial surveys for baseline period 2001/02 to 2005/06; see NPWS, 2013). The most recent available data to assess the population trend is from aerial surveys completed during the period 2008/09 to 2012/13 (NPWS, 2022). A population of 1,134 golden plover estimated to be using the River Suck Callows SPA during this period (5 year mean of peak counts). This represents a population decline of 49% since the baseline period, which is in line with the recorded decrease in the national population trend
Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	Distribution encapsulates the number of locations and area of potentially suitable habitat for the wintering population and its availability for use. The suitability and availability of habitat areas is likely to vary throughout the season, for example, due to variation in land management practices or the abundance of resources available (due to natural variation and other factors). This will affect the spatio-temporal patterns of use of the habitats by the wintering population
Disturbance at wintering site	Intensity, frequency, timing and duration	The intensity, frequency, timing and duration of disturbance occurs at levels that do not significantly impact the achievement of targets for population trend and spatial distribution	The impact of any significant disturbance (direct or indirect) to the over-wintering population will ultimately affect the achievement of targets for population trend and/or spatial distribution. Disturbance contributes to increased energetic expenditure which can result in increased likelihood of over-winter mortality or reduced fitness (if energy expenditure is greater than energy gain), which can negatively impact population trends (see, for example, Madsen and Fox, 1995). Factors such as intensity, frequency, timing and duration of a (direct or indirect) disturbance source must be taken into account to determine the potential impact upon the targets for population trend and spatial distribution
Barriers to connectivity and site use	Number, location, shape and hectares	The number, location, shape and area of barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA	Barriers limiting the population's access to this SPA or ecologically important sites outside the SPA will ultimately affect the achievement of targets for population trend and/or spatial distribution. Factors such as the number, location, shape and area of potential barriers must be taken into account to determine their potential impact. Access to ecologically important sites outside the SPA must also be considered as a single SPA may not satisfy all the ecological requirements of the wintering population, and it may require access to other SPAs or sites for certain activities, such as foraging when preferred foraging areas are unavailable due to disturbance, extensive flooding, or other factors

Forage spatial distribution, extent and abundance	Location and hectares, and available forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	This species forages exclusively at ground level and relies primarily on surface and sub-surface dwelling invertebrate prey, consuming a wide variety of prey items. The species is reliant on open habitats, including a wide range of wetland habitats such as the edges of lakes, turloughs, river floodplains, lagoons, estuaries, intertidal flats and other coastal wetlands, as well as in grasslands (wet grassland, semi-improved and improved grasslands), stubble fields and ploughed farmlands. While golden plover primarily forage diurnally, the species is also known to feed nocturnally on clear and moonlit nights
Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	Golden plover roost exclusively at ground level. Roosting is a critical ecological requirement for the over-wintering population. When roosting over-night, this species typically utilises a similar range of habitats as noted for foraging. Day-time roosting is also a common behaviour, where birds minimise activity levels to conserve energy, while benefitting from the vigilance of other flock members. A lack of sufficient and suitable roosting habitats can result in increased mortality risk, whether indirectly (e.g. via increased energy expenditure travelling to/from roost sites) or directly (e.g. via increased predation risk), or reduction in site use; this would ultimately affect the achievement of targets for population trend and/or spatial distribution
Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	The wintering population can make extensive use of suitable habitats in important areas outside the SPA, for foraging and roosting. The extent, availability and quality of these supporting habitats may be of importance for the resilience of the SPA population. Suitable supporting habitats include those highlighted in the attributes for foraging and roosting habitat

Conservation Objectives for : River Suck Callows SPA [004097]

A142 Lapwing *Vanellus vanellus*

To restore the favourable conservation condition of lapwing in River Suck Callows SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	The national population of over-wintering lapwing in Ireland has declined by 64% from 1994/95 to 2019/20, as monitored via the Irish Wetland Bird Survey (Kennedy et al., 2022). During the baseline assessments to inform SPA designation, 3,906 lapwing were estimated to be using this SPA (5 year mean of peak counts from aerial surveys for baseline period 2001/02 to 2005/06; see NPWS, 2013). The most recent available data to assess the population trend is from aerial surveys completed during the period 2008/09 to 2012/13 (NPWS, 2022). A population of 1,638 lapwing were estimated to be using the River Suck Callows SPA during this period (5 year mean of peak counts). This represents a population decline of 58% since the baseline period, which is in line with the recorded decrease in the national population trend
Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	Distribution encapsulates the number of locations and area of potentially suitable habitat for the wintering population and its availability for use. The suitability and availability of habitat areas is likely to vary throughout the season, for example, due to variation in land management practices or the abundance of resources available (due to natural variation and other factors). This will affect the spatio-temporal patterns of use of the habitats by the wintering population
Disturbance at wintering site	Intensity, frequency, timing and duration	The intensity, frequency, timing and duration of disturbance occurs at levels that do not significantly impact the achievement of targets for population trend and spatial distribution	The impact of any significant disturbance (direct or indirect) to the over-wintering population will ultimately affect the achievement of targets for population trend and/or spatial distribution. Disturbance contributes to increased energetic expenditure which can result in increased likelihood of over-winter mortality or reduced fitness (if energy expenditure is greater than energy gain), which can negatively impact population trends (see, for example, Madsen and Fox, 1995). Factors such as intensity, frequency, timing and duration of a (direct or indirect) disturbance source must be taken into account to determine the potential impact upon the targets for population trend and spatial distribution
Barriers to connectivity and site use	Number, location, shape and hectares	The number, location, shape and area of barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA	Barriers limiting the population's access to this SPA or ecologically important sites outside the SPA will ultimately affect the achievement of targets for population trend and/or spatial distribution. Factors such as the number, location, shape and area of potential barriers must be taken into account to determine their potential impact. Access to ecologically important sites outside the SPA must also be considered as a single SPA may not satisfy all the ecological requirements of the wintering population, and it may require access to other SPAs or sites for certain activities, such as foraging when preferred foraging areas are unavailable due to disturbance, extensive flooding, or other factors

Forage spatial distribution, extent and abundance	Location and hectares, and available forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	This species forages exclusively at ground level and relies primarily on surface and sub-surface dwelling invertebrate prey, consuming a wide variety of prey items. The species is reliant on open habitats, including a wide range of wetland habitats such as the edges of lakes, turloughs, river floodplains, lagoons, estuaries, intertidal flats and other coastal wetlands, as well as grasslands (wet grassland, semi-improved and improved grasslands) and ploughed farmlands. While lapwing feed primarily diurnally, the species is also known to feed nocturnally on clear and moonlit nights
Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	Lapwing roost exclusively at ground level. Roosting is a critical ecological requirement for the over-wintering population. When roosting over-night, this species typically utilises a similar range of habitats as noted for foraging. Day-time roosting is also a common behaviour, where birds minimise activity levels to conserve energy, while benefitting from the vigilance of other flock members. A lack of sufficient and suitable roosting habitats can result in increased mortality risk, whether indirectly (e.g. via increased energy expenditure travelling to/from roost sites) or directly (e.g. via increased predation risk), or reduction in site use; this would ultimately affect the achievement of targets for population trend and/or spatial distribution
Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	The wintering population can make extensive use of suitable habitats in important areas outside the SPA, for foraging and roosting. The extent, availability and quality of these supporting habitats may be of importance for the resilience of the SPA population. Suitable supporting habitats include those highlighted in the attributes for foraging and roosting habitat

Conservation Objectives for : River Suck Callows SPA [004097]

A395 Greenland White-fronted Goose *Anser albifrons flavirostris*

To restore the favourable conservation condition of Greenland white-fronted goose in River Suck Callows SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	The national population of Greenland white-fronted goose, monitored annually by NPWS, has declined by circa 13% between 1985 and 2018 (NPWS, 2019). During the baseline assessments to inform SPA designation, 293 geese were estimated to be using this SPA (5 year mean of peak counts for baseline period 1994/95 to 1998/99; see NPWS, 2013). It was determined during the baseline period that this same population also uses Four Roads Turlough SPA and Lough Croan Turlough SPA. A population of 124 geese were estimated to be using the River Suck Callows SPA in recent years (4 year mean of peak counts 2017/18 to 2020/21; see Fox et al., 2018-2021). This represents a population decline of 58% since the baseline period. Burke et al. (2018) also reported a long term decline in the River Suck population from the early 1990s to winter 2011/12
Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	Distribution encapsulates the number of locations and area of potentially suitable habitat for the wintering population and its availability for use. The suitability and availability of habitat areas is likely to vary throughout the season, for example, due to variation in land management practices or the abundance of resources available (due to natural variation and other factors). This will affect the spatio-temporal patterns of use of the habitats by the wintering population
Disturbance at wintering site	Intensity, frequency, timing and duration	The intensity, frequency, timing and duration of disturbance occurs at levels that do not significantly impact the achievement of targets for population trend and spatial distribution	The impact of any significant disturbance (direct or indirect) to the over-wintering population will ultimately affect the achievement of targets for population trend and/or spatial distribution. Disturbance contributes to increased energetic expenditure which can result in increased likelihood of over-winter mortality or reduced fitness (if energy expenditure is greater than energy gain), which can negatively impact population trends (see, for example, Madsen and Fox, 1995). Factors such as intensity, frequency, timing and duration of a (direct or indirect) disturbance source must be taken into account to determine the potential impact upon the targets for population trend and spatial distribution
Barriers to connectivity and site use	Number, location, shape and hectares	The number, location, shape and area of barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA	Barriers limiting the population's access to this SPA or ecologically important sites outside the SPA will ultimately affect the achievement of targets for population trend and/or spatial distribution. Factors such as the number, location, shape and area of potential barriers must be taken into account to determine their potential impact. Access to ecologically important sites outside the SPA must also be considered as a single SPA may not satisfy all the ecological requirements of the wintering population, and it may require access to other SPAs or sites for certain activities, such as foraging when preferred foraging areas are unavailable due to disturbance, extensive flooding, or other factors

Forage spatial distribution, extent and abundance	Location and hectares, and available forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	This species is a grazer, feeding on a wide range of vegetation. Key forage materials include roots, tubers (such as potatoes), shoots (such as winter wheat), stolons, rhizomes, leaves (such as grasses), and seed such as (spilled) grain. Key habitats include peat bogs (including raised bogs and blanket bogs), grasslands (such as wet grassland, callows, semi-improved grassland, and intensive grassland), arable stubble, winter cereal fields, coastal grasslands, and occasionally saltmarsh. In general, the foraging distance of over-wintering Greenland white-fronted goose from night roosts is estimated at 5 to 8km (Scottish Natural Heritage, 2016), although this will vary depending on site and landscape
Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	Over-night roosting habitat mainly consists of permanent waterbodies, such as lakes, estuaries, bays, and other open waterbodies. When roosting in waterbodies, this species can roost on above-water features such as sandbanks. Roosting is a critical ecological requirement for the over-wintering population. Day-time roosting is also a common behaviour, where birds minimise activity levels to conserve energy, while benefitting from the vigilance of other flock members. A lack of sufficient and suitable roosting habitats can result in increased mortality risk, whether indirectly (e.g. via increased energy expenditure travelling to/from roost sites) or directly (e.g. via increased predation risk), or reduction in site use; this would ultimately affect the achievement of targets for population trend and/or spatial distribution
Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	The wintering population can make extensive use of suitable habitats in important areas outside the SPA, for foraging and roosting. The extent, availability and quality of these supporting habitats may be of importance for the resilience of the SPA population. Suitable supporting habitats include those highlighted in the attributes for foraging and roosting habitat

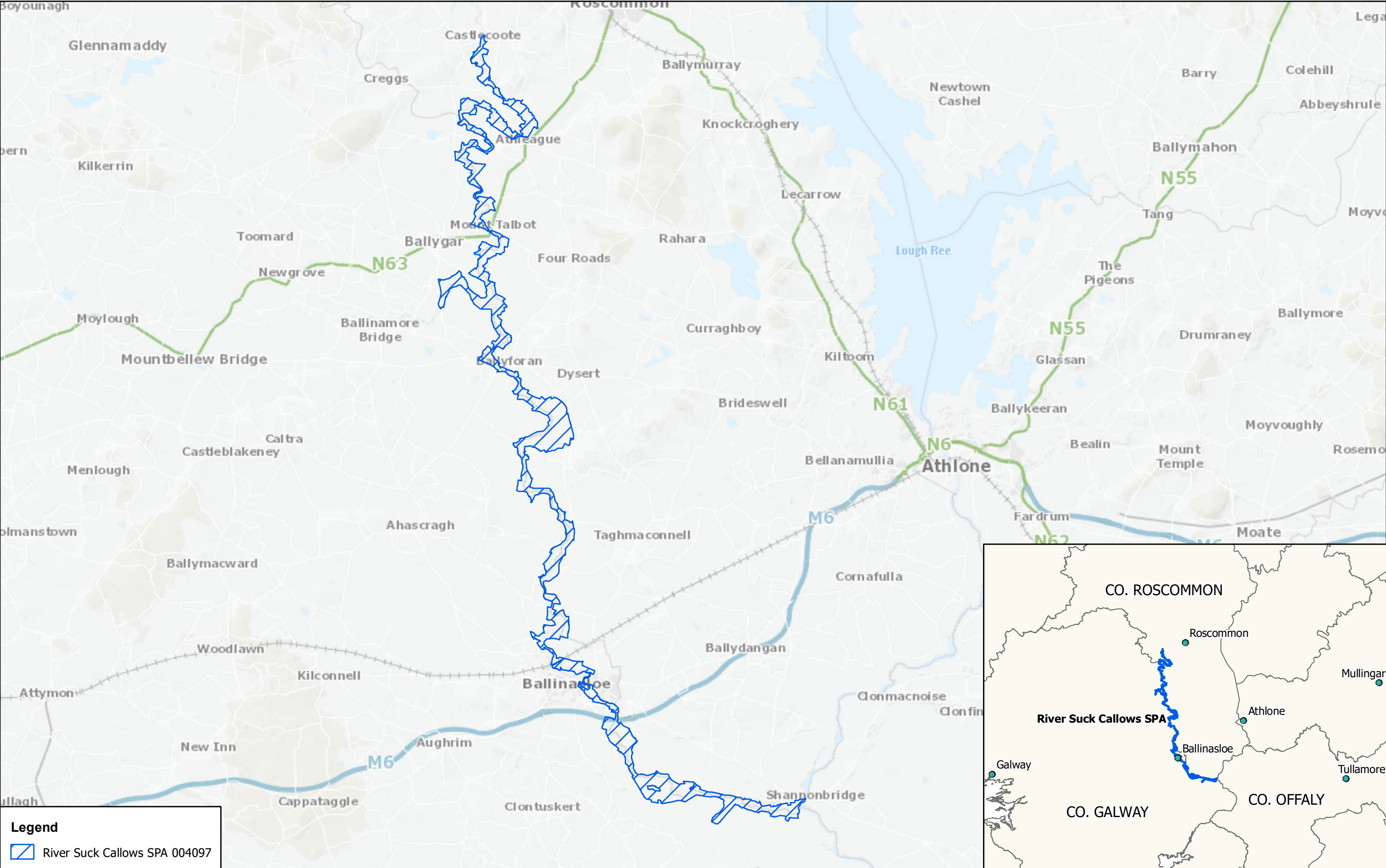
Conservation Objectives for : River Suck Callows SPA [004097]

A999

Wetlands

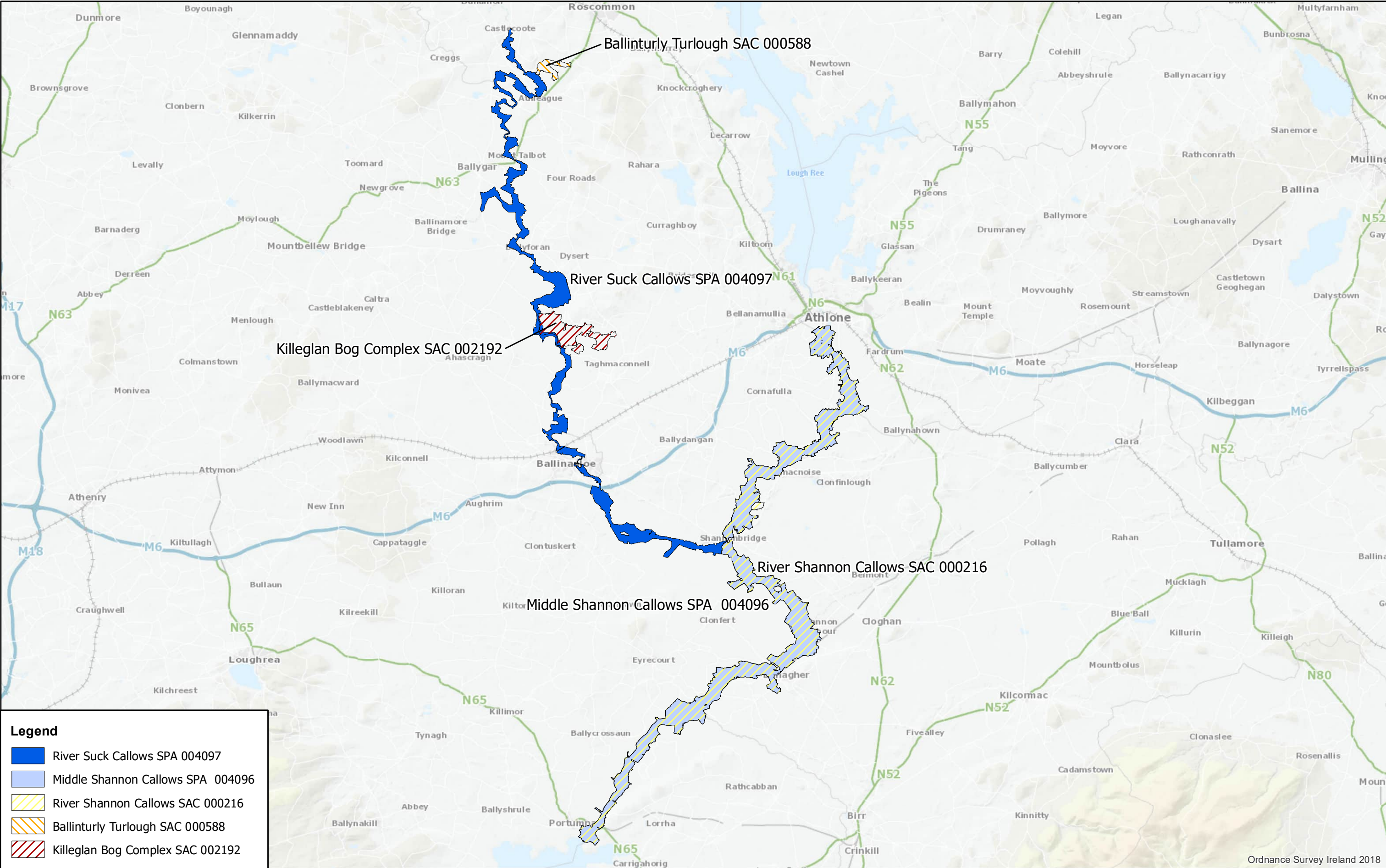
To maintain the wetland habitats at River Suck Callows SPA as a resource for the regularly-occurring migratory waterbirds that utilise these areas, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Wetland habitat area	Hectares	No significant loss to wetland habitat within the SPA, other than that occurring from natural patterns of variation	Any significant loss to the wetland habitat within the SPA would likely significantly negatively impact the regularly-occurring migratory waterbirds that utilise this wetland habitat. Such loss of wetland habitat would likely reduce the diversity and abundance of waterbird species that the wetland can support. This, in turn, could negatively impact the Conservation Objectives for waterbird species listed as Special Conservation Interests in the SPA or other regularly-occurring migratory waterbird species
Wetland habitat quality and functioning	Quality and function of the wetland habitat	No significant impact on the quality or functioning of the wetland habitat within the SPA, other than that occurring from natural patterns of variation	Any significant impact on the quality, functioning and accessibility of the wetland habitat within the SPA would likely significantly negatively impact the regularly-occurring migratory waterbirds that utilise this wetland habitat. Impacts on wetland quality, functioning and accessibility would likely reduce the diversity and abundance of waterbird species that the wetland can support. This, in turn, could negatively impact the Conservation Objectives for waterbird species listed as Special Conservation Interests in the SPA or other regularly-occurring migratory waterbird species



Legend

River Suck Callows SPA 004097



C.2 Further information on the SACs and SPAs that have undergone assessment

Table 6-1: European Sites with Threats and Pressures

Site Code	Site Name	Qualifying Feature	Pressures Codes	Known Threats and Pressures
SACs				
002339	Ballynamona Bog and Corkip Lough SAC	Degraded raised bogs still capable of natural regeneration [7120] Bog woodland [91D0] Depressions on peat substrates of the Rhynchosporion [7150] Turloughs [3180] Active raised bogs [7110]	A10.01, E03.01, J02.05, A04, I01, J02.01	Insufficient fertilisation, Unmapped pressure code, Grazing
000610	Lough Croan Turlough SAC	Turloughs [3180]	A05.02, F03.02.04, A04	Reduction or loss of specific animal breeding practices, Unmapped pressure code, Grazing
002214	Killeglan Grassland SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) * important orchid sites [6210]	J02.01, A04.01.02, A04	Unmapped pressure code, Intensive sheep grazing, Grazing
001625	Castlesampson Esker SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) * important orchid sites [6210] Turloughs [3180]	A04, C01.01, C01.03.01, A10.01	Grazing, Unmapped pressure code, Insufficient fertilisation
000611	Lough Funshinagh SAC	Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation [3270] Turloughs [3180]	D01.01, A08, F03.02.04, A05.02	Unmapped pressure code, Mixed source pollution from agricultural and forestry activities, Reduction or loss of specific animal breeding practices
001637	Four Roads Turlough SAC	Turloughs [3180]	A04, A05.02	Grazing, Reduction or loss of specific animal breeding practices
000440	Lough Ree SAC	Otter (Lutra lutra) [1355] Degraded raised bogs still capable of natural regeneration [7120] Active raised bogs [7110] Bog woodland [91D0], Limestone pavements [8240] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) * important orchid sites [6210] Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation [3150] Alkaline fens [7230] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0]	G01.02, A08, E01.03, K03.05, D03.01.02, G02.09, J02.11.02, H01.08, G01.01, J02.04, F03.01, F02.03, L08, H06.03, H02.06, A04, B02, A03.03, I01	Unmapped pressure code, Mixed source pollution from agricultural and forestry activities, NA, Grazing, Abandonment or lack of mowing
000609	Lisduff Turlough SAC	Turloughs [3180]	G05, A04, A08	Unmapped pressure code, Grazing, Mixed source pollution from agricultural and forestry activities
000216	River Shannon Callows SAC	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) [6510] Limestone pavements [8240] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] Alkaline fens [7230] Otter (Lutra lutra) [1355]	A03, K03.04, A10.01, G05.01, G01, A03.03, A08, J02.05, B02.02, D01.01, B06, F03.01, A07, A04.01, J02.05.02, C01.03.02, A04.02.05, J02.11, A04.03, J02.04.01, J02.01	Mowing or cutting of grassland, NA, Insufficient fertilisation, Unmapped pressure code, Abandonment or lack of mowing, Mixed source pollution from agricultural and forestry activities, Forestry in agricultural landscapes, Intensive grazing, Other mixed or unspecified grazing, Livestock farming and breeding
000588	Ballinturly Turlough SAC	Turloughs [3180]	F03.01, X, A08	Unmapped pressure code, Mixed source pollution from agricultural and forestry activities



Site Code	Site Name	Qualifying Feature	Pressures Codes	Known Threats and Pressures
002200	Aughrim (Aghrane) Bog SAC	Degraded raised bogs still capable of natural regeneration [7120]	B02.02, I01, J02.15, I02, J01.01, J01.02	Unmapped pressure code, NA
002199	Ballygar (Aghrane) Bog SAC	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120]	J02.15, I01, B02.02, I02, J01.01	NA, Unmapped pressure code
002241	Lough Derg, North-East Shore SAC	Limestone pavements [8240] Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae) [91E0] Juniperus communis formations on heaths or calcareous grasslands [5130] Taxus baccata woods of the British Isles [91J0] Calcareous fens with <i>Cladium mariscus</i> and species of the Caricion davallianae [7210] Alkaline fens [7230]	G02.09, B02.01.01, A08, M01.03, I02, G01, C01, J02.10, H01, D01.01, K02.03, A10.01, A04.02.05, A04.01, M01.01, K02.01, H01.08, J02.01.03, J02, D03.01.02, M01.02, I01	NA, Unmapped pressure code, Mixed source pollution from agricultural and forestry activities, Insufficient fertilisation, Other mixed or unspecified grazing, Intensive grazing
SPAs				
004139	Lough Croan Turlough SPA	Wetland and Waterbirds [A999] Shoveler (<i>Anas clypeata</i>) [A056] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Golden Plover (<i>Pluvialis apricaria</i>) [A140]	A08, A04	Mixed source pollution from agricultural and forestry activities, Grazing
004097	River Suck Callows SPA	Wetland and Waterbirds [A999] Wigeon (<i>Anas penelope</i>) [A050] Lapwing (<i>Vanellus vanellus</i>) [A142] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Whooper Swan (<i>Cygnus cygnus</i>) [A038]	A03, G01.01, F02.03, A08, E01.03, A04, B, F03.01	Mowing or cutting of grassland, Unmapped pressure code, Mixed source pollution from agricultural and forestry activities, Grazing
004140	Four Roads Turlough SPA	Wetland and Waterbirds [A999] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395]	A04	Grazing
004064	Lough Ree SPA	Teal (<i>Anas crecca</i>) [A052] Wetland and Waterbirds [A999] Wigeon (<i>Anas penelope</i>) [A050] Goldeneye (<i>Bucephala clangula</i>) [A067] Little Grebe (<i>Tachybaptus ruficollis</i>) [A004] Mallard (<i>Anas platyrhynchos</i>) [A053] Shoveler (<i>Anas clypeata</i>) [A056] Common Scoter (<i>Melanitta nigra</i>) [A065] Lapwing (<i>Vanellus vanellus</i>) [A142] Whooper Swan (<i>Cygnus cygnus</i>) [A038] Coot (<i>Fulica atra</i>) [A125], Common tern (<i>Sterna hirundo</i>) [A193] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Tufted Duck (<i>Aythya fuligula</i>) [A061]	G01.01, B, A08, A04, G01.02, F03.01, I01, F02.03	Unmapped pressure code, Mixed source pollution from agricultural and forestry activities, Grazing
004096	Middle Shannon Callows SPA	Wetland and Waterbirds [A999] Lapwing (<i>Vanellus vanellus</i>) [A142] Black-tailed Godwit (<i>Limosa limosa</i>) [A156] Wigeon (<i>Anas penelope</i>) [A050]	E01, A08, G01.02, D01.01, F02.03, F03.01, A04.03, A04, A03, G01.01, D01.05	Unmapped pressure code, Mixed source pollution from agricultural and forestry activities, Livestock farming and breeding, Grazing, Mowing or cutting of grassland



Site Code	Site Name	Qualifying Feature	Pressures Codes	Known Threats and Pressures
		Whooper Swan (Cygnus cygnus) [A038] Black-headed Gull (Chroicocephalus ridibundus) [A179] Golden Plover (Pluvialis apricaria) [A140] Corncrake (Crex crex) [A122]		
004017	Mongan Bog SPA	Greenland White-fronted Goose (Anser albifrons flavirostris) [A395]	C01.01, C01.03, D05, A04	Unmapped pressure code, Grazing
004058	Lough Derg (Shannon) SPA	Wetland and Waterbirds [A999] Cormorant (Phalacrocorax carbo) [A017] Tufted Duck (Aythya fuligula) [A061] Goldeneye (Bucephala clangula) [A067] Common tern (Sterna hirundo) [A193]	G01.01, F03.01, A08, F02.03	Unmapped pressure code, Mixed source pollution from agricultural and forestry activities



C.3 Further information on the Qualifying Interests of SACs and SPAs that have undergone assessment

C.3.1 Further information on the Qualifying Interests of SACs

Table 6-2: Qualifying Interests of SACs that have undergone assessment including summaries of current threats and sensitivities

Qualifying Interests	EU Code	Threats and Pressures Codes	Known Threats and Pressures	Article 17 Report Summary - Threats and Pressures	Sensitivities Summary
Otter (<i>Lutra lutra</i>) [1355]	1355	Xxp, Xxt	No pressures, No threats	There are no pressures facing this species	Surface and marine water dependent. Moderately sensitive to hydrological change. Sensitivity to pollution.
Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation [3150]	3150	A25, A26, B23, F12, K04, K05, F13, C05, F11	Agricultural activities generating point source pollution to surface or ground waters, Agricultural activities generating diffuse pollution to surface or ground waters, Forestry activities generating pollution to surface or ground waters, Discharge of urban waste water (excluding storm overflows and/or urban run-offs) generating pollution to surface or ground water, Modification of hydrological flow, Physical alteration of water bodies, Plants, contaminated or abandoned industrial sites generating pollution to surface or ground water, Peat extraction, Pollution to surface or ground water due to urban runoffs	Most of the pressures on this habitat are as a result of pollution from agriculture, forestry activities and wastewater.	Surface and groundwater dependant. Highly sensitive to hydrological changes. Highly sensitive to pollution.
Turloughs [3180]	3180	A26, A09, A31	Agricultural activities generating diffuse pollution to surface or ground waters, Intensive grazing or overgrazing by livestock, Drainage for use as agricultural land	The main pressures associated with this habitat are related to drainage, groundwater pollution and ecologically unsuitable grazing.	Surface and groundwater dependant. Highly sensitive to hydrological changes. Highly sensitive to pollution.
Rivers with muddy banks with <i>Chenopodium rubri</i> p.p. and <i>Bidenton</i> p.p. vegetation [3270]	3270	A09, I02	Intensive grazing or overgrazing by livestock, Other invasive alien species (other than species of Union concern)	The only significant pressure on this habitat is a result of intensive grazing resulting in poaching.	Surface and marine water dependent. Moderately sensitive to hydrological change. Moderate sensitivity to pollution. Changes to salinity and tidal regime. Coastal development.
<i>Juniperus communis</i> formations on heaths or calcareous grasslands [5130]	5130	Xxp, Xxt	No pressures, No threats	The pressures associated with this habitat are associated with overgrazing, erosion and scrub removal.	Changes in management such as grazing regime. Changes in nutrient or base status. Changes to vegetation composition. Introduction of alien species.
Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) * important orchid sites [6210]	6210	A02, A10, C01, A09, I02, I04	Conversion from one type of agricultural land use to another (excluding drainage and burning), Extensive grazing or under grazing by livestock, Extraction of minerals (e.g. rock, metal ores, gravel, sand, shell), Intensive grazing or overgrazing by livestock, Other invasive alien species (other than species of Union concern), Problematic native species	The significant pressures related to this habitat are mainly associated with agricultural intensification causing loss of species-rich communities, or abandonment of farmland resulting in succession to scrub.	Changes in management such as grazing regime. Changes in nutrient or base status. Changes to vegetation composition. Introduction of alien species.
<i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410]	6410	A02, A06, A10, B01, A14, A31	Conversion from one type of agricultural land use to another (excluding drainage and burning), Abandonment of grassland management (e.g. cessation of grazing or of mowing), Extensive grazing or under grazing by livestock, Conversion to forest from other land uses, or afforestation (excluding drainage), Livestock farming (without grazing), Drainage for use as agricultural land	The main pressures on the habitat are associated with agricultural intensification (e.g. land drainage, fertiliser application), under grazing and forestry.	Changes in management such as grazing regime. Changes in nutrient or base status. Changes to vegetation composition. Introduction of alien species.
Lowland hay meadows (<i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i>) [6510]	6510	A02, A19, A20, A06, A14	Conversion from one type of agricultural land use to another (excluding drainage and burning), Application of natural fertilisers on agricultural land, Application of synthetic (mineral) fertilisers on agricultural land, Abandonment of grassland management (e.g. cessation of grazing or of mowing), Livestock farming (without grazing)	The main pressures associated with this habitat are due to agricultural intensification (fertiliser application) and changes in agricultural practices.	Changes in management such as grazing regime. Changes in nutrient or base status. Changes to vegetation composition. Introduction of alien species.
Active raised bogs [7110]	7110	C05, K02, B01, A11, N01	Peat extraction, Drainage, Conversion to forest from other land uses, or afforestation (excluding drainage), Burning for agriculture, Temperature changes (e.g. rise of temperature & extremes) due to climate change	The main pressures on active raised bog are peat extraction, drainage, afforestation and burning.	Surface water interactions. Groundwater isolated system with sensitivities related



Qualifying Interests	EU Code	Threats and Pressures Codes	Known Threats and Pressures	Article 17 Report Summary - Threats and Pressures	Sensitivities Summary
					to the bog basin. Drainage and land use management are the key things.
Degraded raised bogs still capable of natural regeneration [7120]	7120	C05, K02, B01, A11, N01	Peat extraction, Drainage, Conversion to forest from other land uses, or afforestation (excluding drainage), Burning for agriculture, Temperature changes (e.g. rise of temperature & extremes) due to climate change	The main pressure on degraded bogs come from peat extraction, drainage, afforestation and burning.	Surface water interactions. Groundwater isolated system with sensitivities related to the bog basin. Drainage and land use management are the key things.
Depressions on peat substrates of the Rhynchosporion [7150]	7150	A09, A11, C05, K02, B01, N01	Intensive grazing or overgrazing by livestock, Burning for agriculture, Peat extraction, Drainage, Conversion to forest from other land uses, or afforestation (excluding drainage), Temperature changes (e.g. rise of temperature & extremes) due to climate change	The main pressures on the habitat are associated with impacts on the supporting bog habitats, especially overgrazing, burning, peat extraction, drainage and conversion to forestry.	Surface and ground water interactions. Drainage and land use management are the key things.
Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [7210]	7210	A06, A09, K01, K02, K04, J01, C05	Abandonment of grassland management (e.g. cessation of grazing or mowing), Intensive grazing or overgrazing by livestock, Abstraction from groundwater, surface water or mixed water, Drainage, Modification of hydrological flow, Mixed source pollution to surface and ground waters (limnic and terrestrial), Peat extraction	Overgrazing, groundwater pollution, abandonment of grassland management and drainage are pressures associated with this habitat.	Surface and groundwater dependent. Highly sensitive to hydrological changes. Inappropriate management.
Alkaline fens [7230]	7230	A06, A09, K02, K04, L02, J01, K01, A26, N02, N03	Abandonment of grassland management (e.g. cessation of grazing or mowing), Intensive grazing or overgrazing by livestock, Drainage, Modification of hydrological flow, Natural succession resulting in species composition change (other than by direct changes of agricultural or forestry practices), Mixed source pollution to surface and ground waters (limnic and terrestrial), Abstraction from groundwater, surface water or mixed water, Agricultural activities generating diffuse pollution to surface or ground waters, Temperature changes (e.g. rise of temperature & extremes) due to climate change, Increases or changes in precipitation due to climate change	The main pressures facing this habitat are land abandonment (and associated succession), overgrazing, drainage and pollution.	Surface and groundwater dependent. Highly sensitive to hydrological changes. Inappropriate management.
Limestone pavements [8240]	8240	A01, A10, C01, F01, I02	Conversion into agricultural land (excluding drainage and burning), Extensive grazing or under grazing by livestock, Extraction of minerals (e.g. rock, metal ores, gravel, sand, shell), Conversion from other land uses to housing, settlement or recreational areas (excluding drainage and modification of coastline, estuary and coastal conditions), Other invasive alien species (other than species of Union concern)	The main pressures facing this habitat are associated with conversion to agricultural land and housing construction, as well as scrub encroachment caused by under grazing.	Erosion, overgrazing and recreation.
Bog woodland [91D0]	91D0	K01, I02, C05, A11, B09	Abstraction from groundwater, surface water or mixed water, Other invasive alien species (other than species of Union concern), Peat extraction, Burning for agriculture, Clear-cutting, removal of all trees	Pressures facing this habitat are related to drainage, invasive species and burning.	Changes in management. Changes in nutrient or base status. Introduction of alien species.
Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, <i>Alnion incanae</i> , <i>Salicion albae</i>) [91E0]	91E0	I02, I04, B09, I05	Other invasive alien species (other than species of Union concern), Problematic native species, Clear-cutting, removal of all trees, Plant and animal diseases, pathogens and pests		
<i>Taxus baccata</i> woods of the British Isles [91J0]	91J0	I02, A09, I05	Other invasive alien species (other than species of Union concern), Intensive grazing or overgrazing by livestock, Plant and animal diseases, pathogens and pests	Pressures facing this habitat are mainly linked to the presence of alien species such as sycamore (<i>Acer pseudoplatanus</i>), beech (<i>Fagus sylvatica</i>), cherry laurel (<i>Prunus laurocerasus</i>) and traveller's joy (<i>Clematis vitalba</i>), with overgrazing by deer also posing a pressure to the habitat.	Changes in management. Changes in nutrient or base status. Introduction of alien species.



C.3.2 Further information on the Qualifying Interests of SPAs

Species Code	Common Name	Scientific Name	Threats and Pressures Codes	Known Threats and Pressures
A050	Eurasian Wigeon	<i>Anas penelope</i>	C03, F01, F03, G01, H01, H03, H07, I01, J02, J03	Renewable abiotic energy use, Marine and Freshwater Aquaculture, Hunting and collection of wild animals (terrestrial), Outdoor sports and leisure activities, recreational activities, Pollution to surface waters (limnic & terrestrial, marine & brackish), Marine water pollution, Other forms of pollution, Invasive non-native species, Human induced changes in hydraulic conditions, Other Ecosystem Modifications
A056	Northern Shoveler	<i>Anas clypeata</i>	C03, F03, G01, H01, H03, H07	Renewable abiotic energy use, Hunting and collection of wild animals (terrestrial), Outdoor sports and leisure activities, recreational activities, Pollution to surface waters (limnic & terrestrial, marine & brackish), Marine water pollution, Other forms of pollution
A061	Tufted Duck	<i>Aythya fuligula</i>	C03, F03, G01, H01, H07, M02	Renewable abiotic energy use, Hunting and collection of wild animals (terrestrial), Outdoor sports and leisure activities, recreational activities, Pollution to surface waters (limnic & terrestrial, marine & brackish), Other forms of pollution, Changes in biotic conditions
A067	Common Goldeneye	<i>Bucephala clangula</i>	C03, F01, F03, G01, H01, H03, H07, M02	Renewable abiotic energy use, Marine and Freshwater Aquaculture, Hunting and collection of wild animals (terrestrial), Outdoor sports and leisure activities, recreational activities, Pollution to surface waters (limnic & terrestrial, marine & brackish), Marine water pollution, Other forms of pollution, Changes in biotic conditions
A122	Corn Crake	<i>Crex crex</i>	A03.01, A03.03, A04.01, K03.04, M01.03	Intensive Mowing or intensification, Abandonment / Lack of Mowing, Intensive grazing, Predation, Flooding and rising precipitations
A140	European Golden Plover	<i>Pluvialis apricaria</i>	A02, A04, B01, C01, C03, F01, G01, H03, J01, K03, M02	Modification of cultivation practices, Grazing, Forest planting on open ground, Mining and quarrying, Renewable abiotic energy use, Marine and Freshwater Aquaculture, Outdoor sports and leisure activities, recreational activities, Marine water pollution, Fire and Fire suppression, Interspecific faunal relations, Changes in biotic conditions
A142	Northern Lapwing	<i>Vanellus vanellus</i>	A02, C03, F01, G01, H03	Modification of cultivation practices, Renewable abiotic energy use, Marine and Freshwater Aquaculture, Outdoor sports and leisure activities, recreational activities, Marine water pollution
A179	Black-Headed Gull	<i>Larus ridibundus</i>	A04, C03, F02, H03, J03, M01	Grazing, Renewable abiotic energy use, Fishing and harvesting aquatic resources, Marine water pollution, Other Ecosystem Modifications, Changes in abiotic conditions
A193	Common Tern	<i>Sterna hirundo</i>	C03, D01, D03, G01, I01	Renewable abiotic energy use, Roads, paths and railroads, Shipping lanes, ports, marine constructions, Outdoor sports and leisure activities, recreational activities, Invasive non-native species
A395	Greater White-Fronted Goose	<i>Anser albifrons flavirostris</i>	A02, A04, A06, A11, B01, C03, D02, D05, F01, F03, G01, H03, H07, K03, M01, M02	Modification of cultivation practices, Grazing, Annual and perennial non-timber crops, Agriculture activities not referred to above, Forest planting on open ground, Renewable abiotic energy use, Utility and service lines, Improved access to site, Marine and Freshwater Aquaculture, Hunting and collection of wild animals (terrestrial), Outdoor sports and leisure activities, recreational activities, Marine water pollution, Other forms of pollution, Interspecific faunal relations, Changes in abiotic conditions, Changes in biotic conditions



C.4 Potential Effects to the COs of Screened In European Sites

C.4.1 Lough Croan Turlough SAC

Table 6-3: Conservation objectives and targets for relevant QI with potential for adverse effects on the integrity of Lough Croan Turlough SAC [000610]

QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project (in absence of mitigation)	Potential adverse effects in-combination with other developments	Potential for the adverse effects (Y/N)
[3180] Turloughs	To restore the favourable conservation condition	Habitat area	Hectares	Area stable at c.106ha or increasing, subject to natural processes.	There will be no direct loss of habitat area or distribution as a result of the Project and potential groundwater impacts will not negatively affect the overall area or distribution of this habitat.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Habitat distribution	Occurrence	No decline, subject to natural processes			
		Hydrological regime	Various	Maintain/restore appropriate natural hydrological regime necessary to support the natural structure and functioning of the habitat	The proposed Project may cause adverse effects to the groundwater via accidental leaks of hydrocarbons and/or increased sedimentation depositing into the quarry sump via surface runoff. Whilst LSE cannot be fully discounted from the Project, LSE are considered unlikely given that groundwater at the Site was assessed to have a south-southeast flow and the SAC is situated north of the Site. This may affect the natural hydrological regime to support the natural structure and functioning of the habitat. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Soil type	Hectares	Maintain variety, area and extent of soil types necessary to support turlough vegetation and other biota	The project will not affect this attribute.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Soil nutrient status: nitrogen and phosphorus	N and P concentration in soil	Maintain/restore nutrient status appropriate to soil types and vegetation communities	The proposed Project may cause adverse effects to the groundwater via accidental leaks of hydrocarbons and/or increased sedimentation depositing into the quarry sump via surface runoff. This may cause increases to N and P concentrations in the soil and thus adversely affect the nutrient status of the soil. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Physical structure: bare ground	Presence	Maintain sufficient wet bare ground, as appropriate	The project will not affect this attribute.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Chemical processes: calcium carbonate deposition and concentration	Calcium carbonate deposition rate/soil concentration	Maintain appropriate calcium carbonate deposition rate and concentration in soil			
		Water quality	Various	Restore appropriate water quality to support the natural structure and functioning of the habitat	The proposed Project may cause adverse effects to the groundwater via accidental leaks of hydrocarbons and/or increased sedimentation depositing into the quarry sump via surface runoff, which may alter the water chemistry and cause an overall reduction in water quality.	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y



QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project (in absence of mitigation)	Potential adverse effects in-combination with other developments	Potential for the adverse effects (Y/N)
					Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).		
		Active peat formation	Flood duration	Maintain active peat formation	The project will not affect this attribute.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Vegetation composition: area of vegetation communities	Hectares	Maintain area of sensitive and high conservation value vegetation communities/units	Any alterations in groundwater chemistry may adversely affect the species composition of the turlough habitat, given that the vegetation is influenced by groundwater, including vegetation communities, zonation, sward height, fringing habitats, and turlough woodland. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Vegetation composition: vegetation zonation	Distribution	Maintain vegetation zonation/mosaic characteristic of the site			
		Vegetation structure: sward height	Centimetres	Maintain sward heights appropriate to the vegetation unit, and a variety of sward heights across the turlough			
		Typical species	Presence	Maintain typical species within and across the turlough			
		Fringing habitats: area	Hectares	Maintain marginal fringing habitats that support turlough vegetation, invertebrate, mammal and/or bird populations			
		Vegetation structure: turlough woodland	Species diversity and woodland structure	Maintain appropriate turlough woodland diversity and structure			



C.4.2 Castleampson Esker SAC

Table 6-4: Conservation objectives and targets for relevant QI with potential for adverse effects on the integrity of Castlesampson Esker SAC [001625]

QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Potential for the adverse effects (Y/N)
[3180] Turloughs	To restore the favourable conservation condition	Habitat area	Hectares	Area stable or increasing, subject to natural processes.	There will be no direct loss of habitat area or distribution as a result of the Project and potential groundwater impacts will not negatively affect the overall area or distribution of this habitat.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Habitat distribution	Occurrence	No decline, subject to natural processes			
		Hydrological regime	Various	Maintain/restore appropriate natural hydrological regime necessary to support the natural structure and functioning of the habitat	The proposed Project may cause adverse effects to the groundwater via accidental leaks of hydrocarbons and/or increased sedimentation depositing into the quarry sump via surface runoff. This may affect the natural hydrological regime to support the natural structure and functioning of the habitat. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Soil type	Hectares	Maintain variety, area and extent of soil types necessary to support turlough vegetation and other biota	The project will not affect this attribute.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Soil nutrient status: nitrogen and phosphorus	N and P concentration in soil	Restore nutrient status appropriate to soil types and vegetation communities	The proposed Project may cause adverse effects to the groundwater via accidental leaks of hydrocarbons and/or increased sedimentation depositing into the quarry sump via surface runoff, which may cause increases to N and P concentrations in the soil. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Physical structure: bare ground	Presence	Maintain sufficient wet bare ground, as appropriate	The project will not affect this attribute.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Chemical processes: calcium carbonate deposition and concentration	Calcium carbonate deposition rate/soil concentration	Maintain appropriate calcium carbonate deposition rate and concentration in soil			
		Active peat formation	Flood duration	Maintain active peat formation, where appropriate			
		Water quality	Various	Restore appropriate water quality to support the natural structure and functioning of the habitat	The proposed Project may cause adverse effects to the groundwater via accidental leaks of hydrocarbons and/or increased sedimentation depositing into the quarry sump via surface runoff, which may alter the	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude	Y



QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Potential for the adverse effects (Y/N)
					water chemistry and cause an overall reduction in water quality. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	that there would be no loss of integrity at any of the European Sites.	
		Vegetation composition: area of vegetation communities	Hectares	Restore area of sensitive and high conservation value vegetation communities/units	Any alterations in groundwater chemistry may adversely affect the species composition of the turlough habitat, given that the vegetation is influenced by groundwater, including vegetation communities, zonation, sward height, fringing habitats, and turlough woodland. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Vegetation composition: vegetation zonation	Distribution	Maintain/restore vegetation zonation/mosaic characteristic of the turlough			
		Vegetation structure: sward height	Centimetres	Maintain sward heights appropriate to the vegetation unit, and a variety of sward heights across the turlough			
		Typical species	Presence	Maintain/restore typical species within and across the turlough			
		Fringing habitats: area	Hectares	Maintain marginal fringing habitats that support turlough vegetation, invertebrate, mammal and/or bird populations			
		Vegetation structure: turlough woodland	Species diversity and woodland structure	Maintain appropriate turlough woodland diversity and structure			
[6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*important orchid sites)	To restore the favourable conservation condition	Habitat area	Hectares	Area stable or increasing, subject to natural processes	This habitat is not influenced by groundwater interactions and therefore no pathway exists for any potential adverse effects as a result of the proposed Project.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Habitat distribution	Occurrence	No decline, subject to natural processes. See map 2 for the habitat surveyed by Dwyer et al. (2007)			
		Vegetation composition: positive indicator specie	Number at a representative number of 2m x 2m monitoring stops; within 20m surrounding area of monitoring stops	At least 7 positive indicator species present in monitoring stop or, if 5–6 present in stop, additional species within 20m of stop; this includes at least two 'high quality' indicator species present in stop or within 20m of stop			
		Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Negative indicator species collectively not more than 20% cover, with cover of an individual species not more than 10%			
		Vegetation composition: nonnative species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of non-native species not more than 1%			
		Vegetation composition: woody	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of woody species (except certain listed species) and bracken (Pteridium aquilinum) not more than 5%			



QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Potential for the adverse effects (Y/N)
		species and bracken					
		Vegetation structure: broadleaf herb: grass ratio	Percentage at a representative number of 2m x 2m monitoring stops	Broadleaf herb component of vegetation between 40% and 90%			
		Vegetation structure: sward height	Percentage at a representative number of 2m x 2m monitoring stops	At least 30% of sward between 5cm and 40cm tall			
		Vegetation structure: litter	Percentage cover at a representative number of 2m x 2m monitoring stops	Litter cover not more than 25%			
		Physical structure: bare soil	Percentage cover at a representative number of 2m x 2m monitoring stops	Not more than 10% bare soil			
		Physical structure: grazing or disturbance	Area in local vicinity of a representative number of monitoring stops	Area of the habitat showing signs of serious grazing or disturbance less than 20m²			



C.4.3 Lough Croan Turlough SPA

Table 6-5: Conservation objectives and targets for relevant QI with potential for adverse effects on the integrity of Lough Croan Turlough SPA (004139)

QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Potential for the adverse effects (Y/N)
[A056] Shoveler Anas clypeata	To maintain the Favourable conservation condition	Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	It is unknown whether groundwater effects may adversely affect the winter population trend as groundwater impacts may impact foraging potential at the SPA. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Disturbance at wintering site	Intensity, frequency, timing and duration	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	The proposed Project will not cause any direct disturbance to this species at the SPA nor will it cause any barriers to wintering populations from accessing the SPA	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Barriers to connectivity and site use	Number, location, shape and hectares	Barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA			
		Forage spatial distribution, extent and abundance	Location, hectares, and forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	Groundwater impacts may cause a reduction in forage biomass through alterations in water chemistry. This effect may reduce the population that the SPA is able to support. There will be no direct alterations of area of suitable habitat as a result of the Project. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	The proposed Project will not reduce the availability of roosting habitat extent.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
[A140] Golden Plover Pluvialis apricaria	To restore the Favourable conservation condition	Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	Groundwater impacts caused by the proposed Project may adversely affect the winter population trend and may adversely affect foraging potential at the SPA causing a decrease in the winter population trend. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	The proposed Project will not cause any direct disturbance to this species at the SPA nor will it cause any barriers to wintering populations from accessing the SPA or negative effects to winter spatial distribution.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Disturbance at wintering site	Intensity, frequency,	Disturbance occurs at levels that do not significantly impact the			



QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Potential for the adverse effects (Y/N)
			timing and duration	achievement of targets for population trend and spatial distribution			
		Barriers to connectivity and site use	Number, location, shape and hectares	Barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA			
		Forage spatial distribution, extent and abundance	Location, hectares, and forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	Groundwater impacts may cause a reduction in the spatial distribution, extent and/or abundance of forage biomass through alterations in water chemistry that could result in a reduction of the population that the SPA is able to support. There will be no alterations of area of suitable habitat. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	The proposed Project will not reduce the availability of roosting habitat extent.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	There is no supporting habitat within the Project Site; nor will the groundwater impact affect any habitats outside designated SPAs.		
[A395] Greenland White-fronted Goose Anser albifrons flavirostris	To restore the Favourable conservation condition	Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	Groundwater impacts caused by the proposed Project may adversely affect the winter population trend as groundwater impacts may adversely affect foraging potential at the SPA. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	The proposed Project will not cause any direct disturbance to this species at the SPA nor will it cause any barriers to wintering populations from accessing the SPA or negative effects to winter spatial distribution.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Disturbance at wintering site	Intensity, frequency, timing and duration	Disturbance occurs at levels that do not significantly impact the achievement of targets for population trend and spatial distribution			
		Barriers to connectivity and site use	Number, location, shape and hectares	Barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA			



QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Potential for the adverse effects (Y/N)
		Forage spatial distribution, extent and abundance	Location, hectares, and forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	Groundwater impacts may cause a reduction in the spatial distribution, extent and/or abundance of forage biomass through alterations in water chemistry that could result in a reduction of the population that the SPA is able to support. There will be no alterations of area of suitable habitat. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	The proposed Project will not reduce the availability of roosting habitat extent.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
		Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	There is no supporting habitat within the Project Site; nor will the groundwater impact affect any habitats outside designated SPAs.		
[A999] Wetlands	To maintain the Favourable conservation condition	Wetland habitat area	Hectares	No significant loss to wetland habitat within the SPA, other than that occurring from natural patterns of variation	There will be no loss to wetland habitat within the SPA as a result of the proposed Project.	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
		Wetland habitat quality and functioning	Quality and function of the wetland habitat	No significant impact on the quality or functioning of the wetland habitat within the SPA, other than that occurring from natural patterns of variation	Groundwater impacts caused by the proposed Project may adversely affect the quality or functioning of the wetland by altering water chemistry. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).		



C.4.4 River Suck Callows SPA

Table 6-6: Conservation objectives and targets for relevant QI with potential for adverse effects on the integrity of River Suck Callows SPA (004097)

QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project		Potential adverse effects in-combination with other developments	Duration of effects in the absence of mitigation	Potential for the adverse effects (Y/N)
[A038] Whooper Swan Cygnus	To maintain the favourable conservation condition		Winter population trend		Percentage change in number of individuals	Long term winter population trend is stable or increasing	Groundwater impacts caused by the proposed Project may adversely affect the winter population trend as groundwater impacts may adversely affect foraging potential at the SPA. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
			Winter spatial distribution		Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	The proposed Project will not cause any direct disturbance to this species at the SPA nor will it cause any barriers to wintering populations from accessing the SPA or negative effects to winter spatial distribution.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
			Disturbance at wintering site		Intensity, frequency, timing and duration	The intensity, frequency, timing and duration of disturbance occur at levels that do not significantly impact the achievement of targets for population trend and spatial distribution			
			Barriers to connectivity and site use		Number, location, shape and hectares	The number, location, shape and area of barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA			
			Forage spatial distribution, extent and abundance		Location and hectares, and available forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	Groundwater impacts may cause a reduction in the spatial distribution, extent and/or abundance of forage biomass through alterations in water chemistry that could result in a reduction of the population that the SPA is able to support. There will be no alterations of area of suitable habitat. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
			Roost spatial distribution and extent		Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to	The proposed Project will not reduce the availability of roosting habitat extent.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N



QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Duration of effects in the absence of mitigation	Potential for the adverse effects (Y/N)
					support the population target			
			Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	There is no supporting habitat within the Project Site; nor will the groundwater impact affect any habitats outside designated SPAs.		
[A050] Wigeon Anas penelope	To restore the favourable conservation condition	Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	Groundwater impacts caused by the proposed Project may adversely affect the winter population trend as groundwater impacts may adversely affect foraging potential at the SPA. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y	
		Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	The proposed Project will not cause any direct disturbance to this species at the SPA nor will it cause any barriers to wintering populations from accessing the SPA or negative effects to winter spatial distribution.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N	
		Disturbance at wintering site	Intensity, frequency, timing and duration	The intensity, frequency, timing and duration of disturbance occur at levels that do not significantly impact the achievement of targets for population trend and spatial distribution				
		Barriers to connectivity and site use	Number, location, shape and hectares	The number, location, shape and area of barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA				
		Forage spatial distribution, extent and abundance	Location and hectares, and available forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	Groundwater impacts may cause a reduction in the spatial distribution, extent and/or abundance of forage biomass through alterations in water chemistry that could result in a reduction of the population that the SPA is able to support. There will be no alterations of area of suitable habitat. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y	



QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Duration of effects in the absence of mitigation	Potential for the adverse effects (Y/N)
			Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	The proposed Project will not reduce the availability of roosting habitat extent.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
			Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	The proposed Project will not increase the footprint of the overall quarry. There will be no loss of habitats of importance to this species in area. However, groundwater impacts may adversely affect surrounding turloughs (i.e., supporting habitat) for this species. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
[A140] Golden Plover Pluvialis pritaria	To restore the favourable conservation condition		Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	Groundwater impacts caused by the proposed Project may adversely affect the winter population trend as groundwater impacts may adversely affect foraging potential at the SPA. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).		
			Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	The proposed Project will not cause any direct disturbance to this species at the SPA nor will it cause any barriers to wintering populations from accessing the SPA or negative effects to winter spatial distribution.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
			Disturbance at wintering site	Intensity, frequency, timing and duration	The intensity, frequency, timing and duration of disturbance occur at levels that do not significantly impact the achievement of targets for population trend and spatial distribution			
			Barriers to connectivity and site use	Number, location, shape and hectares	The number, location, shape and area of barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA			
			Forage spatial distribution,	Location and hectares, and	Sufficient number of locations, area of	Groundwater impacts may cause a reduction in the spatial distribution, extent and/or	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of	Y



QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Duration of effects in the absence of mitigation	Potential for the adverse effects (Y/N)
			extent and abundance	available forage biomass	suitable habitat and available forage biomass to support the population target	abundance of forage biomass through alterations in water chemistry that could result in a reduction of the population that the SPA is able to support. There will be no alterations of area of suitable habitat. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	
			Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	The proposed Project will not reduce the availability of roosting habitat extent.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
			Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	The proposed Project will not increase the footprint of the overall quarry. There will be no loss of habitats of importance to this species in area. However, groundwater impacts may adversely affect surrounding turloughs (i.e., supporting habitat) for this species. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
[A142] Lapwing Vanellus vanellus	To restore the favourable conservation condition		Winter population trend	Percentage change in number of individuals	Long term winter population trend is stable or increasing	Groundwater impacts caused by the proposed Project may adversely affect the winter population trend as groundwater impacts may adversely affect foraging potential at the SPA. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)		
			Winter spatial distribution	Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	The proposed Project will not cause any direct disturbance to this species at the SPA nor will it cause any barriers to wintering populations from accessing the SPA or negative effects to winter spatial distribution.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
			Disturbance at wintering site	Intensity, frequency, timing and duration	The intensity, frequency, timing and duration of disturbance occur at levels that do not significantly impact the achievement of targets for population trend and spatial distribution			



QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Duration of effects in the absence of mitigation	Potential for the adverse effects (Y/N)
			Barriers to connectivity and site use		Number, location, shape and hectares	The number, location, shape and area of barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA		
			Forage spatial distribution, extent and abundance		Location and hectares, and available forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target Groundwater impacts may cause a reduction in the spatial distribution, extent and/or abundance of forage biomass through alterations in water chemistry that could result in a reduction of the population that the SPA is able to support. There will be no alterations of area of suitable habitat. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
			Roost spatial distribution and extent		Location and hectares of roosting habitat	roosting habitat Sufficient number of locations, area and availability of suitable roosting habitat to support the population target The proposed Project will not reduce the availability of roosting habitat extent.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
			Supporting habitat: area and quality		Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA The proposed Project will not increase the footprint of the overall quarry. There will be no loss of habitats of importance to this species in area. However, groundwater impacts may adversely affect surrounding turloughs (i.e., supporting habitat) for this species. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
[A395] Greenland White-fronted Goose <i>Anser albifrons flavirostris</i>	To restore the favourable conservation condition		Winter population trend		Percentage change in number of individuals	Long term winter population trend is stable or increasing Groundwater impacts caused by the proposed Project may adversely affect the winter population trend as groundwater impacts may adversely affect foraging potential at the SPA. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)		
			Winter spatial distribution		Hectares, time and intensity of use	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat The proposed Project will not cause any direct disturbance to this species at the SPA nor will it cause any barriers to wintering populations	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N



QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Duration of effects in the absence of mitigation	Potential for the adverse effects (Y/N)
					to support the population target	from accessing the SPA or negative effects to winter spatial distribution.		
			Disturbance at wintering site	Intensity, frequency, timing and duration	The intensity, frequency, timing and duration of disturbance occur at levels that do not significantly impact the achievement of targets for population trend and spatial distribution			
			Barriers to connectivity and site use	Number, location, shape and hectares	The number, location, shape and area of barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA			
			Forage spatial distribution, extent and abundance	Location and hectares, and available forage biomass	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	Groundwater impacts may cause a reduction in the spatial distribution, extent and/or abundance of forage biomass through alterations in water chemistry that could result in a reduction of the population that the SPA is able to support. There will be no alterations of area of suitable habitat. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase)	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
			Roost spatial distribution and extent	Location and hectares of roosting habitat	Sufficient number of locations, area and availability of suitable roosting habitat to support the population target	The proposed Project will not reduce the availability of roosting habitat extent.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N
			Supporting habitat: area and quality	Hectares and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	The proposed Project will not increase the footprint of the overall quarry. There will be no loss of habitats of importance to this species in area. However, groundwater impacts may adversely affect surrounding turloughs (i.e., supporting habitat) for this species. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y
[A999] Wetlands	To maintain the wetland habitats at River Suck Callows SPA as a resource for the regularly	Wetland habitat area	Hectares		No significant loss to wetland habitat within the SPA, other than that	There will be no loss to wetland habitat within the SPA as a result of the proposed Project.	None – no effects from the proposed project alone; therefore, no in-combination effects will occur.	N



QI species / habitats	Conservation objectives	Attribute	Measure	Target	Potential for adverse effects on site integrity from the proposed project	Potential adverse effects in-combination with other developments	Duration of effects in the absence of mitigation	Potential for the adverse effects (Y/N)
	occurring migratory waterbirds that utilise these areas					occurring from natural patterns of variation		
			Wetland habitat quality and functioning	Quality and function of the wetland habitat	No significant impact on the quality or functioning of the wetland habitat within the SPA, other than that occurring from natural patterns of variation	Groundwater impacts caused by the proposed Project may adversely affect the quality or functioning of the wetland by altering water chemistry. Such impacts would potentially be long-term (i.e., the duration of the lifetime of the operational phase).	Yes - The adjacent Seven Hills Wind Farm may have in-combination effects in the absence of mitigation. However, the NIS for this project detailed bespoke and appropriate mitigation measures to conclude that there would be no loss of integrity at any of the European Sites.	Y



Appendix D Relevant Information

Appropriate Assessment Screening & Natura Impact Statement Report

Cam Quarry Continuance of Use

Roadstone Ltd.

SLR Project No.: 501.065512.00001

14 September 2026



D.1 Pathway Considerations to inform the Zone of Influence for each of the Qualifying interests and Special Conservation Interests

In accordance with Article 6(3) of the Habitats Directive and national AA guidance, the following matrix identifies and evaluates potential effect pathways between the proposed project and European Sites. For each Qualifying Feature (QF), the table outlines:

- the potential pathway (e.g. hydrological, airborne, disturbance);
- the scientific or regulatory basis for the spatial or functional screening distance applied; and
- a rationale supporting whether a pathway is considered likely or can be excluded.

The following matrices outline the known inherent ecological and dispersal pathways associated with each QF. These pathways represent the natural spatial and functional linkages through which ecological or environmental effects could, in principle, be transmitted between a project and a European Site.

For each QF, the matrices summarise:

- the typical ecological or physical pathways relevant to that feature (e.g. hydrological connectivity, air-borne deposition, foraging mobility, dispersal range);
- the evidence-based spatial extent over which such pathways may operate, informed by peer-reviewed literature, conservation objectives, and statutory guidance; and
- a brief rationale describing the ecological basis for these pathway distances.

These distances are not project-specific impact zones but reflect the **intrinsic ecological functioning** and **potential connectivity ranges** that exist irrespective of any proposed activity. They provide a consistent evidence base for determining whether a credible pathway for impact exists and therefore whether a European Site should be taken forward for further consideration under Article 6(3) of the Habitats Directive.

These distances are used in conjunction with the range of sources for impacts identified in Section 2 to ensure ecological processes are included in the zone of influence considerations for the assessment.



Table 6-7: Ecological pathways for each Qualifying Interests and the associated rationale as supported by relevant literature

QI	Hydrological Sensitivity	Hydrogeological Sensitivity	Rationale	Scientific References	Pathway Distance
Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) * important orchid sites [6210]	No	No	This feature does not rely on hydrological or hydrogeological pathways. A 2 km buffer is considered sufficient to encompass the ecological context in which the habitat occurs, including edge effects, dispersal processes, and landscape-scale connectivity. Studies indicate that most edge effects such as microclimatic change, light penetration, or altered species interactions typically operate within the first few hundred metres of a boundary and rarely extend beyond 500 m. Seed dispersal and propagule movement in temperate systems are also generally localised, with the majority occurring within 1–2 km, even for species dispersed by wind or animals. At the landscape scale, patterns of structural connectivity and ecological function are often described at distances of 1–2 km, which represent the effective neighbourhood of interaction for most semi-natural terrestrial habitats. It is important to note that 2 km is identified as the extreme range for these dynamics. On this basis, a 2 km buffer provides an appropriate distance to capture the spatial dynamics most relevant to non-hydrological pathways of effect, while acknowledging that pressures such as dust deposition also diminish to background levels within this range under typical conditions.	Haddad, N.M., Brudvig, L.A., Clobert, J., Davies, K.F., Gonzalez, A., Holt, R.D., Lovejoy, T.E., Sexton, J.O., Austin, M.P., Collins, C.D. and Cook, W.M., 2015. Habitat fragmentation and its lasting impact on Earth's ecosystems. <i>Science advances</i> , 1(2), p.e1500052. Nathan, R. et al. (2008). Mechanisms of long-distance seed dispersal. <i>Trends in Ecology & Evolution</i> , 23(11): 638–647 Forman, R.T.T. & Godron, M. (1986). <i>Landscape Ecology</i> . John Wiley & Sons. Institute of Air Quality Management (IAQM) (2016). <i>Guidance on the Assessment of Dust from Demolition and Construction</i> .	2 km
Turloughs [3180]	Yes	Yes	Karstic groundwater-dependent wetland with seasonal inundation. 2 km buffer captures surface catchment context, with hydrogeological pathways assessed for subsurface connectivity and 5 km is deemed appropriate.	This rationale is supported by the logic of minimal on-land ecological function and interaction – this connects to the broader literature for the terrestrial habitat function and it's more likely that the hydrological interaction pathway is more relevant. Haddad, N.M., Brudvig, L.A., Clobert, J., Davies, K.F., Gonzalez, A., Holt, R.D., Lovejoy, T.E., Sexton, J.O., Austin, M.P., Collins, C.D. and Cook, W.M., 2015. Habitat fragmentation and its lasting impact on Earth's ecosystems. <i>Science advances</i> , 1(2), p.e1500052. Nathan, R. et al. (2008). Mechanisms of long-distance seed dispersal. <i>Trends in Ecology & Evolution</i> , 23(11): 638–647 Forman, R.T.T. & Godron, M. (1986). <i>Landscape Ecology</i> . John Wiley & Sons. Institute of Air Quality Management (IAQM) (2016). <i>Guidance on the Assessment of Dust from Demolition and Construction</i> . Williams, N.H. & Lee, M. (2013). Characterisation of the groundwater environment — Irish aquifers. In <i>Groundwater & Sustainable Development</i> , Geological Survey Ireland. (Note: this is a conference/workshop style document, see “Characterisation of the groundwater environment for resource assessment, development, management and protection” by Taly Hunter Williams & Monica Lee). Gill, L., Bhatnagar, S., Bijkerk, E., Regan, S., Somlai, C., Naughton, O., Ghosh, B., Waldren, S., Coxon, C. & Johnston, P. (2022). <i>EcoMetrics – Environmental Supporting Conditions for Groundwater-dependent Terrestrial Ecosystems</i> . EPA Research Report No. 403. Environmental Protection Agency, Ireland. ISBN 978-1-80009-030-9. Schuler, P., Stoeckl, L., Schnegg, P.-A., Bunce, C. & Gill, L. (2020). A combined-method approach to trace submarine groundwater discharge from a coastal karst aquifer in Ireland. <i>Hydrogeology Journal</i> , 28(2), 561-577. doi:10.1007/s10040-019-02082-0.	2 km for surface water 5 km for groundwater



Table 6-8: Ecological pathways for each Special Conservation Interest species and the associated rationale as supported by relevant literature

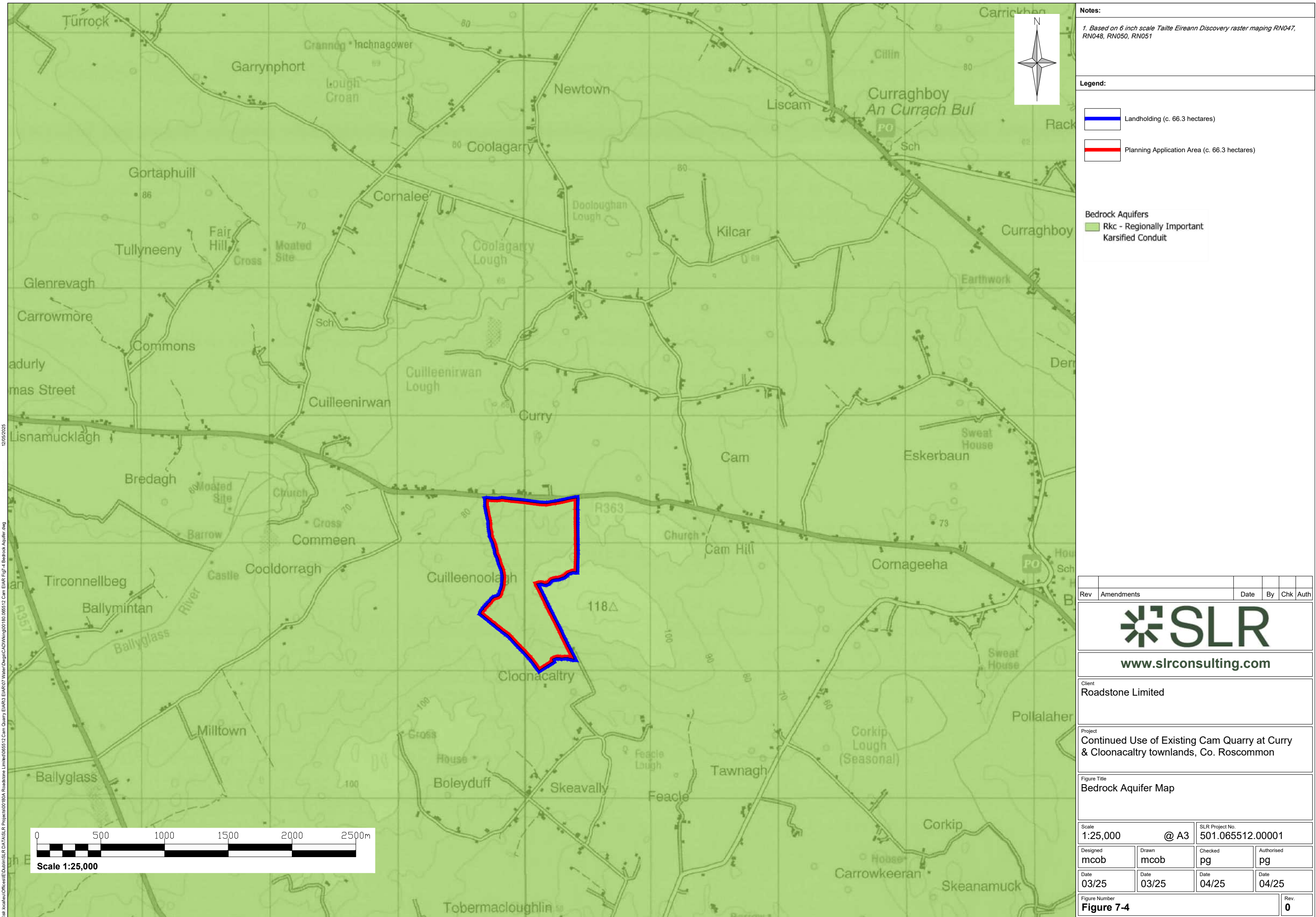
SCI	Latin name	Season of Relevance	Hydrological Sensitivity	Hydrogeological Sensitivity	On-land Travel	Rationale	Evidence / Sources	Pathway Distance (km)
Wetlands and waterbirds	N/A	All	Yes	Yes	N/A	Broad ecological receptor category encompassing habitats dependent on wetland conditions. 2 km buffer captures spatial influence zone related to general ecological functioning, while hydrology and groundwater are considered where applicable.	See Table C-1 above for wetland habitats	2
Eurasian wigeon	<i>Anas penelope</i>	Wintering	Yes	Yes	Yes	1) Designation in Irish SPAs: Wintering population(s) (derived from NPWS SPA datasheets across Irish SPAs). 2) NatureScot (2016) core-foraging-range evidence: None for the relevant population(s). 3) Additional/alternative core-range evidence: Legagneux et al. (2009) show core movements 1-2 km from roosts; Johnson et al. (2014) show flights up to 5 km away. 4) Foraging behaviour & screening mode: Wintering: not central-place; distribution-led assessment appropriate. 5) Hydro(geo)logical dependency: Dependent on surface/groundwater-fed features. 6) AA screening implication: Core range(s) radius applicable for season(s). Hydrological/hydrogeological assessment required.	Johnson, W.P., Schmidt, P.M. & Taylor, D.P. (2014). Foraging flight distances of wintering ducks and geese: a review. <i>Avian Conservation and Ecology</i> 9(2):2. https://pdfs.semanticscholar.org/32ac/f65b7d99bf40ce5251f6c0f6b704dc5eb432.pdf Legagneux, P., Blaize, C., Latraube, F., Gautier, J., & Bretagnolle, V. (2009). Variation in home-range size and movements of wintering dabbling ducks. <i>Journal of Ornithology</i> , 150, 183–193. https://doi.org/10.1007/s10336-008-0333-7 NatureScot (2016). Assessing connectivity with SPAs. Guidance Version 3, June 2016. Scottish Natural Heritage. https://www.nature.scot/sites/default/files/2022-12/Assessing%20connectivity%20with%20special%20protection%20areas.pdf NatureScot (2023). Guidance Note 4: Determining connectivity of marine birds with marine SPAs and breeding seabirds from colony SPAs in the non-breeding season. Version 1, January 2023. https://www.nature.scot/doc/guidance-note-4-guidance-support-offshore-wind-applications-ornithology-determining-connectivity NPWS (2024). SPA datasheets extract: SPA_datasheets_20240514_Bird_SCI_Data.csv (14/05/2024).	5
Golden plover	<i>Pluvialis apricaria</i>	Wintering / Breeding	Yes	No	Yes	1) Designation in Irish SPAs: Wintering & Breeding (Species-Dependent) population(s) (derived from NPWS SPA datasheets across Irish SPAs). 2) NatureScot (2016) core-foraging-range evidence: 3 km core (11 km maximum) for breeding season. 3) Additional/alternative core-range evidence: 12 km for wintering populations (Gillings and Fuller, 1999). 4) Foraging behaviour & screening mode: Wintering and Breeding: central-place forager; distance-led screening appropriate. 5) Hydro(geo)logical dependency: Dependent on surface-water features (e.g. wetlands). 6) AA screening implication: Core range(s) applied to screening to establish theoretical connectivity (acknowledging maxima, but not as a fixed screening radius). Hydrological assessment required.	Gillings and Fuller (1999). Winter Ecology of Golden Plover and Lapwings: A Review and Consideration of Extensive Survey Methods. BTO, Thetford, UK. NatureScot (2016). Assessing connectivity with SPAs. Guidance Version 3, June 2016. Scottish Natural Heritage. https://www.nature.scot/sites/default/files/2022-12/Assessing%20connectivity%20with%20special%20protection%20areas.pdf NPWS (2024). SPA datasheets extract: SPA_datasheets_20240514_Bird_SCI_Data.csv (14/05/2024).	3 (breeding / 12 (wintering))
Greenland white-fronted goose	<i>Anser albifrons flavirostris</i>	Wintering	Yes	Yes	Yes	1) Designation in Irish SPAs: Wintering population(s) (derived from NPWS SPA datasheets across Irish SPAs). 2) NatureScot (2016) core-foraging-range evidence: Wintering: core 5–8 km 3) Additional/alternative core-range evidence: N/A. 4) Foraging behaviour & screening mode: Wintering: central-place forager; distance-led screening appropriate. 5) Hydro(geo)logical dependency: Dependent on surface- and groundwater-fed features (e.g. lakes, estuaries, wetlands). 6) AA screening implication: Core range(s) applied to screening to establish theoretical connectivity (acknowledging maxima, but not as a fixed screening radius); where non-central seasons occur, use distribution-led assessment (GN4). Hydrological/hydrogeological assessment required.	NatureScot (2016). Assessing connectivity with SPAs. Guidance Version 3, June 2016. Scottish Natural Heritage. https://www.nature.scot/sites/default/files/2022-12/Assessing%20connectivity%20with%20special%20protection%20areas.pdf NPWS (2024). SPA datasheets extract: SPA_datasheets_20240514_Bird_SCI_Data.csv (14/05/2024).	8
Lapwing	<i>Vanellus vanellus</i>	Wintering	Yes	No	Yes	1) Designation in Irish SPAs: Wintering population(s) (derived from NPWS SPA datasheets across Irish SPAs). 2) NatureScot (2016) core-foraging-range evidence: None for the relevant population(s). 3) Additional/alternative core-range evidence: Gillings and Fuller (1999) show movements up to 12 km. 4) Foraging behaviour & screening mode: Wintering: central-place; distance-led assessment appropriate. 5) Hydro(geo)logical dependency: Dependent on surface-fed features (wetlands). 6) AA screening implication: Distance-led assessment required. Hydrological assessment required.	Gillings, S., & Fuller, R.J. (1999). Winter Ecology of Golden Plovers and Lapwings: A Review and Consideration of Extensive Survey Methods. BTO Research Report No. 224. British Trust for Ornithology. NatureScot (2016). Assessing connectivity with SPAs. Guidance Version 3, June 2016. Scottish Natural Heritage. https://www.nature.scot/sites/default/files/2022-12/Assessing%20connectivity%20with%20special%20protection%20areas.pdf NPWS (2024). SPA datasheets extract: SPA_datasheets_20240514_Bird_SCI_Data.csv (14/05/2024).	12
Northern shoveler	<i>Anas clypeata</i>	Wintering	Yes	Yes	Yes	1) Designation in Irish SPAs: Wintering population(s) (derived from NPWS SPA datasheets across Irish SPAs). 2) NatureScot (2016) core-foraging-range evidence: None for the relevant	NatureScot (2016). Assessing connectivity with SPAs. Guidance Version 3, June 2016. Scottish Natural Heritage. https://www.nature.scot/sites/default/files/2022-12/Assessing%20connectivity%20with%20special%20protection%20areas.pdf Johnson, W.P., Schmidt, P.M. & Taylor,	5

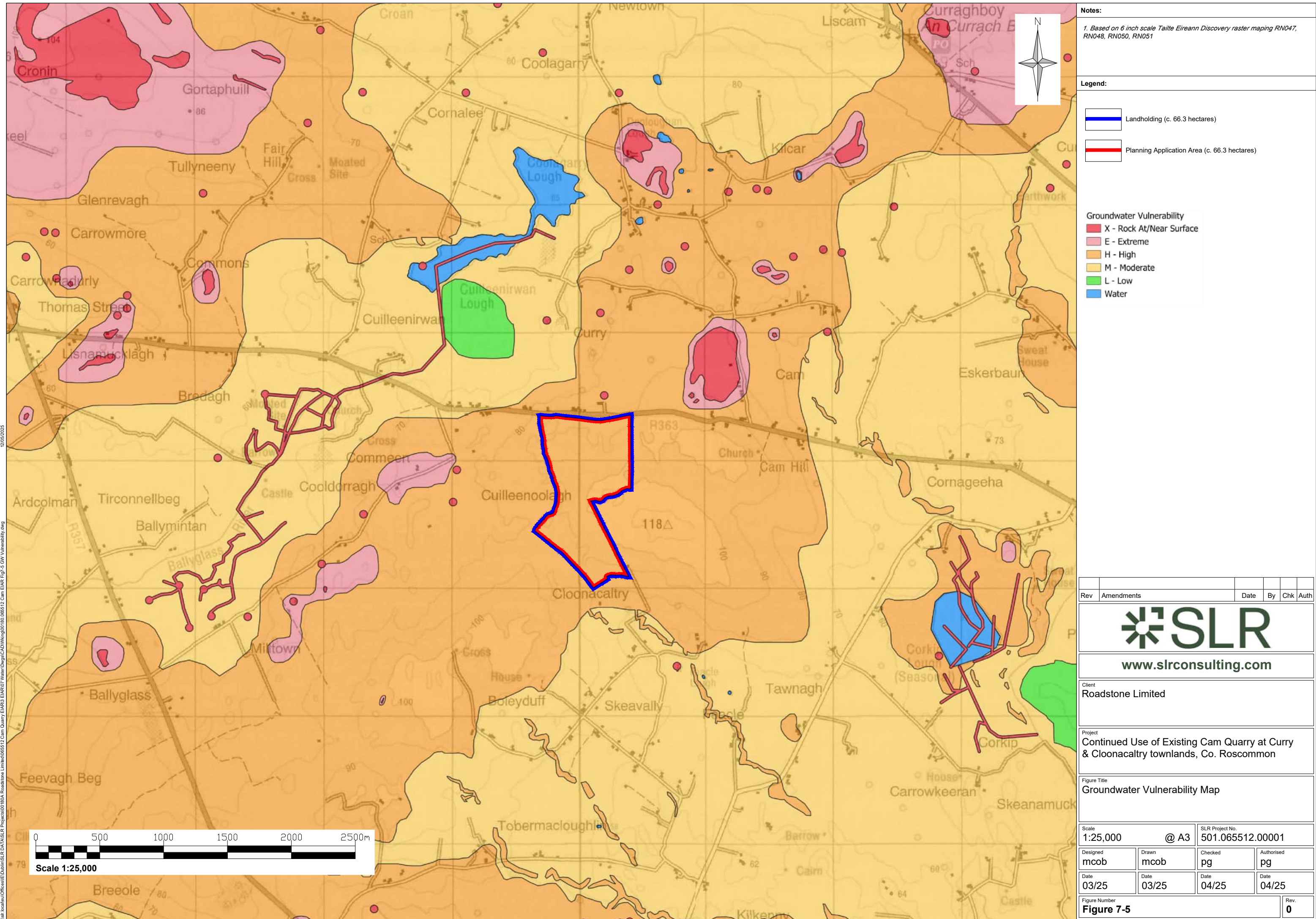


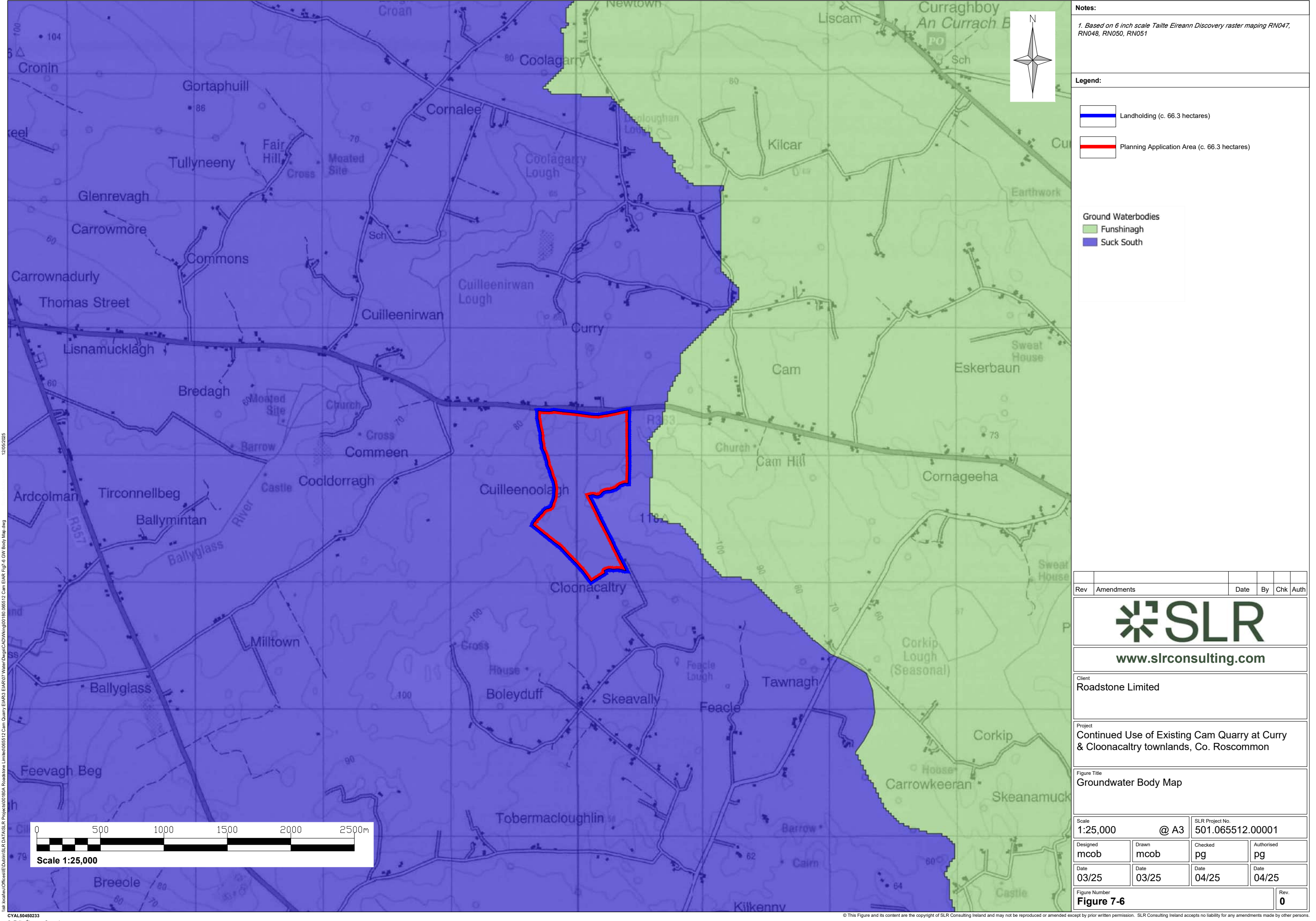
SCI	Latin name	Season of Relevance	Hydrological Sensitivity	Hydrogeological Sensitivity	On-land Travel	Rationale	Evidence / Sources	Pathway Distance (km)
						population(s). 3) Additional/alternative core-range evidence: Johnson et al. (2014) suggests dabbling ducks move up to 5 km in winter. 4) Foraging behaviour & screening mode: Wintering: not a central-place forager; distribution-led screening appropriate. 5) Hydro(geo)logical dependency: Dependent on surface- and groundwater-fed features (e.g. lakes, estuaries, wetlands). 6) AA screening implication: Wintering: use distribution-led assessment (GN4). Hydrological/hydrogeological assessment required.	D.P. (2014). Foraging flight distances of wintering ducks and geese: a review. Avian Conservation and Ecology 9(2):2. https://pdfs.semanticscholar.org/32ac/f65b7d99bf40ce5251f6c0f6b704dc5eb432.pdf NPWS (2024). SPA datasheets extract: SPA_datasheets_20240514_Bird_SCI_Data.csv (14/05/2024).	
Whooper swan	<i>Cygnus cygnus</i>	Wintering	Yes	Yes	Yes	1) Designation in Irish SPAs: Wintering population(s) (derived from NPWS SPA datasheets across Irish SPAs). 2) NatureScot (2016) core-foraging-range evidence: Wintering: core <5 km 3) Additional/alternative core-range evidence: N/A. 4) Foraging behaviour & screening mode: Wintering: central-place forager; distance-led screening appropriate. 5) Hydro(geo)logical dependency: Dependent on surface- and groundwater-fed features (e.g. lakes, estuaries, wetlands). 6) AA screening implication: Core range(s) applied to screening to establish theoretical connectivity (acknowledging maxima, but not as a fixed screening radius); where non-central seasons occur, use distribution-led assessment (GN4). Hydrological/hydrogeological assessment required.	NatureScot (2016). Assessing connectivity with SPAs. Guidance Version 3, June 2016. Scottish Natural Heritage. https://www.nature.scot/sites/default/files/2022-12/Assessing%20connectivity%20with%20special%20protection%20areas.pdf NatureScot (2023). Guidance Note 4: Determining connectivity of marine birds with marine SPAs and breeding seabirds from colony SPAs in the non-breeding season. Version 1, January 2023. https://www.nature.scot/doc/guidance-note-4-guidance-support-offshore-wind-applications-ornithology-determining-connectivity NPWS (2024). SPA datasheets extract: SPA_datasheets_20240514_Bird_SCI_Data.csv (14/05/2024).	5



D.2 Relevant Figures







Notes:

1. Based on 6 inch scale Tailte Eireann Discovery raster maping RN047, RN048, RN050, RN051

Legend:

Landholding (c. 66.3 hectares)

Planning Application Area (c. 66.3 hectares)

Ground Waterbodies

Funshinagh

Suck South

Rev	Amendments	Date	By	Chk	Auth
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Client
Roadstone Limited

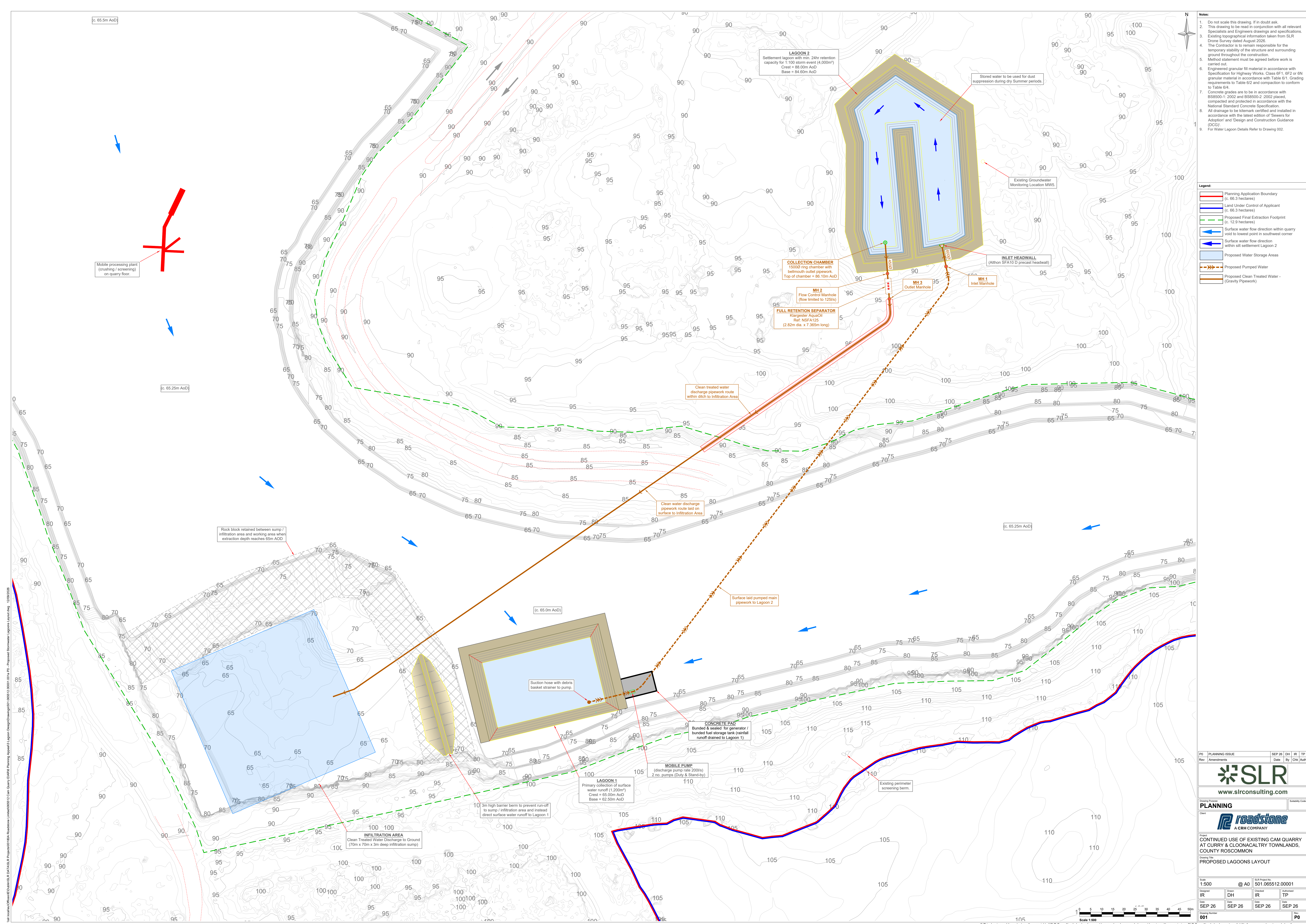
Project
Continued Use of Existing Cam Quarry at Curry & Cloonacaltry townlands, Co. Roscommon

Figure Title
Groundwater Body Map

Scale 1:25,000 @ A3		SLR Project No. 501.065512.00001	
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Date 03/25	Date 03/25	Date 04/25	Date 04/25

Figure Number Figure 7-6	Rev. 0
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- Notes:**
1. Do not scale this drawing. If in doubt ask.
 2. This drawing to be read in conjunction with all relevant Specialists and Engineers drawings and specifications.
 3. Existing topographical information taken from SLR Drone Survey dated August 2025.
 4. The Contractor is to remain responsible for the temporary stability of the structure and surrounding ground throughout the construction.
 5. Method statement must be agreed before work is carried out.
 6. Engineered granular fill material in accordance with Specification for Highway Works, Class 6F1, 6F2 or 6N granular material in accordance with Table 61.1. Grading requirements to Table 62 and compaction to conform to Table 64.
 7. Concrete grades are to be in accordance with BS8500-1:2002 and BS8500-2:2002 placed, compacted and protected in accordance with the National Standard Concrete Specification.
 8. All drainage to be kitemark certified and installed in accordance with the latest edition of 'Sewers for Adoption' and 'Design and Construction Guidance (DCG)'.
 9. For Water Lagoon Details Refer to Drawing 002.

- Legend:**
- Planning Application Boundary (c. 66.3 hectares)
 - Land Under Control of Applicant (c. 66.3 hectares)
 - Proposed Final Extraction Footprint (c. 12.9 hectares)
 - Surface water flow direction within quarry void to lowest point in southwest corner
 - Surface water flow direction within all settlement Lagoon 2
 - Proposed Water Storage Areas
 - Proposed Pumped Water
 - Proposed Clean Treated Water - (Gravity Pipework)

P0	PLANNING ISSUE	SEP 26	DH	IR	TP
Rev	Amendments	Date	By	Chk	Auth
					
www.slrconsulting.com					
Drawing Title: PLANNING					Subsidiary Code:
Client:  A CRH COMPANY					
Project: CONTINUED USE OF EXISTING CAM QUARRY AT CURRY & CLOONACALTRY TOWNLANDS, COUNTY ROSCOMMON					
Drawing Title: PROPOSED LAGOONS LAYOUT					
Scale: 1:500	@ AO		SLR Project No: 501.065512.00001		
Designed: IR	Drawn: DH	Checked: IR	Approved: TP		
Date: SEP 26	Date: SEP 26	Date: SEP 26	Date: SEP 26		
Drawing Number: 001			P0		

D.3 EIAR Chapter 2 – Project Description

Contents

Existing Development	2-1
Existing Quarry Site	2-1
Existing Permitted Development.....	2-1
Development Permitted but not commenced	2-2
Proposed Development.....	2-2
Development Overview.....	2-2
Construction & Operational Phase	2-4
Restoration Phase (Permanent Lake Feature).....	2-4
Aggregate Reserve Assessment.....	2-4
Duration of Extraction	2-5
Site Screening and Boundary Treatment	2-5
Removal of Topsoil & Overburden Soils	2-5
Hedgerows / Treelines	2-6
Site Drainage.....	2-6
Extraction and Blasting	2-6
Method of Extraction.....	2-7
Processing Methods	2-7
Extracted Rock Processing Method	2-7
Readymix Concrete Operations (when implemented).....	2-7
Dispatch of Aggregate Product	2-8
Quarry Working Hours	2-9
Employment.....	2-9
Site Infrastructure.....	2-9
Site Access and Security	2-9
Parking & Hardstanding Areas.....	2-9
Weighbridge	2-9
Wheelwash.....	2-10
Offices and Ancillary Facilities	2-10
Utilities and Services	2-10
Lighting	2-11
Fuel and Oil Storage.....	2-11
Waste Management	2-11
General Waste Management	2-11
Extractive Waste Management	2-12

Description of the Waste Generating Operation.....	2-12
Environmental Controls	2-12
General.....	2-12
Bird Control	2-12
Traffic Control	2-12
Litter Control	2-13
Odour Control	2-13
Vermin Control.....	2-13
Fire Control.....	2-13
Dust Generation and Control	2-13
Noise Generation and Control	2-14
Environmental Monitoring	2-15
Environmental Management System	2-15
Dust Monitoring	2-15
Noise Monitoring.....	2-16
Water Monitoring (Groundwater / Surface Water).....	2-16
Proposed Landscape Management & Final Restoration.....	2-17
Proposed Landscape Management Measures.....	2-17
Site Screening Measures	2-17
Siting of Facilities (not constructed to-date)	2-18
Proposed Restoration Scheme	2-18
Site Management and Supervision	2-19
Long Term Safety and Security	2-19
Long Term Surface Water and Groundwater	2-19
Decommissioning of Plant and Machinery	2-19
Aftercare and Monitoring	2-19
Appendices	
Appendix 2-A: Extractive Waste Management Plan (EWMP).....	

Tables

Table 2-1: Estimated Material Volumes

2-Error! Bookmark not defined.

Figures

Figure 2-1: Existing Site Layout.....	
Figure 2-2: Permitted Development (ABP PL20.215417 / P. Ref. 04/1479).....	
Figure 2-3: Proposed Development Layout	
Figure 2-4: Existing, Permitted & Proposed Cross Sections	
Figure 2-5: Proposed Landscape & Restoration Plan.....	
Figure 2-6: Proposed Restoration Cross Sections.....	

Existing Development

- 2.1 The overall planning application area covers approximately 66.3 hectares (c. 163.8 acres) and comprises the existing operational quarry over the northern half of the site and unimproved pasture, scrub and rock outcrop lands over the southern half over which the current planning permission allows for overburden storage and rock extraction. The general site layout is shown on **Figure 2-1**.

Existing Quarry Site

- 2.2 Within the application area (c. 66.3 hectares) the northeastern portion of the site contains the existing entrance onto the R363 regional road. In the vicinity of the site, the R363 is c. 7 metres wide, with no footways or hard strips. The road widens to 12.5 metres at the site access to accommodate left and right-turning lanes for the quarry site. The posted speed limit on the R363 is currently 80 km/h.
- 2.3 The entrance itself is splayed with stone wing walls and pillars with the gates set back c. 20m from the edge of the carriageway. The access road has sweeping curves to prevent any visibility of the site facilities from the site entrance or public road. The access is hard paved from the entrance for a distance of c. 175m into the site to where the weighbridge and office are located. Adjacent to the weighbridge and office, are the wheelwash and bunded fuel storage / refuelling areas.
- 2.4 The existing quarry extraction area occupies the central part of the site and currently consists of a 2 no. working faces typically 10-15m in height. Current ground levels over the quarry floor range from c. 70-85m AOD. The extraction area is currently c. 8.4 hectares within an overall permitted extraction area of c. 23.7 hectares. Previously stripped soils and overburden have been used to construct perimeter screening berms.
- 2.5 The quarry operations comprise extraction of the limestone using periodic blasting techniques; processing (crushing and screening) of the fragmented rock to produce aggregates for road construction and site development works, and for use in concrete and asphalt manufacturing plants operated at other Roadstone sites. Rock is extracted from the working quarry face by means of explosives placed in drilled holes along the face being worked. Primary size reduction by mobile crushing and screening units takes place within the quarry void.
- 2.6 The quarry is currently worked without the need to discharge water off-site. Any rainfall or water ingress within the current quarry void is managed within the void where water accumulates in the lowest level of the quarry floor allowing the remainder of the quarry to remain dry for extraction operations.
- 2.7 Over the southern portion of the site, an area of c. 2.9 hectares is currently covered with stripped overburden from the site with the remainder of the area still in its natural state of unmanaged grasslands, scrub and gorse. This area is currently permitted under P. Ref. 04/1479 for both rock extraction and overburden storage.

Existing Permitted Development

- 2.8 The existing permitted development under P. Ref. 04/1479 and ABP PL20.215417 was for:
- “...permission for development of a quarry on c.68 hectares of lands at Curry / Cloonacaltry, Brideswell, Co. Roscommon, of which c.23.7 hectares is the extraction area. The proposed development is for extraction of limestone using conventional blasting techniques and processing of rock using crushing and screening plant. The proposal also includes for provision of a concrete block making facility and concrete batching plant, a truck washdown*

facility with wash water recycled via a closed settlement tank system, the storage of aggregates, ESB substation (26m²), portacabin office facilities including canteen and washroom facilities (91m²), a workshop including storage room, canteen and washroom facilities (485m²), septic tank and percolation area, bunded fuel storage area, vehicle circulation/access including wheelwash and weighbridge, settlement tanks/hydrocarbon interceptors for treatment of water, construction of overburden and screening mounds, all other associated site works and ancillary activities.”

- 2.9 The original planning application sought a development life of 46 years (+2 years for restoration). A 20-year life in total was granted under P. Ref. 04/1479 & ABP PL20.215417, which is due to expire in October 2026. The permitted design is shown on **Figure 2-2**.

Development Previously Permitted but not commenced

- 2.10 The permitted development as outlined above is operational with the exception of the concrete batching plant, concrete block making facility and block storage yard which have not been constructed to date. The batching plant is permitted to produce 50,000m³/annum and 5 million concrete blocks. The permitted workshop has also not been constructed to date.
- 2.11 The permitted development also provided for discharge of waters (GW / SW) from the quarry void via a pipe along the R363 regional road to the Ballyglass river c. 1.4km west of the site. There is currently no discharge from the site; the water management system associated with the discharge as shown along the northern boundary on **Figure 2-2** has not been constructed and no discharge licence has been sought from Roscommon County Council.

Proposed Development

Development Overview

- 2.12 This new planning application will be based on the previous application description (in part) and as such will be an application for continuance of use of some of the previously permitted development – including the concrete batching plant not constructed to date.
- 2.13 There will be no requirement for any changes to other facilities, supporting infrastructure, or operational arrangements such as hours of working, extraction volumes or processing methods other than upgrading of the existing wastewater treatment system (WWTS).
- 2.14 The current permitted extraction area is c. 23.7 hectares. The proposed extraction area (as part of this planning application) will reduce to 12.9 hectares.
- 2.15 The proposed development period sought (extraction operations and restoration) is for a period of 10 years.
- 2.16 The applicant now proposes the following amendments to the original planning application details submitted under planning ref. 25/60577. These consist primarily of a reduced quarry extraction design (in surface area and depth) and the omission of several previously permitted elements. The proposed amendments are shown on EIAR **Figure 2-3** and **Drawing FI-1** and summarised below.
- 2.17 The result is that no further extraction or development works will be undertaken on areas of currently undisturbed lands within the application site, i.e. all proposed development will be contained within existing disturbed areas where topsoils have already been removed, with the result that **no grasslands including any potential Annex I grassland habitat** will be affected.
- **Reduction in Overall Depth** of Extraction by 25 metres, changing the previously permitted depth from 40m AOD to 65m AOD.

This reduction will eliminate the requirement to discharge water off-site to the Ballyglass River.

- **Reduction in Quarry Extraction Footprint** area from c. 17.1 hectares to c. 12.9 hectares.

This reduction will eliminate the development from encroaching any further into existing grassland areas within the site over the life of the planning permission (i.e. all development will be carried out within existing areas of disturbed ground where topsoils have already been removed).

Accordingly, no grasslands including any potential Annex I grassland habitat will be affected.

- **Removal of Proposed Water Management System.**

As the revised extraction depth removes the need for any off-site water discharge, the previously proposed Water Management System, including the hydrocarbon interceptor and all associated discharge pipework along the public road, is no longer required.

As a result, no grasslands including any potential Annex I grassland habitat will be disturbed in this area.

- **Removal of Proposed Block Yard Area.**

The previously permitted block yard area for the manufacture and storage of blocks is no longer included within this planning application.

Accordingly, no grasslands including any potential Annex I grassland habitat within this area will be affected.

The installation of the previously permitted concrete batching plant remains part of the proposal. This will be located on existing disturbed ground, ensuring no impact on Annex I grassland habitat.

- **Removal of Proposed Workshop building.**

The previously permitted workshop building has been removed from the current application.

As with other omitted elements, no grasslands including any potential Annex I grassland habitat will be disturbed in this location.

2.18 The proposed development will consist of:

- Permission for continued use of the existing quarry development currently permitted by P. Ref. 04/1479 and ABP PL20.215417 for a further period of 10 years, within an application area of c. 66.3 hectares, with an extraction area of c. 12.9 hectares and permanent overburden storage area of c. 2.9 hectares;
- Permission for continued use of the permitted facilities consisting of: ESB substation (26m²), portacabin office facilities including canteen and washroom facilities (91m²), bunded fuel storage, vehicle circulation/access including wheelwash and weighbridge, settlement tanks/hydrocarbon interceptors for treatment of water, construction of overburden and screening mounds, all other associated site works and ancillary activities;
- Permission for continued extraction of limestone using conventional blasting techniques and processing of rock using crushing and screening plant;
- Upgrade of the existing WWTS and percolation area to new Secondary WWTS and constructed soil polishing filter area;

- Provision of the permitted concrete batching plant, truck washdown facility with wash water recycled via a closed settlement tank system, the storage of aggregates; and
- Restoration of the overall application site to a natural habitat including a seasonal waterbody.

Construction & Operational Phase

- 2.19 As this application primarily relates to continued use of the existing permitted development, the construction and operational phases are effectively considered the same. The quarry will be further developed laterally (up to 12.9 hectares) and at depth (to c. 65m AOD) over the proposed development life of 10 years. The existing extraction and processing operations currently carried out at the site will be maintained and continued over the operational phase of the development.
- 2.20 The permitted quarry extraction area under P. Ref. 04/1479 (ABP PL20.215417) is 23.7 hectares. As noted above, this will reduce to 12.9 hectares. It is proposed to reduce this previously permitted extraction depth by 25 metres, from 40m AOD to 65m AOD. This reduction will eliminate the need for any off-site water discharge to the Ballyglass River.
- 2.21 There is only one element of the existing permitted development that has not been constructed to-date that will be required at a future date during the life of the development:
- The concrete batching plant which has not been constructed to date, as shown in plan on **Figure 2-2** and detailed in **Drawings FI-X & FI-X**. The batching plant is permitted to produce 50,000m³/annum. The installation of the previously permitted concrete batching plant will be located on existing disturbed ground. Accordingly, no grasslands including any potential Annex I grassland habitat area will be affected.

Restoration Phase (Seasonal Lake Feature)

- 2.22 Most restoration works will be carried out on permanent completion of extraction works. As the majority of the site is used for extraction and processing purposes it is not feasible to restore any significant parts of the rock quarry void at an earlier stage. However, it is proposed that all existing grass and scrub areas which have established along the site boundaries will be protected and retained, as much as possible.
- 2.23 Upon the cessation of extraction operations, it is proposed to return the worked-out areas to a beneficial ecological after-use. Following extraction, vegetation through natural colonisation on the redundant quarry benches will occur.
- 2.24 The proposed extraction scheme and associated elements were reduced to restrict all works to the currently disturbed areas and thereby prevent the removal of / impact on any grassland and scrub habitats within the site. The restoration scheme proposes to leave all disturbed areas for natural regeneration. This will ensure that these areas are colonised by locally occurring grass, wildflower and scrub species, rather than introducing such species through wildflower / grass seeding. The restoration areas will therefore provide an opportunity for the expansion of surrounding habitats.
- 2.25 The quarry void will also be left for natural regeneration. Some parts of the quarry floor are likely to seasonally flood, which will create a mosaic of different habitats.

Aggregate Reserve Assessment

- 2.26 A detailed topographical survey of the site was commissioned by Roadstone (refer to **Figure 2-1**). The survey data was used to produce a 3D digital terrain model using a quarry design software package called LSS. In preparing the design, standard criteria were adopted with regard to face heights and bench widths, stand-offs to the site boundaries etc. The existing permitted quarry design is provided in plan on **Figure 2-2**, with the revised (reduced) quarry extraction design provided in on **Figure 2-3** and in cross section on **Figure 2-4**).
- 2.27 The total recoverable reserve of rock from within the proposed revised design development (with an extraction area of c. 12.9 hectares) to the final proposed quarry floor level of 65m AOD is c. 4.5M tonnes .

Duration of Extraction

- 2.28 The duration of quarrying activities at the application site will largely be dictated by the rate at which the rock is extracted from the site. There are many factors which will influence this, including, but not limited to the prevailing economic climate and related construction industry demand and distance of construction projects from the facility (and scale of activity). The extracted rock will be used to primarily supply concrete and asphalt plants at other Roadstone locations, with the remainder supplied directly to the market.
- 2.29 The site is currently permitted to extract up to 500,000 tonnes of rock per annum. At this rate of extraction, the projected life of the proposed development would be c. 9 years (+ 1 year for restoration).
- 2.30 It is considered that planning permission for the proposed quarry development should be commensurate with the life of the reserves. An adequate quarry life is required to secure an acceptable return on investment, when the costs of continued investment in the site development, mobile crushing / screening plant and the on-going operational costs are considered
- 2.31 A planning permission duration of 10 years is considered reasonable and is sought for the development; rock extraction, processing and restoration works.

Site Screening and Boundary Treatment

- 2.32 The quarry has been largely screened from views from adjacent roads and residences by screen planting, screening berms and field boundary hedgerows.
- 2.33 The entrance itself is splayed with stone wing walls and pillars with the gates set back c. 20m from the edge of the carriageway. The access road has sweeping curves to prevent any visibility of the site facilities from the site entrance or public road.
- 2.34 A Landscape Management and Restoration Plan is outlined later in the chapter, and details are provided in **Figure 2-5**.

Removal of Topsoil & Overburden Soils

- 2.35 Previously stripped overburden and topsoil material has been used for the construction of the existing perimeter screening berms and placed within the overburden storage area.
- 2.36 The existing overburden storage area located to the southwest of the quarry void currently has a footprint of c. 2.9 hectares as shown on **Figure 2-1**. The current permitted overburden storage area, as shown on **Figure 2-2**, has a footprint of 13.4 hectares. There is no requirement for any further stripping of topsoil or overburden, so the existing overburden footprint will remain at c. 2.9 hectares as shown on **Figure 2-3**. There will be no impact on any of the Marsh Fritillary butterfly web sites and suitable habitat, Devil's Bit Scabious,

identified during ecological surveys carried out in 2024, nor any Annex 1 calcareous grassland habitat, as shown on **Figure 2-3**.

- 2.37 There is no requirement to remove any soils or overburden materials off site.

Hedgerows / Treelines

- 2.38 The lands comprise unimproved pasture, scrub and boulder strewn land with field walls and sporadic boundary hedgerows / trees.
- 2.39 The existing stonewalls, trees and hedgerows on the site perimeter were retained as part of the original development and will continue to be permanently retained as part of this planning application, and if necessary reinforced, for the duration of the workings. Any gaps in the existing boundary which would provide uncontrolled access to the quarry will be blocked by a suitable means and reinforced with further planting as necessary and / or fenced.
- 2.40 Any hedges and trees planted as part of the proposed landscaping and restoration plans will be comprised of native and typically occurring species present in the local vegetation and/or hedgerows in Co. Roscommon.

Site Drainage

- 2.41 There are no streams or surface water drainage channels within the immediate vicinity of the site.
- 2.42 Site drainage from the overall quarry is currently managed within the site by Roadstone. The quarry is currently worked without the need to discharge water off-site. Any rainfall or water ingress within the current quarry void is managed within the void where water accumulates in the lowest level of the quarry floor (and used for dust suppression measures) allowing the remainder of the quarry to remain dry for extraction operations. It is proposed that this arrangement will continue for the duration of the proposed continued development of the quarry being worked to a depth of c. 65m AOD, with no requirement to discharge any waters off-site.
- 2.43 A hydrological / hydrogeological assessment has been carried out taking into consideration the existing water regime at the quarry site and to determine what the requirements are for the proposed development. It addresses mitigation measures to eliminate and/or minimise the potential impacts, if any, on surface water and groundwater. These measures will be incorporated into the quarry design and operation, refer to EIAR Chapter 7 (Water).

Extraction and Blasting

- 2.44 Cross-sections of the existing and proposed layout are provided in **Figure 2-4** which illustrate the proposed extraction design.
- 2.45 Industry standard blasting techniques have been used to fragment the stone prior to processing (crushing and screening). This technique will continue to be utilised at the site. On average, c. 45,000 to 50,000 tonnes are typically produced per blast at the quarry.
- 2.46 The drilling pattern is typically 110mm diameter vertical holes drilled at c. 4m burden and spacing to full face height. Bulk emission explosives are used to charge the holes. Delivery and placement of explosives is carried out by Irish Industrial Explosives and Roadstone under supervision of a blast engineer. There is no proposed change in the blast design and blast methods employed in further developing the quarry laterally and at depth below the existing quarry floor.
- 2.47 Ground vibration and air-overpressure associated with blasting at the quarry is controlled/limited by condition no's. 10, 11 & 12 of planning ref. ABP PL20.215417 (P. Ref. 04/1479). Every blast at the quarry has been monitored since Roadstone commenced

extraction operations the quarry in 2006/2007. The actual blast monitoring results for the period 2022 to 2025 are provided in Chapter 10 of the EIAR, and show there were:

- 6 no. blasts in 2022;
- 7 no. blasts in 2023;
- 11 no. blasts in 2024; and
- 14 no. blasts in 2025

2.48 It is proposed that the scheme of blast monitoring be continued should permission be granted for the further development of the quarry.

2.49 All rock extracted from the application area will be processed on site to produce a range of aggregates for use in concrete and asphalt production (off-site), site development works, for road construction, and supply to the market generally.

Method of Extraction

2.50 It is proposed that the existing method of extraction will continue to be implemented at the site as follows:

- rock material will be extracted using conventional blasting techniques. Prior to drilling, the quarry face will be surveyed in order to ensure safe and efficient blasting. Drilling will be carried out in accordance with the blast design. Finally, the holes will be filled with bulk emulsion explosives and the blast carried out. All blasting is and will be carried out in accordance with the health & safety regulations, and environmental guidelines for the sector;
- the fragmented rock will be processed using mobile crushing and screening plant located at the blasted quarry face within the quarry void area; and
- the aggregate products will be stored in stockpiles located within the quarry site, as is the current practice.

Processing Methods

Extracted Rock Processing Method

2.51 The processing methods currently used at the quarry constitute size reduction through crushing and sizing by screening using mobile plant.

2.52 An excavator is used to directly feed a mobile crushing / screening plant at the working face. The mobile plant will be relocated after every blast during the life of the quarry development as operational requirements dictate.

2.53 Once screened, the aggregate is stored in various stockpiles on the quarry floor and at surface level to await transported off site.

2.54 It is proposed that the same processing methods will be utilised going forward. There is no requirement for any additional processing plant as part of this planning application.

Readymix Concrete Operations (when implemented)

2.55 It was noted above that the concrete batching plant, permitted under ABP PL20.215417 (P. Ref. 04/1479), has not been constructed to date. The batching plant is permitted to produce 50,000m³/annum. When operational, the following processes will be carried out.

2.56 A combination of sand & gravels, crushed chips and cement will be utilised in the concrete manufacturing process. A dust control system will be used to control any fugitive emissions

- from the cement silos (2 x 80 tonne capacity). The batching unit will be clad to further eliminate fugitive dust. The silos will be filled from ground level, under pressure, through a cement fill pipe.
- 2.57 Concrete lorries will reverse into a partially enclosed loading bay at the base of the batch house (mixer), wherein batched concrete will be discharged from the base of the mixer via a chute into the lorry mixer drums.
- 2.58 The concrete will be produced using the following components:
- **Stone aggregates:** will be sourced from the existing rock quarry area on site;
 - **Sand:** will be sourced locally from a third-party sand suppliers within a c.40km radius;
 - **Water:** will be sourced on site;
 - **Cement & Admixtures:** These materials will be transported to the site as demand requires.
- 2.59 The concrete manufacturing process will be as follows:
- The aggregates will be loaded into 6 x 60 tonne storage bins;
 - The aggregates will then be weighed out from the storage bins (hoppers) into batch sizes depending on the volume of concrete required;
 - The aggregates will be transported from the hoppers to the mixer by conveyor;
 - Cement, water and admixtures will then be added to the aggregates in the mixer.
 - The mixer will agitate the mix and then transfer the mixed material into a concrete truck for despatch off-site.
- 2.60 The weight of water, admixture, cement and the batching cycles will be controlled by computer. Admixtures are compounds which are added to concrete in small amounts in order to change the properties of the concrete. A typical admixture is added at a rate of 1 litre per cubic metre of concrete.
- 2.61 All admixtures will be stored in suitably bunded tanks. Water will be stored in a water tank (c. 3,000 gallon capacity) adjacent to the Concrete Batching Plant. This will be topped up as required.
- 2.62 Concrete trucks will be washed out in a washing bay adjacent to the Concrete Batching Plant. The wash water will be pumped from the trucks for recycle through a closed series of settlement ponds.
- 2.63 The production level of the plant will be c. 50,000m³ per annum of concrete

Dispatch of Aggregate Product

- 2.64 Aggregate from the screened stockpiles will continue to be loaded by means of a mechanical loading shovel directly to incoming HGVs (trucks). Trucks leaving the site will continue to be directed through the weighbridge where loads dispatched off-site are weighed and recorded. The dispatch office will monitor the movement of incoming and outgoing road trucks and will also be responsible for the issuing of dispatch dockets.
- 2.65 Prior to leaving the site, all road trucks pass through a wheel wash, which is currently in place, to minimise dust / mud nuisance on the public carriageway. The site access road is hard surfaced from the exit of the wheelwash facility to its junction with the public road.

Quarry Working Hours

- 2.66 The permitted working hours at the quarry are and will continue to be 07:00 hours to 20:00 hours Monday to Friday and 07:00 hours to 14.00 hours on Saturdays in compliance with condition no. 8 of ABP PL20.215417 (P. Ref. 04/1479). No operations will be carried out on Sundays or Public Holidays¹.
- 2.67 The proposed development will be carried out within the existing permitted hours outlined above and there is no requirement to make any amendments to these operational hours as part of this planning application.

Employment

- 2.68 The existing development provides full time employment for a current work force of c. 30 personnel including direct employees, sub-contractors (e.g. drilling and blasting), contract hauliers, maintenance contractors, material suppliers, etc.
- 2.69 It is envisaged that should planning permission be granted this level of employment will be maintained for the life of the proposed development.

Site Infrastructure

Site Access and Security

- 2.70 The existing quarry entrance is located on the regional road (R363) to the north of the application site and has good, splayed visibility in both directions. There is a low stone wall with pillars on either side of the entrance. The entrance consists of two metal gates which are recessed back (c. 20m) from the road verge to allow vehicles to pull in off the road when the gates are locked. The quarry entrance and internal access road are hard surfaced for a distance of c. 175m to where the weighbridge is located.
- 2.71 In the unlikely event of material being spilled on the public road the operator will ensure that spilled material is removed from the road surface in a safe and timely manner, as soon as they notice or are notified that a spillage has arisen.

Parking & Hardstanding Areas

- 2.72 Internal access roads are provided within the site, running from the site entrance southwards to the existing weighbridge and the main site office.
- 2.73 All HGVs utilising the existing site are confined within the application area. There is adequate provision for HGV parking to ensure that there is no queueing of HGV's on the public road outside the quarry.
- 2.74 Adequate car parking provision for employees, contractors and visitors is provided. in a dedicated area on a hardcore surface adjacent to the weighbridge office. Additional parking with a pedestrian access walkway is provided to the east of the weighbridge office. A hardstanding area and hydrocarbon interceptor is provided around the bunded fuel storage tank.

Weighbridge

- 2.75 In compliance with condition no. 14 of ABP PL20.215417 (P. Ref. 04/1479), all heavy goods vehicles (HGVs) accessing the site are required to pass over the existing weighbridge, which

¹ DoEHLG 2004 Quarry & Ancillary Activities Guidelines for Planning Authorities – Section 4.7 (b)

is located adjacent to the site office, refer to **Figure 2-1**. The weighbridge was supplied and installed and is serviced by Avery Weigh-Tronix from Newtownabbey in Northern Ireland and checked by Weights & Measures to verify accuracy.

- 2.76 The weighbridge is utilised to establish a weight for each truck used for hauling stone. All loaded trucks pass over the weighbridge before exiting the quarry so that a record of each load can be made. Apart from keeping a record of the quarry's productivity, the weighbridge is also used to ensure all loads exiting the site do not exceed the legal weight limit.
- 2.77 It is proposed that the weighbridge will be utilised and maintained for the life of the proposed development.

Wheelwash

- 2.78 In compliance with condition no. 15 of ABP PL20.215417 (P. Ref. 04/1479), all heavy goods vehicles (HGVs) exiting the site are required to pass through the existing wheelwash which is located adjacent to the site office, refer to **Figure 2-1**. The section of internal road between the wheelwash and the site entrance is hard-surfaced.
- 2.79 It is proposed that the wheelwash will be utilised and maintained for the life of the proposed development.

Offices and Ancillary Facilities

- 2.80 An existing prefabricated portacabin structure acts as site offices, and canteen / cloakroom / toilet for staff use. Surface water run-off from the roof directly percolates to ground.
- 2.81 A garage / workshop previously permitted under planning permission ABP PL20.215417 (P. Ref. 04/1479), as shown on **Figure 2-2**, has not been constructed to date. The workshop will not be constructed and does not form part of this planning application.

Utilities and Services

- 2.82 The site is served by on-site water supply and mains electricity. An ESB power line feeds directly into the quarry site to service the offices and weighbridge. An existing on-site generator supplies the fixed processing plant.
- 2.83 Site based staff at the application site are contactable by mobile phone, landline and email and broadband connections to the site office as provided via a mobile network.
- 2.84 Water for drinking and to service the toilet facilities (located within the site office) is supplied from the mains water supply.
- 2.85 Effluent from toilet facilities is treated using an existing Wastewater Treatment System (WwTS) and percolation area.
- 2.86 As part of this planning application, it is proposed to upgrade the overall effluent treatment system by decommissioning the existing WwTS and replacing it with a Secondary Wastewater Treatment System with a constructed soil polishing filter area for final treatment. The existing WwTS will be decommissioned, and the contents of the tank will be taken off site for appropriate treatment by a licenced contractor.
- 2.87 As part of documentation submitted with this planning application, a site characterisation assessment was undertaken in September 2025 for the new wastewater treatment system by Dr. Eugene Bolton. The site characterisation form and details of the Secondary WwTS (Molloy Tanks: Chieftain SBR sewage treatment system) and polishing filter area (90m²) are included in EIAR Chapter 7, **Appendix 7-A**.

Lighting

- 2.88 Lighting is provided at the site as necessary, which includes fixed downlights outside the office / welfare facilities and processing plant; and mobile lighting on the machinery used within the quarry void.
- 2.89 All lighting is only in use for wintertime operations, when darkness has fallen, within the proposed site operating hours of 07.00 hours until 20.00 hours Monday to Friday and until 14.00 hours on Saturdays. There are therefore periods where such lighting is required for up to 1 hour in the morning and up to 2.5 hours in the evening, during periods in winter. As most quarry activity is below surrounding ground level light pollution from site activity is considered to be minimal and not significant.

Fuel and Oil Storage

- 2.90 Bunded fuel storage tanks are located at the site. Oil and lubricants for plant and machinery are stored on spill pallets in designated storage areas.
- 2.91 There is a hard stand refuelling area with hydrocarbon separator at the refuelling station area. All runoff from the hard stand refuelling pad goes to the hydrocarbon separator before the treated runoff percolates to the ground.
- 2.92 Spill Kits and spill training has been provided. All new employees are given an induction which includes spill kit training and how to respond to a fuel spill.

Waste Management

General Waste Management

- 2.93 Roadstone as a member of the Irish Concrete Federation (ICF) commits themselves to the principles of the Federations Environmental Code. The code states:-
- "ICF members will minimise production of waste and where appropriate consider its beneficial use including recycling. They will deal with all waste in accordance with the relevant legislation and other controls in place, including using waste contractors with valid Waste Collection Permits"*
- 2.94 Potential waste produced and the proposed measures used to control it are described as follows:
- **Scrap metal** – these materials are chiefly produced from the maintenance of the processing plant and equipment and can cause a nuisance if allowed to build up in an uncontrolled manner. A designated scrap metal area will be demarcated on site, and the build-up of scrap will be controlled by the regular removal by licensed scrap metal contractors.
 - **Used Oil and Oil Filters** – any waste oil / oil filters that may arise from servicing of processing plant will be removed from the site by a licensed waste contractor.
 - **Used Batteries** – similarly all used batteries will be removed from site for collection and recycling by a licensed waste contractor in accordance with the Waste Management Regulations.
 - **Domestic Waste** (Canteen Waste) – domestic waste generated at the offices and employee's facility will be collected by a licensed waste collection contractor.

Extractive Waste Management

- 2.95 Almost all products and by-products arising from the aggregate processing have commercial value. Any waste materials from the site are stored, collected, recycled and/or disposed of in accordance with any requirements of Roscommon County Council.
- 2.96 In Ireland, the management of extractive waste is regulated by the Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 (SI No. 566 of 2009). Under these Regulations, quarry operators are required to prepare an Extractive Waste Management Plan (EWMP) which outline the plans and procedures for minimisation, treatment, recovery and disposal of extractive wastes, having regard to the principle of sustainable development.

Description of the Waste Generating Operation

- 2.97 There is no intention on behalf of Roadstone to discard, where possible, any material extracted from the quarry at Cam. The principal aim of the extractive waste management plan for the site is to prevent waste production which is in accordance with Section 5(2)(a) of the 2009 Regulations.
- 2.98 An Extractive Waste Management Plan (EWMP) was prepared for the site in 2011, and a new updated version (2026) is provided in **Appendix 2-A**. The purpose of the EWMP is to ensure compliance with the Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 through the provision of measures, procedures and guidance to prevent or reduce as far as possible any adverse effects on the environment, in particular, water, air, soil, biodiversity and landscape, and any resultant risks to human health, brought about as a result of the management of extractive material at Cam Quarry. The Plan is reviewed every 5 years to allow for amendments, as appropriate, in the event of substantial changes to the operations at the site.

Environmental Controls

General

- 2.99 Extraction, processing and ultimately restoration activities at the application site require a number of environmental controls to eliminate or minimise the potential nuisance to the public arising from the extraction and processing operations. The environmental control measures in place at the existing site are outlined in the following sections.
- 2.100 The existing operations at the site are currently regulated by conditions attached to the current planning permission: ABP PL20.215417 (P. Ref. 04/1479).
- 2.101 Any additional control measures, over and above those outlined below, which may be instructed on foot of this planning application, will also be implemented.

Bird Control

- 2.102 As the process of rock extraction is free of putrescible (food / kitchen) waste, site activities are unlikely to attract scavenging birds such as gulls and crows for the duration of works. Accordingly, it is not intended to implement any specific bird control measures at the site as is the case at present.

Traffic Control

- 2.103 As the planning application relates to the continuance of use of the existing quarry operation, the proposed development will continue to utilise the existing site entrance.

- 2.104 The existing site entrance onto the regional road has historically been shown to function satisfactorily at its present location. As such, it is considered unnecessary to alter the existing access point in terms of geometry and/or location.

Litter Control

- 2.105 As the proposed development will be largely free of litter, the daily operational activities are unlikely to give rise to problems with windblown litter. Accordingly, there is no requirement to implement any specific litter control measures at the site.
- 2.106 In the unlikely event that any litter waste is identified, it will be immediately removed off-site to an authorised waste disposal or recovery site.

Odour Control

- 2.107 As the rock extraction activities at the site are not biodegradable and do not therefore emit odorous gases, site activities will not give rise to odour nuisance. No odour control has been required for the existing quarry or will be required for the proposed continued development.

Vermin Control

- 2.108 As the development is free of putrescible (food / kitchen) waste, on-site activities will not attract vermin for the duration of the extraction or subsequent restoration operations. Accordingly, no specific vermin control measures are required.

Fire Control

- 2.109 As the development is free of flammable and biodegradable materials which could create a fire or explosion risk, on-site extraction activities will not present a fire risk for the duration of the extraction operations. Accordingly, there is no requirement to implement specific fire control measures at the site.
- 2.110 A range of fire extinguishers (water, foam and CO₂) are kept at the site office to deal with any localised small scale fires which might occur
- 2.111 In the unlikely event that a fire does occur, the nearest fire station will be contacted, and emergency response procedures will be implemented. Fire extinguishers (water and foam) are provided at the site office to deal with any small outbreaks which may occur.

Dust Generation and Control

- 2.112 In dry, windy weather conditions, site activities may give rise to dust blows across and beyond the existing or planned development site areas.
- 2.113 The incidence of fugitive dust outside of the operation is reduced by the mobile crushing and screening plant located within the quarry void. Generation of fugitive dust is generally limited to periods of very low rainfall (refer to Chapter 8 – Air Quality). Dust generation occurs from three main sources:
- point sources – such as operating plant and machinery;
 - line sources – such as roads and conveyors; and
 - dispersed sources – such as the quarry floor and stockpiles.
- 2.114 In order to control dust emissions, the following measures are / will be implemented:-
- water sprayed from a tractor drawn bowser on dry exposed surfaces and stockpiles (paved roads, unsealed haul roads and hardstand areas) as required;

- fixed sprinkler system on the hard surface site access road between the site entrance and the weighbridge;
 - areas of bare or exposed soils will, insofar as practicable, be kept to a minimum through the phased extraction proposals;
 - dust blows at the existing site are largely screened by the side walls of the existing quarry and the vegetated screening berms and existing boundary hedgerows;
 - all HGV's exiting the site routed through the existing wheelwash. This minimises the transport of fines by HGVs over the access / egress road and the public road network. All loaded vehicles will be wetted down using an overhead spray bar prior to exiting the site;
 -
 - periodic sweeping of the internal paved site access road and surrounding public roads carried out as required by a mechanical road sweeper;
 - Buffer distance of 100 m (minimum) between off-site receptors and dust-generating activities;
 - No material transfers made from the overburden storage area or vegetated screening berms, which shall be kept as a permanent restoration feature.
 - Seed / vegetate surfaces of completed perimeter mounds and stockpiles of restoration soils. All failures shall be replanted within one year.
 - All drilling rigs fitted with dust filters;
 - All excavation activities occur below the natural lay of land due to the open pit nature of the workings, which acts as a barrier to dust emission dispersal;
 - All internal haul roads made of compacted aggregate / hardcore;
 - c. 220 m of hard paved access road from the site access to the wheel wash;
 - Site speed limit of 15 kph on all internal haulage routes;
 - Permanent retention of established vegetated screening berms (see EIAR Figure 8-2);
 - Concrete Batching Plant (CBP) (if constructed) will be fully clad and a dust control system to control fugitive emissions from the cement silos;
 - Haulage routes designed to avoid steep inclines;
 -
- 2.115 These dust mitigation and management measures are in accordance with the DoEHLG (2004) and EPA (2006) guidelines for the sector.

Noise Generation and Control

- 2.116 Potential noise generating sources arising from the operation of the quarry are from the crushing and screening plant, mobile plant such as the loading shovels and from the haulage fleet both within and outside the quarry.
- 2.117 The potential for noise generation from the application area is reduced by locating the processing plant within the quarry floor void. This means that the potential for noise generation from activities associated with the operation of the plant such as movement of vehicles and maintenance is reduced – refer to EIAR Chapter 10 Noise & Vibration.

- 2.118 In addition to the above the following good house-keeping measures are in place in order to reduce noise emitted from plant and machinery as much as possible:
- all machinery used to be CE certified for compliance with EU noise control limits;
 - the machinery regularly maintained, with regular checking of any muffler systems and servicing or replacing as required, and any loose or damaged panels or covers that suppress noise are fixed or replaced immediately;
 - if there are further noise-reducing modifications available for any machinery, they will be fitted wherever practical (e.g. rubber-decked screens, rubber chute linings etc.);
 - haul road grades to be kept as low as possible ($\leq 1:10$) to reduce engine / brake noise from heavy vehicles.
 - The mobile processing plant is and will continue to be located on the quarry floor to maximise natural topographic screening (quarry faces) to noise sensitive receptors;
 - Access / internal haul roads will continue to be kept clean and maintained in a good state of repair, i.e., any potholes are filled, and large bumps removed, to avoid unwanted rattle and “body-slap” from heavy goods vehicles;
 - Vehicles waiting within the site will continue to be prohibited from leaving engines running and there will be no unnecessary revving of engines; and
 - Care will continue to be taken when unloading vehicles to reduce or minimise potential noise disturbance to residents.
 -
- 2.119 These noise mitigation and management measures are provided in accordance with the DoEHLG (2004) and EPA (2006) guidelines for the sector.

Environmental Monitoring

Environmental Management System

- 2.120 As part of the environmental management system, Roadstone has implemented a comprehensive environmental monitoring programme at Cam Quarry in compliance with condition no. 6 of planning permission ABP PL20.215417 (P. Ref. 04/1479) on the operation of the quarry. Environmental noise, ground/surface water, blast, and dust monitoring, carried out on a regular basis, has demonstrated that the quarry has not had any significant adverse effects on the surrounding environment.
- 2.121 Limit values for environmental emissions arising from the site activities are identified by the existing consent from the planning authority. Environmental sampling, monitoring and testing is generally undertaken by the Roadstone in-house environmental team (or by external consultants) as and when required. Records of environmental monitoring and testing are held by Roadstone and will be submitted to the Local Authority on a quarterly basis.
- 2.122 Environmental noise, blast, dust and water monitoring carried out on a regular basis, has demonstrated that the quarry has not had any significant adverse effects on the surrounding environment.

Dust Monitoring

- 2.123 A comprehensive dust monitoring programme has been and will continue to be implemented at Cam Quarry, in compliance with the current planning permission ABP PL20.215417 (P. Ref. 04/1479) - condition 13.

- 2.124 The dust monitoring gauges are located close to emission sources or potentially sensitive receptors located beyond the site boundary. Monitoring is carried out at 4 no. locations around the site boundary (see EIAR **Figure 8-1**) with continuous monitoring over the 12-month period. It is proposed that the existing dust monitoring stations will remain in place for the duration of extraction and processing operations at the site. A fifth monitoring location (D5 on Figure 8-2) has been introduced in May 2026 and will form part of the monitoring programme going forward over the life of the proposed development.
- 2.125 Previous dust deposition monitoring carried out at the site boundaries indicates that the current quarry operations have for the most part complied with the recommended dust deposition emission limit value of 350 mg/m²/day (averaged over 30 days) as set out in condition no. 13. Further details are provided in **Chapter 8** of the EIAR. The dust monitoring to-date has shown that the existing site can operate within the permitted limit of 350 mg/m²/day (averaged over 30 days).
- 2.126 It is proposed that the existing dust monitoring stations will remain in place for the duration of extraction and processing operations at the site with the addition of monitoring location D5 along the eastern site boundary. Monitoring will continue to be undertaken on a monthly basis using the industry standard Bergerhoff method of monitoring to ensure the development complies with the DoEHLG (2004) / EPA (2006) recommended total dust deposition threshold of 350 milligrams per day (averaged over a 30 day period).

Noise Monitoring

- 2.127 An annual noise monitoring programme has been and will continue to be implemented at Cam Quarry, in compliance with the current planning permission ABP PL20.215417 (P. Ref. 04/1479) - condition 9.
- 2.128 The noise monitoring position is located close to sensitive receptors located beyond the northern site boundary (see EIAR **Figure 10-1**). Monitoring is carried out for a 4-hour period once per year. It is proposed that the existing noise monitoring location will remain in place for the duration of extraction and processing operations at the site.
- 2.129 Previous noise monitoring carried out at the nearest noise sensitive receptors to the quarry operations has shown compliance with the recommended daytime noise emission limit value of 55 db (A), as set out in condition no. 9. Further details are provided in **Chapter 10** of the EIAR. The noise monitoring to-date has shown that the existing site can operate within the permitted limit of 55 dB (A) over a continuous four hour period between the hours of 07:00 and 20:00, Monday to Friday and between 07:00 and 14:00 on Saturdays when measured outside any dwelling house in the vicinity of the site.
- 2.130 It is proposed that the noise monitoring location will remain in place for the duration of extraction and processing operations at the site. Monitoring will continue to be undertaken on an annual basis to ensure the development complies with the current ABP PL20.215417 (P. Ref. 04/1479) - condition 9; and the noise threshold limit of 55 dB(A) recommended in the EPA (2006) environmental management guidelines for the sector.

Water Monitoring (Groundwater / Surface Water)

- 2.131 The following monitoring activities will continue to be carried out to demonstrate that the development is not having an adverse impact on the surrounding environment and will document any changes in water quality:

- Monitoring of ground and surface water quality, levels and discharges² - condition 6 (g);
- Groundwater levels in all boreholes monitored on a monthly basis for the duration of the proposed development - condition 7 (d);
- Recording of any breaches over the previous year for water quality monitoring to be provided in the annual environmental audit - condition 7 (e);
- Submission of quarterly reports with full monitoring records of surface water quality monitoring and groundwater monitoring - condition 7;

Proposed Landscape Management & Final Restoration

Proposed Landscape Management Measures

2.132 The principal landscaping aims are:

- the physical and visual integration of the existing site and associated features into the surrounding landscape; and
- screening to minimise visual intrusion and to reduce any significant negative aspects regarding the visual impact of the proposed development on adjacent sensitive receptors.

Site Screening Measures

- A screening berm along the northern boundary of the quarry extraction footprint was completed in 2025 to provide further screening of noise and dust to the nearest residences to the northern side of the R363 regional road.
- the screening berm will be planted with a native mix of hedgerow species to tie into existing berm and vegetation along the northern boundary in the vicinity of the site entrance and internal access road;
- the planting will be carried out in 2 staggered rows, with the rows 50cm apart and plants within each row 50cm apart (i.e. 4 plants per m);
- the tree stock will be made up from transplants and container grown stock at 40-90cm height, as these are known to establish more successfully;
- 4 Hawthorn, 4 Blackthorn, 1 Hazel and 1 Holly to be planted in random succession every 2.5m;
- all plant handling, planting and establishment works will be carried out in accordance with current best practice;
- works are to take place in the appropriate planting season (e.g. bareroot planting: November to March only) and in favourable weather conditions;
- planting will be carried out by a suitably qualified landscape contractor; and
- establishment maintenance will be carried out for 2 years following the planting works. This will include weed control, replacement planting, watering (if required) and the adjustment of spiral guards.

² Note there are currently no discharges from the site and there is no proposed discharge associated with this planning application

- 2.133 In addition to the above, existing boundary vegetation is to be retained to keep the site secure. The boundary vegetation will be checked annually; dead trees will be removed, and any gaps will be filled with new native planting.
- 2.134 There is no requirement for any further screening berms to be provided around the periphery of the site.

Siting of Facilities (not constructed to-date)

- 2.135 The permitted concrete batching plant, when constructed, will be located within the existing development area at a distance of c. 450m from the nearest residence R1, located to the north of the R363 regional road. The existing perimeter berm and planting at the site entrance will afford maximum screening of the structures to the residence and passing traffic along the R363.

Proposed Restoration Scheme

- 2.136 The principal activity which will be undertaken at the application site is the extraction of the in-situ rock with ultimate restoration of the overall application site to a natural habitat including a seasonal lake (shallow flooded quarry floor during winter-time), which is one of the beneficial after uses listed in the EPA Guidelines: 'Environmental Management in the Extractive Industry' (2006). The final restoration scheme and detail is shown on the Landscape Management and Restoration Plan and cross sections in **Figures 2-5 and 2-6**.
- 2.137 The proposed restoration scheme will be achieved by the following measures:
- the extraction void will be left to naturally regenerate and fill with water over the base over the winter months to create a valuable shallow wetland habitat. The rebound water level will typically be around 60-65m AOD.
 - the quarry benches and faces will be left for natural recolonisation by locally occurring tree and scrub species. Please note that it is not proposed to carry out any planting on the quarry benches, as this is not considered feasible for health and safety reasons
 - on completion of all extraction works, all of the plant and machinery within the site will be removed. All hard standing areas will be ripped, in order to achieve a variety of ground conditions, including shallow depressions and small heaps of rock/rubble. These different conditions will encourage soil formation and plant colonisation resulting in diverse natural habitats.
 - all existing boundary fences and hedgerows will be retained to ensure that the site is secure. The existing gates at the site entrance will be retained and kept locked at all times, except for maintenance access;
 -
- 2.138 The majority of restoration works will be carried out on permanent completion of the extraction works. As the majority of the site is used for extraction and processing purposes it is not feasible to restore any parts of the quarry void at an earlier stage. However, it is proposed that all existing grass and scrub areas which have established along the site boundaries will be protected and retained, as much as possible.
- 2.139 The restoration works will be carried out in accordance with the EPA Guidelines (2006). Ecological advice will also be incorporated into the restoration process to facilitate future habitat value in the area for biodiversity.
- 2.140 As the applicant is a long-established mineral extraction operator, it has ample experience and expertise in implementing mineral restoration programmes.

Site Management and Supervision

- 2.141 The applicant will clearly define the management responsibility for the site restoration work and will ensure that this person has the necessary information (from the planning application) and authority to manage the whole restoration process. Relevant staff will be briefed on the scheme and will be adequately supervised / controlled. A system of record keeping for the key restoration activities will be put in place.

Long Term Safety and Security

- 2.142 All components of the barrier system of the site consisting of existing mature boundary hedgerows, fences and walls will remain in place after extractive/ processing operations have ceased.
- As the lands will be restored in part to natural habitat use with a seasonal body of open water, secure fencing will be provided around the perimeter of the extraction area.
 - Paladin fencing was chosen, as it is less visually intrusive than other types of secure fencing. This measure will also help to protect the developing semi-aquatic and terrestrial habitats from disturbance during the critical establishment period.
- 2.143 Existing hedges surrounding the development will be gapped up and thickened where required. These combined with the secure and locked entrance gates to the development will prevent unauthorised third party access.

Long Term Surface Water and Groundwater

- 2.144 The surface water will percolate to ground. There is no requirement for any active long term surface water or groundwater management at the site.

Decommissioning of Plant and Machinery

- 2.145 Redundant structures, plant equipment and stockpiles will be removed from site on permanent cessation of extraction activity. Machinery and buildings will either be utilised by the applicant on other sites or be sold as working machinery or scrap.
- 2.146 As part of the overall decommissioning process, all fuel and oil storage tanks within the existing site will be removed from the site by a licensed waste contractor. Therefore, there will be no potential for fuel, oil or sewage to cause long-term water pollution following completion of extraction activities.

Aftercare and Monitoring

- 2.147 There will be no on-going requirement for monitoring noise or dust after extraction and processing and manufacturing operations have ceased.
- 2.148 A final site inspection 6 months after formal site closure will be carried out to confirm the final site restoration as implemented is functioning.

Figures

Figure 2-1: Existing Site Layout

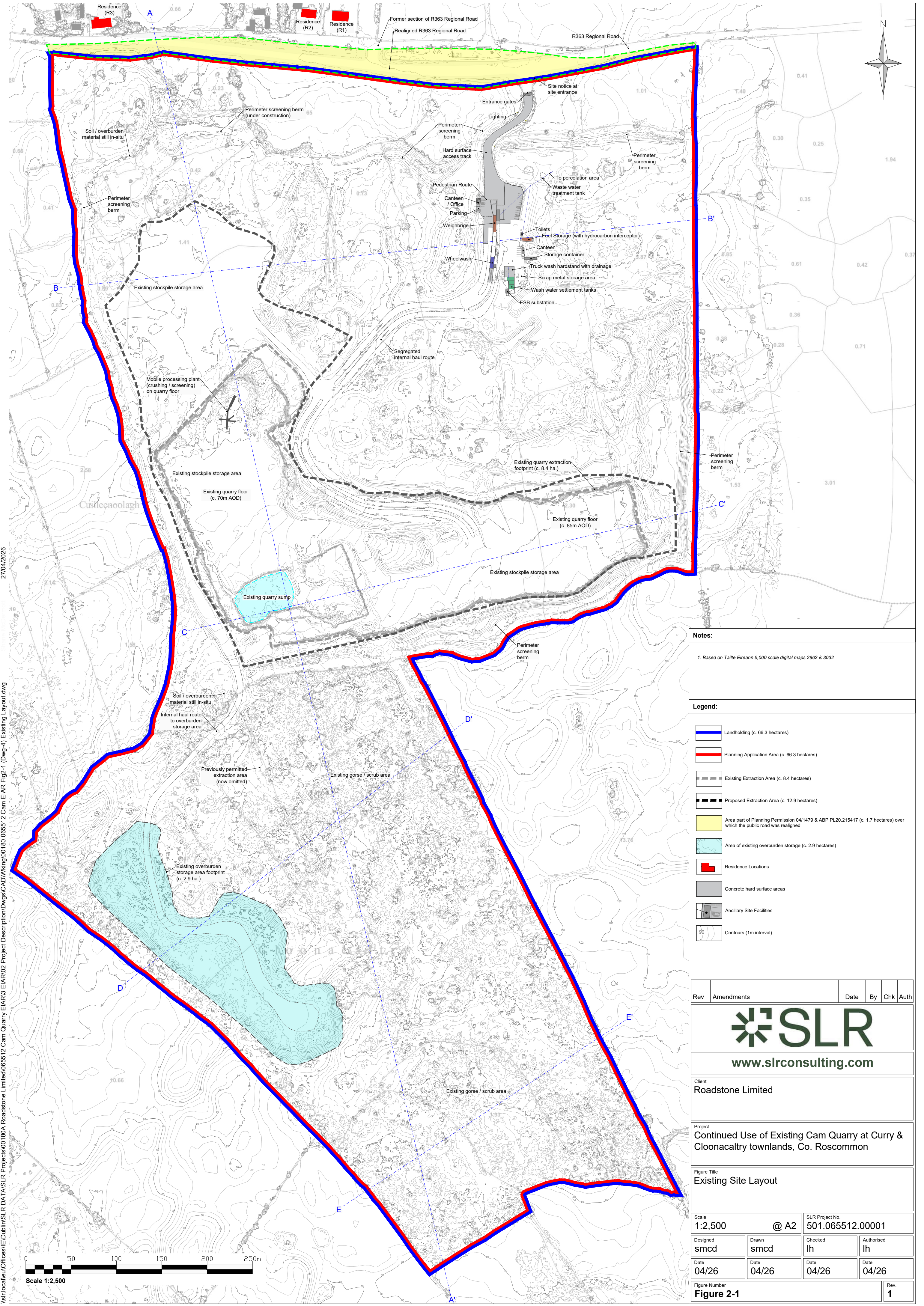
Figure 2-2: Permitted Development (ABP PL20.215417 / P. Ref. 04/1479)

Figure 2-3: Proposed Development Layout

Figure 2-4: Existing, Permitted & Proposed Cross Sections

Figure 2-5: Proposed Landscape & Restoration Plan

Figure 2-6: Proposed Restoration Cross Sections



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\\slr.local\au\offices\IE\Dublin\SLR DATA\SLR Projects\00180A Roadstone Limited\065512 Cam Quarry EIAR\02 Project Description\Drawings\CAD\Wking\00180.065512 Cam EIAR Fig2-1 (Dwg-4) Existing Layout.dwg

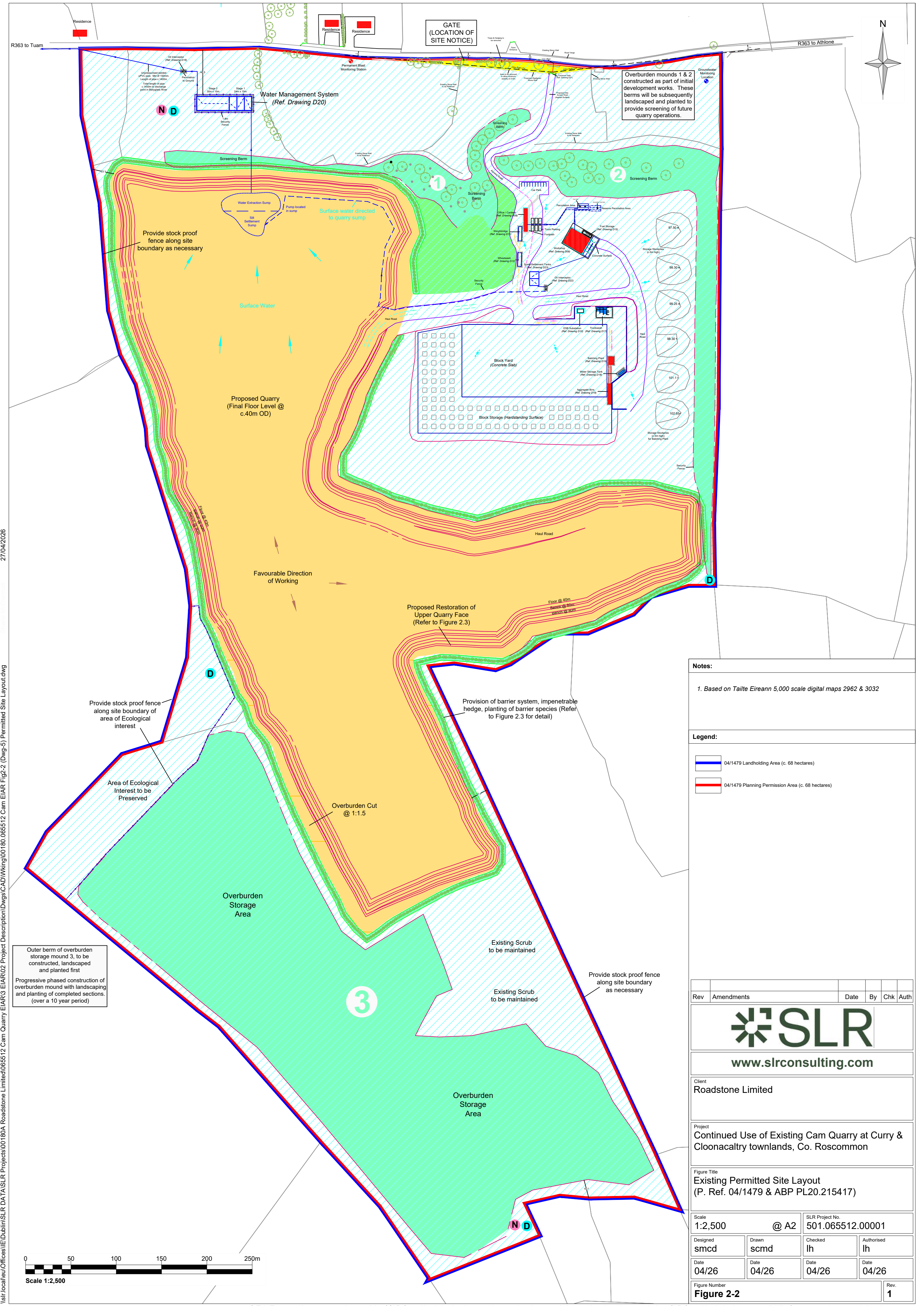
Notes:

1. Based on Tailte Éireann 5,000 scale digital maps 2962 & 3032

Legend:

- Landholding (c. 66.3 hectares)
- Planning Application Area (c. 66.3 hectares)
- Existing Extraction Area (c. 8.4 hectares)
- Proposed Extraction Area (c. 12.9 hectares)
- Area part of Planning Permission 04/1479 & ABP PL20.215417 (c. 1.7 hectares) over which the public road was realigned
- Area of existing overburden storage (c. 2.9 hectares)
- Residence Locations
- Concrete hard surface areas
- Ancillary Site Facilities
- Contours (1m interval)

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SLR www.slrconsulting.com					
Client Roadstone Limited					
Project Continued Use of Existing Cam Quarry at Curry & Cloonacaltry townlands, Co. Roscommon					
Figure Title Existing Site Layout					
Scale 1:2,500 @ A2		SLR Project No. 501.065512.00001			
Designed smcd	Drawn smcd	Checked lh	Authorised lh		
Date 04/26	Date 04/26	Date 04/26	Date 04/26		
Figure Number Figure 2-1					Rev. 1



27/04/2026

\\slr.local\eu\Offices\IE\Dublin\SLR DATA\SLR Projects\00180A Roadstone Limited\065512 Cam Quarry EIAR\02 Project Description\Drawings\CAD\WKing\00180.065512 Cam EIAR Fig2-2 (Dwg-5) Permitted Site Layout.dwg

Outer berm of overburden storage mound 3, to be constructed, landscaped and planted first
Progressive phased construction of overburden mound with landscaping and planting of completed sections. (over a 10 year period)



Notes:

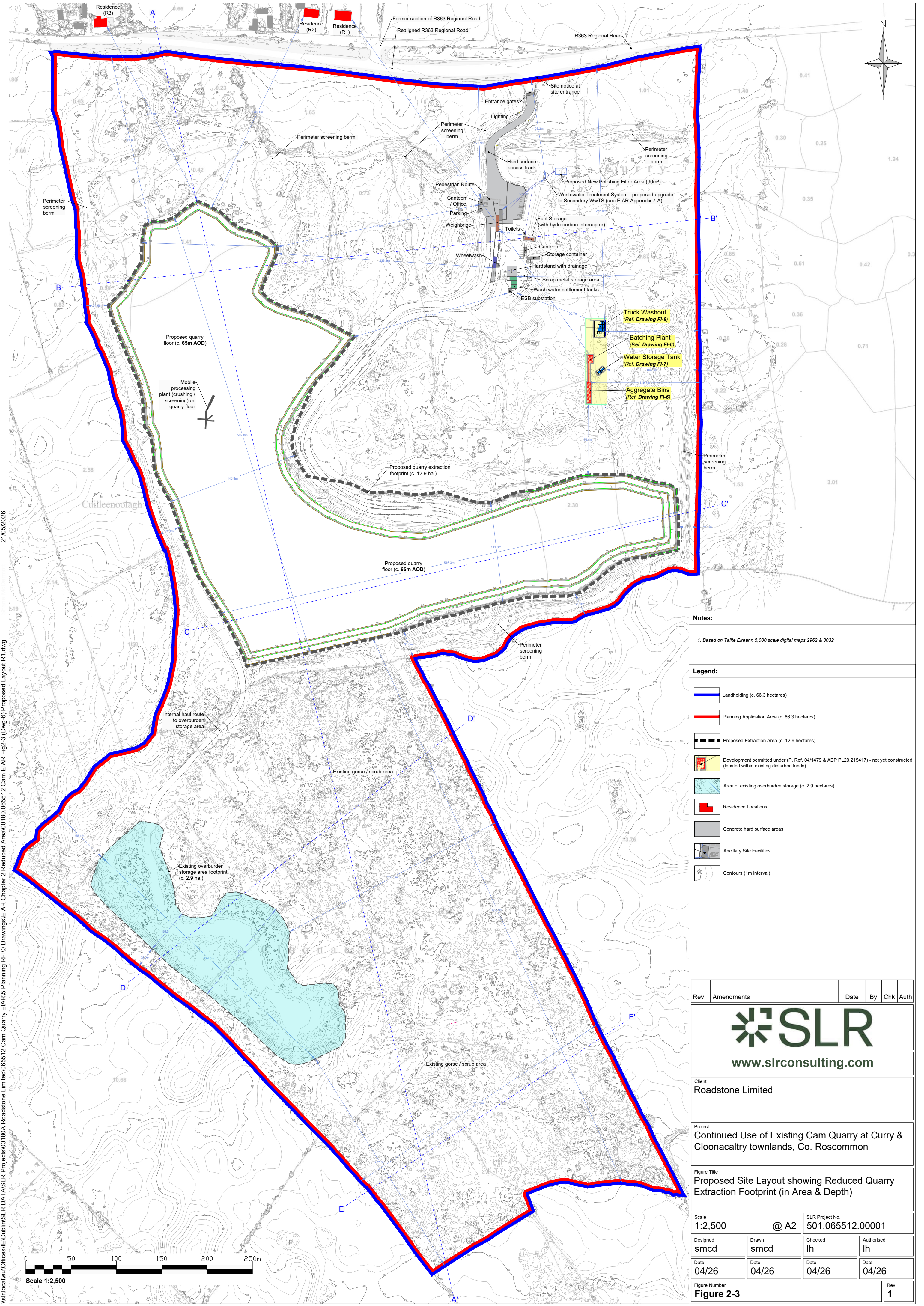
1. Based on Tailte Éireann 5,000 scale digital maps 2962 & 3032

Legend:

04/1479 Landholding Area (c. 68 hectares)

04/1479 Planning Permission Area (c. 68 hectares)

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Project Continued Use of Existing Cam Quarry at Curry & Cloonacally townlands, Co. Roscommon					
Figure Title Existing Permitted Site Layout (P. Ref. 04/1479 & ABP PL20.215417)					
Scale 1:2,500 @ A2		SLR Project No. 501.065512.00001			
Designed smcd	Drawn scmd	Checked lh	Authorised lh		
Date 04/26	Date 04/26	Date 04/26	Date 04/26		
Figure Number Figure 2-2					Rev. 1



Notes:

1. Based on Tailte Éireann 5,000 scale digital maps 2962 & 3032

Legend:

- Landholding (c. 66.3 hectares)
- Planning Application Area (c. 66.3 hectares)
- Proposed Extraction Area (c. 12.9 hectares)
- Development permitted under (P. Ref. 04/1479 & ABP PL20.215417) - not yet constructed (located within existing disturbed lands)
- Area of existing overburden storage (c. 2.9 hectares)
- Residence Locations
- Concrete hard surface areas
- Ancillary Site Facilities
- Contours (1m interval)

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Project	Continued Use of Existing Cam Quarry at Curry & Cloonacally townlands, Co. Roscommon

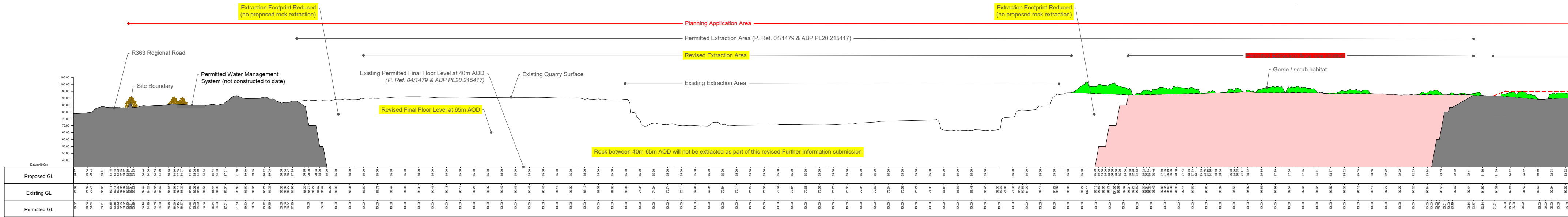
Figure Title
Proposed Site Layout showing Reduced Quarry Extraction Footprint (in Area & Depth)

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Checked	Ih	Authorised	Ih
Date	04/26	Date	04/26

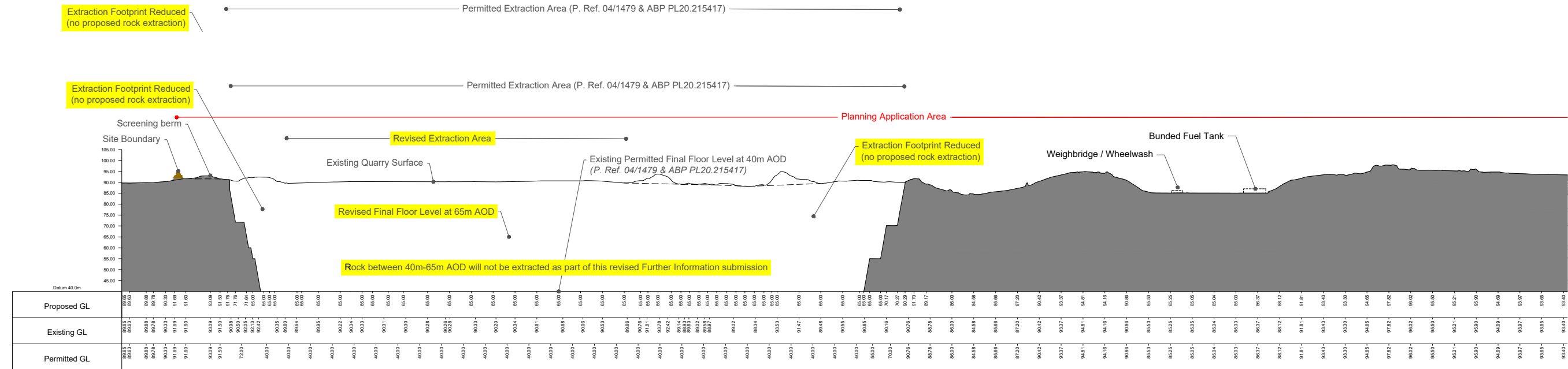
Figure Number	Figure 2-3	Rev.	1
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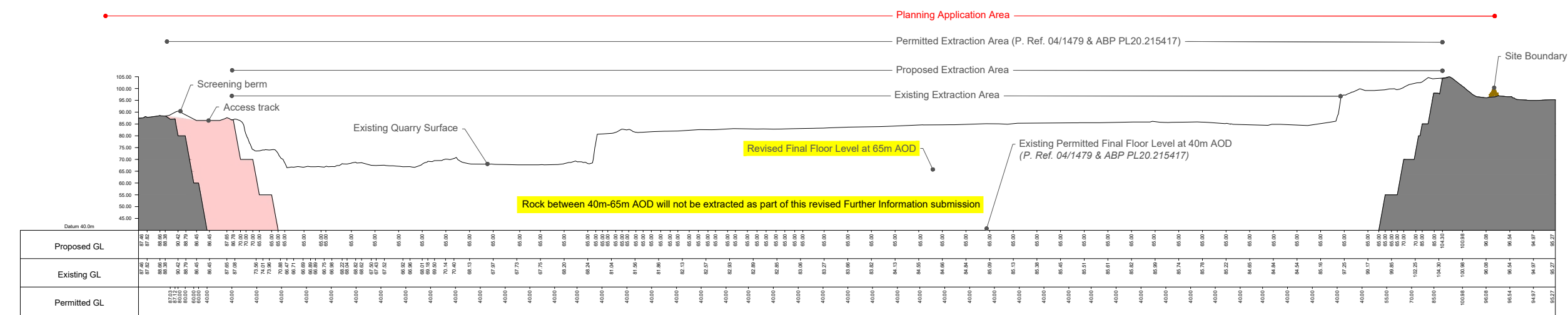
\\slr.local\au\offices\IE\Dublin\SLR DATA\SLR Projects\00180A Roadstone Limited\065512 Cam Quarry EIA\RS Planning RFI\0 Drawings\EIAR Chapter 2 Reduced Area\00180A 065512 Cam EIA\RS Fig2-3 (Dwg-6) Proposed Layout R1.dwg



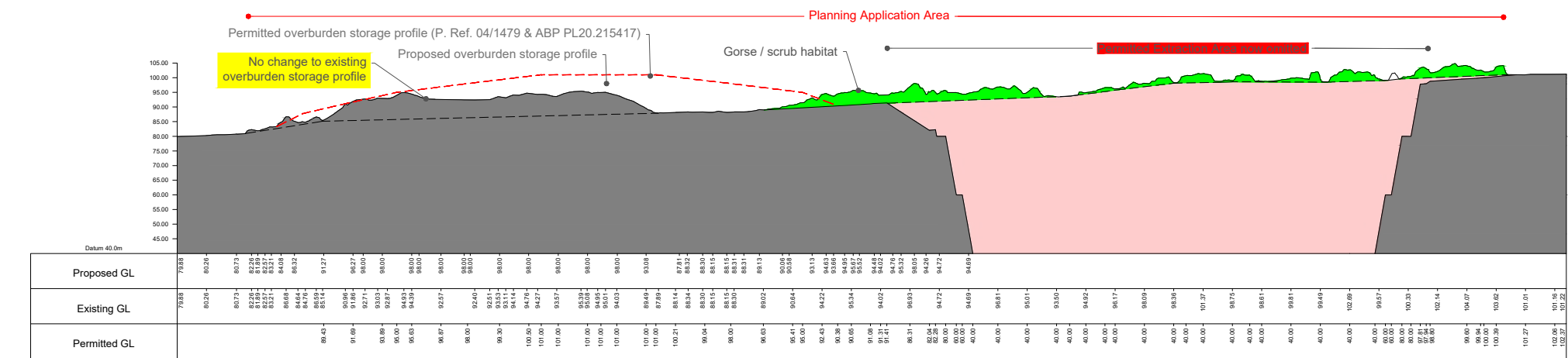
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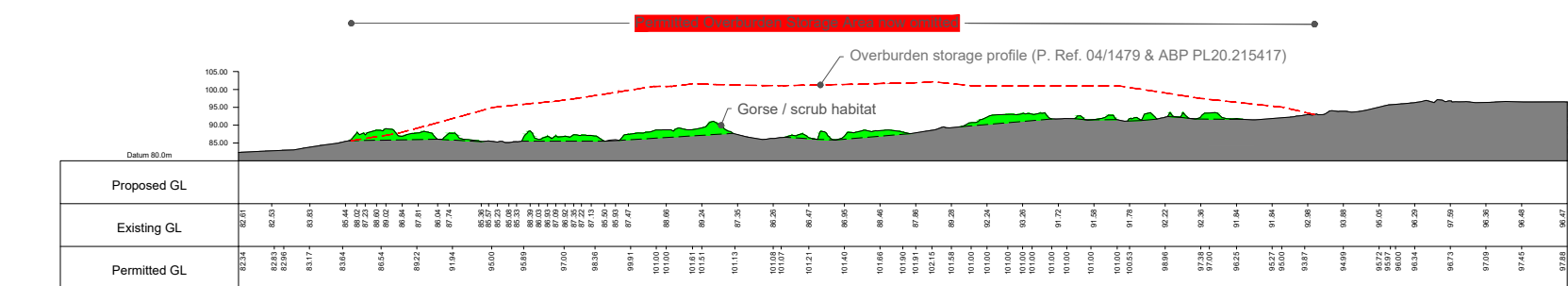
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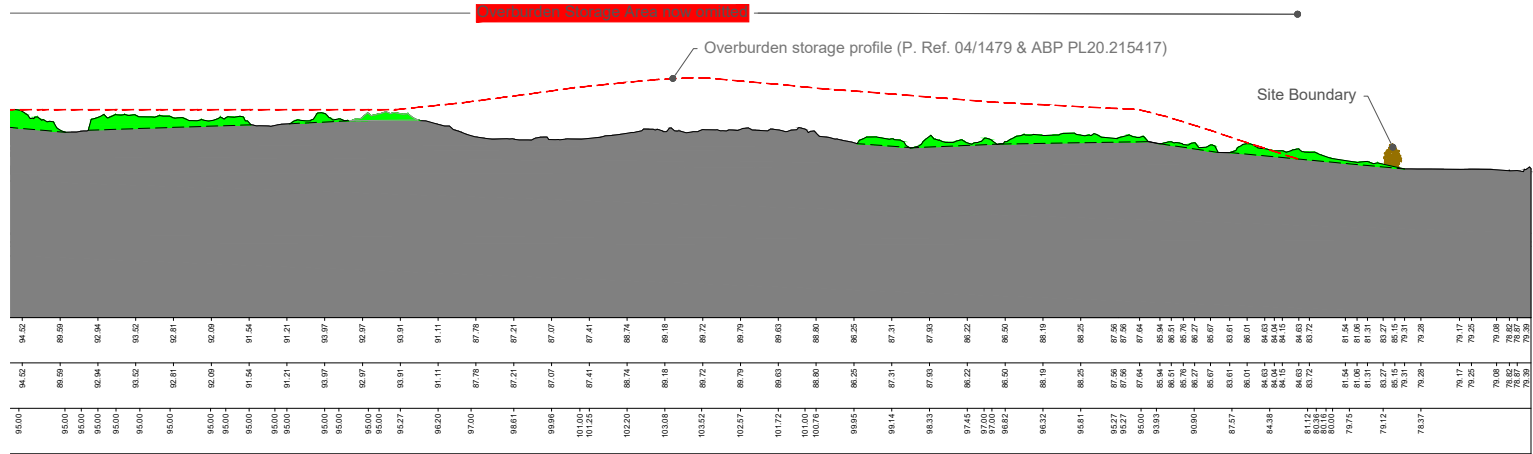
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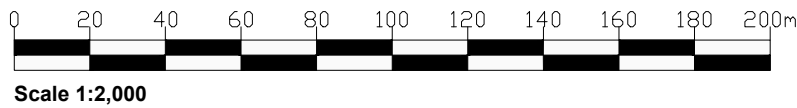
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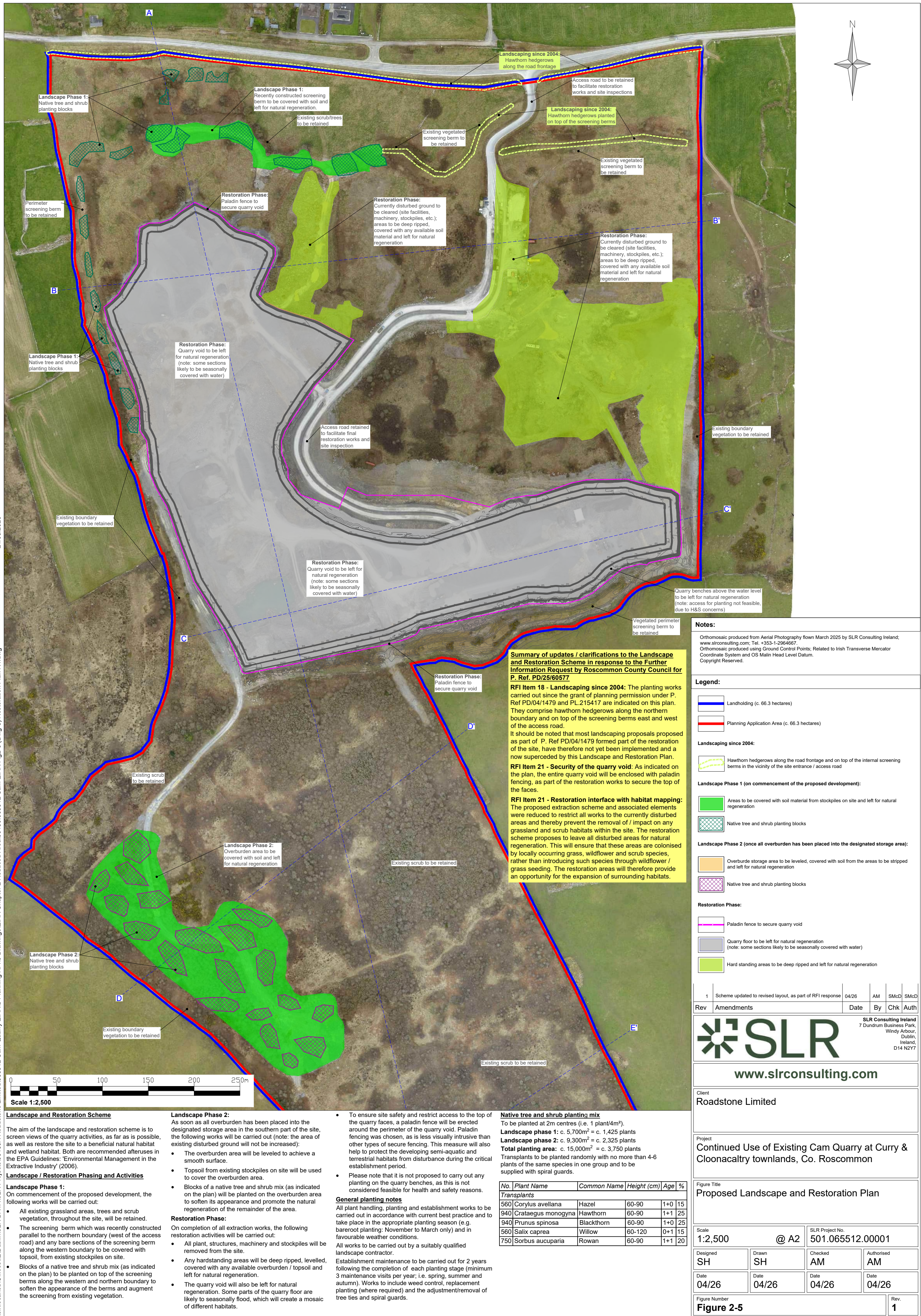
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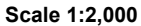
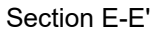
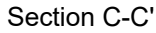
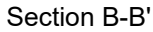
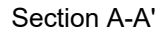


Section A-A' (continued)



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Project Continued Use of Existing Cam Quarry at Curry & Cloonacaltry townlands, Co. Roscommon					
Figure Title Existing and Proposed Cross Sections					
Scale 1:2,500		SLR Project No. @ A2 501.065512.00001			
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Figure Number Figure 2-4				Rev. 1	





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Appendices

Appendix 2-A: Extractive Waste Management Plan (EWMP)



Extractive Waste Management Plan (EWMP): P. Ref. 25/60577

**Continued use of Cam Quarry, Brideswell, Co.
Roscommon**

Roadstone Limited

Prepared by:

SLR Environmental Consulting (Ireland) Ltd

7 Dundrum Business Park, Windy Arbour, Dublin, D14
N2Y7

Client No: 00023

SLR Project No.: 501.000180.065512

1 May 2026

Revision: Final

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
0	5 March 2026	KR	LH	
Final	1 May 2026	KR	SMcD	SMcD

Basis of Report

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Contents

1.0	Introduction	1
1.1	The Operator	1
1.2	The Competent Authority.....	1
1.3	Planning Status	2
1.4	Objective of the Extractive Waste Management Plan	2
2.0	The Site Location and Description	3
2.1	Site Location	3
2.2	Site Access	3
2.3	Site Description	3
3.0	Proposed Development Description	5
4.0	Classification of Extracted Material	6
4.1	General Waste Management.....	6
5.0	Status of Extracted Material	7
5.1	Guidance on the Extractive Waste Regulations.....	7
5.2	Purpose and Timeframe of Future Use of Extraction Materials.....	8
6.0	Summary.....	8



1.0 Introduction

The project is a permission for continued use of the existing operational quarry at Cam, Co. Roscommon, currently operated under P. Ref 04/1479.

The proposed new application for continued use is made under planning application ref. 25/60577.

Extractive waste, primarily consisting of topsoil and overburden, has previously been produced as part of the project's current operational process.

The project is required to comply with all relevant planning conditions and environmental legislation. Roscommon County Council has requested that an Extractive Waste Management Plan (EWMP) be submitted to demonstrate that all extractive waste resulting from the proposed development is/will be managed in compliance with the relevant legislation.

The primary legislation governing the management of waste resulting from the proposed continued use of the existing quarry is the European Union (Management of Waste from the Extractive Industries) Regulations 2011 (S.I. No. 566 of 2009), which transposes the EU Mining Waste Directive (Directive 2006/21/EC).

The core purpose of this EWMP is to ensure the provision of measures, procedures, and guidance to prevent or reduce as far as possible any adverse effects on the environment and any resultant risks to human health.

The topsoil and overburden material previously stripped to access the underlying limestone rock resource has been retained on-site for landscaping purposes (screening berms) and for the final restoration of the site following the completion of extraction works, which will be commensurate with the life of the existing site permission (P. Ref. 04/1749 & ABP PL20.215417) and any further grant of permission.

1.1 The Operator

Roadstone Limited
Cookestown Road
D24 PKK2
County Dublin
Tel: 01 4041200
Email: info@roadstone.ie

1.2 The Competent Authority

Roscommon County Council
Áras an Chontae
Roscommon
County Roscommon
Tel: 090 6637354
Email: planning@roscommoncoco.ie



1.3 Planning Status

Quarry & Ancillary Infrastructure permitted under 04/1479 (ABP PL20.215417)

Planning application for continued use P. Reg. Ref. 25/60577 – lodged 05 December 2025

1.4 Objective of the Extractive Waste Management Plan

Roscommon County Council has requested that an Extractive Waste Management Plan (EWMP) be submitted as part of a wider Request for Further Information (Item 20) on Planning Application Ref. 25/60577 for the proposed continued use of Cam Quarry at Brideswell, Co. Roscommon.

The objective of this Extractive Waste Management Plan (EWMP) is to ensure that all extractive waste resulting from the proposed development is managed in compliance with the relevant legislation. The primary legislation governing the management of waste resulting from the proposed quarry extension is the European Union (Management of Waste from the Extractive Industries) Regulations 2011 (S.I. No. 566 of 2009), which transpose the EU Mining Waste Directive (Directive 2006/21/EC). The core purpose of this EWMP is to ensure the provision of measures, procedures, and guidance to prevent or reduce as far as possible any adverse effects on the environment, in particular water, air, soil, fauna and flora, and landscape and any resultant risks to human health, brought about as a result of the management of extractive material at the site.

“Extractive waste” is referred to in the Regulations as **“waste resulting from prospecting, extraction, treatment and storage of mineral resources and the working of quarries”**.

Waste is defined in Section 4 of the Waste Management Act 1996 and means any substance or object which the holder discards, intends or is required to discard.

All general site operational wastes (e.g. oils, fuels, batteries, etc) will continue to be strictly segregated and managed off-site by authorised waste disposal contractors on a regular basis, ensuring full compliance with the Waste Management Act 1996.

It is important, in the case of the proposed development, to note that under Section 3(1) of the Act **‘Uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated’ are not considered ‘waste’**.

The topsoil and overburden material previously removed at the application site has been retained for landscaping purposes to screen views, noise and dust from the quarry and these plus stockpiled materials will be used for restoration of the site following excavation works. The minerals that are excavated (limestone rock) have economic value and is not waste.

Waste legislation in Ireland places a general obligation on the holder of waste to comply with legislation and ensure all wastes are managed within the requirements of the Waste Management Act 1996. In accordance with the guidelines the EWMP is a ‘live’ document to be updated during the planning and tendering process.

Section 5(2) of the 2009 Regulations states that the objectives of the extractive waste management plan shall be to:

- (a) prevent or reduce waste production and its harmfulness, in particular by considering:
 - i. waste management in the design phase and in the choice of the method used for mineral extraction and treatment;
 - ii. the changes that the extractive waste may undergo in relation to an increase in surface area and exposure to conditions above ground;



- iii. placing extractive waste back into the excavation void after extraction of the mineral, as far as is technically and economically feasible and environmentally sound in accordance with existing environmental standards at Community level and with the requirements of Directive 2006/21/EC 1 where relevant;
 - iv. putting topsoil back in place after the closure of the waste facility or, if this is not practically feasible, reusing topsoil elsewhere;
 - v. using less dangerous substances for the treatment of mineral resources.
- (b) encourage the recovery of extractive waste by means of recycling, reusing or reclaiming such waste, where this is environmentally sound in accordance with existing environmental standards at Community level and with the requirements of Directive 2006/21/EC 1 where relevant,
- (c) ensure short and long-term safe disposal of the extractive waste, in particular by considering, during the design phase, management during the operation and after-closure of a waste facility and by choosing a design which:
- i. requires minimal and, if possible, ultimately no monitoring, control and management of the closed waste facility;
 - ii. prevents or at least minimises any long-term negative effects, for example attributable to migration of airborne or aquatic pollutants from the waste facility, and
 - iii. ensures the long-term geotechnical stability of any dams or heaps rising above the pre-existing ground surface.

2.0 The Site Location and Description

2.1 Site Location

The application site is located within the townlands of Curry and Cloonacaltry, Brideswell, Co. Roscommon, located c. 3.5km west of Brideswell and c. 12 km west of Athlone, refer to **Figure 2-1** below. The site is c. 5.5 km from Roscommon – Galway County boundary, denoted by the River Suck to the southwest of the site.

2.2 Site Access

The existing quarry entrance is located on the regional road (R363) to the north of the application site and has good, splayed visibility in both directions. There is a low stone wall with pillars on either side of the entrance.

2.3 Site Description

The overall planning application area covers approximately 66.3 hectares (c. 163.8 acres) and comprises the existing operational quarry over the northern half of the site and unimproved pasture, scrub and boulder strewn lands over the southern half over which the current planning permission allows for overburden storage and rock extraction.

Within the application area (c. 66.3 hectares) the northeastern portion of the site contains the existing entrance onto the R363 regional road. The entrance itself is splayed with stone wing walls and pillars with the gates set back c. 20m from the edge of the carriageway. The access road has sweeping curves to prevent any visibility of the site facilities from the site entrance or public road. The access is hard paved from the entrance for a distance of c. 175m into the



site to where the weighbridge and office are located. Adjacent to the weighbridge and office, are the wheelwash and bunded fuel storage / refuelling areas.

The existing quarry extraction area occupies the central part of the site and currently consists of a 2 no. working faces typically 10-15m in height. Current ground levels over the quarry floor range from c. 70-85m AOD. The extraction area is currently c. 8.4 hectares within an overall currently permitted (P. ref. 04/1479) extraction area of c. 23.7 hectares.

Over the southern portion of the site, an area of c. 2.9 hectares is currently covered with stripped overburden from the site with the remainder of the area still in its natural state of unmanaged grasslands, scrub and gorse.

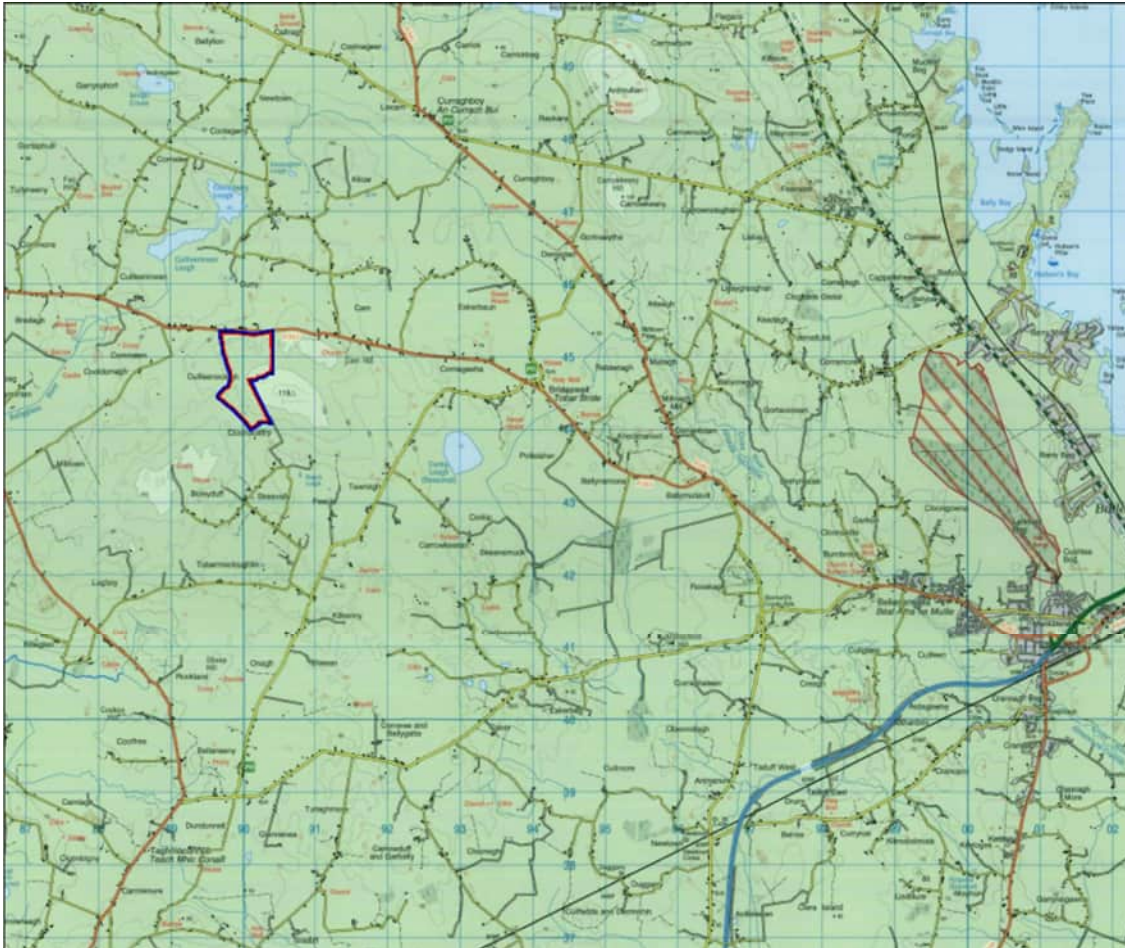


Figure 2-1 Site Location



3.0 Proposed Development Description

This new planning application is for continuance of use in part of the previously permitted development – with the following modifications submitted as part of the Further Information response:

- **Reduction in Overall Depth of Extraction**

It is proposed to reduce the depth of extraction by 25 metres, changing the previously permitted depth from 40m AOD to 65m AOD. This reduction eliminates the requirement to discharge water off-site to the Ballyglass River.

- **Reduction in Quarry Extraction Footprint**

It is proposed to reduce the proposed quarry extraction footprint area from c. 17.1 hectares to c. 12.9 hectares. This reduction eliminates the development from encroaching any further into existing grassland areas within the site over the life of the planning permission (i.e. all development will be carried out within existing areas of disturbed ground where topsoils have already been removed). Accordingly, there is no further requirement for any further topsoil or overburden stripping.

- **Reduction in Proposed Development Life**

The reduced quarry extraction area (in both area and depth) will consequently shorten the overall development life. Planning permission is now sought for a 10-year timeframe, reflecting the revised scale of the scheme.

- **Removal of Proposed Water Management System**

As the revised extraction depth removes the need for any off-site water discharge, the previously proposed Water Management System, including the hydrocarbon interceptor and all associated discharge pipework along the public road, is no longer required.

- **Removal of Proposed Block Yard Area**

The previously permitted block yard area for the manufacture and storage of blocks is no longer included within this planning application. Accordingly, there is no further requirement for any further topsoil or overburden stripping.

The installation of the previously permitted concrete batching plant remains part of the proposal. This will be located on existing disturbed ground.

- **Removal of Proposed Workshop building**

The previously permitted workshop building has been removed from the current application. Accordingly, there is no further requirement for any further topsoil or overburden stripping.

The extraction area is currently c. 8.4 hectares with the proposed limit increasing to c. 12.9 hectares within the existing disturbed areas of the site. Previously stripped soils and overburden have been used to construct perimeter screening berms. There is no further requirement as part of this planning application to carry out any further stripping of topsoils / overburden.

There will be no requirement for any changes to other facilities, supporting infrastructure, or operational arrangements such as hours of working, extraction volumes or processing methods.

As this application primarily relates to continued use of the existing permitted development, the construction and operational phases are effectively considered the same. The existing



extraction and processing operations currently carried out at the site will be maintained and continued over the operational phase of the development.

The proposed development period sought (extraction operations and restoration) is for a period of 10 years.

Most restoration works will be carried out on permanent completion of extraction works. As the majority of the site is used for extraction and processing purposes it is not feasible to restore any significant parts of the rock quarry void at an earlier stage. However, it is proposed that all existing grass and scrub areas which have established along the site boundaries will be protected and retained.

Upon the cessation of extraction operations, it is proposed to return the worked-out areas to a beneficial ecological after-use. Following extraction, vegetation through natural colonisation on the redundant quarry benches will occur.

The only material requirements in respect of the planned restoration scheme are those topsoils and subsoils already present on site, and which were previously stripped and stockpiled within the existing operational site area awaiting re-use in the restoration operations.

In summary:

- Continued use of the site will be contained fully within existing disturbed areas of the site only.
- No further topsoil and overburden stripping required.
- No requirement for any new screening berm construction to be carried out.
- No requirement to increase the footprint of the existing overburden storage area.
- There is no requirement to remove topsoil or overburden off site.

4.0 Classification of Extracted Material

4.1 General Waste Management

Existing waste management systems will be continued to control and manage all potential waste streams, to avoid waste generation where possible and to maximise re-use or re-cycling opportunities thereafter.

There is no requirement for any vegetation to be cut and removed off site as there will be no further site stripping works carried out.

General office and food waste produced at the site offices will be minimised insofar as possible. Arrangements will continue for periodic collection of general / recyclable waste by authorised waste contractors and for submission of collected waste for recovery or disposal, as appropriate, at authorised waste facilities.

Waste oils and batteries will continue to be temporarily stored on site in a designated (bunded) area within a lockable container, for periodic removal off site by a licenced contractor.

The proposed development will comply with all waste management responsibilities prescribed by conditions attached to any future grant of planning permission.

Considering the above, and the limited volume of wastes generated, it is considered that the generation of waste by on-site activities over the period of the extraction and final restoration works will not give rise to any significant short-to-long term effects on local waste collection / off-site waste management capacity.



General Waste management measures relate solely to materials used in the undertaking of quarrying activities, not the material extracted from the ground. These materials are stored, collected, recycled and/or disposed of in accordance with the requirements of Roscommon County Council. Complete records including waste type, quantity, hauliers and destination shall be maintained for inspection by Roscommon County Council in respect of any such waste.

Potential waste produced and the proposed measures used to control it are described as follows:

- **Scrap metal/disused plant and machinery** – these materials are chiefly produced from the maintenance of the processing plants and can cause a nuisance if allowed to build up in an uncontrolled manner. A designated scrap metal area is demarcated on site, and the build-up of scrap is controlled by the regular removal by licensed scrap metal contractors.
- **Used Oil and Oil Filters** – any waste oil/oil filters that arise from servicing of fixed or mobile plant is removed from the site by a licensed waste contractor.
- **Used Batteries** – similarly all used batteries are removed from site for collection and recycling by a licensed waste contractor in accordance with the Waste Management Regulations.
- **Used Tyres** – similarly all used tyres are removed from site for collection and recycling by a licensed waste contractor in accordance with the Waste Management Regulations.
- **Domestic Waste** (Canteen Waste) – domestic waste generated at the offices and employee's facility is collected by a licensed waste collection contractor.

There is no intention on behalf of the Operator to discard any material extracted from the quarry itself. There is no waste facility present and all material extracted at this quarry will either be processed for eventual sale or used for rehabilitation of the site post excavation.

5.0 Status of Extracted Material

The Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 (S.I. 566 of 2009) (the "Extractive Waste Regulations") is the relevant legislation setting out the appropriate management and responsibilities in relation to extractive waste, as well as describing the various obligations that fall on local authorities in respect of the regulatory functions that apply to the extractive industries sector.

5.1 Guidance on the Extractive Waste Regulations

The EPA published a Guidance document 'Guidance on the Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 in 2012 to explain the requirements of the legislation.

Page 38 of the EPA (2012) Guidance refers to a number of European Case Law precedents that support that extracted material

"only becomes waste if it is being held for an indefinite length of time, where its further use is uncertain and/or where there is no market for it. A similar line of reasoning affects topsoil and other similar materials that may be being stored for later utilisation in bona-fide restoration purposes. It also applies to bunds and acoustic screens, as long as the presence of this infrastructure at the site has a legitimate purpose"



5.2 Purpose and Timeframe of Future Use of Extraction Materials

For the proposed development:

- All previously stripped topsoil and overburden was designated for either the creation of screening berms or for the final restoration of the land to a natural habitat (note: no further topsoil or overburden stripping required to be carried out); and
- The operation and restoration plan are tied to the life of the overall Cam Quarry for which an extension of life for 10 years is sought.

Therefore, future use of the extraction material is clearly defined, and it will be achieved within a defined and enforceable timeframe, demonstrating it is not being stockpiled indefinitely.

Based on this guidance and the planned management, the temporary storage of topsoil and overburden is considered a part of the process, and the material is not classified as extractive waste.

6.0 Summary

The proposed development is required to submit this Extractive Waste Management Plan to Roscommon County Council to demonstrate compliance with the EU Mining Waste Directive (Directive 2006/21/EC), as transposed by S.I. No. 566 of 2009.

The main material that directly results typically from the quarry extraction process is topsoil and overburden. The focus of this EWMP is to establish whether extractive waste will arise as a result of the proposed continued use of Cam Quarry.

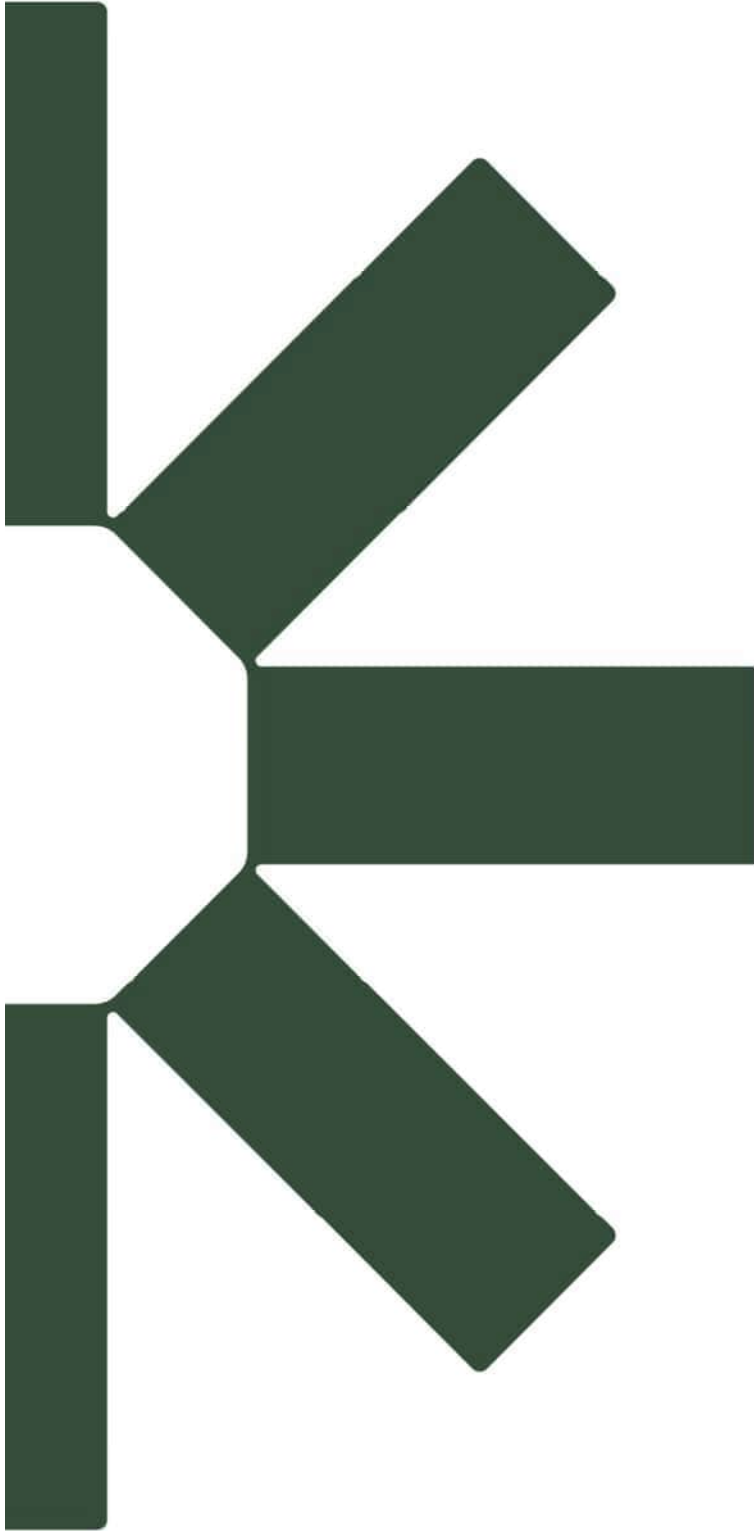
It is confirmed that no extractive waste will arise as a result of the proposed continued use of Cam Quarry.

All topsoil and overburden previously stripped have a clear purpose and a definite timeframe for reuse in the site's final restoration plan. The planned management ensures the recovery and reuse of materials, fully addressing the requirements of the legislation without the need for a risk management procedure.

The EWMP will be reviewed every five years and amended, as appropriate, in the event of substantial changes to the operation of Cam Quarry.

Roscommon County Council will be notified in the event that any amendments are made to the EWMP.





Making Sustainability Happen

D.4 EIAR Chapter 7 – Water (Hydrology & Hydrogeology Information) submitted as part of the Further Information response to Roscommon County Council

Contents

Introduction.....	7-4
Background.....	7-4
Water Management	7-4
Scope of Work	7-5
Project Team.....	7-5
Limitations / Difficulties Encountered	7-5
Regulatory Background	7-6
Legislation.....	7-6
Planning Policy and Development Control.....	7-6
Guidelines and Technical Standards	7-7
Receiving Environment.....	7-8
Study Area	7-8
Baseline Study Methodology	7-8
Sources of Information	7-9
Detailed Site Investigations.....	7-9
Site Setting.....	7-10
Rainfall and Climate	7-11
Soils and Geology.....	7-11
Soils and Subsoils.....	7-11
Local Bedrock Geology.....	7-12
Karst	7-12
Groundwater - Hydrogeology	7-13
Aquifer Characteristics.....	7-13
Groundwater Vulnerability	7-13
Groundwater Bodies	7-14
Groundwater Supply Wells	7-15
Source Protection Areas	7-15
Groundwater Protection Scheme.....	7-17
Quarry Landholding Groundwater Monitoring Boreholes.....	7-17
Groundwater Levels Discussion.....	7-19
Groundwater Quality	7-23
Surface Water - Hydrology.....	7-24
Surface Water Bodies.....	7-24
Catchment	7-24
Flooding and Flood Risk	7-25

Water (Hydrology & Hydrogeology) 7

Water Framework Directive	7-26
Surface Water Biological Quality in the Cross River and River Suck : Q Values	7-27
Surface Water Biological Quality in the Ballyglass River: Q Values	7-28
Surface Water Sampling.....	7-32
Surface Water Quality	7-33
Protected Areas	7-34
Water Environment Receptors.....	7-34
Receiving Environment - Baseline Summary	7-36
Impact Assessment	7-38
Evaluation Methodology.....	7-38
Construction and Operational Stage (No Mitigation)	7-38
Direct Impacts.....	7-38
Indirect Impacts.....	7-39
Cumulative Effects.....	7-39
Rating of Identified Potential Impacts	7-40
Significance of Impacts	7-40
Water Framework Directive	7-44
Mitigation Measures	7-44
Construction & Operational Stages	7-44
Assessment of Impacts with Mitigation Measures in Place	7-45
Residual Impact Assessment	7-45
Monitoring	7-46
References	7-47

Appendices

Appendix 7-A: Site Characterisation and Package WwTS with Percolation Area.....	50
Appendix 7-B EU Directives / National Legislation and Regulations / Guidelines / Technical Standards	51
Appendix 7-C Borehole Logs	54
Appendix 7-D Field Record Sheets for Groundwater Monitoring and Surface Water Monitoring	55
Appendix 7-E Groundwater Screening Results	56
Appendix 7-F Laboratory Results	69
Appendix 7-G Biological Q Survey Data	70
Appendix 7-H Surface Water Quality Results Screened	79
Appendix 7-I Water Framework Directive Assessment.....	83
Appendix 7-J 2004 Environmental Impact Assessment (EIS) Water Chapter	84
Appendix 7-K Rating of Existing Environment Significance / Sensitivity	85
Appendix 7-L Descriptions of Effects (EPA, 2022).....	87
Appendix 7-M Classification of the Significance of Impacts	90

Tables

Table 7-3: Required Information – Data Sources.....	7-9
Table 7-4: Average Monthly Rainfall (mm) 2024 for Athlone OPW	7-11
Table 7-5: Long Term Average Annual Rainfall (1981-2010), Mt. Dillon	7-11
Table 7-6: GSI Groundwater Vulnerability Rating.....	7-14
Table 7-7: Boreholes details (2003 and 2004).....	7-17
Table 7-8: Details of 2023 Boreholes MW3 - MW6.....	7-19
Table 7-9: Summary of groundwater level logger data (August 2023 – April 2025)	7-21
Table 7-10: Summary of manual groundwater levels (August 2023 – April 2025).....	7-21
Table 7-11: Cross River EPA Biological Water Quality Ratings	7-27
Table 7-12: River Suck EPA Biological Water Quality Ratings	7-28
Table 7-13: Q-Rating System and Invertebrate Indicator Groups	7-31
Table 7-14: Q-Rating and Assigned WFD Status	7-31
Table 7-15: Biological Water Quality Results for the Ballyglass River.....	7-32
Table 7-16: Existing Environment - Significance and Sensitivity / Importance	7-35
Table 7-17: Classification of Significance of Impacts (No Mitigation).....	7-41
Table 7-18: Groundwater Quality (5 th August 2023)	7-57
Table 7-19: Groundwater Quality (11 th January 2024).....	7-62
Table 7-20: Groundwater Quality (8 th October 2024).....	7-66
Table 7-21: Freshwater Macroinvertebrate Taxa and Abundance (March 2025)	7-71
Table 7-22: Freshwater Macroinvertebrate Taxa and Abundance (July 2025).....	7-72
Table 7-23: Description of Sampling Locations (July 2025)	7-73
Table 7-24: Surface Water Quality Results Screened	7-80

Figures

Figure 7-1: Onsite Borehole Locations Map
Figure 7-2: Karst Features Map
Figure 7-3: Surface Water Features Map
Figure 7-4: Bedrock Aquifer Map
Figure 7-5: Groundwater Vulnerability Map
Figure 7-6: Groundwater Body Map
Figure 7-7: Source Protection Areas

Introduction

Background

- 7.1 This Chapter of the Environmental Impact Assessment Report (EIAR) addresses the potential impacts on surface water and groundwater of the proposed development site of Cam Quarry, Brideswell, Co. Roscommon (currently permitted by P. Ref. 04/1479 and ABP PL20.215417).
- 7.2 It provides a description of the water, including surface water (hydrology) and groundwater (hydrogeology) conditions in the application area within the context of the site and regional setting, and assesses the potential impacts that the proposed development will have on surface water and groundwater. Mitigation measures, if required, are proposed.
- 7.3 Available information on the hydrology and hydrogeology of the Cam Quarry area and its surrounds was collated and evaluated. Refer to EIAR Chapter 2: Project Description for details of the site and a description of the proposed development.
- 7.4 Unmitigated potential impacts on hydrology and hydrogeology are considered for the initial assessment, before appropriate mitigation measures for the potential impacts identified are discussed, and then the identified potential impacts are reassessed assuming the identified mitigation measures are in place.
- 7.5 Impacts are focused on the quality and quantity of both surface water and groundwater. For the purposes of this assessment, the study area comprises the application site and the surrounding area up to 5 km radius around the site boundary.
- 7.6 The proposed site layout is shown on EIAR **Figure 2-2**. The overall proposed development area covers approximately 66.3 ha. (c. 163.8 acres). The proposed development includes the reduction of the previously permitted extraction area from 23.7 ha. to 12.9 ha. and the associated reduction of the overburden storage area required.

Water Management

- 7.7 There are no streams or surface water drainage channels within the immediate vicinity of the site.
- 7.8 Site drainage from the overall quarry is currently managed within the site by Roadstone. The quarry is currently worked without the need to discharge water off-site. Any rainfall or water ingress within the current quarry void is managed within the void where water accumulates in the lowest level of the quarry floor allowing the remainder of the quarry to remain dry for extraction operations.
- 7.9 The revised extraction depth removes the need for any off-site water discharge so the previously proposed Water Management System, including the hydrocarbon interceptor and all associated discharge pipework along the public road to the Ballyglass River, is no longer required.
- 7.10 Any surface water falling over the site will be directed to the sump on the quarry floor and used for dust suppression at the site as required. This water management system has operated successfully at the site for over 20 years and will remain for the duration of the proposed development over the next 10 years.
- 7.11 A hydrological / hydrogeological assessment has been carried out taking into consideration the existing water regime at the quarry site and to determine what the requirements are for the proposed development. It addresses mitigation measures to eliminate and/or minimise

- the potential impacts, if any, on surface water and groundwater. These measures will be incorporated into the quarry design and operation.
- 7.12 There is a hard stand refuelling area with hydrocarbon separator at the refuelling station area at the site. All runoff from the hard stand refuelling pad goes to the hydrocarbon separator before the treated runoff percolates to the ground.
- 7.13 Effluent from toilet facilities is treated using an existing Wastewater Treatment System (WwTS) and percolation area.
- 7.14 As part of this planning application, it is proposed to upgrade the overall effluent treatment system by decommissioning the existing WwTS and replacing it with a Secondary Wastewater Treatment System with a constructed soil polishing filter area for final treatment. The existing WwTS will be decommissioned and the contents of the tank will be taken off site for appropriate treatment by a licenced contractor.
- 7.15 As part of documentation submitted with this planning application, a site characterisation assessment was undertaken in September 2025 for the new wastewater treatment system by Dr. Eugene Bolton. The site characterisation form and details of the Secondary WwTS (Molloy Tanks: Chieftain SBR sewage treatment system) and polishing filter area (90m²) are included in **Appendix 7-A**.
- 7.16 The package WwTS is designed to cater for 30 staff on site with a Population Equivalent (PE) of eight persons, based on daily hydraulic load.

Scope of Work

- 7.17 The scope of this chapter includes:
- An assessment of the existing surface water and groundwater within approximately 5 km of the application area;
 - An assessment of the potential impact of the proposed development on surface water and groundwater; and
 - Where necessary, recommendation(s) for mitigation measures to reduce or eliminate any potential impacts.

Project Team

- 7.18 This chapter of the EIAR was prepared by SLR Consulting Ireland. The project team consists of:
- Michelle Sherry Graduate Hydrogeologist BSc (Environmental Bio-Science).
 - Dominica Baird Technical Director (Hydrogeology) BSc (Earth Science), MSc (Hydrogeology), CGeol, EurGeol; and
 - Peter Glanville Technical Director (Hydrology & Hydrogeology) PGeo EurGeol and MCIWEM.

Limitations / Difficulties Encountered

- 7.19 The evaluation of the hydrological and hydrogeological environment provided here relies on the detailed assessment, visual inspections conducted during site visits, a comprehensive dataset of monitoring records, publicly available information, and anecdotal evidence from local personnel.

- 7.20 No constraints or challenges were encountered during the compilation of this chapter in the EIAR.

Regulatory Background

Legislation

- 7.21 The key European Directives / European Union Legislation which apply to this Chapter of the EIAR and the hydrology and hydrogeology assessment presented herein are:
- Environmental Impact Assessment Directive (2011/92/EU); and
 - Directive of the European Parliament and of the Council amending Directive 2011/92/EU on assessment of effects of certain public and private projects on the environment (2014/52/EU).
- 7.22 Other European Directives to which this EIAR makes reference, or has had regard, are listed in **Appendix 7-B**.
- 7.23 Irish Government Acts, National Legislation and Regulations which apply to this Chapter of the EIAR and the surface water and groundwater assessment presented herein are also listed in **Appendix 7-B**.
- 7.24 Most notably, under Regulation 4 of the Groundwater Regulations 2010, a duty is placed on public authorities to promote compliance with the requirements of the regulations and to take all reasonable steps including, where necessary, the implementation of programmes of measures, to:
- “(a) prevent or limit, as appropriate, the input of pollutants into groundwater and prevent the deterioration of the status of all bodies of groundwater;*
- (b) protect, enhance and restore all bodies of groundwater and ensure a balance between abstraction and recharge of groundwater with the aim of achieving good groundwater quantitative status and good groundwater chemical status by 2015 or, at the latest, by 2027;*
- (c) reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order to progressively reduce pollution of groundwater;*
- (d) achieve compliance with any standards and objectives established for a groundwater dependent protected area included in the register of protected areas established under Regulation 8 of the 2003 Regulations [S.I. No. 722 of 2003] by not later than 2015, unless otherwise specified in the Community legislation under which the individual protected areas have been established.”*

Planning Policy and Development Control

- 7.25 The project site lies within the scope of the Roscommon County Development Plan 2022-2028.
- 7.26 The County Development Plan, under Section 7.9 Surface Water Drainage, sets out objectives in relation to the Water Framework Directive and the protection of water sources.
- 7.27 These objectives are set out under Infrastructure, Transport and Communications Policy Objectives.
- 7.28 **Objective ITC 7.36** states *“Protect both ground and surface water resources including taking account of the impacts of climate change, support the implementation of the Rural*

Water (Hydrology & Hydrogeology) 7

Water Programme and to support Irish Water in the development and implementation of Drinking Water Safety Plans and the National Water Resources Plan"

- 7.29 **Objective ITC 7.48** states *"Ensure new development is adequately serviced with surface water drainage infrastructure which meets the requirements of the Water Framework Directive, associated River Basin Management Plans and CFRAM Management Plans. Furthermore, the Council will undertake its obligations under the European Union (Good Agricultural Practice for Protection of Waters) Regulations 2017."*
- 7.30 Section 7.9 also states that, *"For new developments, Roscommon County Council will require that all developments incorporate Sustainable Urban Drainage Systems (SuDS) as part of the development proposals. SuDS are effective technologies which aim to reduce flood risk, improve water quality and enhance biodiversity and amenity."*
- 7.31 The County Development Plan, under Section 10.10, also mentions the importance of the inland waterways in Roscommon, including the River Suck and the River Shannon, which are mentioned later in this EIAR chapter.
- 7.32 There are two National Heritage objectives set out in relation to Roscommon's waterways relevant to this EIAR.
- 7.33 **Objective NH 10.19** states *"Ensure that the county's watercourses are retained for their biodiversity and flood protection values and to conserve and enhance where possible, the wildlife habitats of the County's rivers and riparian zones, lakes, canals and streams which occur outside of designated areas to provide a network of habitats and biodiversity corridors throughout the county. The Council shall be available to engage with the NPWS with the objective of facilitating the monitoring and surveying of wetland sites in Roscommon."*
- 7.34 **Objective NH 10.20** states *"Protect waterbodies and watercourses from inappropriate development, including rivers, streams, associated undeveloped riparian strips, wetlands and natural floodplains. To this effect, consideration should be given to Inland Fisheries Ireland's guidance document Planning for Watercourses in the Urban Environment (2020)."*
- 7.35 Under Section 10.6 of the Plan, the River Suck Callows is named as a County Geological Site and a National Heritage Area (NHA). In relation to the protection of NHA's in Roscommon, the following objective was set out.
- 7.36 **Objective NH 10.11** *"Preserve and protect sites of county geological importance from inappropriate development where they comprise designated sites or national heritage areas."*

Guidelines and Technical Standards

- 7.37 The following key guidelines apply to this hydrology and hydrogeology assessment:
- Environmental Protection Agency (EPA), 2006. Environmental Management in the Extractive Industry: Non-Scheduled Minerals;
 - Geological Survey of Ireland (GSI) - Irish Concrete Federation (ICF), 2008. Geological Heritage Guidelines for the Extractive Industry;
 - Institute of Geologists of Ireland (IGI). Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, April 2013;
 - Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports: Environmental Protection Agency;
 - National Roads Authority (NRA) (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

- DEHLG and OPW, 2009. The Planning System and Flood Risk Management: Guidelines for Planning Authorities.
- 7.38 Additional guidelines and technical standards which apply to this report and the hydrology and hydrogeology assessment presented herein are listed in **Appendix 7-B**.

Receiving Environment

Study Area

- 7.39 For the purposes of this assessment, the study area comprises the application site and the surrounding area c. 5km from the site, reflecting the sensitivity of the hydrology and hydrogeology; this is in line with the Institute of Geologists of Ireland's (IGI) guidelines (2013).
- 7.40 The IGI guidelines state that the minimum distance of 5km should be reviewed in the context of the hydrogeological / geological environment as well as the scale of development and increased to reflect the sensitivity of the subsurface with Limestone and karst geology present, and where present the distance should be increased to 5km to reflect the more complex karst geology. The use of a wider 5 km radius for the study area is therefore considered to be a conservative approach.
- 7.41 The IGI guidelines also state that maps should be sourced to allow for the review of the geological and hydrogeological conditions that exist within a minimum of 5km of the site boundary for geology with Limestone and karst identified (from the outer limit of the planning and/or licence area) and presented at a scale of 1:25,000.

Baseline Study Methodology

- 7.42 The investigation methodology adheres to the Environmental Protection Agency's (EPA) 2022 guidelines on environmental impact assessments and the IGI's recommendations on Geology in Environmental Impact Statements (2013).
- 7.43 Existing data on the geology, hydrogeology, and hydrological characteristics of the area and its surroundings was collated and evaluated. Recent groundwater, surface water and groundwater level data is available for the Cam Quarry site. Data and information from an Environment Impact Statement (EIS) produced for Roadstone Ltd in 2004 was also collated and assessed.
- 7.44 The methodology for assessing hydrology and hydrogeology in the Cam area and the development vicinity is outlined as follows:
- A desk study, in which existing data and relevant regional data sources for the area were examined;
 - A review of the Proposed Development design details;
 - Review of all available water monitoring data;
 - Assess the potential impacts that the Proposed Development may have on the receiving water environment; and
 - Analyse and summarise the information gathered.

Sources of Information

7.45 The desk study involved the examination of available datasets to determine the geological and hydrogeological setting of the area (IGI, Required Information), together with all available studies and technical reports in time of preparation of this report, as detailed in Table 7-1.

Table 7-1: Required Information – Data Sources

Data	Dataset Source
Topography and aerial photography	• Tailte Éireann • GeoHive map viewer
Designated Sites	• Environmental Protection Agency (EPA); • Geological Heritage Sites and County Geological Sites; and • Natura 2000 Sites (National Parks and Wildlife Service)
Bedrock Geology	• GSI Groundwater Data Viewer - Bedrock Geology
Subsoil Geology	• Subsoil mapping (GSI and EPA)
Soils	• Irish Soils Information System (Teagasc)
Groundwater	• GSI Groundwater Data Viewer - bedrock and gravel aquifers, vulnerability, karst features, water supplies, groundwater recharge. • GSI Groundwater body description documents and • EPA water maps.
Surface Water	• Watercourses and water quality (EPA); • Water Framework Directive (EPA); and • Flooding (OPW CFRAM and NIFM maps).
Abstractions	• Surface water and groundwater (EPA abstractions register)
Permitted Sites	• EPA licence register
Rainfall/Climate data	• Met Éireann
Environmental Pressures	• Water Framework Directive (EPA)

Detailed Site Investigations

7.46 In addition to the above desk study of publicly available data, extensive data gathering has been undertaken at the site. The works carried out for assessing hydrology and hydrogeology in the Cam area is outlined as follows with the borehole locations shown on **Figure 7-1:**

- Drilling of four groundwater monitoring boreholes (MW3 - MW6) was undertaken in June 2023 by Petersen Drilling Services Ltd and supervised by SLR Consulting Ltd. The boreholes were drilled to between 35m and 67m depth below ground level;
- There are a number of pre-existing boreholes on-site, located around the processing areas in the quarry, which have been drilled at different times. All of the boreholes were found to be inadequate for monitoring;

- Groundwater level data loggers (Van Walt Rugged Troll 100) were installed on the 5th August 2023 in boreholes MW3 - MW6 by SLR Consulting Ltd and were set to take water level readings every hour;
- Quarterly manual dipping of groundwater wells and groundwater level logger downloads since August 2023;
- Three groundwater quality monitoring results at MW3 - MW6 from August 2023 to October 2024;
- The comprehensive Water Chapter from the Cam EIS report (2004) prepared by O'Neill Ground Water Engineering (OGE); and
- Hydrogeology report and calculations (2004 EIS Water Chapter, Appendix 3.4.1).

Site Setting

- 7.47 The application site is for the continued development of the Roadstone Cam Quarry (area c. 66.3 hectares) which lies in Curry and Cloonacaltry, County Roscommon and is located c. 4km west of Brideswell and 12km west of Athlone. The proposed site is located c. 12km west of the Dublin to Galway Motorway (M6) and is accessible from the M6 via the R362. The site is currently being used as an active limestone quarry and has an elevation of between 80m AOD and 110m AOD.
- 7.48 The surrounding landscape consists primarily of agricultural land with some areas of unmanaged scrub, wetland and bog. There are few residences in the immediate vicinity of the site. Most residences comprise of isolated farm dwellings and of owner-occupied bungalow/residences (Refer to EIAR **Figure 1-2**). There are no large residential settlements close to the site.
- 7.49 The land holding is surrounded by walls which separate it from reclaimed fields to the east and west. The lands surrounding the site consists of unimproved pasture and scrub land.
- 7.50 The area in the south of the site (where MW3 is located) is used as an overburden storage area. Other than its use as overburden storage, the remainder of this area appears to have been unmanaged, allowing for the development of a mosaic of semi-natural grassland and scrub.
- 7.51 The lands in the quarry are undulating with a hummocky topography varying in elevation from approximately 80 mAOD along the north, eastern and southeastern margins of the application site and rising in the central and western portion of the site to approximately 110 mAOD.
- 7.52 The Cam EIS (2004) notes that several lineaments are visible when assessing the topography of the application site. The possible lineament trending north-west to south-east may link Corkip Lough with a linear valley structure to the north-west and probable enclosed depression in the north part of the application site. This lineament may represent a fault that has undergone preferential weathering and karstification. Another less developed lineament /fault like structure can be seen on the south-western flank of the hill forming the central upland area of the site which has a north-west to south trend although this swings to a north-northwest-south-southeast trend southwards. A third lineament is seen on the north-western faces of the hill form the uplands of the application site, Cam Hill and a hill to north of the townland of Boleyduff form a general south-west to north-east trend.
- 7.53 There are three surface water systems at the proposed development area. The Ballyglass system which features Coolagarry Lough, Cuilleenirwan Lough (turlough) and Ballyglass River (BALLYGLASS_010) which flows into the River Suck (SUCK_0130). The Cross River System which features the Corkip Lough and the Cross River (CROSS

(ROSCOMMON)_010), which is located c. 2km north of the quarry and flows in an easterly direction towards Athlone where it eventually flows into the River Shannon (located c. 13.7km southeast of the site). The Killeglan System located south of the site features the Killeglan River, located c. 3.6km south of site, the Killeglan Public Water Supply (PWS) and Feacle Lough.

Rainfall and Climate

7.54 The nearest Met Éireann rainfall gauging station to the proposed application site is Athlone OPW which is c. 14.4km east of the site. The monthly precipitation amount (mm) for 2024 is tabulated in **Table 7-2**.

Table 7-2: Average Monthly Rainfall (mm) 2024 for Athlone OPW

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
68.9	106.9	108.7	71.4	58.1	27.3	43.8	84.1	30.6	71.8	78.5	66

7.55 There is no Long-Term Average (LTA) annual rainfall data available for Athlone O.P.W so the nearest Met Eireann station with LTA available was chosen instead. Mt. Dillon, which is c. 28.8km northeast of the site is the closest station with this data. The most recent period published is 1981-2010. The LTA annual rainfall for Mt Dillon is 1047.1mm/yr for the period 1981-2010 (Met Eireann, 2021). The LTA monthly rainfall for the period 1981-2010 are shown in **Table 7-3** below.

Table 7-3: Long Term Average Annual Rainfall (1981-2010), Mt. Dillon

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
105.0	77.7	88.2	66.6	70.5	74.2	73.1	88.3	79.4	111.8	102.4	109.8

7.56 According to Met Éireann's Past Weather Statement, 2024 was defined as being mild and wet during the first half of the year and dry for the second half. The highest daily rainfall total was 57.4 mm at Knock Airport, Co. Mayo on Saturday 23rd November. According to the report, all monthly rainfall totals from across Ireland were below their LTA.

Soils and Geology

7.57 Soils and Geology are discussed in detail in Chapter 6 of this EIAR. A summary is provided below. The Soils are shown in **Figure 6-2**; Subsoils are presented in **Figure 6-3** and Bedrock Geology is presented in **Figure 6-4**.

Soils and Subsoils

7.58 The Irish Soil Information System project has developed a national association soil map for Ireland; the project is co-funded by Teagasc and the Environmental Protection Agency (EPA). The soils are discussed in detail in Chapter 6 of this EIAR.

7.59 The soils surrounding the overall Quarry landholding are a mixture between fine loamy drift with limestone stones known as the Rathowen Association (1030RA) and coarse loamy over calcareous gravels known as Baggotstown (1150BG), see **Figure 6-2**.

7.60 The EPA website publishes subsoil maps created by the Spatial Analysis Unit and Teagasc in collaboration with the Geological Survey Ireland (GSI). The subsoils are discussed in detail in Chapter 6 of this EIAR.

- 7.61 The subsoils at the site are limestone till (Carboniferous) which are mainly derived from calcareous parent materials. These subsoils are moderately permeable. Other subsoils at the site include poorly drained mineral tills chiefly derived from Limestone, see **Figure 6-3**. These subsoils are classified as being moderately permeable (GSI online map viewer).

Local Bedrock Geology

- 7.62 The GSI online map viewer (1:100,000 geology map) shows the site is underlain by undifferentiated limestone known as Visean Limestones. The local bedrock geology is shown in **Figure 6-4**. Rock core logs retrieved from the boreholes drilled in 2004, indicated that the limestone is a grey, crystalline and bioclastic with corals, brachiopods and crinoid fragments.
- 7.63 These rocks have experienced partial karstification, resulting in numerous clay-filled fractures and fissures. These fissures and fractures are most likely associated with the area's main faulting and jointing pattern, which is thought to be south-west to north-east and north-west to south-east, reflecting the wider regional faulting pattern around the site. The regional fault patterns can be seen on GSI's bedrock geology maps.

Karst

- 7.64 There are several karst features recorded by the GSI and located within 5km of the proposed application site, see **Figure 7-2**. There are tens of enclosed depressions located in the surrounding of the proposed development, except to the east of the site. The closest enclosed depression is located c. 200m north of the site. The closest turlough is Feacle Lough, located approximately 550m southeast of the site boundary (reference IE_GSI_Karst_40K_949). Cuileenirwan Lough located approximately 1.4km north of the site (reference IE_GSI_Karst_40K_948). Corkip turlough is located approximately 2km southeast of the site boundary (IE_GSI_Karst_40K_950). A traced underground connection between Corkip turlough and Killeglan Spring to the southeast was confirmed by the GSI.
- 7.65 According to the 2004 Cam EIS, a further three possible enclosed depressions were identified in the northern section of the application site but were not featured on GSI's karst map database. These could be potential links between surface water and groundwater.
- 7.66 The Feacle Turlough is a proposed National Heritage Area (pNHA) and Corkip is protected as a Special Area of Conservation (SAC) called the Ballynamona Bog and Corkip Lough SAC.
- 7.67 The Cuileenirwan Lough feeds into the Ballyglass River. Unlike Corkip Lough and Feacle Lough, the water depth at Cuileenirwan Lough does not appear to fluctuate a significant amount seasonally. The 2004 EIS stated that the surface water level at Coolagarry Lough, connected to Cuileenirwan Lough, was 65 mAOD.
- 7.68 A study of the turloughs was carried out as part of the 2004 EIA application, and details are provided in **Appendix 7-J**. The extractive area of the quarry is located within the unfractured bedrock where the permeability is low and steep hydraulic gradient is likely to develop behind the quarry faces. Limited seepage of ground water may occur from the areas more fractured and karstified bedrock. However, since Feacle Lough and Corkip Lough are fed by ground water predominantly from the epikarst the proposed development is unlikely to significantly impact on these.

Groundwater - Hydrogeology

Aquifer Characteristics

- 7.69 The GSI online map viewer shows the site is underlain by a regionally important karstic aquifer (Rkc). This aquifer is defined as being an aquifer capable of sustaining significant yields and supplying regionally important supplies, see **Figure 7-4**. The aquifer has an area of 1,099 km².
- 7.70 As part of the O'Neill Groundwater Engineering (OGE) hydrogeological investigations carried out for the Cam EIS (2004), a 72 hour pumping test was commenced on the 28th June 2004, and completed on the 1st July 2004. A hydrogeological report based upon the findings of the pump test was compiled by OGE and is presented as Appendix 3.4.1 in the EIS chapter in **Appendix 7-J**.
- 7.71 Hydraulic gradients in the less fractured bedrock was noted at approximately 0.07 whereas in the fractured and karstified bedrock the hydraulic gradient falls to approximately 0.007.
- 7.72 Analyses of the time/drawdown graphs for the nearest monitoring well (Borehole BH10) during the pumping test suggested a Transmissivity (T) value of 12m²/d, and a storativity value of 1.4×10^{-4} . The geomean figure for Rkc from the GSI's Irish Aquifer Properties Manual 2015 is 20 m²/d. Assuming an aquifer thickness of 38 metres, then the Hydraulic Conductivity of the aquifer in this location is 0.14m/d (1.66×10^{-6} m/s). This Hydraulic Conductivity value would be considered medium to low. The GSI estimate for Rkc is 0.53 m/d.
- 7.73 The Pumping Well (PW2A) is located within a zone of fractured bedrock. The value of Hydraulic Conductivity recorded is therefore likely to be at the upper range of values for the bedrock beneath the site as a whole.
- 7.74 The 2004 EIS notes that the geology of the application site and its environs is controlled by two sets of faults. The primary fault trend is north-west or north-northwest to south-east or south-southeast. The secondary fault trends north-east to south-west. These faults may have been preferentially weathered and karstified. The primary conduits for ground water flow beneath the site will be along these faults. The direction of groundwater flow beneath the site is influenced by both the topography and the structural bedrock geology. Surface water catchment areas do not define the boundaries of the groundwater catchment areas. Groundwater can move from one surface water catchment to another through groundwater conduits.

Groundwater Vulnerability

- 7.75 The GSI has developed a groundwater vulnerability classification for Ireland, refer to **Table 7-4** below. The groundwater vulnerability at a particular point is controlled by the natural geological and hydrogeological characteristics at that point. The vulnerability depends on the nature of the subsoils (i.e. their permeability characteristics), the type of recharge (point or diffuse) and the thickness of the unsaturated zone (depth to groundwater).
- 7.76 The groundwater vulnerability at the site is classed as High, see **Figure 7-5**.

Table 7-4: GSI Groundwater Vulnerability Rating

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand / gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/Gravel aquifers only)	(< 30 m radius)
Extreme (E)	0-3.0m	0-3.0m	0-3.0m	0-3.0m	-
High (H)	>3.0m	3.0-10.0m	3.0-5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0-10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A
Notes: (i) N/A= not applicable (ii) Precise permeability value cannot be given at present. (iii) Release point of contaminants is assumed to be 1-2m below ground surface.					

7.77 The GSI online database indicates that the hydrogeological setting of the proposed development is described as having moderate permeability subsoil. The effective rainfall (rainfall after evaporation) is 565.60 mm/yr. The groundwater recharge at the site is 339.36 mm/yr and no recharge cap applies to this site.

Groundwater Bodies

7.78 The proposed development is located within the Suck South Groundwater Body (GWB). A description of the GWB is published by the GSI and is summarised below and refers to the karst limestone bedrock underlying the limestone till deposits at the site. The Funshinagh GWB is located to the east of the site. Groundwater bodies are shown in **Figure 7-6**.

Suck South GWB

7.79 This groundwater body has an area of 1,099km² and is bordered by twelve other GWBs. The Suck South GWB received a Good WFD status during the 2016-2021 period. The Suck South GWB is considered to be “Not at Risk”. Most of the surrounding GWBs are also considered “Not at Risk of deteriorating in quality” except for the GWDTE-Rahasane Turlough (SAC000322) GWB (located on the southwest border of the Suck South GWB) which is considered “At Risk”.

7.80 Groundwater is recharged in this GWB through both point and diffuse recharge. Point recharge occurs as a result of karst features such as swallow holes and collapse features. Diffuse recharge is the dominant recharge mechanism in the GWB and it occurs via rainfall percolating through the subsoil. It is evident by the lack of surface drainage that potential recharge regularly infiltrates into the aquifer. The subsoil in the GWB is of predominantly moderate permeability so it's unlikely that recharge from percolation will be restricted. Recharge may get rejected in low lying areas where there is a high water table due to limited storage space.

7.81 Groundwater in this GWB is typically unconfined and most of the groundwater flow is found in the upper epikarst layer and in zones of interconnected fissures which have been enlarged by karstification. These fissures are typically 30m deep. Groundwater storage is low in karstified aquifers so there is a limited capacity for contaminant reduction.

- 7.82 Across the GWB, groundwater varies in hardness, alkalinity and conductivity. High turbidity was observed after periods of heavy rainfall due to sediment which had collected in fissures and cavities being washed out or where groundwater has a direct link to surface water containing sediment (such as in swallow holes).
- 7.83 According to the GSI's GWB Description Report, karstification is widespread in this GWB. Current records of karst features are considered to represent only a fraction of existing features. As with most karstic systems, permeability and transmissivity data are very variable. Transmissivity in karstified aquifers with conduit flow can range up to a few thousand m^2/d . A pumping test carried out within this GWB at Ballinlough estimated a bulk transmissivity of $80 \text{ m}^2/\text{d}$ to $90 \text{ m}^2/\text{d}$ although the transmissivity of the intensely fractured zone is estimated as $400 \text{ m}^2/\text{d}$ (K.T. Cullen & Co., 1999). The aquifer supports a large number of high and intermediate yielding springs. Rapid groundwater flow velocities have been recorded. Rapid velocities recorded for groundwater in these areas imply flow through relatively sizeable conduits. Storativity in this aquifer will be low.

Groundwater Supply Wells

- 7.84 A survey of private water supplies was carried out to support the 2004 EIA application. The majority of the residences within the study area are on public water mains supply, so it was found there was little reliance on ground water. All the houses and farms in the local area use septic tanks.
- 7.85 The Cam area is within the Uisce Éireann Killeglan South Roscommon Regional Water Supply Scheme.
- 7.86 The Geological Survey Ireland (GSI) has a historical online database of wells and springs in Ireland; however it is noted that the well database is updated. According to the GSI well database there are a number of wells within a 2km radius of the site. The wells abstract from the regionally important Rkc karstified bedrock aquifer. The distances below are taken from the centre of the locational accuracy radius.
- 7.87 The closest GSI recorded well is an agricultural and domestic well located across from the entrance of the quarry (GSI name 1723NEW012), c. 700m north of the site. This well was drilled in March 1971 and reports a depth of 46m with a 5.8m depth to rock. The yield class is noted as poor ($10.9 \text{ m}^3/\text{day}$).
- 7.88 There is another well located just on the southern border of the site. This well is a domestic and agricultural well (GSI name 1723NEW024). The well was drilled in November 1971 and has a depth of 8.5m with a depth to rock of 8.5m. The well is classified as poor with a yield of $21.8 \text{ m}^3/\text{day}$.
- 7.89 There are several other wells within 2km of the site which are of domestic / agricultural / unknown use or are used a public supply (Co Co) well. These wells range from having a yield class of poor to moderate.

Source Protection Areas

- 7.90 The Killeglan Public Water Supply (PWS) Source Protection Area, which exploits the Tobermore Spring, is located within the site redline boundary and along the southern border of the existing quarry and abstracts approximately $7,000 \text{ m}^3/\text{day}$ (see **Figure 7-7**). The Killeglan River flows in a west-south-westerly direction where it discharges to the River Suck. Feacle Lough is also located within this system.
- 7.91 The surface hydrology featured in the zone of contribution to the Killeglan Public Water Supply is quoted directly from the work of Kelly and Lee (2003):

“The surface water regime is closely interconnected with the groundwater regime. There are several springs, swallow holes and numerous collapse features that are linked to the main surface water bodies in the area.

There are four main stream networks in the vicinity of Tobermore Spring. These are as follows:

- i. Just north of Taghmaconnell, a stream rises in the townland of Bellaneeny. This stream flows west for approximately 4 km, to join the Killeglan River, which then discharges in the River Suck.*
- ii. A stream network exists to the south of Taghmaconnell, in the townlands of Knock and Sraduff. These streams flow to a turlough in the townland of Glennanea. This turlough appears to take all the flow from the stream network. Another section of stream rises east of this network and then disappears after flowing approximately 1 km to the north-east.*
- iii. An intermittent, seasonal stream is located to the east of the Tobermore Spring. This stream rises in the townland of Carrowduff and Garbally, and travels first north and then east. During wet weather the upper parts of the stream are flowing. Groundwater from the Tobermore Spring and discharge area joints this channel to form the head of the Killeglan River.*
- iv. A small stream network is located in the townland of Esker. This stream network is recorded as having permanent flow, but has no apparent surface outlet. It is therefore likely that this area of surface water feeds into the groundwater system.*

The majority of outflow from this area is via the Killeglan River, which includes the Tobermore Spring discharge. A second smaller outflow is through the stream at Bellaneeny, south of the springs.”

- 7.92 The EPA carried out a site visit of the PWS on 16/04/2024, and issued a Site Visit Report, reference SV29550 - Uisce Éireann. The Site Visit Report states that the Killeglan PWS serves a population of 7,341. The drinking water treatment plant has three raw water sources comprising of two boreholes and a spring source however only the spring source is currently in use. The plant produces approximately 4,400m³ of treated water daily based on 20 hours production. The design capacity of the plant is 350m³/hour. Treatment consists of chemical conditioning, coagulation, flocculation (DAF), filtration, UV, chlorination, and fluoridation. There is one reservoir serving the plant with a capacity of 2,650m³ (6-7 hours storage). The plant is operated by Glanua under contract to Uisce Éireann. The spring source is situated in a highly karstified region which is classified as extremely vulnerable. The audit was conducted to examine all aspects of the treatment plant with a focus on compliance with the aluminium parametric value for drinking water. The Site Visit Report outlined a number of recommendations, including conducting a review of plant processes and controls to enable sustainable compliance with the aluminium parametric value in the public water supply.
- 7.93 The 2004 Water EIA application included calculations on the impact on the water supply from the lowering of the groundwater at the quarry. The calculations are presented in the Response to the RFI in **Appendix 7-J**. The likely impact on the Killeglan PWS from discharges of ground water that will ingress into the quarry are negligible, probably less than 1%.
- 7.94 There is no group water supply source protection area within the vicinity of the proposed site. The closest Group Water Scheme (GWS) Source Protection Area, Lowville No. 1, is located c. 15.5km southwest of the site.

Groundwater Protection Scheme

- 7.95 The County Roscommon Groundwater Protection Scheme (GWPS) published in June 2003, following The Geological Survey of Ireland (GSI), the Department of Environment and Local Government (DoELG) and the Environmental Protection Agency (EPA) methodology for the preparation of groundwater protection schemes (DoELG/EPA/GSI, 1999). The following is noted from the GWPS report.
- 7.96 At the time of writing, 12 public water schemes and 47 group water schemes were identified in Roscommon that were supplied by groundwater. The 12 public water schemes make up for about 73% of the water abstracted in the county.
- 7.97 Water samples were taken from 28 Public/Group Water Scheme wells in areas of Undifferentiated Viséan Limestone for analysis and found that they mainly consisted of bicarbonate and calcium ions. The total hardness ranged from hard (250-350 mg/l CaCO_3) to very hard (>350 mg/l CaCO_3) and had a neutral pH.
- 7.98 A second report on Groundwater quality within Roscommon was also drafted. This report stated that the Killeglan Water Supply exceeded GSI's guide levels for phosphate and the potassium to sodium ratio. It also exceeded the EU MAC values for ammonia and potassium. Faecal coliforms in excess of 10 were also discovered in the water samples. According to the report, these results indicate that slurry or manure spreading from a nearby farm are the most likely cause of contamination.

Quarry Landholding Groundwater Monitoring Boreholes

- 7.99 There were previously fifteen groundwater monitoring well locations in total within the quarry landholding. Prior to 2023, only eleven boreholes existed on site. However, it was determined that these pre-existing boreholes were not viable for groundwater monitoring. Hence, four new wells were installed in 2023 for monitoring groundwater quality and groundwater levels using data loggers.
- 7.100 In 2004, O'Neill Ground Water Engineering carried out a hydrological investigation in Cam as part of an Environmental Impact Statement (EIS) for the original quarry planning application. In this EIS, it stated that Roadstone Provinces Ltd (Now Roadstone Ltd) drilled nine cored boreholes in June 2003 and as part of the hydrological investigation, O'Neill Ground Water Engineering drilled five more boreholes between March and May 2004, although two of them were terminated and backfilled. A list of these aforementioned boreholes and their details are presented in **Table 7-5** below.

Table 7-5: Boreholes details (2003 and 2004)

BH Ref.	Easting, Northing (ING)	Ground Level Elevation (m AOD)	Depth of well (m bgl)	Depth to water (m bgl)	Depth to water (m AOD.)	Date Drilled
BH1	E190455 N244044	84.20	46	16.51	67.70	June 2003
BH3	E190099 N244700	101.58	61.40	46.86	54.72	June 2003
BH5	E190606 N244222	95.99	84.50	41.85	54.14	June 2003
BH6	E190211 N244403	99.48	60	28.73	70.75	June 2003

Water (Hydrology & Hydrogeology) 7

BH Ref.	Easting, Northing (ING)	Ground Level Elevation (m AOD)	Depth of well (m bgl)	Depth to water (m bgl)	Depth to water (m AOD.)	Date Drilled
BH8	E189939 N244576	91.00	61.40	35.36	55.64	June 2003
BH9	E189933 N244912	96.48	62	28.40	68.09	June 2003
BH10	E190273 N244912	96.71	61.80	41.89	54.82	June 2003
BH11	E189894 N245238	87.35	56	26.04	61.31	June 2003
MW1	E190056 N244348	88.40	39	34.61	53.79	22/03/2004
MW2	E190427 N245328	90.28	39	27.26	63.02	19/03/2004
PW2A	E190281 N2448897	96.84	80	42.60	60.40	26/04/04- 10/05/05

- 7.101 The four new wells (MW3, MW4, MW5 and MW6) were drilled in June 2023 by Peterson Drilling Ltd and supervised by SLR Consulting personnel. Each borehole was drilled to a depth between 35m and 67m. The boreholes each had a gravel pack installed in the annular space between the slotted casing and the borehole. A bentonite seal was installed above the gravel pack to prevent the entry of surface water runoff from surrounding areas flowing directly into the boreholes. They were fitted with a stand-up cover with a concrete surround. Borehole logs are presented in **Appendix 7-C**.
- 7.102 Borehole MW3 is located south of quarry void, between the quarry void and Public Water Supply inner source protection area; borehole MW4 is located northeast of the quarry void; borehole MW5 is located in the central area of quarry void and upgradient of Public Water Supply inner source protection area. Borehole MW6 is located upgradient of the quarry void. The groundwater monitoring borehole locations are presented **Figure 7-1**.
- 7.103 The ground conditions encountered consisted of medium dense gravelly Sand, which ranged in thickness from 1.1m at MW5 to 6.1m at MW 4. This is underlain by weathered grey Limestone, which ranged in thickness from 1.1m at MW6 to 13.6m at MW5. The weathered limestone at MW6 had highly fractured rock zones with clay infill. The weathered limestone is underlain by strong grey limestone with rare fractures, proven to depths of up to 67m bgl at MW6. During drilling MW3 collapsed at 21.5m due to highly unstable clay. The standpipe was pushed to 36m through the clay. Water strikes were encountered at all locations except MW3.
- 7.104 Details of the groundwater monitoring boreholes installed on the Quarry landholding are presented in **Table 7-6** below.

Table 7-6: Details of 2023 Boreholes MW3 - MW6

	MW3	MW4	MW5	MW6
Easting, Northing (I.T.M)	589943 744232	590373 745364	590238 745008	589959 745326
Ground Level Elevation (m AOD)	84.26	90.05	87.89	86.38
Reference Level* Elevation (m AOD)	84.66	90.41	88.30	86.72
Depth (m bgl)	36	59.5	56.50	67.00
Fractures (m bgl)	Occasional	Rare to Frequent	Rare	Rare
Water strikes (m bgl)	No water strike encountered	51.50	Seepage at 27.00 Rapid Flow at 42.00	Seepage at 22.00 Slow flow at 42.00
Standpipe installation (m bgl)	Plain 0 – 27, Slotted 27 – 36	Plain 0 – 44.50, Slotted 44.50 – 59.5	Plain 0 – 29.50, Slotted 29.50 – 56.50	Plain 0 – 37, Slotted 37 – 67
Gravel pack installation (m bgl)	Backfill Bentonite 12 – 16, Gravel 16-36	Backfill, Bentonite 40 – 43, Gravel 43 – 59.5	Backfill Bentonite 24 – 27, Gravel 27 – 56.50	Backfill Bentonite 30 – 35, Gravel 35 – 67
* Top of uPVC standpipe				

Groundwater Levels Discussion

- 7.105 Manual groundwater levels have been taken from MW3 – MW6 on a quarterly basis since August 2023 by SLR personnel. These manual readings were used to calibrate, verify and adjust the logger groundwater level data. Manual readings coupled with barometric data were used to correct the logger groundwater data for the site conditions.
- 7.106 Four water level loggers were placed in MW3, MW4, MW5 and MW6 on the 3rd August 2023 and set to record a groundwater level every hour. On the 23rd January 2025, the logger settings were reset to record a groundwater level every six hours. Groundwater level data from August 2023 to April 2025 is shown in **Chart 7-1** below.
- 7.107 A barometer was installed in borehole MW5 and set to take readings every hour. The barometer records variations in atmospheric pressure. One barometer is sufficient for a 25 km² area, therefore only one is needed for this site.
- 7.108 No rainfall gauge station was established on the site. Therefore, rainfall data was taken from Ballinasloe (Derrymullan) which is the closest rainfall gauging station c. 14.3km south-west.
- 7.109 At the time of writing this report, rainfall data is only available up to February 28th, 2025, and is graphed against groundwater levels in **Chart 7-1**. A summary of the groundwater levels recorded by the data loggers can be seen in **Chart 7-1** below. The groundwater levels manually recorded are summarised in **Table 7-7** and a combination of the groundwater levels is summarised in **Chart 7-1**. As previously mentioned, 2024 was defined as being mild and wet during the first half of the year and dry for the second half and all monthly rainfall totals were below their LTA 1981-2020.

- 7.110 A review of groundwater level data (maximum, average, minimum) in relation to the reference datum (mAOD) allows the hydraulic head at each location to be estimated. The groundwater flow can also be estimated. Groundwater levels are lower in MW3, MW4 and MW5, located the south to south-east of the quarry, and higher in MW6, located in the north-northwest of the quarry. This indicates a general groundwater flow direction of north-north-west to south-south-east.
- 7.111 Between 2023,2024 and January-April 2025, there has been limited variation in all four monitoring wells. MW3 and MW4 show greater groundwater fluctuation compared to MW5 and MW6. Since monitoring began, MW3 shows the highest range of 13.76 m, with a maximum groundwater level of 67.34m AOD and a minimum groundwater level of 53.59m AOD. The least variation can be seen in MW4 and MW6 with a range of 8.15m and 10.78, a maximum of 65m AOD and 75.2m AOD, and a minimum groundwater level of 56.85m AOD and 64.42m AOD. MW5 shows a range of 11.95m, with a maximum groundwater level of 63.85m AOD and a minimum groundwater level of 51.90m AOD.
- 7.112 There are a number of sharp, rapid, fluctuations that can be seen in MW3 and MW4, particularly throughout the October 2023 – April 2024 monitoring period. This period is accompanied by greater ‘rain’ days (over 2 mm rainfall in a 24-hour period). These fluctuations taper after April 2024, where less rainfall events occur over the summer months. From May 2024 to September 2024, groundwater levels in MW3, MW4 and MW5 show a decreasing trend, and from July - September 2024 in MW6, as seen on **Chart 7-1**.
- 7.113 The groundwater level decreased below the level of the loggers in borehole MW6 during 9th February 2024 to 11th May 2024 monitoring period, which was illustrated by a straight horizontal line on **Chart 7-1**. It appears that throughout the 2023,2024 and up-to-date 2025 monitoring period groundwater levels, while still variable, have remained above the level of the logger, allowing the full range of groundwater levels to be observed.
- 7.114 The groundwater levels in MW3 and MW4 correlate strongly with rainfall events and groundwater level response appears to quickly return to ‘baseline’ levels. This is particularly evident by more significant rainfall events in mid-2023 to late 2024, with less significant rainfall events throughout 2024.
- 7.115 The groundwater levels in MW5 show a flatlined pattern which is less reactive to heavy rainfall events. Groundwater levels (mAOD) slightly increased in September 2023, before dipping to their lowest range from September to November 2024. Groundwater levels returned to their ‘typical’ range in mid-December 2024, following a significant rainfall event on the 22nd of November where 34.3mm of rainfall fell in a 24-hour period. From May 2025, groundwater levels have shown a slight downward trend.
- 7.116 The groundwater levels in MW6 shows a similar pattern to MW5 and appear to stay continual and have no significant reaction to heavy or light rainfall events, with the exception of the 22nd of November rainfall event. During extended periods of no rain or limited rainfall, the groundwater levels remain similar. However from July – November the groundwater level in MW6 is significantly lower, decreasing by ~10 meters.

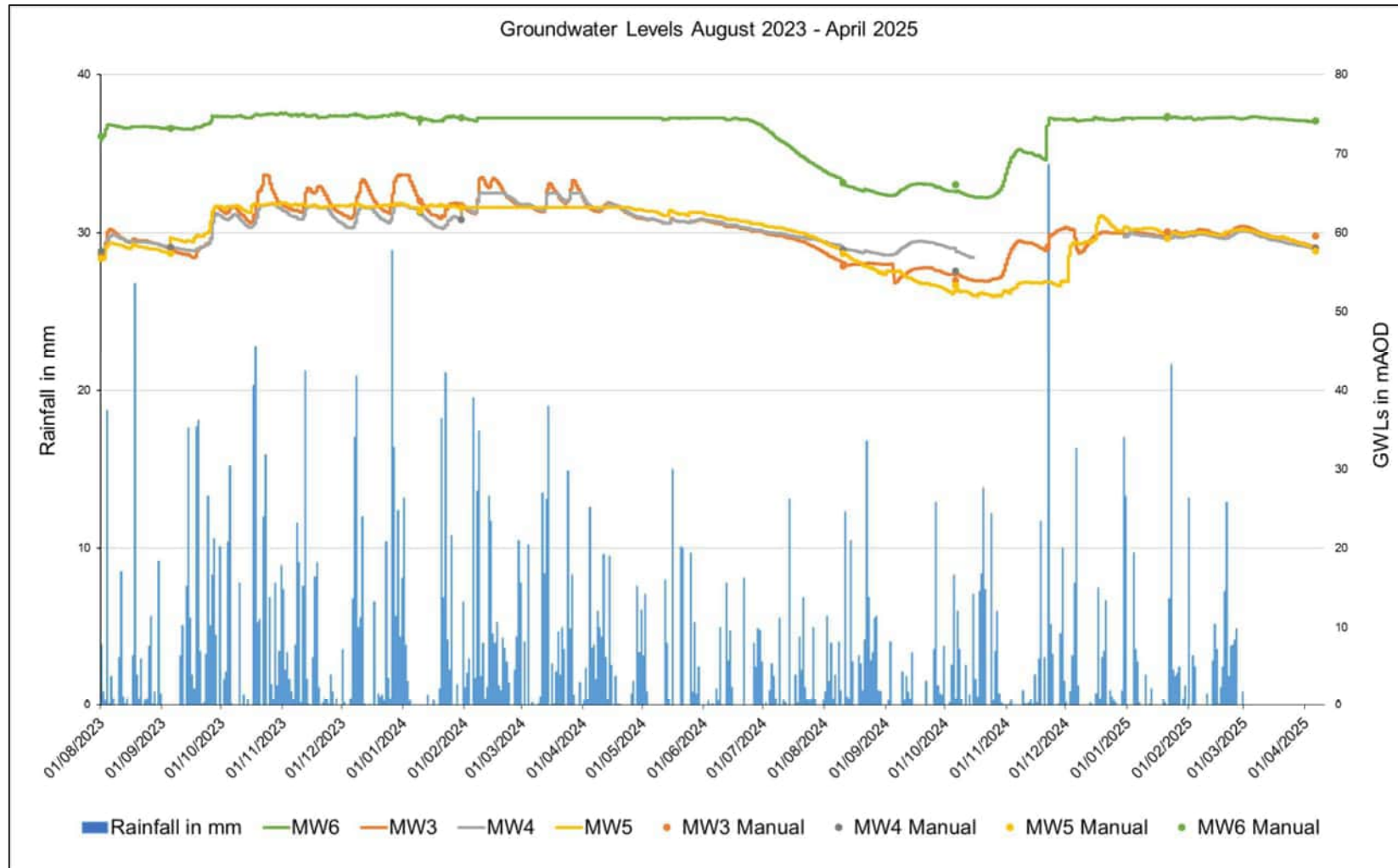
Table 7-7: Summary of groundwater level logger data (August 2023 – April 2025)

		MW3	MW4	MW5	MW6
Strata			Limestone	Limestone	Limestone
mAOD	Minimum	53.59	56.85	51.90	64.42
	Average	60.59	60.94	60.09	72.51
	Maximum	67.34	65	63.85	75.20
m	Range	13.76	8.15	11.95	10.78

Table 7-8: Summary of manual groundwater levels (August 2023 – April 2025)

	Units	MW3	MW4	MW5	MW6
Min	m AOD	53.97	55.17	53.36	66.06
Max	m AOD	64.01	62.63	63.14	74.73
Range	m	10.04	7.46	9.78	8.67

Chart 7-1: Groundwater levels at on-site boreholes and on-site rainfall



Groundwater Quality

Groundwater Quality Methodology

- 7.117 Groundwater quality monitoring was carried out on 5th August 2023, 11th January 2024 and 8th October 2024. The samples were collected by SLR personnel. A Waterra pump and tubing were used to pump water from depth in the borehole and ensure that recent surface water inflow was not collected. Each borehole was purged of three well volumes prior to taking the groundwater sample. Where the groundwater level was too deep to use the pump, the well was sampled using a bailer.
- 7.118 The samples were collected in the appropriate sample containers, which are supplied by the laboratory for the required analysis. Sample containers were filled so that there was minimum free air space. The containers were securely sealed so that there was no loss of volatile components such as moisture and no separation of components. All sample containers were clearly and uniquely labelled with details including ID and sampling date.
- 7.119 All samples were placed into a cooler box with ice packs to maintain a temperature at 5°C ± 3°C. The analysis required for each sample was listed on the Chain of Custody Record which accompanied samples. The samples were analysed at the ALS laboratories.
- 7.120 The following parameters were tested for on each water sample:
- Inorganics: Ammoniacal Nitrogen as N Low Level, Ammoniacal Nitrogen as NH₃ Low Level, Ammoniacal Nitrogen as NH₄ Low Level, Cyanide Free Low Level, Cyanide Total Low Level, Conductivity, Chloride, Fluoride, Nitrate as NO₃, Nitrite as NO₂, pH, Phosphate (Orthophosphate as P), Sulphate, Sulphide, Alkalinity Total as CaCO₃ and Total Oxidised Nitrogen as N.
 - Filtered (Dissolved) Metals: Aluminium, Arsenic, Barium, Boron, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Mercury, Nickel, Phosphorus, Potassium, Selenium, Sodium, Vanadium and Zinc.
 - Unfiltered Metals: Aluminium, Magnesium and Manganese.
 - Microbiological: *Escherichia coli* (*E.coli*) and Total Coliforms
 - Phenols, Volatile Organic Compounds (VOCs), Total petroleum hydrocarbons (TPHs) and Extractable Petroleum Hydrocarbons (EPHs), Polyaromatic Hydrocarbons (PAHs)
- 7.121 Field record sheets were completed for each round of sampling and these sheets are included in **Appendix 7-D**.

Groundwater Quality Results

- 7.122 The results were compared against several screening criteria, including SI No 366 of 2016 (GW Regs), SI No 122 of 2014 (DW Regs), and EPA IGVs, in that order, see **Appendix 7-E**.
- 7.123 The results compared against assessment criteria are presented in **Table 7-16: Groundwater Quality (5th August 2023)**
- 7.124 Phenols, VOCs, TPHs, EPHs and PAHs are only reported if detected or exceedances occur. Across the three monitoring rounds, exceedances for TPHs, VOCs or EPHs were only reported for the August 2023 round.
- 7.125 There was no visual or olfactory evidence of contamination during monitoring. Phenols, VOCs, TPHs, EPHs and PAHs were detected in MW3 in August 2023 however, no further exceedances were noted in MW3 or any other monitoring location in the other monitoring rounds.

- 7.126 The most exceedances were observed in August 2023, mostly in MW3. In MW3, during the Q3 monitoring round, the following exceedances were reported: Ammoniacal Nitrogen as N (Low level) and Ammoniacal Nitrogen Low as NH₃, Manganese (unfiltered), total aliphatics & aromatics >C5-C35(aq), *E.coli*, total coliforms, phenanthrene and Benzo(a)pyrene as well as a few parameters exceeding the laboratory limit of detection (LOD).
- 7.127 In MW4, nitrite exceeded the EPA IGVs during the Q1/Q2 2024 monitoring round. In MW3, MW4 and MW5 manganese (total unfiltered) exceeded the DW Regs in all three rounds and it also exceeded the DW Regs in MW6 in Q1/Q2 2024. In MW3, MW4 and MW6, *E.coli* and total coliforms exceeded the DW Regs in all three monitoring rounds and in MW5 during Q1/2 and Q3/4 2024 monitoring rounds.
- 7.128 Borehole MW6 experienced the fewest exceedances of all four boreholes and is located in the northwest area of the site. It is upgradient of the quarry and away from the current working areas of the quarry.

Surface Water - Hydrology

Surface Water Bodies

- 7.129 Surface water bodies in the area are shown in **Figure 7-3**.
- 7.130 The BALLYGLASS_010 stream is located c. 1.1km northwest of the entrance of the quarry. This river flows from the Cuilleenirwan Lough / Coolagarry Lough in a south-westerly direction west of the site where it joins with the River Suck (SUCK_0130).
- 7.131 The River Suck then flows in a south to southeasterly direction until it eventually reaches the River Shannon c. 21km southeast of the proposed application area.
- 7.132 The Cross River (CROSS (ROSCOMMON)_010) is located c. 2km northeast of the proposed site which flows in a southeasterly direction until it also joins the River Shannon c. 15km southeast of the site.
- 7.133 Feacle Lough pNHA, Corkip Lough SAC, Lough Croan Turlough SAC/SPA/pNHA, as well as Cuilleenirwan Lough / Coolagarry Lough, are all turloughs located within 5km of the application site.
- 7.134 The closest turlough is Feacle Lough, located approximately 550m southeast of the site (reference IE_GSI_Karst_40K_949). Cuilleenirwan Lough located approximately 1.4km northwest of the site (reference IE_GSI_Karst_40K_948). Corkip turlough is located approximately 2km southeast of the site (IE_GSI_Karst_40K_950). A traced underground connection between Corkip turlough and Killeglan Spring to the southeast was confirmed by the GSI.

Catchment

- 7.135 The site is located in the lower mid-east region of the Upper Shannon (Suck) Catchment (ID 26D) by the border of the Upper Shannon Catchment (ID 26G). The Upper Shannon (Suck) Catchment (ID 26D) has an area of 1,598km².
- 7.136 The catchment encompasses the region drained by the River Suck and all tributary streams eventually flow into the River Shannon.
- 7.137 In terms of local catchments under the WFD, the quarry is situated in the Suck_SC_090 Sub Catchment (ID 26D_5) and on the border of the Shannon[Upper]_SC_100 Sub Catchment (ID 26G_2). The quarry is located in the BALLYGLASS_010 River Sub-Basin. The southern border of the quarry is located on the cusp of the KILLEGLAN_010 River Sub-

Basin and the eastern border of the quarry is on the cusp of the CROSS (ROSCOMMON)_020 River Sub-Basin, see **Figure 7-1**.

Flooding and Flood Risk

- 7.138 Flood risk at a particular location can be from a number of sources, or combination of sources, including fluvial, groundwater, pluvial and coastal flooding, as well as from other sources such as reservoirs, artificial waterways and foul drainage systems.
- 7.139 The Office of Public Works (OPW) is the government agency with statutory responsibility for flooding in Ireland. The OPW produced two national datasets for flooding, the Catchment Flood Risk Assessment and Management (CFRAM) maps and National Indicative Flood Mapping (NIFM) maps for the preliminary assessment of flood risk. The CFRAM maps are more detailed, and cover areas identified as being at significant risk of flooding, which are mainly urban areas. The NIFM maps cover predominantly rural areas where the catchment area to the stream is greater than 5km² and not covered by CFRAM. Due to the national scale the NIFM mapping only provides an indication of areas that may be prone to flooding, the mapping detail is not necessarily locally accurate and should not be used as the sole basis for defining the Flood Zones nor for making decisions on planning applications.
- 7.140 CFRAM maps are not available for the site due to its rural location. The closest NIFM modelled stream to the site is the Ballyglass River located northwest of the site and is prone to local flooding; the closest modelled flood extent to the site is approximately 2km to the west of the site. Based on the available OPW flood mapping it is concluded that the site is at a low risk of fluvial flooding.
- 7.141 Groundwater flooding is caused when the water table rises up above ground level, causing flooding to occur at the surface. Such groundwater flooding tends to be seasonal occurring after seasonally higher rainfall. Rainfall infiltrates into the ground causing the groundwater level to rise and where it rises above the ground surface then groundwater flooding occurs. According to the Geological Survey of Ireland (GSI) groundwater flooding probability maps the site is at a low risk of groundwater flooding.
- 7.142 Given the distance of the site from the sea and its elevation above Mean Sea level, the site is not at risk of coastal flooding.
- 7.143 The site is not located within the OPW Arterial Drainage designated 'benefiting lands'. Benefitting lands are lands benefiting from works undertaken as part of the Arterial Drainage Scheme. The OPW have a statutory duty to maintain Arterial Drainage Schemes.
- 7.144 The OPW records of historical flooding events indicate six recurring flooding events identified by the within 5km of the site at Cam.
- 7.145 Four of the recorded recurring flood events relate to known Turloughs:
- Cuilleenirwan Lough turlough rises to c. 1.5 m above field level during the winter months when groundwater levels are elevated. There is a recurring flooding site close to the Cuilleenirwan Lough, c. 1.6 km north/northwest of the site, called Ballinteleava which is described as being a low-lying area that floods every winter. The road and a property in the area is liable to flooding;
 - Lough Croan turlough has an area of c. 106.9 ha and is located c. 2.6km north of the application site;
 - Feacle Lough turlough is a designated pNHA, is located c. 1.3km southeast of the site and has an area of approximately 15.7 ha.;
 - Corkip Lough turlough is located c. 3.7km southeast of the quarry at Cam.

- 7.146 The other two recurring flooding sites were identified by Roscommon County Council as sites that flood regularly as a result of the River Suck. One such area is located along the Ballyglass river c. 3km southwest of the site and the other area is located in a field in Dysert, c. 3.8km northwest of the site.
- 7.147 To date there has been no discharge of water from the existing quarry site to the Ballyglass River. The revised extraction depth removes the need for any off-site water discharge and any associated increased risk of flooding at the Ballyglass River.

Water Framework Directive

- 7.148 A Water Framework Directive (WFD) Assessment report has been prepared to support the Planning Application and EIAR for the proposed development and the full report is provided in **Appendix 7-I**. In summary, the report includes three stages, a screening stage, a scoping stage and an assessment stage.
- 7.149 The WFD assessment includes information from the EIAR for the planning application, which includes a Hydrogeological report, a borehole ground investigation and groundwater monitoring. In addition, a baseline aquatic survey has been undertaken in SW2. An Appropriate Assessment Screening and Natura Impact Assessment Report has also been prepared for the proposed development.
- 7.150 A zone of influence was taken to be a 15km radius from the site boundary. The assessment identified eight potential receptors: Ballyglass River, River Suck, Cuilleenirwan Lough Turlough, Killeglan Public Water Supply (PWS) or Killeglan River Sub Basin, Corkip Lough SAC and Feacle Lough pNHA (Turloughs), River Shannon And Suck South groundwater body (GWB).
- 7.151 In terms of hydrological links between the proposed development and the identified WFD receptors it is considered that:
- i. there is no direct hydrological pathway between the proposed development and the adjacent surface water courses as there is no abstraction of surface water or discharge to surface watercourses for the existing development. As of 2026, there is no discharge to the Ballyglass River and with the revised extraction depth, there will be no need for any off-site water discharge, hence, there is, and will not be, any direct hydrological pathway between the two;
 - ii. there is no direct hydrological pathway between the proposed extraction and the bedrock aquifer as the extraction will not intersect the underlying aquifer;
 - iii. there is a direct hydrogeological pathway via the shallow groundwater in the epikarst which feeds the majority of turloughs in the area;
 - iv. there is direct hydrogeological link pathway via the groundwater underlying the site and the Killeglan Spring as demonstrated by OGE in their report. They found that the ground water below the site discharges to both the Killeglan Spring catchment and the Cross River (Corkip Lough); and
 - v. there is an indirect hydrological pathway between the proposed development and the River Suck SAC and NHA or the River Shannon via the shallow groundwater in the epikarst and the adjacent surface water courses.
- 7.152 Mitigation measures will be embedded within the proposed development to protect surface water and groundwater and the identified WFD receptors. The measures for the proposed development will be secured via any future planning permission and associated conditions relating to an approval.
- 7.153 Based on the findings from the WFD screening, scoping and assessment, it is considered that the proposed development, with the embedded mitigation measures in place, will not

result in a deterioration of the existing status of the identified WFD receptors and it will not be a factor in the receptors failing to achieve their status objectives.

Surface Water Biological Quality in the Cross River and River Suck : Q Values

- 7.154 The surface water quality data of surface water bodies within the study area, was obtained from EPA web map. The EPA has registered surface water monitoring stations through Ireland, which are continuously recording near real time river ecology monitoring results. The results are presented through “Q” values, that are reflecting average water quality at any location. These values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates (the young stages of insects primarily but also snails, worms, shrimps etc.) resident at a river site. Results scores are in range from Q1 to Q5, from the lowest (Q1) to the highest (Q5) water quality rating.
- 7.155 The closest monitoring station to the site is Br E of Eskerbaun located c. 4.5km east of the application site on the Cross River. The monitoring station is located downstream of CROSS (ROSCOMMON)_010 which is located c. 2.5km northeast of the site.
- 7.156 The latest water quality reports a 3-4 Q value, meaning that the river is moderate, slightly polluted and in unsatisfactory condition. There has been no change in status since the last monitoring round in 2020. Table 7-9 summarises the monitoring station data.

Table 7-9: Cross River EPA Biological Water Quality Ratings

Station ID	RS26C100060
Station Name	Br E of Eskerbaun
Watercourse	CROSS (ROSCOMMON)_010
Distance	c. 4.5km east of site
Year	Q Value
2002	3-4
2006	3-4
2009	3
2014	3
2017	3
2020	3-4
2023	3-4

- 7.157 The Ballyglass rivers runs in a south-westerly direction to the west of the site where it joins the River Suck. The nearest monitoring station on the River Suck is the SUCK - Bridge W. of Feevagh located c. 7.9km southwest of the site.
- 7.158 The area along the River Suck received a 4 Q value in the most recent river Q survey (2005) which defines the river as good, unpolluted and in satisfactory conditions.
- 7.159 As there is no recent data past 2005, another monitoring station downstream of the River Suck and Ballyglass River (Bellagill Bridge c. 12.2km south of the site) was also investigated. This EPA station undertook a more recent river Q survey in 2024, where a 3-4 Q value was reported so the river was in a moderate, slightly polluted and unsatisfactory condition.

Table 7-10: River Suck EPA Biological Water Quality Ratings

Station ID	RS26S071100
Station Name	Bellagill Bridge
Watercourse	SUCK_130
Distance	c. 12.2 km south of site
Year	Q Value
2002	4
2005	4
2008	4
2011	4
2014	4
2017	4
2020	4
2023	4
2024	3-4

Surface Water Biological Quality in the Ballyglass River: Q Values

- 7.160 There is no published biological water quality information available for the Ballyglass River so two rounds of monitoring were undertaken in March and July 2025. Three biological quality samples were taken from the Ballyglass River to characterise the existing baseline water quality; One sample was taken in March 2025 and two samples were taken in July 2025, see **Appendix 7-G**.
- 7.161 The March 2025 sample was taken at SW2 as it was not possible to safely access the river at location SW1 at the time. The two samples taken in Julys 2025 were from locations SW1 and SW2; see **Figure 7-3** for the sampling locations.
- 7.162 The primary aim of the biological study is to provide an assessment on the indicative biological water quality in the Ballyglass River.
- 7.163 The July 2025 samples were taken at a favourable time of the year for biological monitoring and during lower flow conditions in the stream. It is considered that all due care and attention to the sampling, sorting and the identification of organisms has been made to ensure that all taxa collected are representative of the macroinvertebrate communities present, at all the sites sampled, at the time of the survey.
- 7.164 The macroinvertebrate were identified to a family and where possible, at the species level also. However, it should be noted that for some macroinvertebrate, their genus and species are unidentifiable without the use of a microscope.
- 7.165 It should be noted that the assessment of biological water quality here is based on a single set of samples and therefore does not consider annual seasonal variation that may occur in the macroinvertebrate assemblage at the sampling locations. However, as macroinvertebrates are better short-term (i.e. in any one year) water quality indicators than would otherwise be achieved by physiochemical water quality analysis, they provide a robust overview of the prevailing water quality conditions at a site. They can also be used comparatively for inter-annual water quality comparison as applied in the current reporting.
- 7.166 The samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide using a 2-minute kick sample, as per Environmental

Water (Hydrology & Hydrogeology) 7

- Protection Authority (EPA) methodology (Feeley *et al.*, 2020). Large cobbles were also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley *et al.*, 2020). Samples were converted to Q-ratings as per Toner *et al.* (2005) and assigned to WFD status classes, see **Table 7-11**. This system has been adopted by the EPA and therefore allows a comparison to be made on the results in context to national standards and in accordance with the Water Framework Directive (WFD).
- 7.167 All organic matter, woody debris and stones were returned to water once invertebrate specimens were separated. Invertebrates were identified to family level and or species level where possible.
- 7.168 The Q rating is determined by the presence and diversity of invertebrate groups from Group A (clean water indicator species) through to group E (most pollution tolerant group & indicative of very poor water quality).
- 7.169 The EPA classification groups, i.e. from group A through to group E, are set out in Appendix 1 of Toner *et al.* (2005). **Table 7-11** below shows a summary of the Q-rating system relative to invertebrate indicator groups and associated pollution tolerances. The sample community representation of groups of various pollution tolerances assigns a Q-Rating to indicate WFD status as shown in **Table 7-12** below.
- 7.170 The biological survey was conducted by Ms Michelle Sherry, a Graduate Hydrogeologist from SLR. Michelle has a BSc in Environmental Bioscience with a focus on surface water monitoring and reporting.

Plate 7-1: The sampling location for the Ballyglass River Q survey (SW2) March 2025



Table 7-11: Q-Rating System and Invertebrate Indicator Groups

Q-Value	Water Quality & Invertebrate Indicator Groups (EPA)
Q5	Pristine. A good diversity of EPA group A stoneflies & mayflies should be present. High quality indicator cased caddis also normally present. EPA group C few in numbers with very limited or absent EPA group D and E invertebrates.
Q4	Unpolluted. At least one EPA group A stonefly and or mayfly present in reasonable numbers. Group B invertebrates few to numerous (i.e. Leuctrid stoneflies, cased caddis & narrow bodied Baetid mayflies (i.e. excluding <i>Baetis rhodani</i>).
Q3-4	Slightly Polluted. Group A invertebrates present, but diversity typically restricted to a single taxon in lower numbers. EPA group B taxon present, but with EPA group C invertebrates dominating the sample composition.
Q3	Moderately Polluted. No EPA group A invertebrates present. Few or absent EPA group B species present. EPA group C invertebrates dominant with smaller numbers of group D and E pollution tolerant invertebrates present.
Q1, Q1-2, Q2	Seriously polluted. Clean water EPA groups A and B absent. Few or absent EPA group C invertebrates. Class D dominant but being replaced by higher numbers of Class E (heavy pollution) indicator species at Q1 (lowest water quality class).

Table 7-12: Q-Rating and Assigned WFD Status

Q Value Quality Rating	WFD Description and Pollution Status
Q5, Q4-5	High (Pristine)
Q4	Good (Unpolluted)
Q3-4	Moderate (Slightly polluted)
Q3, Q2-3	Poor (Moderately polluted)
Q2, Q1-2, Q1	Bad (Seriously polluted)

7.171 The abundances of organisms present in each sample were measured as follows: Present (1 or 2 individuals); Scarce/Few (<1%); Small Numbers (<5%); Fair Numbers (5-10%); Common (10-20%); Numerous (25-50%); Dominant (50-75%); and Excessive (>75%).

March 2025 Q Survey Results

7.172 The macroinvertebrates were grouped according to their pollution sensitivity. The sample composition at the SW2 location on the Ballyglass River was dominated by *Baetis rhodani* (mayflies), *Gammarus duebeni* (freshwater shrimp) which are both Group C. The sample also featured a fair percentage of pollution tolerant *Asellidae* (Group D) and of clean water sensitive cased caddisfly of the *Hydropsychidae* family, which are Group B. The results for each of the sampling sites are provided in **Appendix 7-G** and summarised in **Table 7-13**.

7.173 The results indicated that the Ballyglass River has Q value of **Q3-4** which is of Moderate Status, indicating the river is slightly polluted.

7.174 Note that for some macroinvertebrates, in this case *Oligochaeta* and *Chironomidae*, their genus and species are unidentifiable without a microscope. The macroinvertebrates in this survey were identified on site and hence, cannot be placed in a specific EPA Group.

July 2025 Q Survey Results

- 7.175 The macroinvertebrate taxonomic composition, including an abundance for each taxonomic family was grouped according to their pollution sensitivity. The results for each of the sampling sites are shown in Appendix 7-G Table 7-20.
- 7.176 The sample composition at sites SW1 supported a small number of good water quality indicator species (i.e. second highest water quality indicator group B (Appendix 7-G Table 7-20). The sample was represented by the clean water indicator (EPA group B) cased caddisfly of the Limnephilidae family. The cleaner water indicator species (i.e. EPA Group B taxa) were also present at the site SW2 in the form of mayfly (*Baetis muticus*) and cased caddisfly (*Sericostoma personatum*), see Appendix 7-G Table 7-20.
- 7.177 However, sample SW1 was dominated by EPA Group E, blood worms (*Chironomus spp.*) and SW2 was dominated by EPA Group C, *Gammarus duebeni* freshwater shrimp. Both sites featured low numbers of pollution tolerant EPA Group D species, *Asellus aquaticus*), Appendix 7-G Table 7-20.
- 7.178 Both sites did not support any EPA group A taxa and SW1 displayed a wider biodiversity of taxa number and abundance compared to SW2. As a result, SW2 scored a lower Q value despite featuring some good quality species such as mayflies and cased caddisfly.

Biological Q Survey Findings

- 7.179 The results of the biological sampling are set out in Table 7-13 below. The results indicate that the Ballyglass river at the sample locations is Slightly Polluted to Moderately Polluted and of Moderate Status to Poor Status.
- 7.180 The results for the biological water quality assessment made in July 2025 indicates that the quality of water along the Ballyglass River is of Poor status. The SW1 location water quality was deemed to be moderately polluted (Q2-3) and the SW2 location decreased in water quality from being Slightly Polluted (Q3-4) in March 2025 to Moderately Polluted (Q3) in July 2025. The decrease in the diversity and abundance of EPA Group A and B clean water indicator species in the July 2025 monitoring round accounted for the deteriorated water quality at survey site SW2.
- 7.181 Under the WFD, the Ballyglass River is assigned as under review and has not yet received a risk status. The surrounding lands of both SW1 and SW2 are all agricultural pastures and SW2 displayed evidence of bank and channel disturbance as a result of livestock poaching. The water quality pressures to the Ballyglass River at SW2 appear to be from agriculture.
- 7.182 The variations in recorded water quality at SW2 between March and July 2025 are likely to be as a result of seasonal conditions during sampling. The optimum time of year for biological sampling for water quality is May to September.

Table 7-13: Biological Water Quality Results for the Ballyglass River

Parameter	SW2 (March 2025)	SW1 (July 2025)	SW2 (July 2025)
Q-Rating	Q3-4	Q2-3	Q3
WFD Pollution Status	Slightly Polluted	Moderately Polluted	Moderately Polluted
WFD Status	Moderate Status	Poor Status	Poor Status

Surface Water Sampling

- 7.183 Surface water sampling was undertaken at two locations on the Ballyglass River to the west of the site in August 2023, January 2024, October 2024, July 2025 and September 2025.

- The surface water field record sheets are included in **Appendix 7-D** and the screened results are shown in **Appendix 7-H, Table 7-22**
- 7.184 During the July 2025 round of quality sampling an additional water sample (SW3) was taken from the River Suck at Derrycahill Bridge, which is downstream of the Ballyglass River. Derrycahill Bridge is at ITM GR E582521, N742463.
- 7.185 During the September 2025 round of quality sampling an additional water sample was taken from the sump at Cam Quarry for comparison.
- 7.186 Sampling locations SW1 and SW2 are situated on the Ballyglass River. SW1 is located along the R363 approximately 1.6km west of the site and SW2 is located c. 2.8km downstream of SW1, see **Figure 7-3**. SW2 is located upstream from the EPA monitoring station on the Suck River mentioned above (Bridge W. of Feevagh). This station has been monitored since 1983; however, the most recent Q survey was undertaken in 2005 and from other EPA stations located downstream from this station (i.e. Bellagill Bridge), it can be seen that water quality has deteriorated since 2005.
- 7.187 These sample points are safe, with ease of access. These are grab sampling points only and a telescopic grab sampler was used to collect samples.
- 7.188 The samples were collected in the appropriate sample containers, which are supplied by the laboratory for the required analysis. Sample containers were filled so that there was minimum free air space. The containers were securely sealed so that there was no loss of volatile components such as moisture and no separation of components. All sample containers were clearly and uniquely labelled with details including ID and sampling date.
- 7.189 All samples were placed into a cooler box with ice packs to maintain a temperature at $5^{\circ}\text{C} \pm 3^{\circ}\text{C}$. The analysis required for each sample was listed on the Chain of Custody Record which accompanied samples. The samples were analysed at ALS laboratories.
- 7.190 The following parameters are tested for:
- Metals (Filtered): Aluminium, Arsenic, Barium, Boron, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Mercury, Nickel, Phosphorus, Potassium, Selenium, Sodium and Vanadium.
 - Metals (Unfiltered): Aluminium, Magnesium and Manganese.
 - Inorganics: Alkalinity, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Phosphate (Ortho as P), pH, Total Suspended Solids and Total Oxidised Nitrogen as N.
 - Speciated Extractable Petroleum Hydrocarbons Criteria Working Group (EPH CWG).
 - Volatile Organic Compounds (VOCs) and Total Petroleum Hydrocarbons CWG (TPH CWG)

Surface Water Quality

- 7.191 The surface water quality monitoring were screened against the Environmental Quality Standards (EQS) for Inland Surface Water SI No. 272 of 2009 and SI No. 77 of 2019. The laboratory results are presented in **Appendix 7-F** and the screened results are presented in **Appendix 7-H, Table 7-22: Surface Water Quality Results Screened**.
- 7.192 For all four monitoring rounds all hydrocarbons and volatiles were reported at less than detection limit. During the 8th August 2023 round (Q3/Q4 2023) and the 8th October 2024 (Q3/Q4 2024) monitoring rounds, SW1 exceeds the High status (≤ 1.3) and Good status (≤ 1.5) mean MAC value for BOD at a value of 2.36 mg/l and 2.04 mg/l, respectively.

- 7.193 Total Suspended Solids in SW1 during Q3/Q4 2023 and Q3/Q4 2024 were significantly higher than in SW2.
- 7.194 In Q3/Q4 2023, SW1 exceeded the High status mean of 10 µg/l for Phosphorus at a value of 12.2 µg/l. In Q3/Q4 2024, the High and Good status (25 µg/l) for Phosphorus at a value of 31.2 µg/l in SW1 and at a value of 22.1 µg/l.
- 7.195 The water quality results for the Ballyglass River in July and September were below the surface water EQS for all parameters.
- 7.196 The water quality at SW3 (Derrycahill Bridge) on the River Suck in July 2025 was below the surface water EQS for parameters. The Alkalinity was higher at SW3 than SW1 or SW2 (Ballyglass River) during this round of monitoring and this reflects the limestone geology and catchment size at SW3 compared to the sample locations on the Ballyglass River, see Appendix 7-H, **Table 7-22**.
- 7.197 A water quality sample was taken from the quarry sump in September 2025 to provide baseline water quality for the surface water runoff / groundwater in the sump. The water quality from the sump reflects the geological conditions at the quarry and the mix of surface water and groundwater present in the sump; elevated parameters include TON, Mg, B, Ni and Se.

Protected Areas

- 7.198 The following Natura 2000 sites (SAC or SPA) are within 5km of the site.
- Ballynamona Bog and Corkip Lough SAC (002339), c. 2km southeast of the proposed development.
 - Lough Croan Turlough SPA (004139) and Lough Croan Turlough SAC (000610), located c.3.1km north of the proposed application site.
 - Killeglan Grassland SAC (002214), located c. 3.25km southwest of site
 - Castlesampson Esker SAC (001625), located c. 3.6km southeast of site
 - River Suck Callows SPA (004097), located c. 4.6km west of site
- 7.199 There are four pNHA and NHA sites within 5 km of the site.
- Lough Croan Turlough pNHA (000610), located c. 3.1km north of site
 - Castlesampson Esker pNHA (001625), located c. 3.6km southeast of site
 - Suck River Callows NHA (000222), located c. 4.6km west of site
 - Feacle Turlough pNHA (001634), located c. 550m southeast of site

Water Environment Receptors

- 7.200 From the baseline study undertaken here, the following water environment sensitive receptors have been identified in the receiving environment:
- Local rivers and streams (moderate WFD status, at risk);
 - Regionally important karstic aquifer, within Suck South Groundwater Body (good WFD status, not at risk);
 - Corkip Lough SAC (002339 and Feacle Lough pNHA (001634) which are both turloughs influenced by the groundwater levels in the area.

Water (Hydrology & Hydrogeology) 7

- Private and Public Scheme groundwater supply wells;
- River Suck Callows SPA (004097) and NHA (000222), located c. 4.6km west, which is in confluence with the Ballyglass river located c. 1.1km northwest; and
- River Shannon Callows SAC/pNHA (000216) / Middle Shannon Callows SPA (004096), downstream of both the River Suck and Cross River.

7.201 For each identified receptor, the significance and sensitivity of the receptor is assessed in **Table 7-14** below and a rating (High / Medium / Low / Negligible) applied, based on the methodology outlined in existing guidance and reproduced in **Appendix 7-K**.

Table 7-14: Existing Environment - Significance and Sensitivity / Importance

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance / Sensitivity Rating (H / M / L / N)
1	Local Rivers and Streams	Surface watercourses Ballyglass river and Cross River location within c. 2km of site. Site is within Upper Shannon (Suck) Catchment (ID 26D)	Ballyglass river has a Good WFD status and is under review. Cross River is Moderate WFD status and at risk. High degree of interaction between surface water and groundwater due to numerous karst features (e.g. turloughs, swallow holes, springs etc). surface and groundwater quality are closely linked.	Medium – Attribute has a medium quality or value on a local and regional scale due to regionally important karstic aquifer
2	Regionally important karstic aquifer	Located within the Suck South Groundwater Body (GWB)	All GWBs received 'Good Status' 2016-2021.	High - Attribute has a high quality or value on a local scale (Regionally Important Aquifer)
3	Corkip Lough SAC and Feacle Lough pNHA turloughs	The turloughs are fed by groundwater. In wintertime, when groundwater levels rise, the turloughs fill with water.	The groundwater levels under the turloughs may be affected if groundwater levels under the site are affected.	High - Attribute has a high quality or value on an international (SAC & SPA status) and regional scale (pNHA status)
4	Private and Public Groundwater Supplies	Most local residents are assumed to have a private water supply or via Killeglan PWS. Other nearby public water supplies identified by GSI.	The private wells will supply many homes in the local area and may be sensitive to changes at the local scale.	High - Outer source protection area for regionally important water source. Regionally important potable water source supplying >2,500 homes SPZ within site boundary along southern border of existing quarry. PWS supply located south of site
5	River Suck Callows SPA	Downstream surface watercourse,	The River Suck has a Good WFD status and is	High - Attribute has a high quality or value on an

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance / Sensitivity Rating (H / M / L / N)
	(004097) and NHA (000222)	confluence c. 4.6km west of site.	not at risk of meeting targets by 2027.	international (SAC & SPA status) and regional scale (NHA status)
6	River Shannon Callows SAC/pNHA (000216) / Middle Shannon Callows SPA (004096)	River Shannon is located downstream from River Suck and Cross River	The confluence where the River Suck and the River Shannon meet is of Moderate WFD status (2016-2021) and is under review. The confluence where the Cross River and the River Shannon meet is of Poor WFD status (2016-2021) and is at risk.	High - Attribute has a high quality or value on an international (SAC & SPA status) and regional scale (pNHA status)

Receiving Environment - Baseline Summary

- 7.202 The site is underlain by undifferentiated limestone known as Visean Limestones. The soils surrounding the quarry site are both, fine loamy drift with limestone stones known as the Rathowen (1030RA) and coarse loamy over calcareous gravels known as Baggotstown (1150BG) Soil Association.
- 7.203 The GSI online map viewer shows the site is underlain by a regionally important karstic aquifer (Rkd). This aquifer is defined as being a good aquifer capable of supplying regionally important supplies e.g. large public water supplies, see **Figure 7-2**. The aquifer has an area of 1,099 km².
- 7.204 The site is within the Water Framework Directive (WFD) Suck_SC_090Sub Catchment (ID 26D_5) and the BALLYGLASS_010 River Sub-Basin catchment.
- 7.205 The closest surface water body to the site is the Ballyglass river located to the northwest of the site.
- 7.206 Under the WFD classification, the River Suck is of Good WFD status and 'Not At Risk' and the Ballyglass river is classified as being of 'Good' WFD status and is 'Under Review'.
- 7.207 There is no risk of potential flooding within the site. Previous recurring flooding events, known as turloughs, have been identified within 2km of the proposed development area. The closest flooding event is the Cuilleenirwan Lough turlough, c. 1.4km north/northwest of the site boundary.
- 7.208 The proposed development is located within the Suck South Groundwater Body (GWB). The groundwater flow in this aquifer is expected to be close to the surface through karstic conduits and enlarged fissures, mainly along fault zones. This GWB is bordered by twelve other GWBs. All of these GWBs, including Suck South GWB, received a Good WFD status during the 2016-2021 period. The Suck South GWB is considered to be Not At Risk. All of the surrounding GWBs are considered Not At Risk or deteriorating in quality except for the GWDTE-Rahasane Turlough (SAC000322) GWB.
- 7.209 The groundwater vulnerability at the site is classed as High.
- 7.210 There is the Killeglan Public Scheme Source Protection Area which exploits the Tobermore Spring, is located along the southern border of the existing quarry and abstracts

- approximately 7,000 m³/day. There is no group water supply source protection area within the vicinity of the proposed site. The closest Group Water Scheme (GWS) Source Protection Area, Lowville No. 1, is located c. 15.5km southwest of the site. The Cam area is within the Uisce Éireann South Roscommon Regional Water Supply Scheme supply zone for Killeglan.
- 7.211 There are four groundwater monitoring well locations on site, see **Figure 7-6: Groundwater Body Map**
- 7.212 SLR monitor these wells for groundwater levels, groundwater quality and for data loggers. There are eleven other boreholes present on site that were drilled between June 2003 and May 2004 but they have been labelled as not viable for monitoring purposes.
- 7.213 Between 2023 and 2025, significant variations have been observed in all four monitoring wells. Since monitoring began, the largest variation in groundwater levels is in MW03 with a range of 13.76m, a maximum groundwater level of 67.34m AOD and a minimum groundwater level of 53.59m AOD. The least variation was seen in MW4 with a range of 8.15m, a maximum groundwater level of 65m AOD and a minimum level of 56.85m AOD.
- 7.214 Groundwater levels are generally highest at MW6, which is located in the north-west of the quarry and lower in MW3, MW4 and MW5. This indicates a general groundwater flow direction of north-north-west to south-south-east.
- 7.215 Groundwater quality monitoring was carried out on 5th August 2023, 11th January 2024 and 8th October 2024. The results were compared against several criteria: SI No 366 of 2016 (GW Regs), SI No 122 of 2014 (DW Regs), and EPA IGVs, in that order. Across the three monitoring rounds, microorganisms and manganese (total unfiltered) exceeded regulations at MW3.
- 7.216 Surface water quality testing was also undertaken during all three monitoring rounds. All hydrocarbons and volatiles were reported at less than detection limit for all three rounds. During Q3/Q4 2023 and the Q3/Q4 2024, SW1 exceeded the High status and Good status mean MAC values for BOD. In Q3/Q4 2023, SW1 exceeded the High status mean for Phosphorus and in Q3/Q4 2024, phosphorus exceeded the High and Good status for Phosphorus SW1 and SW2.

Impact Assessment

Evaluation Methodology

- 7.217 The potential direct and indirect impacts to surface water and groundwater associated with the proposed continuance of use of all previously permitted development at Cam Quarry are initially assessed in this chapter without any mitigation measures in place.
- 7.218 The methodology applied here is a qualitative risk assessment methodology in which the nature of the potential impacts are described in terms of the character, magnitude, duration, probability and consequence of the impact are considered. The terms used to describe the potential hydrological and hydrogeological impact or effects are explained in tables reproduced in **Appendix 7-L**. The cumulative impact of any potential impacts is also assessed.
- 7.219 The description of the potential impact is then screened against the significance and sensitivity of the receiving environment to establish the overall significance of the potential impact (without mitigation). The classification of the impact significance is determined using the matrix from the EPA Guidelines (2022) which is reproduced in **Appendix 7-L**.
- 7.220 This approach provides a mechanism for identifying the key areas where mitigation measures are required, and for identifying mitigation measures appropriate to the risk presented by the proposed development. Following consideration of mitigation measures (existing and proposed) an assessment of the residual impacts arising from the proposed development is provided.
- 7.221 The following sections identify the potential impacts of the proposed development on the hydrogeological and hydrological environments. It also assesses the likelihood of occurrence of each identified impact. As previously noted, the impacts are initially assessed with no mitigation or design measures incorporated to reduce the risk.
- 7.222 The potential direct and indirect impacts to surface waters and groundwater during the Construction Stage, the Operation Stage and Post Operational Stage (site restoration) are discussed below.

Construction and Operational Stage (No Mitigation)

- 7.223 As this application primarily relates to continued use of the existing permitted development, the construction and operational phases are effectively considered the same. The potential direct and indirect construction and operational stage impacts to surface waters and groundwater are discussed below. In the context of the proposed continuance of use of all previously permitted development, the construction stage is taken to comprise the installation of the previously permitted concrete batching plant on existing disturbed ground. The operational stage comprises the continued quarrying within the existed permitted area. These stages are likely to take place concurrently.

Direct Impacts

Surface Water

- 7.224 Runoff from the site has the potential to impact on surface water quality in the Ballyglass River.
- 7.225
- 7.226 The accidental leaking or spillage of fuel and/or other petroleum-based products could also impact on surface water in the Ballyglass River. .

Groundwater

- 7.227 Elevated suspended solids could impact on groundwater in the regionally important karstified bedrock aquifer.
- 7.228 The accidental leaking or spillage of fuel and/or other petroleum-based products could also impact on groundwater in the regionally important karstified bedrock aquifer. .

Indirect Impacts

Surface Water

- 7.229 Elevated suspended solids could indirectly impact on nearby rivers, streams and turloughs.
- 7.230 The accidental leaking or spillage of fuel and/or other petroleum-based products or concrete could also indirectly impact on nearby rivers, streams and turloughs.

Groundwater

- 7.231 Elevated suspended solids could indirectly impact on groundwater in the regionally important karstified bedrock aquifer could indirectly impact on local water supplies, PWS and turloughs.
- 7.232 The accidental leaking or spillage of fuel and/or other petroleum-based products or concrete could also indirectly impact on local water supplies, PWS and turloughs.
- 7.233 The evidence presented in the Hydrogeological Report (Appendix 3.4.1 in the EIS chapter in **Appendix 7-J**) is that the permeability of the bedrock aquifer relatively low. The majority of the residences in the study area have access to mains water supply. The Cam area is within the Uisce Éireann Killeglan water supply zone.
- 7.234 The extractive area of the quarry is located within the unfractured bedrock where the permeability is low.

Protected Areas

- 7.235 Any indirect impact on the local rivers and streams could impact the downstream surface water bodies, i.e. River Suck Callows SPA and NHA and River Shannon Callows SAC/pNHA / Middle Shannon Callows SPA at distance from the site.

Cumulative Effects

- 7.236 The following plans were reviewed for strategies and objectives that may act in-combination with the project:
- Roscommon County Development Plan 2022-2028.
- 7.237 There are no strategies or objectives in the Roscommon County Development Plan 2022-2028 that are likely to result in significant effects when considered in-combination with the proposed development.
- 7.238 A search of recent (within the last five years) planning applications was carried out for applications that may give rise to in combination effects with the project. A 17-turbine wind farm (Seven Hills Wind Farm) surrounding the quarry to the south, east and west (with the closest infrastructure c. 100m from the site boundary) has been granted planning permission by An Bord Pleanála in November 2023 (ABP Ref. 313750-22).
- 7.239 The wind farm may require localised, short-term dewatering at the turbine bases and any borrow pits, during construction stage. It is not considered that the wind farm will give rise to any significant adverse cumulative impacts for the water environment.

Rating of Identified Potential Impacts

7.240 The potential impacts outlined above during the construction and operational stages have been described in terms of the character, magnitude, duration, probability and consequence, and each impact is rated in terms of High (H), Medium (M), Low (L) and Negligible (N) based on the magnitude, extent, duration and consequence of the identified effects.

Significance of Impacts

The significance of impacts is based on the significance and sensitivity of the existing environment (Table 7-14 above), and the description of identified potential impacts with likely significant effects outlined in Table 7-15 below. The significance of Impact is determined from the Classification of the Significance of Impacts in Appendix 7-M.

Table 7-15: Classification of Significance of Impacts (No Mitigation)

No.	Potential Impacts	Impact Rating (No Mitigation)	Significance of Impact (No Mitigation)
Construction and Operational Stage – Direct – Surface Water			
1	Potential impact of suspended solids in surface water runoff to the Ballyglass River	Medium - Low. Potential to affect surface water quality in the Ballyglass River through run-off from the site	Moderate - Slight
2	The accidental leaking or spillage of fuel and/or other petroleum-based products could impact on surface water runoff to the Ballyglass River.	Medium. Potential to affect surface water quality in the Ballyglass River through contaminated runoff. Any leakage / spillage would be accidental only and of limited volume.	Moderate
Construction and Operational Stage – Direct - Groundwater			
3	Elevated suspended solids could impact on groundwater in the regionally important karstified bedrock aquifer.	Medium - Low. Potential to affect groundwater quality in bedrock underlying facility through vertical migration of sediment in run-off.	Moderate - Slight
4	The accidental leaking or spillage of fuel and/or other petroleum-based products could also impact on groundwater in the regionally important karstified bedrock aquifer.	Medium. Potential to affect groundwater quality in underlying karstified bedrock aquifer through vertical migration of fuels etc. Any leakage / spillage would be accidental only and of limited volume.	Moderate
Construction and Operational Stage – Indirect – Surface Water			
5	Elevated suspended solids could indirectly impact on local water courses and turloughs.	Low. Potential to affect surface water quality (suspended solids) in local water courses and turloughs, through groundwater baseflow to the watercourse. Groundwater may not be in hydraulic continuity with watercourses. Since Feacle Lough and Corkip Lough are fed by groundwater predominantly from the epikarst the proposed development is considered unlikely to significantly impact on these.	Slight
6	The accidental leaking or spillage of fuel and/or other petroleum-based products or concrete could also indirectly impact on local water courses and turloughs.	Medium - Low. Potential to affect surface water quality (fuels etc) in local water courses and turloughs, through groundwater baseflow to the watercourse. Groundwater may not be in hydraulic continuity with watercourses. Since Feacle Lough and Corkip Lough are fed by groundwater predominantly from the epikarst the proposed development is considered unlikely to significantly impact on these.	Moderate - Slight

Water (Hydrology & Hydrogeology) 7

No.	Potential Impacts	Impact Rating (No Mitigation)	Significance of Impact (No Mitigation)
7	The accidental leaking or spillage of concrete could also indirectly impact on local water courses and turloughs.	Low. Potential to affect surface water quality (concrete) in local water courses and turloughs, through groundwater baseflow to the watercourse. Groundwater may not be in hydraulic continuity with watercourses. Since Feacle Lough and Corkip Lough are fed by groundwater predominantly from the epikarst the proposed development is considered unlikely to significantly impact on these.	Slight
Construction and Operational Stage – Indirect – Groundwater			
8	Elevated suspended solids could indirectly impact on groundwater in the regionally important karstified bedrock aquifer and indirectly impact on PWS and local water supplies.	Low Potential to affect the Killeglan PWS and local supply wells through lateral migration in the bedrock aquifer. The majority of the residences in the study area have access to mains water supply. The Cam area is within the Uisce Éireann Killeglan water supply zone.	Slight
9	The accidental leaking or spillage of fuel and/or other petroleum-based products could also indirectly impact on PWS and local water supplies.	Medium – Low Potential to affect the Killeglan PWS and local supply wells through lateral migration in the bedrock aquifer. The majority of the residences in the study area have access to mains water supply. The Cam area is within the Uisce Éireann Killeglan water supply zone.	Moderate - Slight
10	The accidental leaking or spillage of concrete could indirectly impact on PWS and local water supplies.	Low. Potential to affect the Killeglan PWS and local supply wells through lateral migration in the bedrock aquifer. The majority of the residences in the study area have access to mains water supply. The Cam area is within the Uisce Éireann Killeglan water supply zone.	Slight
Construction and Operational Stage – Indirect – Protected Areas			
14	Any indirect impact on the local rivers and streams could impact the designated surface water bodies downstream, i.e. River Suck Callows SPA and NHA and River Shannon Callows SAC/pNHA /	Low. Any reduction in quality in local water bodies (suspended solids / fuel / concrete leakages) could migrate downstream and impact on designated areas. The protected areas are located at distance; the Suck River Callows is located c. 4.6km from the site.	Slight

Water (Hydrology & Hydrogeology) 7

No.	Potential Impacts	Impact Rating (No Mitigation)	Significance of Impact (No Mitigation)
	Middle Shannon Callows SPA at distance from the site.		

Water Framework Directive

- 7.241 The Water Framework Directive (WFD) assessment is based on the information outlined in this EIAR including baseline data, groundwater and surface water monitoring data for the site and the identification of sensitive receptors under the WFD and the mitigation measures outlined above. An Appropriate Assessment Screening and Natura Impact Assessment Report has also been prepared for the proposed development which identifies ecological sensitive receptors.
- 7.242 A potential zone of influence was taken to be a 15 km radius from the site boundary. The assessment identified eight potential receptors; they are:
- Ballyglass River;
 - River Suck;
 - Cuilleenirwan Lough Turlough;
 - Killeglan Public Water Supply (PWS) or Killeglan River Sub Basin;
 - Corkip Lough SAC and Feacle Lough pNHA (Turloughs);
 - River Shannon; and
 - Suck South groundwater body (GWB).
- 7.243 Mitigation measures, outlined below in relation to water, will be embedded within the proposed development to protect surface water and groundwater and the identified WFD receptors. The measures for the proposed development will be secured via any future planning permission and associated conditions relating to an approval.
- 7.244 It is considered here, that based on the nature of the proposed development, which has been operational since 2006 and with the designed embedded mitigation measures in place, that the proposed development will not result in a deterioration in the status of the identified WFD receptors or prevent them from achieving their status objectives.

Mitigation Measures

Construction & Operational Stages

- 7.245 The revised extraction depth removes the need for any off-site water discharge. Therefore, the previously proposed Water Management System, including the hydrocarbon interceptor and all associated discharge pipework along the public road to the Ballyglass River, is no longer required.
- 7.246 Any surface water falling over the site will either infiltrate naturally to the ground or will be directed to the sump on the quarry floor and used for dust suppression at the site, as required.
- 7.247 Roadstone propose to upgrade the overall effluent treatment system by decommissioning the existing WwTS and replacing it with a Secondary WwTS at the site with a constructed soil polishing filter for final treatment. The Site Characterisation form and details of the Secondary WwTS and polishing filter are included in **Appendix 7-A**. The package WwTS is designed to cater for 30 staff on site with a Population Equivalent (PE) of eight persons, based on daily hydraulic load.
- 7.248 In order to mitigate against the risk of pollution to groundwater and surface water occurring at the site the following management measures will be implemented.

- There will be no discharge off site to any surface watercourse;
- A double skinned fuel storage tank is located at the site and stands on a concrete pad area. Oil and lubricants for plant and machinery are stored on spill pallets in designated storage areas;
- A hard stand refuelling area with hydrocarbon separator for treating runoff waters is in place at the refuelling station area;
- Spill Kits and spill training has been provided. All new employees are given an induction which includes spill kit training and how to respond to a fuel spill;
- To control dust, water sprayed from a tractor drawn bowser on dry exposed surfaces and stockpiles (paved roads, unsealed haul roads and hardstand areas) will be implemented as required;
- Fixed sprinkler system on the hard surface site access road between the site entrance and the weighbridge;
- Areas of bare or exposed soils will, insofar as practicable, be kept to a minimum through the phased extraction proposals;
- Dust blows at the existing site are largely screened by the side walls of the existing quarry and the vegetated screening berms and existing boundary hedgerows;
- All HGVs exiting the site routed through the existing wheelwash. This minimises the transport of fines by HGVs over the access / egress road and the public road network;
- Periodic sweeping of the internal paved site access road and surrounding public roads carried out as and when required by a mechanical road sweeper;
- When the concrete batching plant is operational, all admixtures will be stored in suitably bunded tanks at the site. Water will be stored in a water tank (c. 3,000 gallon capacity) adjacent to the Concrete Batching Plant. This will be topped up as required; and
- Concrete trucks will be washed out in a washing bay adjacent to the Concrete Batching Plant. The wash water will be pumped from the trucks for recycling through a closed series of settlement ponds.

7.249 Implementation of these measures at the application site will further reduce the potential impacts identified above.

Assessment of Impacts with Mitigation Measures in Place

7.250 With the above mitigation measures in place at the application site, it is assessed significance of potential impacts during the construction and operational stage will be “**slight**” or lower to the water environment receptors and therefore will be Not Significant.

Residual Impact Assessment

7.251 Examination of the identified potential impacts on the receiving environment show that with the mitigation measures in place, there are no significant residual impacts with respect to groundwater and surface water during the construction and operational stages of the proposed continued use of the quarry.

7.252 Following mitigation, the residual impacts identified will be “**slight**” or lower and therefore will be Not Significant.

Monitoring

7.253 The following monitoring activities will continue to be carried out (where required) to demonstrate that the development is not having an adverse impact on the surrounding environment and will document any changes in water quality:

- Monitoring of ground and surface water quality - Condition 6 (g);
- Groundwater levels in all boreholes monitored on a quarterly basis for the duration of the proposed development - Condition 7(d);
- Recording of any breaches over the previous year for water quality monitoring to be provided in the annual environmental audit - Condition 7(e);
- Submission of quarterly reports with full monitoring records of surface water quality monitoring and groundwater monitoring - Condition 7.

References

Feeley, H. B., Baars, J. R., Kelly-Quinn, M., & Nelson, B. (2020). Ireland Red List No. 13: Stoneflies (Plecoptera). National Parks and Wildlife Service.

Toner, P., Bowman, J., Clabby, K., Lucey, J., McGarrigle, M., Concannon, C., ... & MacGarthaigh, M. (2005). Water quality in Ireland. Environmental Protection Agency, Co. Wexford, Ireland.

Figures

Figure 7-1: Onsite Borehole Locations Map

Figure 7-2: Karst Features Map

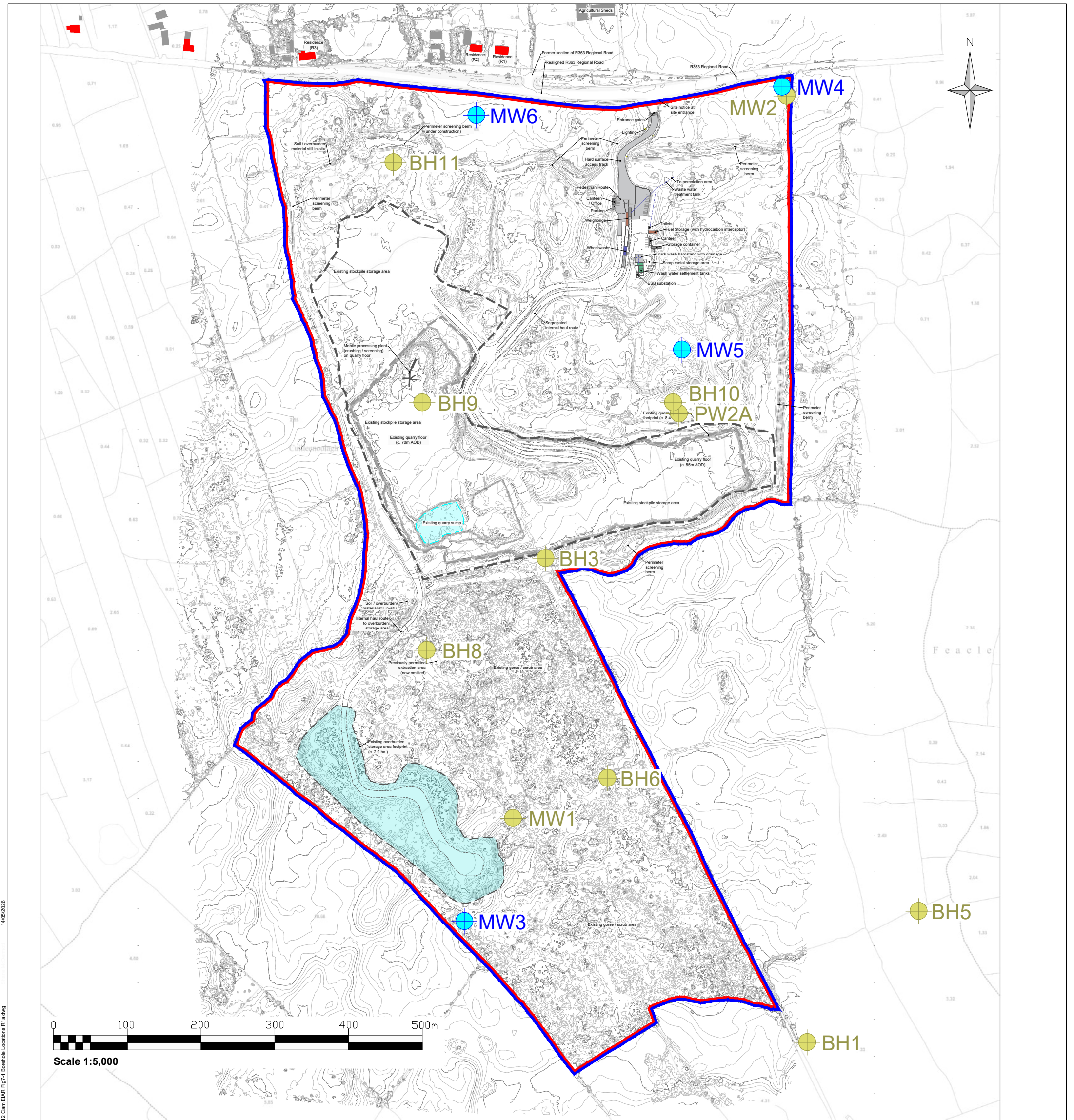
Figure 7-3: Surface Water Features Map

Figure 7-4: Bedrock Aquifer Map

Figure 7-5: Groundwater Vulnerability Map

Figure 7-6: Groundwater Body Map

Figure 7-7: Source Protection Areas



Notes:

1. Based on 6 inch scale *Tailte Eireann* Discovery raster maping RN047, RN048, RN050, RN051

Legend:

Landholding (c. 66.3 hectares)

Planning Application Area (c. 66.3 hectares)

Existing Extraction Area (c. 8.4 hectares)

Proposed Extraction Area (c. 12.9 hectares)

Area part of Planning Permission 04/1479 & ABP PL20.215417 (c. 1.7 hectares) over which the public road was realigned

Area of existing overburden storage (c. 2.9 hectares)

Residence Locations

Concrete hard surface areas

Ancillary Site Facilities

Contours (1m interval)

Groundwater Monitoring Well Locations

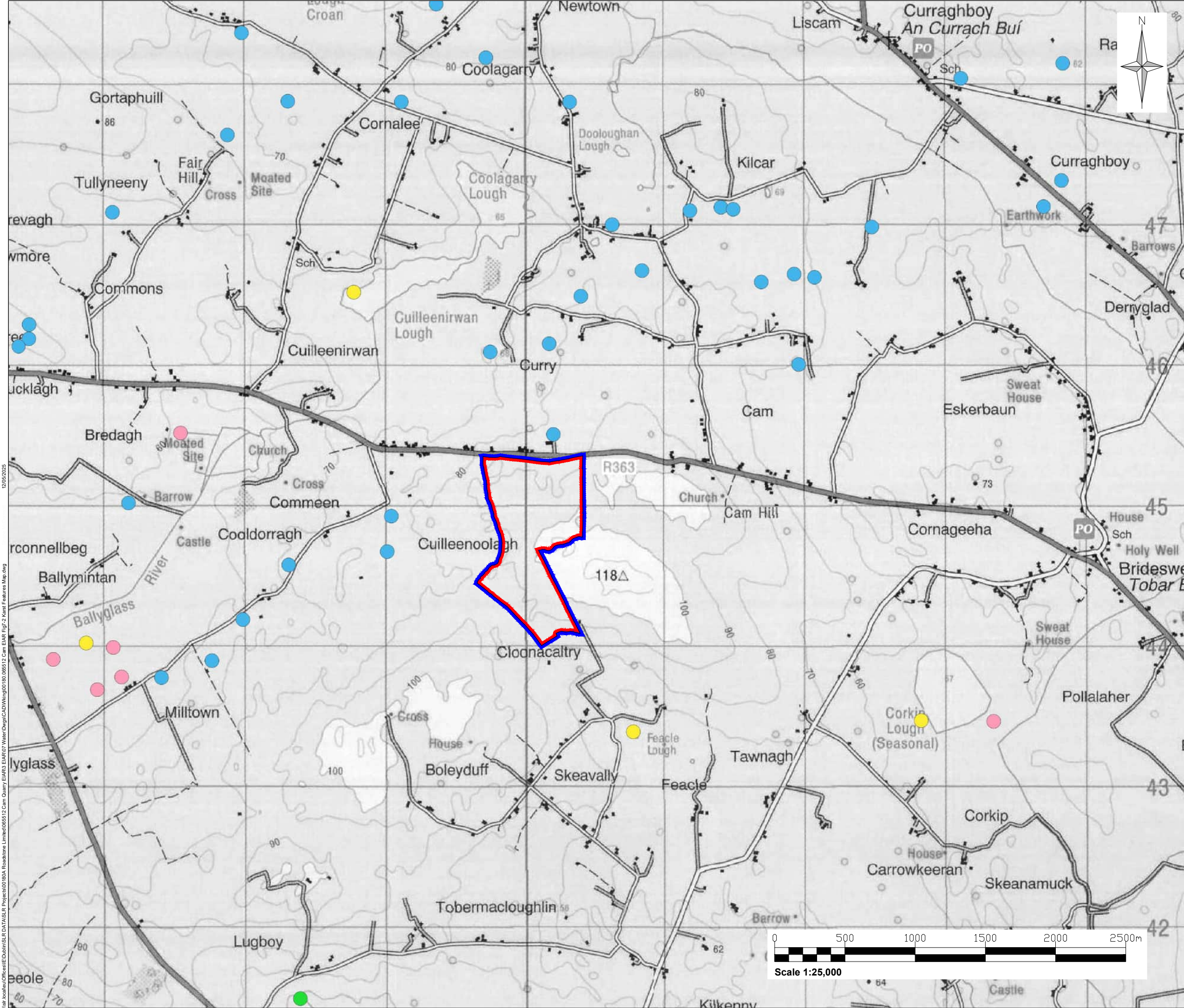
Other Site Boreholes

Rev	Amendments	Date	By	Chk	Auth
SLR www.slrconsulting.com					
Client Roadstone Limited					
Project Continued Use of Existing Cam Quarry at Curry & Cloonacaltry townlands, Co. Roscommon					
Figure Title Onsite Borehole Locations Map					
Scale 1:5,000 @ A3		SLR Project No. 501.065512.00001			
Designed mcob	Drawn mcob	Checked pg	Authorised pg		
Date 04/26	Date 04/26	Date 04/26	Date 04/26		
Figure Number Figure 7-1					Rev. 0

CYAL50522699

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Notes:

1. Based on 6 inch scale Tailte Eireann Discovery raster maping RN047, RN048, RN050, RN051

Legend:

Landholding (c. 66.3 hectares)

Planning Application Area (c. 66.3 hectares)

Surface Water Bodies

Karst Features

Enclosed Depression

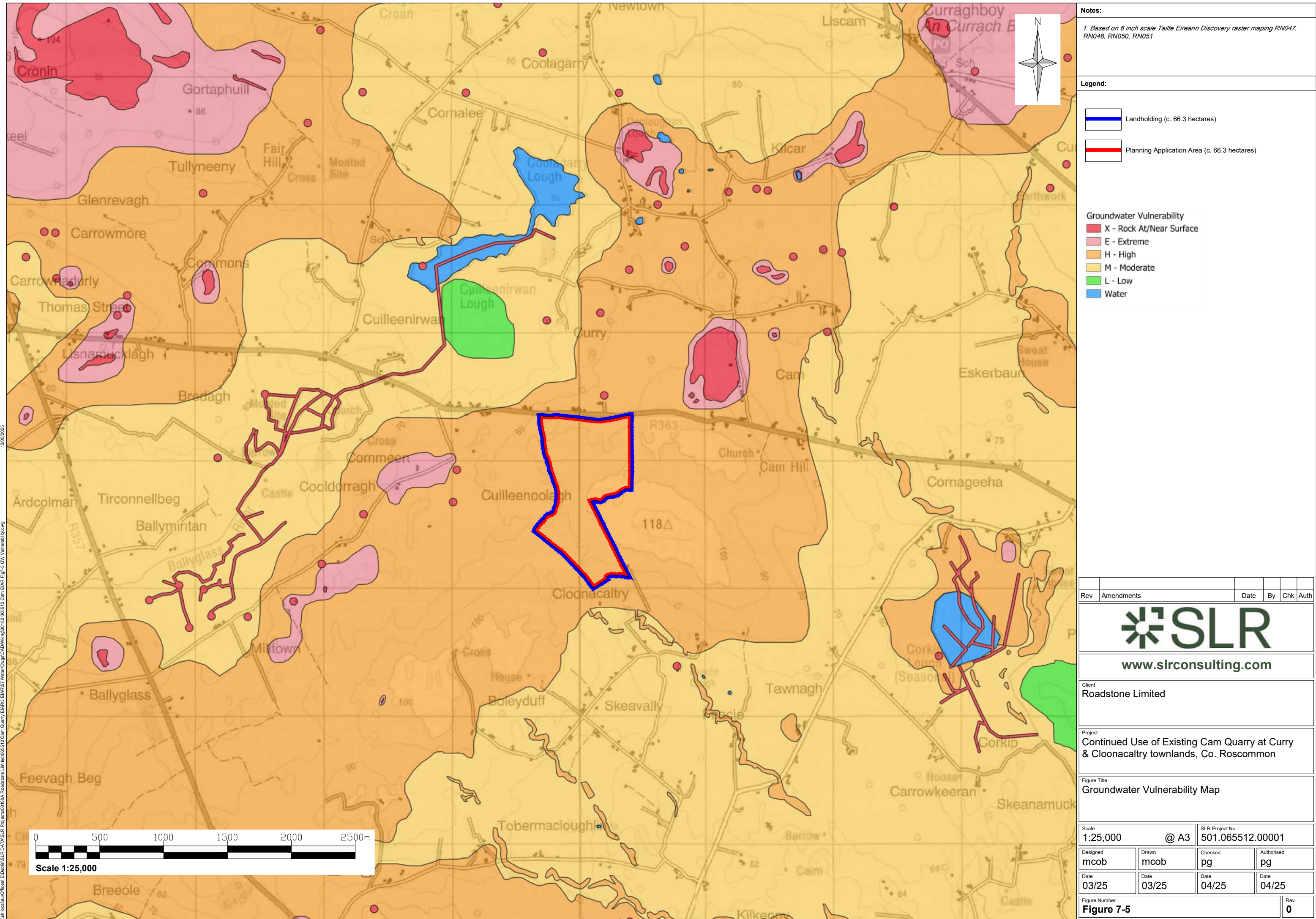
Spring

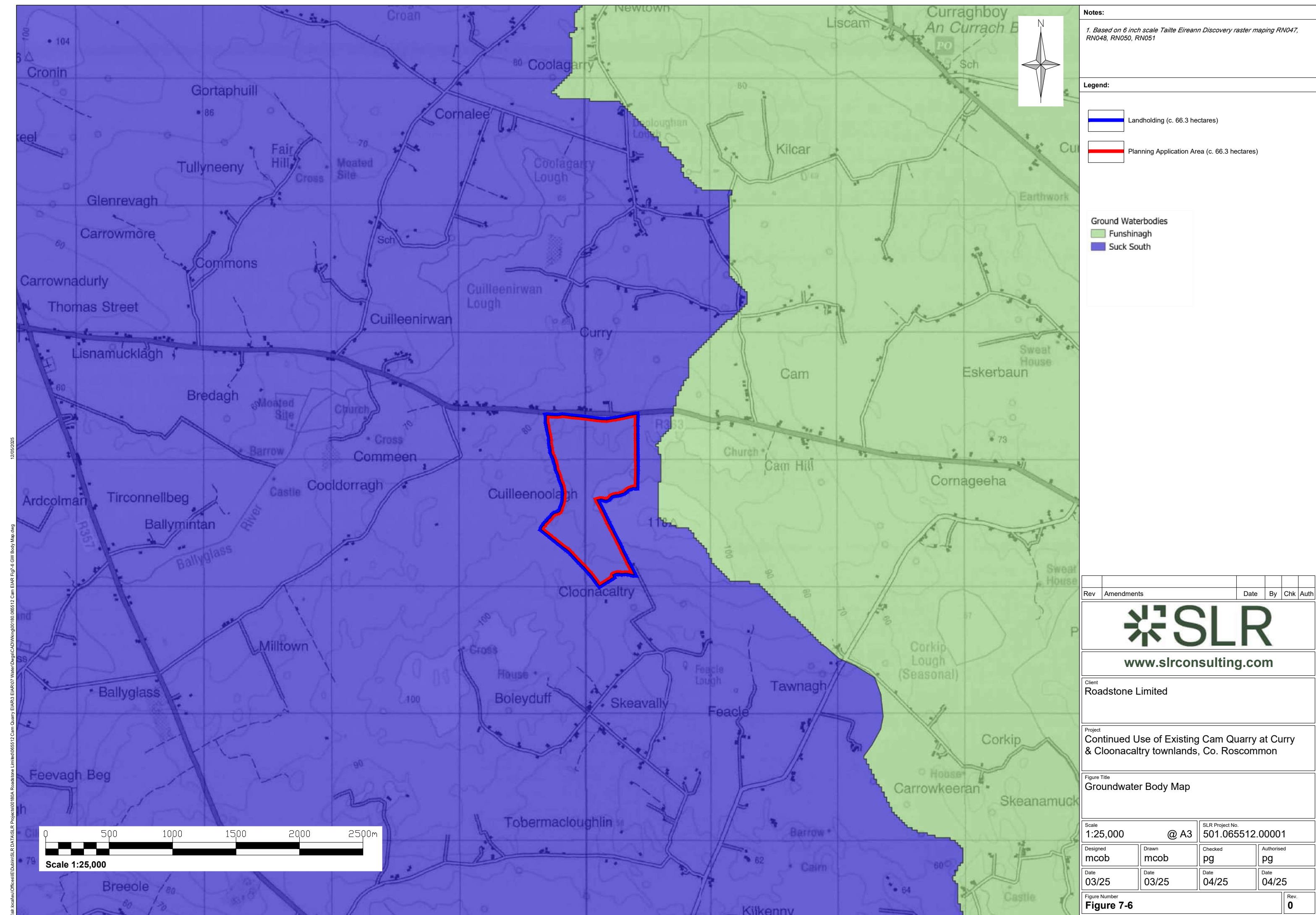
Swallow Hole

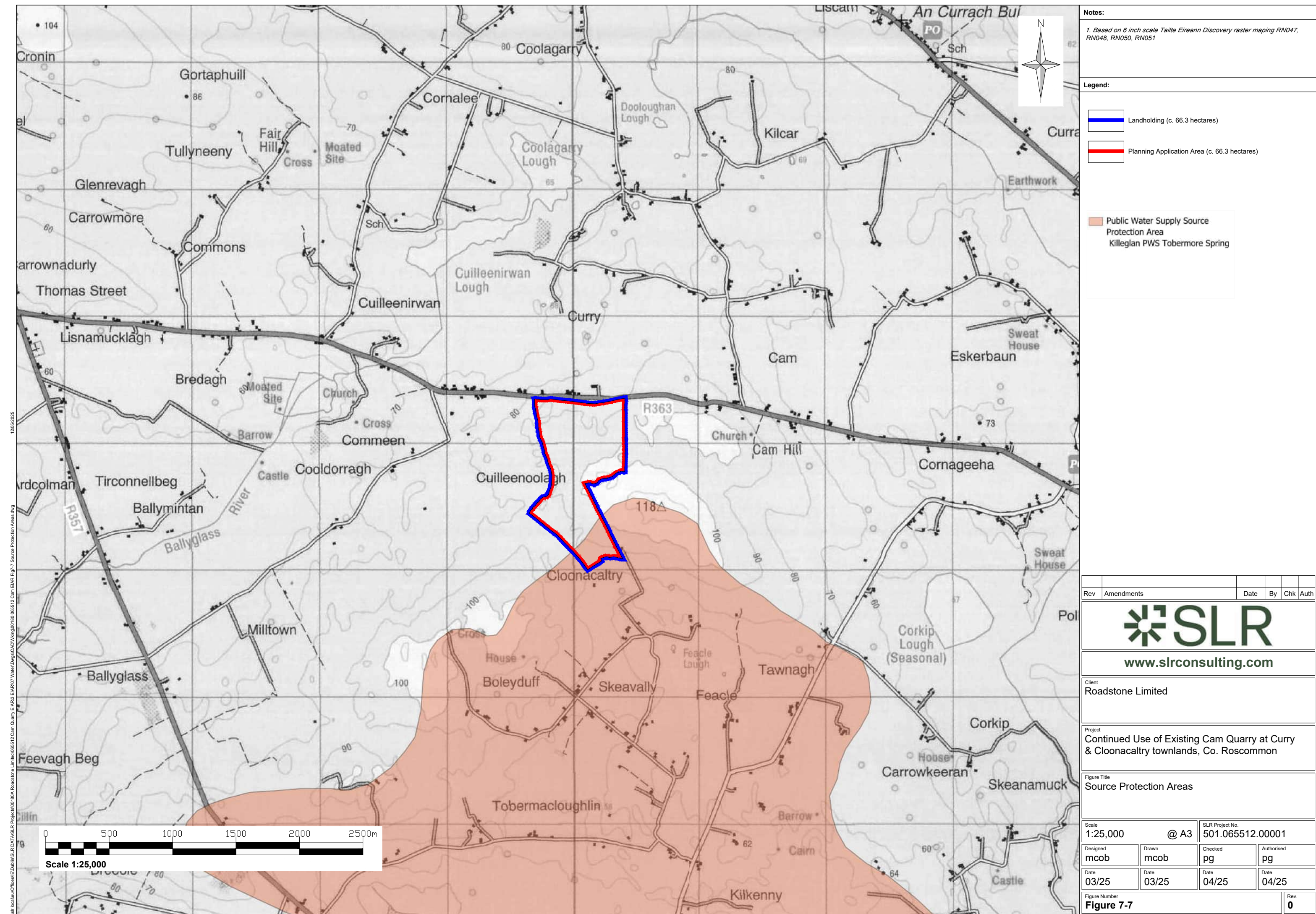
Turlough

Rev	Amendments	Date	By	Chk	Auth
 www.slrconsulting.com					
Client Roadstone Limited					
Project Continued Use of Existing Cam Quarry at Curry & Cloonacaltry townlands, Co. Roscommon					
Figure Title Karst Features Map					
Scale 1:25,000 @ A3		SLR Project No. 501.065512.00001			
Designed mcob	Drawn mcob	Checked pg	Authorised pg		
Date 03/25	Date 03/25	Date 04/25	Date 04/25		
Figure Number Figure 7-2					Rev. 0

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12/05/2025







Appendices

Appendix 7-A: Site Characterisation and Package WwTS with Percolation Area

Site Characterisation Report

By

Dr. Eugene Bolton

Applicant: Roadstone Ltd.

APPENDIX A: SITE CHARACTERISATION FORM

File Reference:

1.0 GENERAL DETAILS (From planning application)

Prefix: First Name: Surname:

Address: Site Location and Townland:

Number of Bedrooms: Maximum Number of Residents:

Comments on population equivalent

There will be a max of 30 workers @ 40 Litres and 25 Grams BOD = 1200 litres and 750 Grams BOD.
This equates to 8 PE based on hydraulic Load and 12PE based on Organic load

Proposed Water Supply:

Mains ☒ Private Well/Borehole ☒ Existing well on-site Group Well/Borehole ☐

2.0 GENERAL DETAILS (From planning application)

Soil Type, (Specify Type):

Subsoil, (Specify Type):

Bedrock Type:

Aquifer Category: Regionally Important Locally Important Poor

Vulnerability: Extreme ☐ High ☒ Moderate ☐ Low ☐

Groundwater Body: Status

Name of Public/Group Scheme Water Supply within 1 km:

Source Protection Area: ZOC ☐ SI ☐ SO ☐ Groundwater Protection Response:

Presence of Significant Sites
(Archaeological, Natural & Historical):

Past experience in the area:

Comments:

(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, and/or any potential site restrictions).

Bedrock Aquifer is Rkc - Vulnerability is High - Groundwater will be the main target at risk. Surface water will also be a target at risk.

Note: Only information available at the desk study stage should be used in this section.

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment

Landscape Position:

Slope: Steep (>1:5) ☐ Shallow (1:5-1:20) ☐ Relatively Flat (<1:20) ☒

Slope Comment

Surface Features within a minimum of 250m (Distance To Features Should Be Noted In Metres)

Houses:

There are 4 houses to North or northwest of the site within 300m

Existing Land Use:

Quarry

Vegetation Indicators:

Nothing to suggest poor soakage

Groundwater Flow Direction:

Ground Condition:

Dry

Site Boundaries:

Within the quarry

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment (contd.)

Roads:

R363 is to north of quarry

Outcrops (Bedrock And/Or Subsoil):

Sand and gravels with Limestone rock exposed

Surface Water Ponding:

None

Lakes:

None within 500m

Beaches/Shellfish Areas:

None

Wetlands:

None

Karst Features:

enclosed depression to north of the R563

Watercourses/Streams:*

None within 500m

*Note and record water level

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment (contd.)

Drainage Ditches:*

No ditch bordering site

Springs:*

None

Wells:*

Area on mains and Mains serves the quarry
However there are wells in the quarry rhiugh not in use and all are in excess of 100m from location of percolation area

Comments:

(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, the suitability of the site to treat the wastewater and the location of the proposed system within the site).

The site is dry.
Likely to be acceptable

*Note and record water level

3.2 Trial Hole (should be a minimum of 2.1m deep (3m for regionally important aquifers))

To avoid any accidental damage, a trial hole assessment or percolation tests should not be undertaken in areas which are at or adjacent to significant sites, (e.g. NHAs, SACs, SPAs, and/or Archaeological etc.), without prior advice from National Parks and Wildlife Service or the Heritage Service.

Depth of trial hole (m):

Depth from ground surface
to bedrock (m) (if present):

Depth from ground surface
to water table (m) (if present):

Depth of water ingress:

Rock type (if present):

Date and time of excavation:

Date and time of examination:

Depth of
Surface and

Subsurface
Percolation
Tests

Soil/Subsoil

Texture &
Classification**

Plasticity and
dilatancy***

Soil
Structure

Density/
Compactness

Colour****

Preferential
flowpaths

0.1 m		Sandy CLAY	Diklatent	Blocky	Firm	Brown	Rootlets
0.2 m							
0.3 m		Sandy Silty GRAVEL	No Trds or Ribs	Structureless	Firm	Dark Grey	None
0.4 m		with lots of cobbles					
0.5 m		and boulders if varying					
0.6 m		sizes					
0.7 m							
0.8 m							
0.9 m							
1.0 m							
1.1 m							
1.2 m							
1.3 m							
1.4 m							
1.5 m							
1.6 m							
1.7 m							
1.8 m							
1.9 m							
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2.6 m							
2.7 m							
2.8 m							
2.9 m							
3.0 m							
3.1 m		Base of Pit					
3.2 m							
3.3 m							
3.4 m							
3.5 m							

Likely Subsurface Percolation Value:

Likely Surface Percolation Value:

Note: *Depth of percolation test holes should be indicated on log above. (*Enter Surface or Subsurface at depths as appropriate).

** See Appendix E for BS 5930 classification.

*** 3 samples to be tested for each horizon and results should be entered above for each horizon.

**** All signs of mottling should be recorded.

3.2 Trial Hole (contd.) Evaluation:

The subsoil is Gravel with silt present - soakage will be good
High cobbles and some large boulders - may give rise to some preferential flow. However depth of overburden is in excess of 3m

3.3(a) Subsurface Percolation Test for Subsoil

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm) (A)	600	600	700
Depth from ground surface to base of hole (mm) (B)	1,000	1,000	1,100
Depth of hole (mm) [B - A]	400	400	400
Dimensions of hole [length x breadth (mm)]	300 x 300	300 x 300	300 x 300

Step 2: Pre-Soaking Test Holes

Pre-soak start	Date	19-Sep-2025	19-Sep-2025	19-Sep-2025
	Time	08:15	08:15	08:15
2nd pre-soak start	Date	19-Sep-2025	19-Sep-2025	19-Sep-2025
	Time	17:00	17:00	17:00

Each hole should be pre-soaked twice before the test is carried out.

Step 3: Measuring T_{100}

Percolation Test Hole No.	1	2	3
Date of test	20-09-2025	20-09-2025	20-09-2025
Time filled to 400 mm	08:10	08:11	08:12
Time water level at 300 mm	08:36	08:22	08:42
Time (min.) to drop 100 mm (T_{100})	26.00	11.00	30.00
Average T_{100}			22.33

If $T_{100} > 480$ minutes then Subsurface Percolation value >120 – site unsuitable for discharge to ground

If $T_{100} \leq 210$ minutes then go to Step 4;

If $T_{100} > 210$ minutes then go to Step 5;

Step 4: Standard Method (where $T_{100} \leq 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)
1	08:36	09:04	28.00	08:22	08:39	17.00	08:42	09:17	35.00
2	09:04	09:41	37.00	08:39	08:56	17.00	09:17	10:04	47.00
3	09:41	10:35	54.00	08:56	09:17	21.00	10:04	11:08	64.00
Average Δt Value			39.67			18.33			48.67
	Average $\Delta t/4$ = [Hole No.1] 9.92 (t_1)			Average $\Delta t/4$ = [Hole No.2] 4.58 (t_2)			Average $\Delta t/4$ = [Hole No.3] 12.17 (t_3)		

Result of Test: Subsurface Percolation Value = 8.89 (min/25 mm)

Comments:

Soakage is good

Step 5: Modified Method (where $T_{100} > 210$ minutes)

Percolation Test Hole No.	1					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = $4.45 / K_{fs}$
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			1,439.0	0.01	454.15
Average	T- Value		T- Value Hole 1 = (T_1)		113.54	

Percolation Test Hole No.	3					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = $4.45 / K_{fs}$
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 3 = (T_3)		0.00	

Percolation Test Hole No.	2					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = $4.45 / K_{fs}$
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 2 = (T_2)		0.00	

Result of Test: Subsurface Percolation Value =

56.77 (min/25 mm)

Comments:

3.3(b) Surface Percolation Test for Soil

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm)	0	0	0
Depth from ground surface to base of hole (mm)	400	400	400
Depth of hole (mm)	400	400	400
Dimensions of hole [length x breadth (mm)]	300 x 300	300 x 300	300 x 300

Step 2: Pre-Soaking Test Holes

Pre-soak start	Date	19-Sep-2025	19-Sep-2025	19-Sep-2025
	Time	08:15	08:15	08:15
2nd pre-soak start	Date	19-Sep-2025	19-Sep-2025	19-Sep-2025
	Time	17:00	17:00	17:00

Each hole should be pre-soaked twice before the test is carried out.

Step 3: Measuring T_{100}

Percolation Test Hole No.	1	2	3
Date of test	20-Sep-25	20-Sep-25	20-Sep-2025
Time filled to 400 mm	08:15	08:16	08:17
Time water level at 300 mm	09:00	09:00	09:02
Time to drop 100 mm (T_{100})	45.00	44.00	45.00
Average T_{100}			44.67

If $T_{100} > 480$ minutes then Surface Percolation value >90 – site unsuitable for discharge to ground

If $T_{100} \leq 210$ minutes then go to Step 4;

If $T_{100} > 210$ minutes then go to Step 5;

Step 4: Standard Method (where $T_{100} \leq 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	ΔT (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	ΔT (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	ΔT (min)
1	09:00	09:46	46.00	09:00	09:51	51.00	09:02	09:52	50.00
2	09:46	10:53	67.00	09:51	11:01	70.00	09:52	11:07	75.00
3	10:53	12:19	86.00	11:01	12:28	87.00	11:07	12:38	91.00
Average ΔT Value			66.33			69.33			72.00
	Average $\Delta T/4 =$ [Hole No.1] 16.58 (T_1)			Average $\Delta T/4 =$ [Hole No.2] 17.33 (T_2)			Average $\Delta T/4 =$ [Hole No.3] 18.00 (T_3)		

Result of Test: Surface Percolation Value = 17.31 (min/25 mm)

Comments:

Soakage in topsoil, is good

Step 5: Modified Method (where $T_{100} > 210$ minutes)

Percolation Test Hole No.	1					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = $4.45 / K_{fs}$
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value	T- Value Hole 1 = (T_1)				0.00

Percolation Test Hole No.	3					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = $4.45 / K_{fs}$
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value	T- Value Hole 3 = (T_2)				0.00

Percolation Test Hole No.	2					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = $4.45 / K_{fs}$
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value	T- Value Hole 2 = (T_2)				0.00

Result of Test: Surface Percolation Value = 0.00 (min/25 mm)

Comments:

4.0 CONCLUSION of SITE CHARACTERISATION

Integrate the information from the desk study and on-site assessment (i.e. visual assessment, trial hole and percolation tests) above and conclude the type of system(s) that is (are) appropriate. This information is also used to choose the optimum final disposal route of the treated wastewater.

Slope of proposed infiltration / treatment area:

Are all minimum separation distances met?

☒

Depth of unsaturated soil and/or subsoil beneath invert of gravel (or drip tubing in the case of drip dispersal system)

Percolation test result: Surface:

Sub-surface:

Not Suitable for Development

☐

Suitable for Development

☒

Identify all suitable options

1. Septic tank system (septic tank and percolation area) **(Chapter 7)**
2. Secondary Treatment System **(Chapters 8 and 9)** and soil polishing filter **(Section 10.1)**
3. Tertiary Treatment System and Infiltration / treatment area **(Section 10.2)**

Discharge Route ¹

Groundwater

5.0 SELECTED DWWTs

Propose to install:

Secondary Treatment System and soil polishing filter

and discharge to:

Ground Water

Invert level of the trench/bed gravel or drip tubing (m)

Site Specific Conditions (e.g. special works, site improvement works testing etc.

It is recommend to install a secondary treatment unit followed by a soil polishing filter with discharge to ground.
As there is in excess of 3m of free draining soil the base of the infiltration gravel can be at about 500mm below existing ground level - Area is cleared and leveled.
A 300mm deep, bed of distribution gravel (20mm pebble) is placed on the prepared area. The 32mm diameter distribution pipes are placed on this.
Load filter at 20 Litres/M2
PE is 12 area required is a minimum of 90m2

¹ A discharge of sewage effluent to "waters" (definition includes any or any part of any river, stream, lake, canal, reservoir, aquifer, pond, watercourse or other inland waters, whether natural or artificial) will require a licence under the Water Pollution Acts 1977-90. Refer to Section 2.4.

6.0 TREATMENT SYSTEM DETAILS

SYSTEM TYPE: Septic Tank Systems (Chapter 7)

Tank Capacity (m ³)	3.50	Percolation Area		Mounded Percolation Area	
		No. of Trenches		No. of Trenches	
		Length of Trenches (m)		Length of Trenches (m)	
		Invert Level (m)		Invert Level (m)	

SYSTEM TYPE: Secondary Treatment System (Chapters 8 and 9) and polishing filter (Section 10.1)

Secondary Treatment Systems receiving septic tank effluent (Chapter 8)

Media Type	Area (m ²)*	Depth of Filter	Invert Level
Sand/Soil			
Soil			
Constructed Wetland			
Other			

Packaged Secondary Treatment Systems receiving raw wastewater (Chapter 9)

Type	SBR
Capacity PE	12
Sizing of Primary Compartment	5.00 m ³

Polishing Filter*: (Section 10.1)

Surface Area (m ²)*		Option 3 - Gravity Discharge Trench length (m)	
Option 1 - Direct Discharge Surface area (m ²)		Option 4 - Low Pressure Pipe Distribution Trench length (m)	
Option 2 - Pumped Discharge Surface area (m ²)	90.00	Option 5 - Drip Dispersal Surface area (m ²)	

SYSTEM TYPE: Tertiary Treatment System and infiltration / treatment area (Section 10.2)

Identify purpose of tertiary treatment

Provide performance information demonstrating system will provide required treatment levels

Provide design information

DISCHARGE ROUTE:

Groundwater	☒	Hydraulic Loading Rate * (l/m ² .d)	20.00	Surface area (m ²)	90.00
Surface Water **	☐	Discharge Rate (m ³ /hr)			

* Hydraulic loading rate is determined by the percolation rate of subsoil

** Water Pollution Act discharge licence required

6.0 TREATMENT SYSTEM DETAILS

QUALITY ASSURANCE:

Installation & Commissioning

Install as specified & supervised by appropriately qualified person

On-going Maintenance

Regular desludging & Maintenance contract with supplier or installer

7.0 SITE ASSESSOR DETAILS

Company: Trinity Green

Prefix: Dr First Name: Eugene Surname: Bolton

Address: Clonfert, Maynooth, Co. Kildare

Qualifications/Experience: FETAC Site assessor, PhD Microbiology

Date of Report: 23-Sep-2025

Phone: 0862434828 E-mail: info@trinitygreen.ie

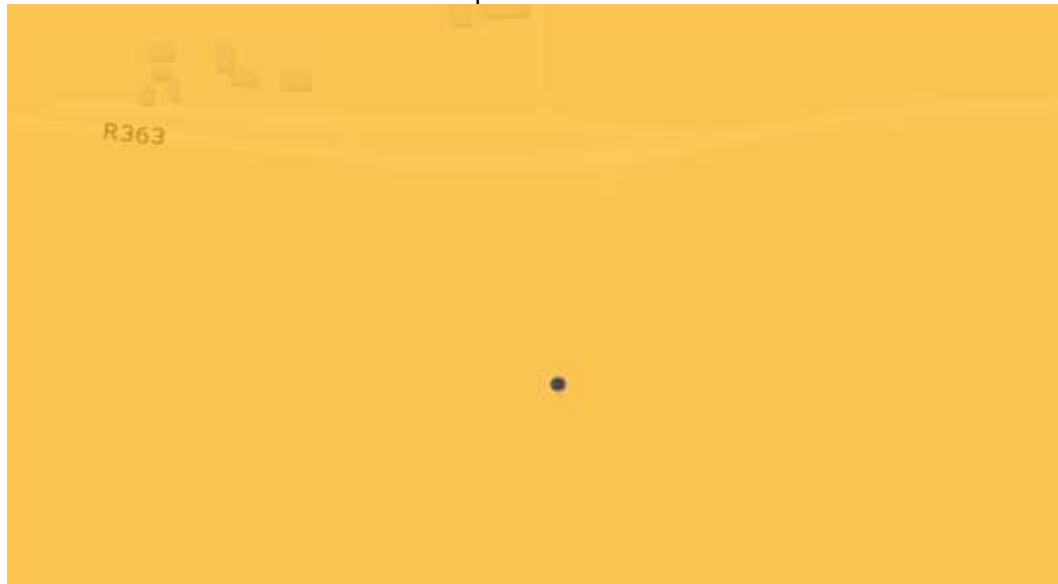
Indemnity Insurance Number: PI/C/12453/21/1

Signature: _____

Maps – Aquifer, Vulnerability, bedrock



Aquifer is RKc



Vulnerability is High



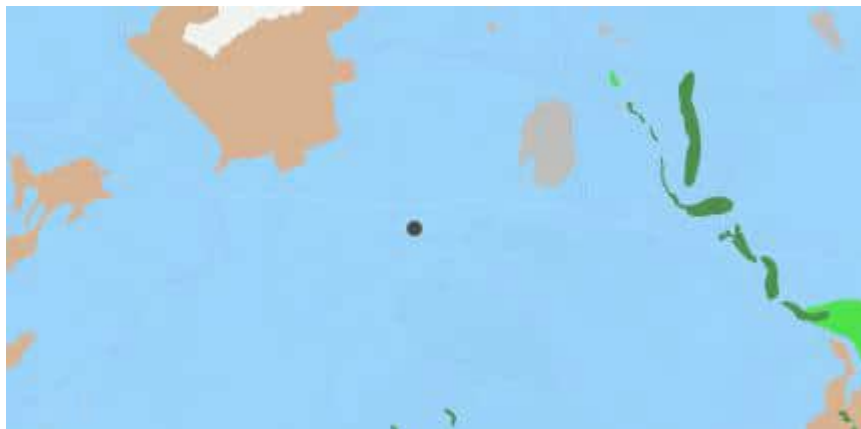
Bedrock is Dinantian Pure Bedded Limestone

Soil



Parent Material Code	TLs		
Parent Material Name	Till derived chiefly from limestone	Irish Forest Soils (IFS) Soil Description	Derived from mainly calcareous parent materials
Parent Material Description	Limestone till (Carboniferous)	County	ROSCOMMON
Soil Group	Grey Brown Podzolics, Brown Earths (medium-high base status)	Category	Deep well drained mineral (Mainly basic)
Irish Forest Soils (IFS) Soil Code	BminDW	Legend	BminDW - Deep well drained mineral (Mainly basic)
Irish Forest Soils (IFS) Code	12		

Subsoil



Quaternary Sediment Type	Till derived from limestones
Quaternary Sediment Code	TLs

Photos

Row 1 – P1, P2



Row 2 – P3, T1



Row 3 – T2, T3



Trial Pit



Excavated Material



Site Overview



Site |

Eugene Bolton
T/a Trinity Green
Clonfert
Maynooth
Co Kildare
W23H6F3

2nd May, 2025
Our Ref: 70290275

Dear Eugene,

Client Name: Eugene Bolton COVER NOTE 2025-2026

We, Howden Insurance (Ireland) Limited, as insurance brokers, provide services to you in accordance with our terms of business agreement only. We are writing to you to confirm that the contracts of insurance described below (the '**Insurances**') are in force at the date of this letter. All of the Insurances are subject to their specific policy terms, conditions, exceptions, warranties, and limitations, not all of which are summarised below, but which are detailed in the policy document.

The Business Description covered under the Insurances (unless qualified under individual headings below) is as follows: Environmental Consultant.

Class:	Professional Indemnity
Policy Number:	PI/C/12453/21/1
Insurer:	Howden Insurance (Ireland) Limited t/a RL Underwriting
Ultimate Insurer:	Aspen
Period:	02/05/2025 to 01/05/2026
Limit of Indemnity:	€1,000,000

Any queries, please do not hesitate to contact the undersigned.

Yours sincerely,



Ger Brennan
Commercial Account Manager
Howden Insurance

Unit 3, Swords Business Campus, Balheary Road, Co. Dublin, K67TY09

T: 01 840 8060 E: info@howdeninsurance.ie W: www.howdenbroking.com/ie-en

Directors: Robert Kennedy, Mark Nolan, Mark Boland, Mark Whelan, Denise Behan
Howden Insurance (Ireland) Limited trading as Howden, Build-Zone, CRS Yachts, Haven Knox-Johnston, Lark Music, Performance Film and Media Insurance, Principal Insurance, Protean Risk, RL Underwriting, Robertson Low, Sanctum Health, Sanctum Superyacht Insurance, Self-Build Zone and Wright Insurance Brokers is regulated by the Central Bank of Ireland. Howden Insurance (Ireland) Limited is authorised and regulated by the Financial Conduct Authority, No. 973308. Registered in Ireland under company registration number 338916. Registered Office: 10 The Courtyard, Kilcarbery Park, Nangor Road, Dublin 22, Ireland. Calls may be monitored and recorded for quality assurance purposes.

Appendix 7-B EU Directives / National Legislation and Regulations / Guidelines / Technical Standards

European Directives

- Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment;
- Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment;
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy;
- Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration;
- Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks;
- Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (recast); and
- Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC.

Irish Government Acts, National Legislation and Regulations

- S.I. No. 349/1989, European Communities (Environmental Impact Assessment) Regulations, as amended;
- Planning and Development Act 2000, as amended;
- S.I. No. 600/2001 - Planning and Development Regulations, 2001, as amended.
- S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended;
- S.I. No. 272/2009 European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended;
- S.I. No. 684/2007 Waste Water Discharge (Authorisation) Regulations, 2007, as amended;
- S.I. No. 122/2010 European Communities (Assessment and Management of Flood Risks) Regulations 2010, as amended;
- S.I. No. 457/2008 European Communities (Environmental Liability) Regulations 2008, as amended;
- S.I. No. 404/2018 - European Union (Planning and Development) (Environmental Impact Assessment) (No. 2) Regulations 2018;
- Local Government (Water Pollution) Acts 1977, as amended;
- S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988;
- S.I. No. 268/2006 - European Communities (Quality of Shellfish Waters) Regulations 2006, as amended;
- S.I. No. 79/2008 - Bathing Water Quality Regulations 2008, as amended; and
- S.I. No. 99/2023 - European Union (Drinking Water) Regulations 2023, as amended.
- Water Environment (Abstractions and Associated Impoundments) Act 2022.
- S.I. No. 418/2024 - Water Environment (Abstractions and Associated Impoundments) Licencing Fees Regulations 2024
- S.I. No. 419/2024 - Water Environment (Abstractions and Associated Impoundments) Regulations 2024

Guidelines

- European Commission (2007). Common Implementation Strategy (CIS) for the Water Framework Directive (2000/60/EC) Guidance on preventing or limiting direct and indirect

inputs in the context of the Groundwater Directive 2006/118/EC. Guidance Document No. 17.

- European Commission (2010). Common Implementation Strategy (CIS) for the Water Framework Directive (2000/60/EC). Guidance on risk assessment and the use of conceptual models for groundwater. Guidance document No. 26.
- DEHLG (2004). National Urban Waste Water Study. National Report.
- DEHLG (2009). Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities.
- DELG/EPA/GSI (1999). Groundwater Protection Schemes. Document prepared jointly by the Geological Survey of Ireland (GSI), the Environmental Protection Agency, and the Department of Environment, Heritage and Local Government.
- EPA (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.
- EPA (2010). Methodology for Establishing Groundwater Threshold Values and the Assessment of Chemical and Quantitative Status of Groundwater, Including and Assessment of Pollution Trends and Trend Reversal.
- EPA (2011). Guidance on the Authorisation of Direct Discharges to Groundwater.
- EPA (2003). Towards Setting Guideline Values for the Protection of Groundwater in Ireland. Interim Report.
- EPA (2006). Ireland Water Framework Directive Monitoring Programme.
- Fitzsimons, V., Daly, D. and Deakin, J. (2003). Draft GSI guidelines for assessment and mapping of groundwater vulnerability to contamination. Groundwater Chapter, Geological Survey of Ireland.
- GSI (2006). Criteria used in aquifer classification. Available from <http://www.gsi.ie/Programmes/Groundwater/Aquifer+Classification.htm>
- IGI (2007). Guidelines on Water Well Construction. Available from <http://www.igi.ie/assets/files/Water%20Well%20Guidelines/Guidelines.pdf>
- Kilroy, G., Dunne, F., Ryan, J., O'Connor, A., Daly, D., Craig, M., Coxon, C., Johnston, P. and Moe, H. (2008). A Framework for the Assessment of Groundwater – Dependent Terrestrial Ecosystems under the Water Framework Directive. Environmental Research Centre Report Series No. 12.
- Institute of Geologists of Ireland (2007). Recommended collection, presentation and interpretation of geological and hydrogeological information for quarry developments.

Technical Standards

- British Standards Institute (2015). Code of Practice for Ground Investigations BS 5930:2015+A1:2020.

Appendix 7-C Borehole Logs

ROTARY CORE LOG
CURRY / CLOONACALTRY
BOREHOLE BH1

CORE 1

DEPTH	THICK- NESS	GRAPHIC	DESCRIPTION	DISCONTINUITIES	DISC' FREQ.	CORE REC.	R.Q.D.
02.0			Core box comments 'overburden to 3m'. None recovered.		/	/	/
03.0							
04.0			Light grey C bioclastic crystalline limestone with brachiopod float 1cm from base.	Badly broken and drill rounded pebbles. Occ. core string with drill breaks. [prob. till]	38	41	15
04.5							
06.0			Light grey M bioclastic crystalline limestone with thin shale partings. Minor calcitic joints.	Top 0.3m section very broken and pebbly. Some drill rounding. Lower 1.5m is good core with stylolites, drill breaks and v. thin shale partings. [upper part till]	24	57	40
07.5							
08.0			Light grey bioclastic crystalline limestone with some stylolites and crinoid float. Minor calcitic joints.	Good core with breaks on stylolites and drill breaks. Occ. broken on calcitic joint fractures.	5	105	97
10.0							
10.5							
12.0			Light grey M bioclastic crystalline limestone with occ. brachiopod bands. Hairline stylolites and crinoid float present.	Gen. good core with stylolites, drill breaks and occ. pre-drill weathered fracture.	6	100	85
13.5							
14.0			Dark M-C bioclastic crystalline limestone. Upper 0.5m is laminated and burrowed. stylolites are well spaced. Many solitary corals at 0.45 and 2.5m down.	V. good core with mainly stylolite and drill breaks.	3	100	97
16.0							
16.5			Massive dark C-M bioclastic crystalline limestone with well developed stylolites and minor float incl. crinoids at 1.3-1.5m down.	V. good core with stylolite associated breaks and some drill breaks.	3	98	95
18.0							
19.5							
20.0			F-M bioclastic crystalline limestone with occ. floating brachiopods. Some subvertical calcitic jointing. Stylolites developed and well spaced.	V. good core with breaks on stylolites and horizontal and oblique drill breaks.	4	100	98
22.0							
22.5							
24.0			M bioclastic crystalline limestone with coarse band 1.2-1.5m down. Stylolites developed and well spaced. Minor calcitic joints.	V. good core with breaks on drill breaks and rare stylolite.	3	99	98

ROTARY CORE LOG
CURRY / CLOONACALTRY
BOREHOLE BH3

CORE 3

DEPTH	THICK- NESS	GRAPHIC	DESCRIPTION	DISCONTINUITIES	DISC' FREQ.	CORE REC.	R.Q.D.
02.0			No core box comments. Assume overburden of glacial till.		/	/	/
03.0							
04.0			Top pebbles of F black limestone. Below, core is M-F bioclastic crystalline limestone with stylolites developed.	V. good core excl. top and base 0.05m. Top pebbles [prob till derived] drill worn and broken. Remainder is stylolite breaks and fractures on calcitic joints.	10	95	84
04.5							
06.0			M-F bioclastic crystalline limestone with crinoid and brachiopods large floating fossils. Fine stylolites are concentrated towards base of core string.	Good core but shattered to top along fine calcitic joints. Further breaks are on oblique joints and stylolites.	13	90	76
07.5							
08.0			Light grey F-M bioclastic crystalline limestone with occ. coarse bands. Fine stylolites and float incl. solitary corals and crinoid ossicles.	V. good core with few breaks on stylolites and occ. drill break.	4	100	100
10.0							
10.5			Dark M-F bioclastic crystalline limestone with some float incl. corals and crinoids. Freq. fine stylolites. Single 1cm thick calcite band 2.7m down. Single well developed stylolite at base with high amplitude.	V. good core broken rarely on stylolites and drill breaks.	3	100	100
12.0							
13.5			Dark M-F bioclastic crystalline limestone with some float incl. corals, crinoids and brachiopods. Freq. and fine stylolites.	V. good core broken rarely on stylolites and drill breaks.	3	99	96
14.0							
16.0			Dark M-F bioclastic crystalline limestone with solitary corals and crinoidal float. Stylolites are freq. and fine.	V. good core broken on stylolites and occ. drill breaks.	4	100	95
16.5							
18.0							
19.5			Dark F-M bioclastic crystalline limestone with minor float. Shell band at 1.0m down containing gastropods and brachiopods. Group of stylolites with severe dissolution 1.6m down makes rock friable. V fine calcitic joints some void infilling.	Upper 0.6m broken along calcitic joints, remainder is good core. Main breaks on stylolites and drill breaks.	12	99	86
20.0							
22.0							

CORE 3

48.0		F-M grey bioclastic crystalline limestone with well developed stylolites. Calcitic veins up to 4mm and minor vugs with pink calcitic infill. Base slightly friable.	Broken up core with majority of breaks on stylolites some on joint fractures and smaller drill breaks.	8	100	85
49.5						
50.0		M-F bioclastic crystalline limestone with well developed stylolites. Pink calcitic subvertical joints and some veins. Clast replacement in calcite. Minor dissolution in upper 0.1m.	Good core excl. jointed zone. Many drill breaks and stylolites various joint fractures esp. near calcitic veins.	10	103	86
52.0						
52.5						
54.0		Gen. M-F dark bioclastic crystalline limestone with float but coarse zone 1.5-1.8m down. 1cm calcitic band and various minor calcitic joints.	Good core with breaks on drill breaks and some on stylolites.	6	98	90
55.5						
56.0		M-F bioclastic crystalline limestone with some float. Stylolites developed. Some subvertical calcitic joints. Some oblique joints show slickensides.	Fair core with many stylolites and oblique joints, some drill breaks.	7	95	73
58.0						
58.5						
60.0		M bioclastic crystalline limestone with some stylolites and calcitic joints.	Fair core with number of drill breaks often closely related to stylolites and minor joints.	14?	100?	66?
??		Final core string 1.74m long. No wood chip depth marker. END OF CORE				
2.0						

ROTARY CORE LOG
CURRY / CLOONACALTRY
BOREHOLE BH5

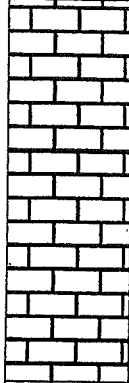
CORE 5

DEPTH	THICK- NESS	GRAPHIC	DESCRIPTION	DISCONTINUITIES	DISC' FREQ.	CORE REC.	R.Q.D.
02.0			Core box comment 'Overburden to 6m. B. Row at 5m approx' No core recovered assume glacial till.		/	/	/
04.0							
06.0	06.0			Upper 0.4m badly broken and rubbly. Breaks along stylolites and calcitic joints. Soil filled cavity c0.3m down. Remainder of core is good. Main breaks along stylolites, some show severe dissolution.	9	89	79
07.5							
08.0			C bioclastic crystalline limestone below 1.4m M-F. Stylolites with severe dissolution where crossing calcitic joints.	Fair core broken along subvertical joints with thick calcitic infills. Also on major stylolites. Pebbly drill chippings c 1.4m down.	8	100	97
10.0							
10.5			Light grey, C, v. bioclastic crystalline limestone. Gen massive with few large bioclasts.	Gen. good core with majority drill breaks and some severely dissolved stylolites.	5	100	96
12.0							
13.5							
14.0			C-M bioclastic crystalline limestone grey and massive with rare large bioclasts. Well spaced minor stylolites and occ. with bad dissolution.	Good core excl. 1.5 to 2.3m down. Breaks occur on stylolites and many drill breaks some associated to minor subvertical jointing. Thin shale parting at 0.35m down.	8	97	83
16.0							
16.5			C grey bioclastic crystalline limestone. Gen. massive with rare large bioclasts. Some stylolites occur.	Top 0.4m is jointed and broken remainder is v. good core. Breaks along stylolites and few drill breaks.	4	97	94
18.0							
19.5							
20.0			C bioclastic crystalline limestone light grey. Fine burrows at 0.45m down and shell band at 2.8m down. Subvertical joint has brown calcitic infill up to 3mm thick.	Good core, none missing. Major stylolite at 0.8m down with severe dissolution where crossing vertical joint with brown calcitic infill. Breaks on drill breaks and few stylolites.	4	100	100
22.0							
22.5							

48.0		M-F dark bioclastic crystalline limestone. Occ. stylolites and some thin impersistent calcitic joints. Rare large bioclasts incl. crinoids. Occasional vugs.	Good core broken on drill breaks and some at stylolites.	5	100	92
49.5						
50.0		F bioclastic crystalline limestone with coarse bands to base. Occ. stylolites up to 2mm residuum, some broken.	Fair core improves to base with drill and stylolite fractures common. Rare weathered pre-drill fractures are subvertical and oblique.	7	98	87
52.0						
52.5		F dark hard bioclastic crystalline limestone with rare floating large bioclasts. Minor brown calcitic joints and v. thin stylolites. At base dolomitised v. coarse.	Good core to 1.13m down then 0.2m drill broken gravel zone pink friable dolomitic then 0.27m pink good core. Breaks are horizontal and oblique drill breaks and occ. stylolite.	10	107	83
54.0		Recrystallised dolomite pink and gen. friable or highly crystalline. Thick calcitic veining. Base good pink dolomitised.	Core poor uppermost as drill broken rubble of calcite vein crystals but towards base core is good though friable.	15	77	35
55.5						
56.0		Pink friable dolomite with large calcite lined vugs (<5cm). Chicken wire veining means easily broken.	Gen good core though many horizontal and oblique drill breaks.	10	100	68
58.0						
58.5		Pink very coarsely recrystallised dolomite with calcite lined vugs. Sugary and friable.	Very broken up core. Vugs split and many drill breaks incl. drillers rubble.	20	100	89
60.0		Pink recrystallised dolomite with large calcite lined vugs. Sugary and friable.	Good core though missing section poss. rubble. Mainly horizontal and oblique drill breaks.	5	66	50
61.5		Pink sugary dolomitised with calcitic vugs and rare stylolites.	Fair core with fractures gen. drill breaks influenced by subvertical calcitic joints and veining. Vugs also broken.	8	100	88
64.0						
64.5		Pink recrystallised friable sugary dolomitic limestone with calcite lined vugs some yellowed.	Good core gen. oblique and pointed drill breaks. Vugs also fractured.	5	100	97
66.0						
67.5		Pink recrystallised sugary dolomitic limestone with calcitic vugs. Occ. stylolite and some veining.	Good core with oblique and pointed drill breaks. Vugs also fractured.	6	98	85
68.0						
70.0						

ROTARY CORE LOG
CURRY / CLOONACALTRY
BOREHOLE BH6

CORE 6

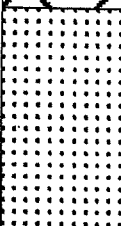
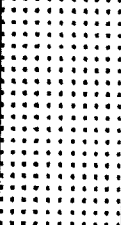
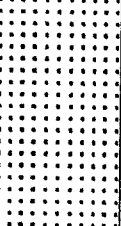
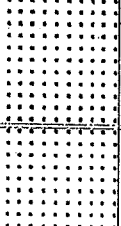
DEPTH	THICK- NESS	GRAPHIC	DESCRIPTION	DISCONTINUITIES	DISC' FREQ.	CORE REC.	R.Q.D.
02.0			No core box comments. Assume overburden to 5.5m. Some core recovered. Pebbles and short unrelated drill strings of C bioclastic crystalline limestone with various weathering artifacts. Rusty coloured weathering, poss. calcitic jointing and minor stylolites.	V. poor core with numerous unrelated drill rounded pebbles.	10	07	2
04.0							
05.5							
06.0			Light grey bioclastic crystalline limestone with brachiopod float 0.7m down. Minor calcitic joints. Some developed stylolites. Coarse calcitic joint infill 1.1m down.	Good core with horizontal drill breaks and stylolites dominant.	6	101	82
07.5							
08.0			M-C banded bioclastic crystalline limestone with floating large bioclasts incl. brachiopod and solitary corals 0.3m down and colonial coral 2.3m down. Network of fine calcitic joints in upper portion and some developed stylolites throughout.	Good core with various drill breaks and some stylolites. Subvertical joints not broken.	7	96	84
10.0							
10.5			M-C dark bioclastic crystalline limestone with moderate float incl. solitary corals and crinoid ossicles. Many fine stylolites and fine calcitic joints. Calcite lined vug 1.7m down.	Good core with breaks mainly stylolite related. Also some drill breaks.	7	100	88
12.0							
13.5			M-C bioclastic crystalline limestone with thick bioclastic bands at 1.3, 1.5 and 2.6m down. Some developed stylolites single example with late void infilling calcite. Occ. red weathered fractures.	Good core with stylolite and drill breaks dominant. Pre-drill weathered fracture occurs 0.6m down.	5	100	97
14.0							
16.0							
16.5			M-C bioclastic crystalline limestone with float incl. crinoids. Minor calcitic jointing. Some severely developed stylolites showing late dissolution.	Good core broken on stylolites and some drill breaks.	7	100	88
18.0							
19.5			Light grey M-C bioclastic crystalline limestone with well spaced stylolites and floating brachiopods. Freq. but thin calcitic joint network.	Good core broken on drill breaks and occ. stylolite.	5	98	93
20.0							
22.0							
22.5			F-M bioclastic crystalline limestone with well spaced stylolites. 5 calcitic bands 3-10cm thick occur at 0.2, 0.5, 2.1, 2.3 and 2.6m down.	Fair core but drill broken on calcite bands. Remaining breaks on stylolites and further drill breaks.	7	99	89
24.0							

CORE 6

50.0	50.0	Upper 0.9m are pink crystalline dolomitised limestone with large joint vein and severe dissolution. core smashed from 0.9-1.05m down. Below this large joint continues into grey bioclastic crystalline limestone with severe dissolution adjacent to joint. Single severely dissolute stylolite.	Poor core broken on many drill breaks, most stylolites, freq. subvertical joint fractures. Drill smashed gravel from 0.9-1.05m down.	10	100	73
52.0	52.5	M-C bioclastic crystalline limestone with calcitic joints. Some developed stylolites. Lowest 1.0m M-F bioclastic crystalline limestone without joints.	Fair core with breaks on subvertical joints some on stylolites and a number of drill breaks often associated with joints.	8	100	82
54.0	55.5	F bioclastic crystalline limestone with some well separated coarse bioclastic bands. Freq., fine stylolites. 0.1m thick calcitic band occurs 1.8-1.9m down.	V. good core with rare stylolite and oblique drill breaks. Calcitic band badly broken.	3	100	95
56.0	58.5	F dark grey bioclastic crystalline limestone with rare float and few calcitic joints.	Good core with breaks on oblique drill shears, stylolites and horizontal drill breaks.	7	107	100
58.0	60.0	END OF CORE				
60.0	60.0					

ROTARY CORE LOG
CURRY / CLOONACALTRY
BOREHOLE BH7

CORE 7

DEPTH	THICK- NESS	GRAPHIC	DESCRIPTION	DISCONTINUITIES	DISC' FREQ.	CORE REC.	R.Q.D.
02.0			Core box marked 'Overburden to 9m. Rock and boulder. ?Rock Large bands of clay'. Probably glacial till.				
04.0					/	/	/
06.0							
08.0							
09.0							
10.0			Pebbles and short string of core of F bioclastic crystalline limestone.	Unrelated pebbles with some drill rounded margins.	8	7	7
10.5			Orangey red clay with shards of grey and pale yellow limestone. gen., soft and unlithified. [probably recent clay]	Good core string present but lots missing. Drill breaks.	2	19	10
12.0							
13.5							
14.0			Rusty brown clay with organically mediated Fe staining perhaps iron pan. Tubular pitting possibly root holes. [Part of regolith]	Poor core with drill breaks and crumbling.	3	4	0
16.0							
16.5			Grey clay weathering orange with single limestone pebble. [Regolith]	Poor core broken on drill breaks. Lots missing.	1	6	0
18.0							
19.5							
20.0			Pale grey shale, orange chickenwire weathering and slickensided internally [soil development].	Poor core lots missing. Drill breaks and crumbling.			
22.0							
22.5					5	17	4

ROTARY CORE LOG
CURRY / CLOONACALTRY
BOREHOLE BH8

CORE 8

DEPTH	THICK- NESS	GRAPHIC	DESCRIPTION	DISCONTINUITIES	DISC' FREQ.	CORE REC.	R.Q.D.
02.0			Core box marked 'Overburden to 3m Boulders and clay'. No core recovered. Probably glacial till.	/	/	/	/
03.0							
04.0			Core box marked boulders. C light grey bioclastic crystalline limestone. Some dissolution of clasts. Rare floating bioclasts incl. brachiopods.	Unacquainted core strings. Dominated by pebbles to top and larger boulders to base. Poss. still coring glacial till.	10	31	16
04.5							
06.0			Core box marked boulders. Pebbles of M light grey bioclastic crystalline limestone.	Pebbles some with joint fractures. Badly dissociated strings. Much missing core.	20	17	4
07.5							
08.0			M-C bioclastic crystalline limestone with minor float. 0.2m of contorted pale buff yellow clay to base, prob. recent void infill.	Very broken up core incl. many dissociated pebbles but majority of strings refit. Breaks incl. stylolites and joints but majority are drill breaks.	35	73	28
10.0							
10.5			M-C bioclastic crystalline limestone with minor calcitic joints and numerous stylolites. Some stylolites are well developed and dissolution makes core friable.	Core gen. good but poorly fitting. Stylolites dominate breaks with minor drill breaks.	10	87	59
12.0							
13.5			M-C bioclastic crystalline limestone with patchy bands of float incl. brachiopods. Dissolution of stylolites makes adjacent core friable. Pitted as minor dissolution of clasts esp. near stylolites.	Top 0.3m of core broken pebbles. Remainder good core with breaks on stylolites and few drill breaks. Mud filled joint in upper portion of core string.	10	73	58
14.0							
16.0							
16.5			Upper and lowermost 1.0m light grey M-C bioclastic crystalline limestone. Middle 1.0m is M-F bioclastic crystalline limestone with floating large bioclasts in mud enriched bands. Major dissolution of stylolites.	Gen. good core, refits well. Majority of breaks on stylolites with major dissolution. Others incl. horizontal and oblique drill breaks.	7	93	81
18.0							
19.5			M-C light grey bioclastic crystalline limestone with rare floating large bioclasts incl. brachiopods. Lowest 0.5m is M-F crystalline limestone. Friable in shattered zone and at 2.4m down adjacent to stylolite dissolution.	Gen good core but vertical joints at 1.4-1.6m down produce shattered zone of joint and associated drill breaks. Further breaks elsewhere dominated by stylolites.	10	97	77
20.0							
22.0							
22.5			Upper and lowermost 0.3m are M-F bioclastic crystalline limestone remainder is M-C. Large colonial coral at 2m down, appears recrystallised. Minor calcitic joints and some stylolites showing moderate dissolution.	V. good core excl. shattering at 2.3m down associated to minor calcitic jointing. Further breaks dominated by stylolites.	7	102	88
24.0							

CORE 8

50.0		C-M banded bioclastic crystalline limestone with rare float incl. corals and crinoids. Pre-drill weathered joints esp. c1.5- 2.0m down. Some dissolution of bioclasts and veins.	Upper 1.5m good core lower 1.5m broken on clay filled joint. Lowest part breaks along pre-drill weathered fractures. Stylolites dominate breaks in longer core strings.	18	100	72
52.0	52.5	M-C bioclastic crystalline limestone with v. coarse bands. Narrow stylolites gen. broken, minor calcitic jointing.	Fair core but some missing. Badly broken in places esp. associated to pre-drill weathered fractures. Breaks thus dominated by weathered fractures and by stylolites with only minor drill breaks.	15	84	58
54.0	55.5	M-C bioclastic crystalline limestone mud enriched at 2.3- 2.6m down. Freq. stylolites are broken. Colonial coral at 2.6m down.	Broken up core. Dominated by stylolites but also with oblique joints and shattering. Pebbles rounded by drill bit.	13	93	68
56.0	58.5	M-C bioclastic crystalline limestone with few stylolites. Some red staining on veinlets.	Badly shattered to pebbles in places esp. along weathered fractures and oblique joints. Occ. drill breaks. Crystalline calcite to base.	28?	77?	27?
58.0						
60.0						
62.0	c60?	Unknown final depth. (Wood chip remarks 37.5m) END OF CORE				

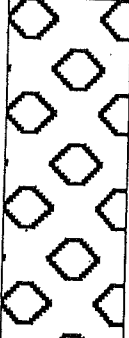
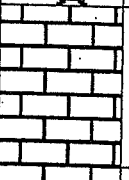
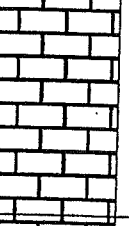
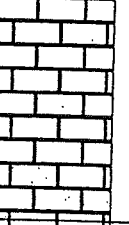
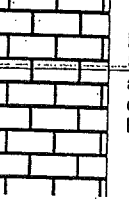
ROTARY CORE LOG
CURRY / CLOONACALTRY
BOREHOLE BH9

CORE 9

DEPTH	THICK- NESS	GRAPHIC	DESCRIPTION	DISCONTINUITIES	DISC' FREQ.	CORE REC.	R.Q.D.
02.0			No core box comments. Assume overburden. No core recovered.		/	/	/
03.0							
04.0			Limestone rubble. F-M, bioclastic, crystalline, minor float and stylolites.	Mostly pebbles and rubble with few refittable strings. Poss. further regolith.	82	40	11
05.0			Limestone rubble. F-M, bioclastic, crystalline, minor float and stylolites.	Gen. pebbly rubble. Poss. further regolith.	72	26	19
06.0			Rubble of dark M bioclastic crystalline limestone with occ. float.	Gen. rubble. Some pebbles show weathered joint evidence. Poss. further regolith.	26	8	8
07.0							
08.0			Rubble of dark F bioclastic crystalline limestone with some floating large bioclasts.	Gen. rubble long strings show subvertical weathered joints and stylolites.	48	70	24
10.0			Rubble of M-F bioclastic crystalline limestone with occ. float.	Gen. pebbles but single long string 24cm long. Poss regolith.	15	12	10
10.5							
12.0			F-M bioclastic crystalline limestone with rare float. Few but well developed stylolites. occ. subvertical joint breaks.	Good core prob. true bedrock. Breaks gen. on stylolites and drill breaks rare joint fractures.	6	99	91
13.5							
14.0			M-F bioclastic crystalline limestone with rare float. In upper 1.5m well developed stylolites are rotten in lower half less developed. Calcitic band occurs 0.5m down associated with most rotten stylolites and minor dissolution of bioclasts.	Good core dominated by stylolites and some drill breaks with minor oblique joint fracturing.	8	103	62
16.0							
17.0							
18.0			M-F bioclastic crystalline limestone with float incl. solitary corals. Minor calcitic veins and vertical joints. 7 well spaced 1-3cm calcitic bands occur at all levels. Calcitic infill of some voids and stylolite zones.	Good core with breaks dominated by stylolites and few drill breaks.	8	99	80
20.0							
20.0			M-F bioclastic crystalline limestone with some float contains minor subvertical calcitic joints.	Good core with some stylolites and fractured zone associated with red, friable pre-drill weathered fractures.	12	100	78
22.0							

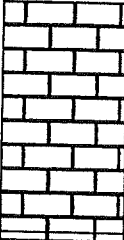
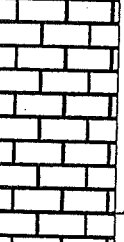
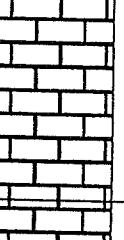
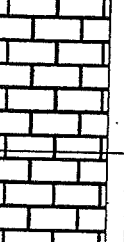
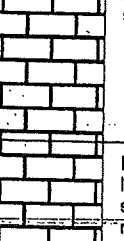
47.0						
48.0		M-F bioclastic crystalline limestone with some float. Minor vertical calcitic veining and infilling of voids. Stylolites are few and fine.	V. good core. Majority of breaks on drill breaks and a few on stylolites and joints.	5	100	90
50.0	50.0					
52.0		Top 0.3m mud enriched bioclastic crystalline limestone with well developed stylolites and obvious bioclastic clasts. Remainder is M-F bioclastic crystalline limestone with occ. coarse bands incl. shell bed at 1.2m down.	Good core gen. broken on horizontal drill breaks but some on stylolites and oblique joints.	5	98	96
53.0						
54.0		M-F bioclastic crystalline limestone with some float. Minor calcitic joints. Stylolites are few and fine. A single 1cm thick calcitic band occurs 1.0m down.	Good core. broken evenly on horizontal drill breaks and oblique calcitic jointing.	9	100	94
56.0	56.0					
58.0		M-F bioclastic crystalline limestone with increasing float downwards incl. large brachiopods at 1.2 and 2.75m down. Stylolites are few and fine. Minor subvertical calcitic joints present.	V. good core broken on stylolites and horizontal drill breaks and occ. oblique joints.	6	100	90
59.0						
60.0		M-F bioclastic crystalline limestone with some crinoidal float. Stylolites are few and fine.	V. good core. Majority of breaks on horizontal drill breaks. A few on stylolites and calcitic joints.	6	100	95
62.0	62.0					
		END OF CORE				

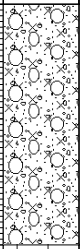
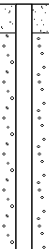
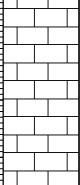
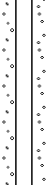
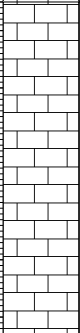
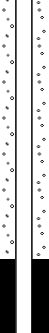
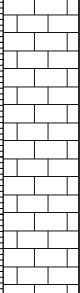
ROTARY CORE LOG
CURRY / CLOONACALTRY
BOREHOLE BH10

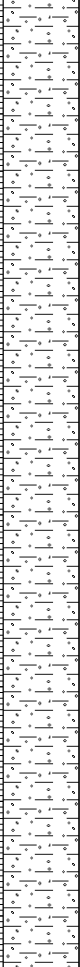
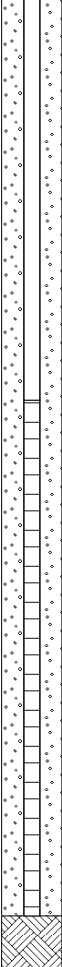
DEPTH	THICK- NESS	GRAPHIC	DESCRIPTION	DISCONTINUITIES	DISC' FREQ.	CORE REC.	R.Q.D.
02.0			Core box marked 'Overburden to 9m Boulder clay and boulders to 7.4m approx'. First wood chip marked 7.4m.				
04.0					/	/	/
06.0							
08.0	7.4		Gen. pebbles of weathered light grey M-C bioclastic crystalline limestone showing some joints and large bioclast float.	Poor core, great deal missing. Few large sections, mainly pebbles. Pointed and polished drill breaks suggests drilling further glacial fill containing large boulders.	10	24	12
10.0							
12.0	11.9		Top 1.4m is clean bioclastic crystalline limestone with solitary corals, crinoids and brachiopod floating bioclasts. Fine calcitic jointing is present. Lower 0.5m contains calcitic joints, steep angle veins and bands of coarsely crystalline calcite.	Very broken core with many oblique joints and fractures, some pre-drill weathered. Drill breaks very common in crystalline calcite bands. These ground into gravel.	20	90	45
14.0	14.0		Light grey bioclastic crystalline limestone with occ. calcitic bands to top. 1.0m down rock is friable bioclasts weather proud. 1.7m down recent sand is mixed with limestone pebbles and calcite crystal debris.	Badly broken core. Freq. drill breaks esp. in crystalline calcite. Some fracturing of calcitic joints and oblique pre-drill fractures.	14	55	28
16.0							
18.0	17.0		Gen. M-C light grey bioclastic crystalline limestone. Calcitic bands are brecciated and adjacent areas are friable with bioclasts weathering proud.	Badly broken core. Fracturing on veins and calcitic joints, some pre-drill weathered fractures. Drill breaks common throughout. Poss. void present with recent sandy infill.	24	55	30
20.0	20.0		Light grey bioclastic crystalline limestone rich in crinoid debris. Some calcite bands (c3cm) and adjacent friable zones. Base of core is F-M bioclastic crystalline limestone with rare float.	Badly broken core with a great deal missing. Majority of drill breaks in recovered core. Lower portion of core comprises drill rounded pebbles.	13	30	23
22.0							

47.0						
48.0		F-M bioclastic crystalline limestone with minor stylolites and some float. Minor subvertical joints are present.	Upper 0.4m drill broken. Remainder fair core with majority of drill breaks plus some along stylolites and joints.	9	97	77
50.0	50.0					
52.0		M-C bioclastic crystalline limestone with rare float. Few well developed stylolites many fine.	Good core to 1.5m down then 0.4m shattered remainder broken up core. Main breaks on stylolites and drill breaks. Shattered zone is fractured on subvertical calcite joints.	12	99	77
53.0						
54.0		F-M bioclastic crystalline limestone with fine stylolites oblique to the core. Colonial coral 1.0m down and brachiopod float in upper 0.5m. Calcite veins occur at 1.5m down.	Broken core incl. brecciate at 1.3m down. Breaks mainly drill breaks often related to joints and stylolites. Breccia zone is broken on calcite veins and along pre-drill weathered fractures.	14	90	77
56.0	56.0					
58.0		F-M bioclastic crystalline limestone with occ. float incl. colonial coral 0.7m down. Some calcitic jointing. Stylolites well developed and oblique to core.	Exceptional core with no vertical joint fracturing. Mixture of drill and stylolite breaks.	3	100	96
59.0						
60.0	59.0	F bioclastic crystalline limestone with rare float incl. crinoids. No wood chip at base. 1.0m of core minimum.	Good core with oblique stylolite breaks and oblique drill breaks. Single wide subvertical calcitic joint fractured.	8	100	76
60.0	60.0+					
		Light grey bioclastic crystalline limestone with 1cm thick calcitic banding. Lowest piece of core is calcite band >6cm.	Horizontal drill breaks on calcite bands.	11?	100?	66?
+0.3m						
62.0		Final string is 0.3m long with no final depth wood chip. END OF CORE				

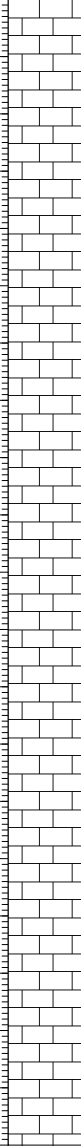
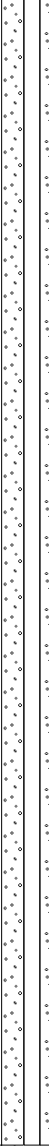
ROTARY CORE LOG
CURRY / CLOONACALTRY
BOREHOLE BH11

DEPTH	THICK- NESS	GRAPHIC	DESCRIPTION	DISCONTINUITIES	DISC' FREQ.	CORE REC.	R.Q.D.
02.0	02.5		No core box comments. Assume overburden.		/	/	/
04.0	05.5		M-F bioclastic crystalline limestone with floating large bioclasts of crinoids and brachiopods. Stylolites are well developed but well spaced.	Top 0.4m rubbly then 1m good core and remainder badly broken. Large subvertical joint from 1.0m down is broken further breaks are on stylolites and many drill breaks.	15	97	77
06.0	08.5		Grey M-F bioclastic crystalline limestone with dissolution esp. along stylolites. Some bioclast float. 2cm thick calcite band at 1.3m down cut by 2mm major calcite filled joints.	Top 1.65m v. good core remainder broken core. Breaks are on stylolites and some drill breaks. Joint fractures at base only.	6	98	93
08.0	11.5		Grey F-M bioclastic crystalline limestone with some float incl. band corals, crinoids and brachiopods at 1.8m down. Major calcitic joints towards base.	Fair core with many stylolite and drill breaks. Joint fracturing at 0.1-0.4m down and 1.3m down.	8	94	82
10.0	14.5		M-C bioclastic crystalline limestone with float. Calcitic veining and 3cm thick steeply angled calcite band 1.0-1.2m down.	Badly broken core esp. upper 1.5m. Stylolites dominate breaks with some drill breaks. Calcite band is drill broken to rubble.	12	95	70
12.0	17.0		F bioclastic crystalline limestone with rare float incl. crinoid ossicles and solitary corals. Occ. coarse bands.	V. good core, none missing. stylolite breaks dominate with occ. drill break.	4	98	78
14.0	20.0		F bioclastic crystalline limestone with some floating solitary corals, crinoids and brachiopods. Well developed stylolites.	V. good core. Breaks dominated by stylolites with occ. drill breaks.	5	100	95
16.0			F-M bioclastic crystalline limestone with some float. Well spaced developed stylolites and minor calcitic joints throughout.	Good core with stylolite breaks dominant. Occ. drill break.	6	100	90
18.0							
20.0							
22.0							

BOREHOLE LOG										BOREHOLE No MW 3	
Client: Roadstone											
Project No: 501.065091.00001			Date: 06/06/2023		Ground Level: 84.26m		Co-ordinates: E589943 N744233				
Project: Cam Quarry GW Monitoring 2023											
SAMPLES & TESTS				Water	STRATA					Instrument	Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
1						(4.20)	[Drillers Description] Medium dense brown very silty gravelly SAND with frequent limestone cobbles and boulders				
2											
3						(3.30)	[Drillers Description] Weak to Medium strong weathered grey LIMESTONE with occasional highly fractured joints				
4											
5						(11.00)	[Drillers Description] Strong grey LIMESTONE occasional fractures				
6											
7						(18.50)	[Drillers Description] Soft to firm orangish brown gravelly CLAY with occasional limestone karst limestone 18.50 - 37.00 Karst limestone with some voids and clay infill				
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
06/06/2023	0.00	0.00	Start of shift								
06/06/2023	37.00	5.00	End of shift								
All dimensions in metres Scale 1:132		Contractor: Stephan Petersen Plant: Knebel HY79			Method: Rotary open hole Hole Size: 120mm			Logged By: SPD		Approved By: DB	
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

BOREHOLE LOG										BOREHOLE No MW 3	
Client: Roadstone											
Project No: 501.065091.00001			Date: 06/06/2023		Ground Level: 84.26m		Co-ordinates: E589943 N744233				
Project: Cam Quarry GW Monitoring 2023											
SAMPLES & TESTS				Water	STRATA					Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION			
21						(18.50)	[Drillers Description] Soft to firm orangish brown gravelly CLAY with occasional limestone karst limestone				
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											
37				47.26				37.00		Borehole Complete at 37.00m	
38											
39											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks General; Borehole collapse at 21.5m due to highly unstable clay formation, managed to push 50mm standpipe to 36m	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
All dimensions in metres Scale 1:132		Contractor: Stephan Petersen Plant: Knebel HY79			Method: Rotary open hole Hole Size: 120mm			Logged By: SPD		Approved By: DB	
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

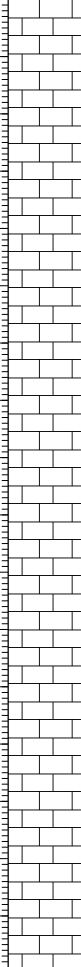
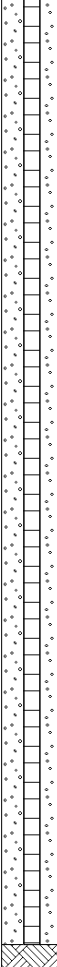
BOREHOLE LOG										BOREHOLE No MW 4	
Client: Roadstone											
Project No: 501.065091.00001		Date: 08/06/2023		Ground Level: 90.05m		Co-ordinates: E590374 N745365					
Project: Cam Quarry GW Monitoring 2023											
SAMPLES & TESTS				Water ▼	STRATA					Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19				89.85		0.20	[Drillers Description] Firm brown TOPSOIL				
							[Drillers Description] Medium dense fine brown silty gravelly SAND with frequent cobbles and boulders				
					(5.90)						
				83.95	6.10	[Drillers Description] Medium strong weathered grey LIMESTONE					
					(1.90)						
	82.05	8.00	[Drillers Description] Strong grey LIMESTONE rare fractures								
			10.50 - 10.80 Fractured rock zone, with some clay infill								
Borehole Continued on Next Page											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
08/06/2023	0.00	0.00	Start of shift								
08/06/2023	60.00	6.60	End of shift								
All dimensions in metres Scale 1:132		Contractor: Stephan Petersen Plant: Knebel HY79			Method: Rotary open hole Hole Size: 120mm			Logged By: SPD		Approved By: DB	
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

BOREHOLE LOG										BOREHOLE No MW 4	
Client: Roadstone											
Project No: 501.065091.00001			Date: 08/06/2023		Ground Level: 90.05m		Co-ordinates: E590374 N745365				
Project: Cam Quarry GW Monitoring 2023											
SAMPLES & TESTS				Water	STRATA					Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
21							[Drillers Description] Strong grey LIMESTONE rare fractures				
22							22.00 - 22.30 Minor fracture, change in flush to brown				
23											
24											
25											
26											
27											
28											
29											
30						(39.00)					
31							31.00 - 31.40 Fractured rock zone, with some clay infill				
32											
33											
34											
35											
36											
37											
38											
39											
Borehole Continued on Next Page											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
All dimensions in metres Scale 1:132					Contractor: Stephan Petersen Plant: Knebel HY79		Method: Rotary open hole Hole Size: 120mm			Logged By: SPD	Approved By: DB
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

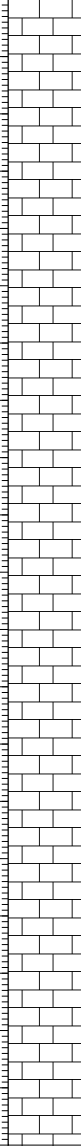
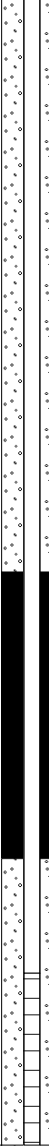
BOREHOLE LOG										BOREHOLE No MW 4	
Client: Roadstone											
Project No: 501.065091.00001			Date: 08/06/2023		Ground Level: 90.05m		Co-ordinates: E590374 N745365				
Project: Cam Quarry GW Monitoring 2023											
SAMPLES & TESTS				Water	STRATA					Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
41						43.05	47.00	[Drillers Description] Strong grey LIMESTONE rare fractures			
42								[Drillers Description] Medium strong occasional Weak brownish grey karst LIMESTONE frequent fractures			
43						(13.00)	60.00	51.50 - 53.00 Highly fractured rock			
44								58.00 - 58.50 Highly fractured rock with clay infill			
45											
46											
47											
48											
49											
50											
51											
52											
53											
54											
55											
56											
57											
58											
59											
Borehole Complete at 60.00m											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
All dimensions in metres Scale 1:132		Contractor: Stephan Petersen Plant: Knebel HY79			Method: Rotary open hole Hole Size: 120mm			Logged By: SPD	Approved By: DB		
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

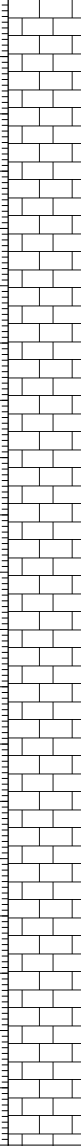
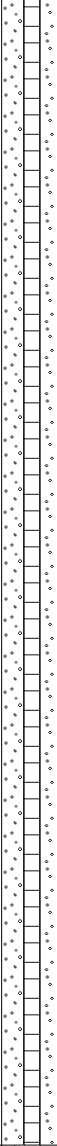
BOREHOLE LOG										BOREHOLE No MW 5	
Client: Roadstone											
Project No: 501.065091.00001		Date: 02/06/2023		Ground Level: 87.89m		Co-ordinates: E590238 N745008					
Project: Cam Quarry GW Monitoring 2023											
SAMPLES & TESTS				Water ▼	STRATA					Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19				87.59		0.30	[Drillers Description] Rock Fill MADE GROUND				
						(1.10)	[Drillers Description] Medium dense fine brown silty slightly gravelly SAND				
				86.49		1.40					
						(13.60)	[Drillers Description] Weak occasional highly weathered karst light grey LIMESTONE some clayey karst joints				
				5.50 - 7.50 Fractured rock zone, with some clay infill							
							9.00 - 12.00 Highly fractured rock with clay infill				
				72.89		15.00	[Drillers Description] Strong grey LIMESTONE rare fractures				
Borehole Continued on Next Page											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
02/06/2023	0.00	0.00	Start of shift								
02/06/2023	57.00	2.00	End of shift								
All dimensions in metres Scale 1:132		Contractor: Stephan Petersen Plant: Knebel HY79		Method: Rotary open hole Hole Size: 120mm			Logged By: SPD		Approved By: DB		
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

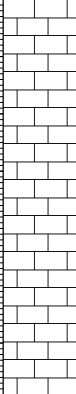
BOREHOLE LOG										BOREHOLE No MW 5	
Client: Roadstone											
Project No: 501.065091.00001			Date: 02/06/2023		Ground Level: 87.89m		Co-ordinates: E590238 N745008				
Project: Cam Quarry GW Monitoring 2023											
SAMPLES & TESTS				Water	STRATA					Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
21								[Drillers Description] Strong grey LIMESTONE rare fractures			
22											
23											
24							(12.00)				
25											
26											
27					60.89		27.00	[Drillers Description] Very weak highly weathered karst light grey LIMESTONE frequent calcite veins 27.00 - 31.00 Highly fractured rock with clay infill			
28											
29											
30											
31							(8.00)				
32											
33											
34											
35					52.89		35.00	[Drillers Description] Medium strong light grey LIMESTONE occasional karst layers frequent calcite veins			
36											
37											
38											
39											
Borehole Continued on Next Page											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
All dimensions in metres Scale 1:132		Contractor: Stephan Petersen Plant: Knebel HY79			Method: Rotary open hole Hole Size: 120mm			Logged By: SPD		Approved By: DB	
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

BOREHOLE LOG										BOREHOLE No MW 5	
Client: Roadstone											
Project No: 501.065091.00001		Date: 02/06/2023		Ground Level: 87.89m		Co-ordinates: E590238 N745008					
Project: Cam Quarry GW Monitoring 2023										Sheet 3 of 3	
SAMPLES & TESTS				Water	STRATA				Instrument Backfill		
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
41						(22.00)	[Drillers Description] Medium strong light grey LIMESTONE occasional karst layers frequent calcite veins				
42							42.50 - 44.00 Highly fractured rock with clay infill				
43											
44											
45											
46											
47											
48											
49											
50											
51											
52											
53											
54											
55											
56											
57				30.89		57.00	Borehole Complete at 57.00m				
58											
59											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
All dimensions in metres Scale 1:132		Contractor: Stephan Petersen Plant: Knebel HY79			Method: Rotary open hole Hole Size: 120mm			Logged By: SPD		Approved By: DB	
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

BOREHOLE LOG										BOREHOLE No MW 6	
Client: Roadstone											
Project No: 501.065091.00001		Date: 07/06/2023		Ground Level: 86.38m		Co-ordinates: E589959 N745326					
Project: Cam Quarry GW Monitoring 2023											
SAMPLES & TESTS				Water ▼	STRATA					Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19				86.18		0.20	[Drillers Description] Firm brown TOPSOIL				
						(4.60)	[Drillers Description] Medium dense fine brown very silty gravelly SAND with frequent cobbles and boulders				
				81.58		4.80	[Drillers Description] Very weak highly weathered grey LIMESTONE				
				80.48		5.90	[Drillers Description] Strong grey LIMESTONE with occasional light brown fractured layers				
				66.38		20.00	Borehole Continued on Next Page				
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
07/06/2023	0.00	0.00	Start of shift								
07/06/2023	67.00	6.40	End of shift								
All dimensions in metres Scale 1:132		Contractor: Stephan Petersen Plant: Knebel HY79			Method: Rotary open hole Hole Size: 120mm			Logged By: SPD		Approved By: DB	
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

BOREHOLE LOG										BOREHOLE No MW 6	
Client: Roadstone											
Project No: 501.065091.00001			Date: 07/06/2023		Ground Level: 86.38m		Co-ordinates: E589959 N745326				
Project: Cam Quarry GW Monitoring 2023											
SAMPLES & TESTS				Water	STRATA					Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION			
21							[Drillers Description] Strong grey LIMESTONE rare fractures				
22							21.50 - 21.80 Fractured rock zone, with some clay infill				
23											
24											
25											
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											
37											
38											
39											
Borehole Continued on Next Page											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
All dimensions in metres Scale 1:132		Contractor: Stephan Petersen Plant: Knebel HY79			Method: Rotary open hole Hole Size: 120mm			Logged By: SPD		Approved By: DB	
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

BOREHOLE LOG										BOREHOLE No MW 6	
Client: Roadstone											
Project No: 501.065091.00001			Date: 07/06/2023		Ground Level: 86.38m		Co-ordinates: E589959 N745326				
Project: Cam Quarry GW Monitoring 2023											
SAMPLES & TESTS				Water	STRATA					Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION			
41						(47.00)	[Drillers Description] Strong grey LIMESTONE rare fractures				
42							41.50 - 42.00 Minor fracture, change in flush to brown				
43											
44											
45											
46											
47											
48											
49											
50											
51											
52											
53											
54											
55											
56											
57											
58											
59											
Borehole Continued on Next Page											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
All dimensions in metres Scale 1:132		Contractor: Stephan Petersen Plant: Knebel HY79			Method: Rotary open hole Hole Size: 120mm			Logged By: SPD		Approved By: DB	
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

BOREHOLE LOG										BOREHOLE No MW 6	
Client: Roadstone											
Project No: 501.065091.00001		Date: 07/06/2023		Ground Level: 86.38m		Co-ordinates: E589959 N745326					
Project: Cam Quarry GW Monitoring 2023										Sheet 4 of 4	
SAMPLES & TESTS				Water	STRATA				Instrument Backfill		
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION			
61						67.00	[Drillers Description] Strong grey LIMESTONE rare fractures				
62											
63											
64											
65											
66											
67				19.38							
68											
69											
70											
71					Borehole Complete at 67.00m						
72											
73											
74											
75											
76											
77											
78											
79											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
All dimensions in metres Scale 1:132		Contractor: Stephan Petersen Plant: Knebel HY79			Method: Rotary open hole Hole Size: 120mm			Logged By: SPD		Approved By: DB	
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

Appendix 7-D Field Record Sheets for Groundwater Monitoring and Surface Water Monitoring

GROUNDWATER SAMPLING FIELD RECORD SHEET

Site location: Cam Quarry, Roscommon.

SLR job number: 501.000180.65091 **Date:** 03/08/2023

Time: 10.00– 18:00 on site

Staff: Orlaith Tyrrell, Mairead Brown

Equipment: Watterra, Dip, YSI, Bailer

	MW3	MW4	MW5	MW6
Groundwater level (m toc)	27.35	32.75	31.57	13.52
Total depth (m)	36	59.58	56.50	67
Volume of water in borehole (litres)	47.6	147.6	137.1	294.1
Watterra/bailer	Bailer	Bailer	Watterra	Watterra

Temperature (°C)	-	-	10.8	11.4
Specific conductivity (µS/cm)	-	-	293.7	343.1
Salinity (PSU)	-	-	0.16	0.19
pH	-	-	7.38	7.3
Total Dissolved Solids (ppt)	-	-	0.19	0.22
Turbidity (NTU)	-	-	4599.3	73.7

	MW3	MW4	MW5	MW6
RDO Concentration (mg/L)	-	-	266.1	265.9

Odour	No	No	No	No
Sheen	No	No	No	No
Silt	Extremely Silty	Medium	Medium	Low
Colour	Brown/Opaque	Light Brown/Opaque	Light Brown/Opaque	Cloudy/Opaque
Free product	No	No	No	No
Volume Purged	-	-	135L	30L
Well purged dry	No	No	No	No

Any other field observations:

MW3 – Clay at base of borehole due to a partial well collapse during installation. Unable to pump due to the extremely high clay content. Attempted to bail but the bailer would not fill, grab sample taken but not enough bailed to fill containers completely. Unable to filter sample due to the high clay content. No Aquatroll data as water was too clayey and not enough bailed.

MW4 – Grab sample taken. No Aquatroll data, not enough water bailed.

MW5 – Pumping started at 10:50 and finished at 11:25 – 35 minutes of pumping. 9 buckets purged.

MW6 – Pumping started at 12.30, after 10 minutes there was very little outflow, which quickly stopped. Tubing was changed but still no water outflow. 2 buckets purged. Grab sample taken.

ONE WELL VOLUME (50mm diameter casing)	BS 10175
Terrier Borehole with 50mm Pipe	4l/m
6" Borehole with 50mm Pipe	5.5l/m
6" Borehole with 100mm Pipe	11.5l/m
8" Borehole with 50mm Pipe	8.25l/m
8" Borehole with 100mm Pipe	14.25l/m
Note : <i>Purging should continue until Removal of at least three well volumes, or pH, conductivity and temperature readings have stabilised (any two successive reading are within 10% of each other). If well is not recovering and it is not possible to meet these criteria then a grab sample should be obtained.</i>	

SURFACE WATER SAMPLING FIELD RECORD SHEET

Site location: Cam Quarry, Roscommon.

SLR job number: 501.000180.65091 **Date:** 03/08/2023

Time: 10:00 – 18.00 on site

Staff: Orlaith Tyrrell, Mairead Brown

Equipment: SW Scoop

	SW2	SW1
Odour	No	No
Sheen	No	No
Silt	V. Low	Low
Colour	Light Yellow/ Transparent	Light Green/ Transparent
Free product	No	No

Any other field observations:

SW1: Contained free suspended particles.

SW2: Contained free suspended particles.

SURFACE WATER SAMPLING FIELD RECORD SHEET

Site location: Cam Quarry, Roscommon.

SLR job number: 501.00180.065091 **Date:** 11/01/2024

Time: 8.45– 15.45 on site

Staff: Mairead Brown

Equipment: SW Scoop

	SW2	SW1
Odour	No	No
Sheen	No	No
Silt	V. Low	V. Low
Colour	Light Yellow/ Transparent	Light Green/ Transparent
Free product	No	No

	SW1	SW2
Specific conductivity ($\mu\text{S}/\text{cm}$)	490.06	492.78
Salinity (PSU)	0.23	0.23
Total Dissolved Solids (ppt)	0.32	0.32

	SW1	SW2
Turbidity (NTU)	0.05	0.23
pH (pH)	7.38	7.68
RDO Concentration (mg/L)	10.45	11.95
Temperature (°C)	3.00	3.36

GROUNDWATER SAMPLING FIELD RECORD SHEET

Site location: Cam Quarry, Roscommon.

SLR job number: 501.00180.065091 **Date:** 11/01/2024

Time: 8.45– 15.45 on site

Staff: Mairead Brown

Equipment: Waterra, Dip, YSI, Bailer

	MW3	MW4	MW5	MW6
Groundwater level (m toc)	20.60	27.80	25.53	11.35
Total depth (m)	36	59.58	56.50	67
Volume of water in borehole (litres)	86.62	174.35	172.43	308
Waterra/bailer	Waterra	Bailer	Waterra	Waterra

Temperature (°C)	10.15	-	10.26	9.8
Specific conductivity (µS/cm)	555.46	-	316.94	458.85
Salinity (PSU)	0.27	-	0.15	0.22
pH	6.76	-	7.19	6.88
Total Dissolved Solids (ppt)	0.36	-	0.20	0.30
Turbidity (NTU)	1129.36	-	7864.81	5533.63

	MW3	MW4	MW5	MW6
RDO Concentration (mg/L)	6.15	-	9.80	9.09

Odour	No	No	No	No
Sheen	No	No	No	No
Silt	Extremely Silty	Medium	Medium	Low
Colour	Brown/Opaque	Light Brown/Opaque	Light Brown/Opaque	Grey/Transparent
Free product	No	No	No	No
Volume Purged	90	-	180	330
Well purged dry	No	No	No	No

Any other field observations:

MW3 – Pumping started at 10.45 and finished at 11.00 – 15 minutes of pumping. 6 buckets purged. Unable to filter sample completely due to the high clay content (>20 filters used).

MW4 – No aquatroll data due to a connection issue. Pump broke while sampling, grab sample taken.

MW5 – Pumping started at 12.00 and finished at 12.25 – 25 minutes of pumping. 12 buckets purged.

MW6 – Pumping started at 9.15 and finished at 9.55 – 40 minutes of pumping. 22 buckets purged.

ONE WELL VOLUME (50mm diameter casing)	BS 10175
Terrier Borehole with 50mm Pipe	4l/m
6" Borehole with 50mm Pipe	5.5l/m
6" Borehole with 100mm Pipe	11.5l/m
8" Borehole with 50mm Pipe	8.25l/m
8" Borehole with 100mm Pipe	14.25l/m
Note : Purging should continue until Removal of at least three well volumes, or pH, conductivity and temperature readings have stabilised (any two successive reading are within 10% of each other). If well is not recovering and it is not possible to meet these criteria then a grab sample should be obtained.	

Groundwater Sampling Field Record Sheet

Date:	8 October 2024	Time:	8.30 – 16.00 on site	Location:	Cam Quarry, Roscommon
Staff:	Michelle Sherry, Mairead Brown			SLR Project No.:	501.065505.00001
Equipment	Dip meter, Aquatroll, Waterra, Bailer, Scoop				

Table 1- Water Measurements

	MW3	MW4	MW5	MW6
Groundwater level (m bgl)	30.29	34.88	34.53	20.32
Total depth (m)	36	59.58	56.50	67
Volume of water in borehole (litres)	31.41	135.85	120.84	256.74
Volume purged (L)	15	15	15	125
Waterra / Bailer	Bailer	Bailer	Bailer	Waterra

Table 2 – Visual field parameters

Parameter	MW3	MW4	MW5	MW6
Odour	No	No	No	No
Sheen	No	No	No	No
Silt	V. High	Low	No	Low
Colour	Dark Brown, Opaque	Brown, Opaque	Clear, Transparent	Slightly cloudy, Transparent
Free product	No	No	No	No

Table 3 – Aquatroll Field Parameters

Field Record Sheet



Parameter	MW3	MW4	MW5	MW6
Temperature (°C)	11.19	10.86	11.15	10.74
Specific conductivity (µS/cm)	652.87	744.54	297.22	439.6
Salinity (PSU)	0.32	0.36	0.14	0.21
pH	6.94	6.79	7	7.34
Total Dissolved Solids (ppt)	0.42	0.48	0.19	0.29
Turbidity (NTU)	5450.78	70.73	2075.22	34.03
RDO Concentration (mg/L)	7.32	4.43	10.66	9.94

Other field observations:

MW5 – Pump refuelled >10m away.

MW3, MW4, MW5 – Unable to get a sample by Waterra, hence, a bailer was used to obtain a grab sample from these three wells.

Surface Water Sampling Field Record Sheet

Date:	8 October 2024	Time:	8.30– 16.00 on site	Location:	Cam Quarry, Roscommon
Staff:	Mairead Brown, Michelle Sherry			SLR Project No.:	501.065505.00001
Equipment	Aquatroll, Scoop				

Table 1 – Visual Field Parameters

Parameter	SW1	SW2
Odour	No	No
Sheen	No	No
Silt	Low	No
Colour	Clear, Transparent	Yellow, Transparent
Free product	Yes, Organic materials (leaves, dirt) in sample	No

Table 2 – Aquatroll Field Parameters

Parameter	SW1	SW2
Temperature (°C)	12.25	12.43
Specific conductivity (µS/cm)	499.02	501.82
Salinity (PSU)	0.24	0.24
pH	6.98	7.59
Total Dissolved Solids (ppt)	0.32	0.33
Turbidity (NTU)	943.22	4.45
RDO Concentration (mg/L)	0.36	9.29

Other field observations:

Surface Water Sampling Field Record Sheet

Date:	17 July 2025	Time:	8.30– 16.00 on site	Location:	Curry, Bridewell, Co. Roscommon
Staff:	Michelle Sherry	SLR Project No.:			501.065512.0001
Equipment	Aquatroll, Scoop				

Table 1 – Visual Field Parameters

Parameter	SW1 Ballyglass US	SW2 Ballyglass DS	SW3 River Suck at Derrycahill Br.
Odour	No	No	No
Sheen	No	No	No
Silt	Low	Low	Low
Colour	Transparent, Clear	Transparent, Yellow	Transparent, Yellow
Free product	Leaves	No	No

Table 2 – Aquatroll Field Parameters

Parameter	SW1 Ballyglass US	SW2 Ballyglass DS	SW3 River Suck at Derrycahill Br.
Temperature (°C)	16.34	16.32	20.32
Specific conductivity (µS/cm)	105.17	105.76	165.20
Salinity (PSU)	0.05	0.05	0.08
pH	6.66	-	7.52
Total Dissolved Solids (ppt)	0.07	0.07	0.11
Turbidity (NTU)	4.55	0	0.03
RDO Concentration (mg/L)	4.27	7.85	8.30

Field Notes:

SW2 – pH sensor didn't work

Surface Water Sampling Field Record Sheet

Date:	16 September 2025	Time:	8.30– 16.00 on site	Location:	Cam quarry, Co. Roscommon
Staff:	Michelle Sherry	SLR Project No.:		501.065512.00001	
Equipment	Aquatroll, Scoop				

Table 1 – Visual Field Parameters

Parameter	SW1 Ballyglass Stream US	SW2 Ballyglass Stream US	Quarry Sump
Odour	No	No	No
Sheen	No	No	No
Silt	Low	Low	No
Colour	Transparent, yellow	Transparent, yellow	Clear / Transparent
Free product	No	No	No

Table 2 – Aquatroll Field Parameters

Parameter	SW1 Ballyglass Stream US	SW2 Ballyglass Stream US	Quarry Sump
Temperature (°C)	12.18	12.01	11.64
Specific conductivity (µS/cm)	383.03	375.85	578.30
Salinity (PSU)	0.18	0.18	0.28
pH	6.00	6.18	6.73
Total Dissolved Solids (ppt)	0.25	0.24	0.38
Turbidity (NTU)	509.97	0.76	3.33
RDO Concentration (mg/L)	6.13	9.58	10.06

Appendix 7-E Groundwater Screening Results

Water (Hydrology & Hydrogeology) 7

Table 7-16: Groundwater Quality (5th August 2023)

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Inorganics								
Ammoniacal Nitrogen as N (low level)	0.065-0.175		0.15	mg/l	0.288	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₃	0.07891-0.21245		0.1821	mg/l	0.35	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₄	0.083525-1.651225			mg/l	0.37	<0.3	<0.3	<0.3
Chloride	187.5	250	30	mg/l	24.9	63.4	7.8	13.1
Conductivity	0.8 - 1.875	2.5	1	mS/cm	0.581	0.626	0.349	0.414
Cyanide, Free (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Cyanide, Total (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Fluoride		0.8	1	mg/l	<0.5	<0.5	<0.5	<0.5
Nitrate as NO ₃	37.5	50	25	mg/l	6.61	3.9	1.88	12.4
Nitrite as NO ₂	0.375	0.5	0.1	Mg/l	<0.25	<0.05	<0.05	<0.05
pH		6.5-9.5	6.5-9.5	pH Units	7.68	7.76	7.96	8
Phosphate (Ortho as PO ₄)			0.03	mg/l	<0.05	<0.05	<0.05	<0.05
Sulphate	187.5	250	200	mg/l	6.3	5.4	18.8	<2
Sulphide				mg/l	0.0681	0.0378	0.0328	0.0138
Alkalinity, Total as CaCO ₃				mg/l	303	280	260	204
Total Oxidised Nitrogen as N				mg/l	-	-	-	-

Water (Hydrology & Hydrogeology) 7

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Metals Filtered (Dissolved)								
Aluminium (diss.filt)	150	200	200	µg/l	<10	<10	<10	11.1
Arsenic (diss.filt)	7.5	10	10	µg/l	<0.5	<0.5	<0.5	<0.5
Barium (diss.filt)			100	µg/l	8.08	7.78	3.92	3.92
Boron (diss.filt)	750,000	1000		µg/l	<10	<10	<10	<10
Cadmium (diss.filt)	3.75*	5	5	µg/l	<0.08	<0.08	<0.08	<0.08
Calcium (Dis.Filt)			200	mg/l	96.7	95.7	71.9	87.2
Chromium (diss.filt)	37.5	50	30	µg/l	1.74	<1	<1	<1
Copper (diss.filt)	1500	2000	30	µg/l	1.38	0.692	<0.3	1.62
Iron (Dis.Filt)		200	200	mg/l	<0.019	<0.019	<0.019	<0.019
Lead (diss.filt)	7.5	10	10	µg/l	<0.2	<0.2	<0.2	<0.2
Mercury (diss.filt)	0.75	1	1	µg/l	<0.01	<0.01	<0.01	<0.01
Nickel (diss.filt)	15	20	20	µg/l	5.23	1.51	1.55	0.725
Phosphorus (diss.filt)				µg/l	<10	<10	<10	<10
Potassium (Dis.Filt)			5	mg/l	0.762	0.669	0.213	0.996
Selenium (diss.filt)		10		µg/l	1.9	<1	<1	<1
Sodium (Dis.Filt)				mg/l	7.83	29.3	4.06	6.33
Vanadium (diss.filt)				µg/l	2.74	<1	<1	<1
Zinc (diss.filt)	75		100	µg/l	5.09	9.13	3.73	22.5

Water (Hydrology & Hydrogeology) 7

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Metals Unfiltered (Total)								
Aluminium (tot.unfilt)				µg/l	-	-	-	-
Magnesium (tot.unfilt)				mg/l	14.5	14	3.81	2.39
Manganese (tot.unfilt)				µg/l	2190	1160	290	14.5
TPH Criteria Working Group (TPH CWG)								
Aliphatics >C10-C12				µg/l	<10	<10	<10	<10
Aliphatics >C12-C16 (aq)				µg/l	<10	<10	<10	<10
Aliphatics >C16-C21 (aq)				µg/l	<10	<10	<10	<10
Aliphatics >C21-C35 (aq)				µg/l	213	<10	<10	<10
Aliphatics >C5-C6				µg/l	<10	<10	<10	<10
Aliphatics >C6-C8				µg/l	<10	<10	<10	<10
Aliphatics >C8-C10				µg/l	<10	<10	<10	<10
Aromatics >EC10-EC12				µg/l	<10	<10	<10	<10
Aromatics >EC12-EC16 (aq)				µg/l	<10	<10	<10	<10
Aromatics >EC16-EC21 (aq)				µg/l	<10	<10	<10	<10
Aromatics >EC21-EC35 (aq)				µg/l	12	<10	<10	<10
Aromatics >EC5-EC7				µg/l	<10	<10	<10	<10
Aromatics >EC7-EC8				µg/l	<10	<10	<10	<10
Aromatics >EC8-EC10				µg/l	<10	<10	<10	<10
GRO >C5-C12				µg/l	<50	<50	<50	<50

Water (Hydrology & Hydrogeology) 7

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Total Aliphatics & Aromatics >C5-35 (aq)	7.5			µg/l	225	<10	<10	<10
Total Aliphatics >C12-C35 (aq)				µg/l	213	<10	<10	<10
Total Aromatics >EC12-EC35 (aq)				µg/l	12	<10	<10	<10
EPH CWG (Speciated)								
Aliphatics >C16-C35 Aqueous				µg/l	213	<10	<10	<10
Polyaromatic Hydrocarbons (PAHs)								
Acenaphthene (aq)				µg/l	<0.005	<0.005	<0.005	<0.005
Acenaphthylene (aq)				µg/l	<0.005	<0.005	<0.005	<0.005
Anthracene (aq)			10000	µg/l	<0.0052 5	<0.005	<0.005	<0.005
Benzo(a)anthracene (aq)				µg/l	0.00824	<0.005	<0.005	<0.005
Benzo(a)pyrene (aq)	0.0075	0.01	0.01	µg/l	0.0192	<0.002	<0.002	<0.002
Benzo(b)fluoranthene (aq)			0.5	µg/l	0.0223	<0.005	<0.005	<0.005
Benzo(g,h,i)perylene (aq)			0.05	µg/l	<0.005	<0.005	<0.005	<0.005
Benzo(k)fluoranthene (aq)			0.05	µg/l	<0.005	<0.005	<0.005	<0.005
Chrysene (aq)				µg/l	0.0195	<0.005	<0.005	<0.005
Dibenzo(a,h)anthracene (aq)				µg/l	<0.005	<0.005	<0.005	<0.005
Fluoranthene (aq)			1	µg/l	0.0697	<0.005	<0.005	<0.005
Fluorene (aq)				µg/l	0.0074	<0.005	<0.005	<0.005
Indeno(1,2,3-cd)pyrene (aq)			0.05	µg/l	0.00711	<0.005	<0.005	<0.005

Water (Hydrology & Hydrogeology) 7

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Naphthalene (aq)			1	µg/l	<0.01	<0.01	<0.01	<0.01
PAH, Total Detected USEPA 16 (aq)		0.075	0.1	µg/l	0.272	<0.082	<0.082	<0.082
Phenanthrene (aq)				µg/l	0.0617	<0.005	<0.005	<0.005
Pyrene (aq)				µg/l	0.0519	<0.005	<0.005	<0.005
Microbiological								
Escherichia coli		0	0	CFU/100 ml	2	>100	0	0
Coliform bacteria		0	0	CFU/100 ml	31	>100	0	2
Highlighted values; exceedances assessment criteria; SI No 366 of 2016 (GW Regs), SI No 122 of 2014 (EC Drinking Water Regs), EPA IGVs (in that order)								

Water (Hydrology & Hydrogeology) 7

Table 7-17: Groundwater Quality (11th January 2024)

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Inorganics								
Ammoniacal Nitrogen as N (low level)	0.065-0.175		0.15	mg/l	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₃	0.07891-0.21245		0.1821	mg/l	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₄	0.083525-1.651225			mg/l	<0.3	<0.3	<0.3	<0.3
Chloride	187.5	250	30	mg/l	16.6	66.8	7.2	10.5
Conductivity	0.8 - 1.875	2.5	1	mS/cm	0.582	0.657	0.281	0.407
Cyanide, Free (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Cyanide, Total (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Fluoride		0.8	1	mg/l	<0.5	<0.5	<0.5	<0.5
Nitrate as NO ₃	37.5	50	25	mg/l	11.8	2.4	2.94	17
Nitrite as NO ₂	0.375	0.5	0.1	Mg/l	<0.25	<0.5	<0.5	<0.5
pH		6.5-9.5	6.5-9.5	pH Units	7.68	7.74	7.88	7.87
Phosphate (Ortho as PO ₄)			0.03	mg/l	<0.05	<0.05	<0.05	<0.05
Sulphate	187.5	250	200	mg/l	4	4.6	21.2	7.3
Sulphide				mg/l	<0.01	<0.01	<0.01	<0.01
Alkalinity, Total as CaCO ₃				mg/l	366	270	143	202
Total Oxidised Nitrogen as N				mg/l	2.66	0.542	0.665	3.85

Water (Hydrology & Hydrogeology) 7

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Metals Filtered (Dissolved)								
Aluminium (diss.filt)	150	200	200	µg/l	<10	<10	<10	<10
Arsenic (diss.filt)	7.5	10	10	µg/l	0.524	0.577	<0.5	<0.5
Barium (diss.filt)			100	µg/l	16.1	11	3.12	4.41
Boron (diss.filt)	750,000	1000		µg/l	10.5	15.2	<10	10.2
Cadmium (diss.filt)	3.75	5	5	µg/l	0.167	<0.08	<0.08	<0.08
Calcium (Dis.Filt)			200	mg/l	121	98.6	55.5	82.9
Chromium (diss.filt)	37.5	50	30	µg/l	<1	<1	<1	<1
Copper (diss.filt)	1500	2000	30	µg/l	1.99	1.25	1.82	1.37
Iron (Dis.Filt)		200	200	mg/l	<0.019	<0.019	<0.019	<0.019
Lead (diss.filt)	7.5	10	10	µg/l	0.543	0.521	0.334	<0.2
Mercury (diss.filt)	0.75	1	1	µg/l	<0.01	<0.01	<0.01	<0.01
Nickel (diss.filt)	15	20	20	µg/l	4.38	0.801	0.565	<0.4
Phosphorus (diss.filt)				µg/l	<10	<10	11.3	<10
Potassium (Dis.Filt)			5	mg/l	1.91	0.726	0.227	0.835
Selenium (diss.filt)		10		µg/l	2.71	<1	<1	<1
Sodium (Dis.Filt)				mg/l	8.96	32.3	5.03	6.69
Vanadium (diss.filt)				µg/l	5.62	<1	<1	<1
Zinc (diss.filt)	75		100	µg/l	Null	Null	Null	Null

Water (Hydrology & Hydrogeology) 7

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Metals Unfiltered (Total)								
Aluminium (tot.unfilt)				µg/l	36200	241	9590	46.9
Magnesium (Tot. Unfilt.)				mg/l	13.2	14.2	3.42	2.23
Manganese (tot.unfilt)				µg/l	1340	50.9	416	<1
TPH Criteria Working Group (TPH CWG)								
Aliphatics >C10-C12				µg/l	<10	<10	<10	<10
Aliphatics >C12-C16 (aq)				µg/l	<50	<10	<50	<10
Aliphatics >C16-C21 (aq)				µg/l	<50	<10	<50	<10
Aliphatics >C21-C35 (aq)				µg/l	<50	<10	<50	<10
Aliphatics >C5-C6				µg/l	<10	<10	<10	<10
Aliphatics >C6-C8				µg/l	<10	<10	<10	<10
Aliphatics >C8-C10				µg/l	<10	<10	<10	<10
Aromatics >EC10-EC12				µg/l	<10	<10	<10	<10
Aromatics >EC12-EC16 (aq)				µg/l	<50	<10	<50	<10
Aromatics >EC16-EC21 (aq)				µg/l	<50	<10	<50	<10
Aromatics >EC21-EC35 (aq)				µg/l	<50	12	<50	<10
Aromatics >EC5-EC7				µg/l	<10	<10	<10	<10
Aromatics >EC7-EC8				µg/l	<10	<10	<10	<10
Aromatics >EC8-EC10				µg/l	<10	<10	<10	<10
GRO >C5-C12				µg/l	<50	<50	<50	<50

Water (Hydrology & Hydrogeology) 7

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Total Aliphatics & Aromatics >C5-35 (aq)	7.5			µg/l	<10	34	<50	<10
Total Aliphatics >C12-C35 (aq)				µg/l	<50	<10	<50	<10
Microbiological								
Escherichia coli		0	0	CFU/100ml	10	46	3	0
Coliform bacteria		0	0	CFU/100ml	3	49	17	11
Highlighted values ; exceedances assessment criteria; SI No 366 of 2016 (GW Regs), SI No 122 of 2014 (EC Drinking Water Regs), EPA IGVs (in that order)								

Table 7-18: Groundwater Quality (8th October 2024)

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Inorganics								
Ammoniacal Nitrogen as N (low level)	0.065-0.175		0.15	mg/l	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₃	0.07891-0.21245		0.1821	mg/l	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₄	0.083525-1.651225			mg/l	<0.3	<0.3	<0.3	<0.3
Chloride	187.5	250	30	mg/l	17.4	63.7	6.8	10.3
Conductivity	0.8 - 1.875	2.5	1	mS/cm	0.579	0.653	0.293	0.421
Cyanide, Free (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Cyanide, Total (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Fluoride		0.8	1	mg/l	<0.5	<0.5	<0.5	<0.5
Nitrate as NO ₃	37.5	50	25	mg/l	10.8	0.33	2.61	12.4
Nitrite as NO ₂	0.375	0.5	0.1	mg/l	<0.25	0.269	0.062	<0.05
pH		6.5-9.5	6.5-9.5	pH Units	7.54	7.84	7.96	7.76
Phosphate (Ortho as PO ₄)			0.03	mg/l	<0.05	<0.05	<0.05	<0.05
Sulphate	187.5	250	200	mg/l	5.2	6.5	14.2	5.7
Sulphide				mg/l	<0.01	<0.01	<0.01	<0.01
Alkalinity, Total as CaCO ₃				mg/l	312	272	203	534
Total Oxidised Nitrogen as N				mg/l	2.44	0.156	0.607	2.81

Water (Hydrology & Hydrogeology) 7

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Filtered (Dissolved) Metals								
Aluminium (diss.filt)	150	200	200	µg/l	<10	<10	13.6	<10
Arsenic (diss.filt)	7.5	10	10	µg/l	<0.5	<0.5	<0.5	<0.5
Barium (diss.filt)			100	µg/l	11	9.57	3.4	4.94
Boron (diss.filt)	750,000	1000		µg/l	<10	<10	<10	<10
Cadmium (diss.filt)	3.75	5	5	µg/l	<0.08	<0.08	<0.08	<0.08
Calcium (Dis.Filt)			200	mg/l	115	96	60.3	88.4
Chromium (diss.filt)	37.5	50	30	µg/l	<1	<1	<1	1
Copper (diss.filt)	1500	2000	30	µg/l	0.33	0.589	0.708	0.915
Iron (Dis.Filt)		200	200	mg/l	<0.019	<0.019	0.0227	0.0203
Lead (diss.filt)	7.5	10	10	µg/l	<0.2	<0.2	0.267	1.83
Mercury (diss.filt)	0.75	1	1	µg/l	<0.01	<0.01	<0.01	<0.01
Nickel (diss.filt)	15	20	20	µg/l	2.04	1.29	1	0.851
Phosphorus (diss.filt)				µg/l	<10	13	21.4	<10
Potassium (Dis.Filt)			5	mg/l	1.34	0.716	0.45	0.907
Selenium (diss.filt)		10		µg/l	1.16	<1	<1	<1
Sodium (Dis.Filt)				mg/l	8.4	28.2	4.31	6
Vanadium (diss.filt)				µg/l	2.08	<1	<1	<1
Zinc (diss.filt)	75		100	µg/l	-	-	-	-

Water (Hydrology & Hydrogeology) 7

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Unfiltered (Total) Metals								
Aluminium (tot.unfilt)				µg/l	-	-	-	-
Magnesium (Tot. Unfilt.)			50	mg/l	16.3	12.7	4.84	10.7
Manganese (tot.unfilt)		50	50	µg/l	2190	177	697	692
Microbiological								
Escherichia coli		0	0	CFU/100ml	11	11	15	248
Coliform bacteria		0	0	CFU/100ml	1	4	8	0
Highlighted values: exceedances assessment criteria; SI No 366 of 2016 (GW Regs), SI No 122 of 2014 (EC Drinking Water Regs), EPA IGVs (in that order) Bold values: Exceeds laboratory limit of detection for organics where no assessment criteria exists								

Appendix 7-F Laboratory Results



Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US

Tel: (01244) 528777
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

SLR Consulting Ireland
CSA House
Unit 7
Dundrum Business Park
Windy Harbour
Dublin
Dublin14

Attention: Dominica Baird

CERTIFICATE OF ANALYSIS

Date of report Generation:	15 August 2023
Customer:	SLR Consulting Ireland
Sample Delivery Group (SDG):	230807-27
Your Reference:	501.000180.65091
Location:	Cam Quarry Roscommon
Report No:	700217
Order Number:	8784

This report has been revised and directly supersedes 699500 in its entirety.

We received 6 samples on Monday August 07, 2023 and 6 of these samples were scheduled for analysis which was completed on Tuesday August 15, 2023. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.

Incorrect sampling dates and/or sample information will affect the validity of results.

The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan

Operations Manager





CERTIFICATE OF ANALYSIS

Validated

SDG: 230807-27
Client Ref.: 501.000180.65091

Report Number: 700217
Location: Cam Quarry Roscommon

Superseded Report: 699500

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
28441687	MW3		0.00 - 0.00	03/08/2023
28441698	MW4		0.00 - 0.00	03/08/2023
28441711	MW5		0.00 - 0.00	03/08/2023
28441723	MW6		0.00 - 0.00	03/08/2023
28441668	SW1		0.00 - 0.00	03/08/2023
28441678	SW2		0.00 - 0.00	03/08/2023

Only received samples which have had analysis scheduled will be shown on the following pages.

SDG: 230807-27
Client Ref.: 501.000180.65091

Report Number: 700217

Superseded Report: 699500

Location: Cam Quarry Roscommon

[illegible]

SDG: 230807-27
Client Ref.: 501.000180.65091

Report Number: 700217 **Site:** Su
Location: Cam Quarry Roscommon

Superseded Report: 699500

Results Legend X Test N No Determination Possible Sample Types - S - Soil/Solid UNS - Unspecified Solid GW - Ground Water SW - Surface Water LE - Land Leachate PL - Prepared Leachate PR - Process Water SA - Saline Water TE - Trade Effluent TS - Treated Sewage US - Untreated Sewage RE - Recreational Water DW - Drinking Water Non-regulatory UNL - Unspecified Liquid SL - Sludge G - Gas OTH - Other	Lab Sample No(s)		28441687												28441698												28441711											
	Customer Sample Reference		MW3												MW4												MW5											
	AGS Reference																																					
	Depth (m)		0.00 - 0.00												0.00 - 0.00												0.00 - 0.00											
	Container		0.5l glass bottle (ALE227)	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	HNO3 Unfiltered (ALE204)	NaOH (ALE245)	Vial (ALE297)	ZnAc (ALE246)	0.5l glass bottle (ALE227)	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	HNO3 Unfiltered (ALE204)	NaOH (ALE245)	Vial (ALE297)	ZnAc (ALE246)	0.5l glass bottle (ALE227)	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	HNO3 Unfiltered (ALE204)	NaOH (ALE245)	Vial (ALE297)	ZnAc (ALE246)	0.5l glass bottle (ALE227)	500ml Plastic (ALE208)	H2SO4 (ALE244)									
	Sample Type		GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW									
	pH Value	All	NDPs: 0 Tests: 6	X								X									X								X									
Phenols by HPLC (W)	All	NDPs: 0 Tests: 4		X								X																X										
Phosphate by Kone (w)	All	NDPs: 0 Tests: 6	X								X									X								X										
Sulphide	All	NDPs: 0 Tests: 4							X								X																					
Suspended Solids	All	NDPs: 0 Tests: 2																																				
Total Metals by ICP-MS	All	NDPs: 0 Tests: 6				X								X																								
TPH CWG (W)	All	NDPs: 0 Tests: 6	X							X									X								X											
VOC MS (W)	All	NDPs: 0 Tests: 6						X								X								X														



CERTIFICATE OF ANALYSIS

Validated

SDG: 230807-27
Client Ref.: 501.000180.65091

Report Number: 700217
Location: Cam Quarry Roscommon

Superseded Report: 699500

Results Legend



Test



No Determination Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)

28441678

Customer
Sample Reference

SW2

AGS Reference

Depth (m)

0.00 - 0.00

Container

HNO3 Unfiltered
(ALE204)
HNO3 Filtered
(ALE204)
Vial (ALE297)

Sample Type

SW SW SW

Dissolved Metals by ICP-MS

All

NDPs: 0
Tests: 6

X

GRO by GC-FID (W)

All

NDPs: 0
Tests: 6

X

Mercury Dissolved

All

NDPs: 0
Tests: 6

X

Total Metals by ICP-MS

All

NDPs: 0
Tests: 6

X

VOC MS (W)

All

NDPs: 0
Tests: 6

X



CERTIFICATE OF ANALYSIS

Validated

SDG: 230807-27
Client Ref.: 501.000180.65091

Report Number: 700217
Location: Cam Quarry Roscommon

Superseded Report: 699500

Results Legend			Customer Sample Ref.		MW3	MW4	MW5	MW6	SW1	SW2
# ISO17025 accredited. M mCERTS accredited. aq Aqueous / settled sample. diss.filt Dissolved / filtered sample. tot.unfilt Total / unfiltered sample. * Subcontracted - refer to subcontractor report for accreditation status. ** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery (F) Trigger breach confirmed 1-4*§@ Sample deviation (see appendix)			Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference		0.00 - 0.00 Ground Water (GW) 03/08/2023	0.00 - 0.00 Ground Water (GW) 03/08/2023	0.00 - 0.00 Ground Water (GW) 03/08/2023	0.00 - 0.00 Ground Water (GW) 03/08/2023	0.00 - 0.00 Surface Water (SW) 03/08/2023	0.00 - 0.00 Surface Water (SW) 03/08/2023
Component	LOD/Units	Method								
Escherichia Coli (W)*		SUB	See Attached		See Attached	See Attached	See Attached	See Attached		
Coliforms, Total*		SUB	See Attached		See Attached	See Attached	See Attached	See Attached		
Suspended solids, Total	<2 mg/l	TM022							189 #	8.6 #
BOD, unfiltered	<1 mg/l	TM045							2.36 @ #	<1 @ #
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	0.288 #		<0.2 #	<0.2 #	<0.2 #	<0.2 #		
Ammoniacal Nitrogen as NH3	<0.2 mg/l	TM099	0.35 #		<0.2 #	<0.2 #	<0.2 #	<0.2 #		
Ammoniacal Nitrogen as NH4	<0.3 mg/l	TM099	0.37 #		<0.3 #	<0.3 #	<0.3 #	<0.3 #		
Sulphide	<0.01 mg/l	TM101	0.0681 #		0.0378 #	0.0328 #	0.0138 #			
Fluoride	<0.5 mg/l	TM104	<0.5 #		<0.5 #	<0.5 #	<0.5 #			
COD, unfiltered	<7 mg/l	TM107							108 #	50.2 #
Aluminium (diss.filt)	<10 µg/l	TM152	<10 #		<10 #	<10 #	11.1 #	<10 #	<10 #	<10 #
Aluminium (tot.unfilt)	<10 µg/l	TM152	32000 #		1510 #	6490 #	202 #	151 #	24.8 #	
Arsenic (diss.filt)	<0.5 µg/l	TM152	<0.5 #		<0.5 #	<0.5 #	<0.5 #	0.791 #	0.841 #	
Barium (diss.filt)	<0.2 µg/l	TM152	8.08 #		7.78 #	3.92 #	3.92 #	10.2 #	9.56 #	
Boron (diss.filt)	<10 µg/l	TM152	<10 #		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
Cadmium (diss.filt)	<0.08 µg/l	TM152	<0.08 #		<0.08 #	<0.08 #	<0.08 #	<0.08 #	<0.08 #	<0.08 #
Chromium (diss.filt)	<1 µg/l	TM152	1.74 #		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Copper (diss.filt)	<0.3 µg/l	TM152	1.38 #		0.692 #	<0.3 #	1.62 #	0.403 #	0.416 #	
Manganese (tot.unfilt)	<1 µg/l	TM152	2190 #		1160 #	290 #	14.5 #	218 #	192 #	
Lead (diss.filt)	<0.2 µg/l	TM152	<0.2 #		<0.2 #	<0.2 #	<0.2 #	<0.2 #	<0.2 #	<0.2 #
Nickel (diss.filt)	<0.4 µg/l	TM152	5.23 #		1.51 #	1.55 #	0.725 #	1.54 #	1.27 #	
Phosphorus (diss.filt)	<10 µg/l	TM152	<10 #		<10 #	<10 #	<10 #	12.2 #	10.1 #	
Selenium (diss.filt)	<1 µg/l	TM152	1.9 #		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium (diss.filt)	<1 µg/l	TM152	2.74 #		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc (diss.filt)	<1 µg/l	TM152	5.09 #		9.13 #	3.73 #	22.5 #	2.72 #	2.74 #	
Sodium (Dis.Filt)	<0.076 mg/l	TM152	7.83 #		29.3 #	4.06 #	6.33 #	8.09 #	8.31 #	
Potassium (Dis.Filt)	<0.2 mg/l	TM152	0.762 #		0.669 #	0.213 #	0.996 #	1.37 #	1.38 #	
Calcium (Dis.Filt)	<0.2 mg/l	TM152	96.7 #		95.7 #	71.9 #	87.2 #	87.9 #	88.6 #	
Iron (Dis.Filt)	<0.019 mg/l	TM152	<0.019 #		<0.019 #	<0.019 #	<0.019 #	0.507 #	0.457 #	
Magnesium (Tot. Unfilt.)	<0.05 mg/l	TM152	14.5 #		14 #	3.81 #	2.39 #	2.52 #	2.54 #	
Mineral oil >C10 C40 (aq)	<100 µg/l	TM172						<100	<100	
Mercury (diss.filt)	<0.01 µg/l	TM183	<0.01 #		<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #
Nitrite as NO2	<0.05 mg/l	TM184	<0.25 #		<0.05 #	<0.05 #	<0.05 #			



Superseded Report: 699500



CERTIFICATE OF ANALYSIS

Validated

SDG: 230807-27
Client Ref.: 501.000180.65091

Report Number: 700217
Location: Cam Quarry Roscommon

Superseded Report: 699500

VOC MS (W)

Results Legend			Customer Sample Ref.		MW3	MW4	MW5	MW6	SW1	SW2
# ISO17025 accredited. M mCERTS accredited. aq Aqueous / settled sample. diss.filt Dissolved / filtered sample. tot.unfilt Total / unfiltered sample. * Subcontracted - refer to subcontractor report for accreditation status. ** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery (F) Trigger breach confirmed 1-4*§@ Sample deviation (see appendix)			Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference		0.00 - 0.00 Ground Water (GW) 03/08/2023 07/08/2023 230807-27 28441687	0.00 - 0.00 Ground Water (GW) 03/08/2023 07/08/2023 230807-27 28441698	0.00 - 0.00 Ground Water (GW) 03/08/2023 07/08/2023 230807-27 28441711	0.00 - 0.00 Ground Water (GW) 03/08/2023 07/08/2023 230807-27 28441723	0.00 - 0.00 Surface Water (SW) 03/08/2023 07/08/2023 230807-27 28441668	0.00 - 0.00 Surface Water (SW) 03/08/2023 07/08/2023 230807-27 28441678
Component	LOD/Units	Method								
Dibromofluoromethane**	%	TM208			111	111	109	112		
Toluene-d8**	%	TM208			100	101	100	99.7		
4-Bromofluorobenzene**	%	TM208			96.7	98.5	102	99.7		
Dichlorodifluoromethane	<1 µg/l	TM208			<1	<1	<1	<1		
Chloromethane	<1 µg/l	TM208			<1	<1	<1	<1		
Vinyl chloride	<1 µg/l	TM208			<1	<1	<1	<1		
Bromomethane	<1 µg/l	TM208			<1	<1	<1	<1		
Chloroethane	<1 µg/l	TM208			<1	<1	<1	<1		
Trichlorofluoromethane	<1 µg/l	TM208			<1	<1	<1	<1		
1,1-Dichloroethene	<1 µg/l	TM208			<1	<1	<1	<1		
Carbon disulphide	<1 µg/l	TM208			<1	<1	<1	<1		
Dichloromethane	<3 µg/l	TM208			<3	<3	<3	<3		
Methyl tertiary butyl ether (MTBE)	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
trans-1,2-Dichloroethene	<1 µg/l	TM208			<1	<1	<1	<1		
1,1-Dichloroethane	<1 µg/l	TM208			<1	<1	<1	<1		
cis-1,2-Dichloroethene	<1 µg/l	TM208			<1	<1	<1	<1		
2,2-Dichloropropane	<1 µg/l	TM208			<1	<1	<1	<1		
Bromochloromethane	<1 µg/l	TM208			<1	<1	<1	<1		
Chloroform	<1 µg/l	TM208			<1	<1	<1	<1		
1,1,1-Trichloroethane	<1 µg/l	TM208			<1	<1	<1	<1		
1,1-Dichloropropene	<1 µg/l	TM208			<1	<1	<1	<1		
Carbontetrachloride	<1 µg/l	TM208			<1	<1	<1	<1		
1,2-Dichloroethane	<1 µg/l	TM208			<1	<1	<1	<1		
Benzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
Trichloroethene	<1 µg/l	TM208			<1	<1	<1	<1		
1,2-Dichloropropane	<1 µg/l	TM208			<1	<1	<1	<1		
Dibromomethane	<1 µg/l	TM208			<1	<1	<1	<1		
Bromodichloromethane	<1 µg/l	TM208			<1	<1	<1	<1		
cis-1,3-Dichloropropene	<1 µg/l	TM208			<1	<1	<1	<1		
Toluene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
trans-1,3-Dichloropropene	<1 µg/l	TM208			<1	<1	<1	<1		
1,1,2-Trichloroethane	<1 µg/l	TM208			<1	<1	<1	<1		
1,3-Dichloropropane	<1 µg/l	TM208			<1	<1	<1	<1		



CERTIFICATE OF ANALYSIS

Validated

SDG: 230807-27
Client Ref.: 501.000180.65091

Report Number: 700217
Location: Cam Quarry Roscommon

Superseded Report: 699500

VOC MS (W)

Results Legend			Customer Sample Ref.		MW3	MW4	MW5	MW6	SW1	SW2
#	ISO17025 accredited.		Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference		0.00 - 0.00 Ground Water (GW) 03/08/2023	0.00 - 0.00 Ground Water (GW) 03/08/2023	0.00 - 0.00 Ground Water (GW) 03/08/2023	0.00 - 0.00 Ground Water (GW) 03/08/2023	0.00 - 0.00 Surface Water (SW) 03/08/2023	0.00 - 0.00 Surface Water (SW) 03/08/2023
M	mCERTS accredited.									
aq	Aqueous / settled sample.									
diss.filt	Dissolved / filtered sample.									
tot.unfilt	Total / unfiltered sample.									
* Subcontracted - refer to subcontractor report for accreditation status.					07/08/2023 230807-27 28441687	07/08/2023 230807-27 28441698	07/08/2023 230807-27 28441711	07/08/2023 230807-27 28441723	07/08/2023 230807-27 28441668	07/08/2023 230807-27 28441678
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery										
(F) Trigger breach confirmed										
1-4* @ Sample deviation (see appendix)										
Component	LOD/Units	Method								
Tetrachloroethene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
Dibromochloromethane	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,2-Dibromoethane	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
Chlorobenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,1,1,2-Tetrachloroethane	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
Ethylbenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
m,p-Xylene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
o-Xylene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Styrene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
Bromoform	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
Isopropylbenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,1,2,2-Tetrachloroethane	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,2,3-Trichloropropane	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
Bromobenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
Propylbenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
2-Chlorotoluene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,3,5-Trimethylbenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
4-Chlorotoluene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
tert-Butylbenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,2,4-Trimethylbenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
sec-Butylbenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
4-iso-Propyltoluene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,3-Dichlorobenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,4-Dichlorobenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
n-Butylbenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,2-Dichlorobenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,2-Dibromo-3-chloropropane	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,2,4-Trichlorobenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
Hexachlorobutadiene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
tert-Amyl methyl ether (TAME)	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
Naphthalene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,2,3-Trichlorobenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		
1,3,5-Trichlorobenzene	<1 µg/l	TM208			<1 #	<1 #	<1 #	<1 #		



CERTIFICATE OF ANALYSIS

Validated

SDG: 230807-27
Client Ref.: 501.000180.65091

Report Number: 700217
Location: Cam Quarry Roscommon

Superseded Report: 699500

Table of Results - Appendix

Method No	Description
TM107	Determination of Chemical Oxygen Demand using COD Dr Lange Kit
TM178	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters
TM104	Determination of Fluoride using the Kone Analyser
TM174	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID
TM183	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM245	Determination of GRO by Headspace in waters
TM022	Determination of total suspended solids in waters
TM045	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids
TM099	Determination of Ammonium in Water Samples using the Kone Analyser
TM101	Determination of Sulphide in soil and water samples using the Kone Analyser
TM259	Determination of Phenols in Waters and Leachates by HPLC
SUB	Subcontracted Test
TM152	Analysis of Aqueous Samples by ICP-MS
TM172	EPH in Waters
TM208	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters
TM227	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate
TM256	Determination of pH, EC, TDS and Alkalinity in Aqueous samples

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).



CERTIFICATE OF ANALYSIS

Validated

SDG: 230807-27
Client Ref.: 501.000180.65091

Report Number: 700217
Location: Cam Quarry Roscommon

Superseded Report: 699500

Test Completion Dates

Lab Sample No(s)
Customer Sample Ref.

AGS Ref.

Depth

Type

	28441687	28441698	28441711	28441723	28441668	28441678
	MW3	MW4	MW5	MW6	SW1	SW2
	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water	Surface Water
Ammoniacal Nitrogen	09-Aug-2023	08-Aug-2023	09-Aug-2023	09-Aug-2023		
Anions by Kone (w)	08-Aug-2023	08-Aug-2023	08-Aug-2023	08-Aug-2023		
BOD True Total					12-Aug-2023	12-Aug-2023
COD Unfiltered					14-Aug-2023	14-Aug-2023
Coliforms (W)	09-Aug-2023	09-Aug-2023	09-Aug-2023	09-Aug-2023		
Cyanide Comp/Free/Total/Thiocyanate	09-Aug-2023	09-Aug-2023	09-Aug-2023	09-Aug-2023		
Dissolved Metals by ICP-MS	11-Aug-2023	10-Aug-2023	10-Aug-2023	10-Aug-2023	10-Aug-2023	10-Aug-2023
EPH CWG (Aliphatic) Aqueous GC (W)	14-Aug-2023	14-Aug-2023	14-Aug-2023	14-Aug-2023	10-Aug-2023	10-Aug-2023
EPH CWG (Aromatic) Aqueous GC (W)	14-Aug-2023	14-Aug-2023	14-Aug-2023	14-Aug-2023	10-Aug-2023	10-Aug-2023
Fluoride	08-Aug-2023	08-Aug-2023	08-Aug-2023	08-Aug-2023		
GRO by GC-FID (W)	09-Aug-2023	09-Aug-2023	09-Aug-2023	09-Aug-2023	09-Aug-2023	09-Aug-2023
Mercury Dissolved	14-Aug-2023	11-Aug-2023	11-Aug-2023	09-Aug-2023	09-Aug-2023	09-Aug-2023
Mineral Oil C10-40 Aqueous (W)					10-Aug-2023	10-Aug-2023
Nitrite by Kone (w)	08-Aug-2023	08-Aug-2023	08-Aug-2023	08-Aug-2023		
PAH Spec MS - Aqueous (W)	11-Aug-2023	11-Aug-2023	11-Aug-2023	11-Aug-2023		
pH Value	11-Aug-2023	11-Aug-2023	11-Aug-2023	11-Aug-2023	14-Aug-2023	11-Aug-2023
Phenols by HPLC (W)	09-Aug-2023	09-Aug-2023	09-Aug-2023	09-Aug-2023		
Phosphate by Kone (w)	08-Aug-2023	08-Aug-2023	08-Aug-2023	08-Aug-2023	08-Aug-2023	08-Aug-2023
Sulphide	15-Aug-2023	15-Aug-2023	15-Aug-2023	15-Aug-2023		
Suspended Solids					14-Aug-2023	14-Aug-2023
Total Metals by ICP-MS	11-Aug-2023	10-Aug-2023	10-Aug-2023	10-Aug-2023	10-Aug-2023	10-Aug-2023
TPH CWG (W)	14-Aug-2023	14-Aug-2023	14-Aug-2023	14-Aug-2023	10-Aug-2023	10-Aug-2023
VOC MS (W)	10-Aug-2023	10-Aug-2023	10-Aug-2023	10-Aug-2023	10-Aug-2023	10-Aug-2023



ALS Life Sciences Ltd trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
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Report No: ALSH-240040823

Document No: EF0011

SUPPLEMENTARY CERTIFICATE OF ANALYSIS

Client	ALS Hawarden Units 7-8 Hawarden Business Park Manor Lane Hawarden CH5 3US	Date Submitted	04/08/2023
		Date Reported	08/08/2023
		Order Number	N/A
For the Attention of:	ALS Hawarden		
Sample Reception	4 sample(s) received in good condition.		
Comments	Update required for sample descriptions		

Report Authorised by:

Ann-Marie Fitzgerald
Microbiology Manager

Conditions:

1. Results in this report relate only to the items tested
2. Reports may not be reproduced except in full without the approval of ALS Life Sciences Ltd
3. All queries regarding this report should be addressed to the Technical Manager at the above address
4. A * next to a method reference signifies that ALS Life Sciences Ltd is NOT INAB accredited for this method
5. Results reported as CFU/cm² are calculated based on information supplied by customer regarding area swabbed
6. SUBCON* indicates analysis subcontracted to approved subcontractors who do not hold accreditation for this test
7. SUBCON^ indicates analysis subcontracted to approved subcontractors who hold accreditation for this test
8. Where sampling is undertaken by ALS personnel, sampling activities are outside the scope of INAB accreditation
9. Dil next to a method reference indicates that a dilution of the water sample was undertaken during testing
10. Statement of conformity made against the result does not take into account the uncertainty of measurement associated with the method
11. This supplementary certificate replaces the previous certificate which must be destroyed



ALS Life Sciences Ltd trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Telephone: +353 (0) 52 617 8100



Report No: ALSH-240040823

Document No: EF0011

SUPPLEMENTARY CERTIFICATE OF ANALYSIS

Date Submitted 04/08/2023

Date Reported 08/08/2023

Order Number N/A

Sample Type Water
Client ID MW3 (03/08/2023 @ 15.45)
Date Tested 04/08/2023
ALS ID 5692981

Test	Result	Unit	Method
Escherichia coli	2	CFU/100ml	SP140/SP241 MODW Part 4, B 2016
Coliform bacteria	31	CFU/100ml	SP140/SP241 MODW Part 4, B 2016

Sample Type Water
Client ID MW4 (03/08/2023 @ 16.49)
Date Tested 04/08/2023
ALS ID 5692982

Test	Result	Unit	Method
Escherichia coli	>100	CFU/100ml	SP140/SP241 MODW Part 4, B 2016
Coliform bacteria	>100	CFU/100ml	SP140/SP241 MODW Part 4, B 2016

Sample Type Water
Client ID MW5 (03/08/2023 @11.24)
Date Tested 04/08/2023
ALS ID 5692983

Test	Result	Unit	Method
Escherichia coli	0	CFU/100ml	SP 140 MODW Part 4, B 2016
Coliform bacteria	0	CFU/100ml	SP 140 MODW Part 4, B 2016

Sample Type Water
Client ID MW6 (03/08/2023 @ 13.20)
Date Tested 04/08/2023
ALS ID 5692984

Test	Result	Unit	Method
Escherichia coli	0	CFU/100ml	SP140/SP241 MODW Part 4, B 2016
Coliform bacteria	2	CFU/100ml	SP140/SP241 MODW Part 4, B 2016

Report Authorised by:

Ann-Marie Fitzgerald

Ann-Marie Fitzgerald
Microbiology Manager



CERTIFICATE OF ANALYSIS

SDG: 230807-27
Client Ref: 501.000180.65091

Report Number: 700217
Location: Cam Quarry Roscommon

Superseded Report: 699500

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

General

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Matrix interference
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to late arrival of instructions or samples
§	Sampled on date not provided

20. Asbestos

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials and soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.



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SLR Consulting Ireland
CSA House
Unit 7
Dundrum Business Park
Windy Harbour
Dublin
Dublin14

Attention: Mairead Brown

CERTIFICATE OF ANALYSIS

Date of report Generation:	22 January 2024
Customer:	SLR Consulting Ireland
Sample Delivery Group (SDG):	240115-11
Your Reference:	501.000180.65091
Location:	Cam Quarry
Report No:	717607
Order Number:	1004

This report has been revised and directly supersedes 716930 in its entirety.

We received 6 samples on Monday January 15, 2024 and 6 of these samples were scheduled for analysis which was completed on Monday January 22, 2024. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.

Incorrect sampling dates and/or sample information will affect the validity of results.

The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan

Operations Manager





CERTIFICATE OF ANALYSIS

Validated

SDG: 240115-11
Client Ref.: 501.000180.65091

Report Number: 717607
Location: Cam Quarry

Superseded Report: 716930

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
29208014	MW3		0.00 - 0.00	11/01/2024
29208025	MW4		0.00 - 0.00	11/01/2024
29208037	MW5		0.00 - 0.00	11/01/2024
29208050	MW6		0.00 - 0.00	11/01/2024
29207994	SW1		0.00 - 0.00	11/01/2024
29208005	SW2		0.00 - 0.00	11/01/2024

Only received samples which have had analysis scheduled will be shown on the following pages.

SDG: 240115-11
Client Ref.: 501.000180.65091

Report Number: 717607
Location: Cam Quarry

Superseded Report: 716930

Results Legend X Test N No Determination Possible Sample Types - S - Soil/Solid UNS - Unspecified Solid GW - Ground Water SW - Surface Water LE - Land Leachate PL - Prepared Leachate PR - Process Water SA - Saline Water TE - Trade Effluent TS - Treated Sewage US - Untreated Sewage RE - Recreational Water DW - Drinking Water Non-regulatory UNL - Unspecified Liquid SL - Sludge G - Gas OTH - Other	Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container	Sample Type
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 4				
Anions by Kone (w)	All	NDPs: 0 Tests: 6				
BOD True Total	All	NDPs: 0 Tests: 2				
COD Unfiltered	All	NDPs: 0 Tests: 2				
Coliforms (W)	All	NDPs: 0 Tests: 4				
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 4				
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 6				
EPH and CWG by FID	All	NDPs: 0 Tests: 6				
Fluoride	All	NDPs: 0 Tests: 4				
GRO by GC-FID (W)	All	NDPs: 0 Tests: 6				
Mercury Dissolved	All	NDPs: 0 Tests: 6				
Nitrite by Kone (w)	All	NDPs: 0 Tests: 4				
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 4				
pH Value	All	NDPs: 0 Tests: 6				
Phenols by HPLC (W)	All	NDPs: 0 Tests: 4				



CERTIFICATE OF ANALYSIS

Validated

SDG: 240115-11
Client Ref.: 501.000180.65091

Report Number: 717607
Location: Cam Quarry

Superseded Report: 716930

Results Legend



Test



No Determination Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Results Legend	Lab Sample No(s)		29208014		29208025		29208037	
	Customer Sample Reference		MM3		MM4		MM5	
Sample Types -	AGS Reference							
	Depth (m)		0.00 - 0.00		0.00 - 0.00		0.00 - 0.00	
Sample Types -	Container		H2SO4 (ALE244)		500ml Plastic (ALE208)		0.5l glass bottle (ALE227)	
	Sample Type		GW		GW		GW	
Sample Types -	Phosphate by Kone (w)		NDPs: 0 Tests: 6		X		X	
	Sulphide		NDPs: 0 Tests: 4		X		X	
Sample Types -	Suspended Solids		NDPs: 0 Tests: 2					
	Total Metals by ICP-MS		NDPs: 0 Tests: 6		X		X	
Sample Types -	TPH CWG (W)		NDPs: 0 Tests: 6		X		X	
	VOC MS (W)		NDPs: 0 Tests: 6		X		X	



CERTIFICATE OF ANALYSIS

Validated

SDG: 240115-11
Client Ref.: 501.000180.65091

Report Number: 717607
Location: Cam Quarry

Superseded Report: 716930

Results Legend



Test



No Determination
Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)

29208005

Customer
Sample Reference

SW2

AGS Reference

Depth (m)

0.00 - 0.00

Container

Vial (ALE297)
HNO3 Unfiltered
(ALE204)
HNO3 Filtered
(ALE204)
500ml Plastic
(ALE208)

Sample Type

SW

Anions by Kone (w)

All

NDPs: 0
Tests: 6

X

Dissolved Metals by ICP-MS

All

NDPs: 0
Tests: 6

X

GRO by GC-FID (W)

All

NDPs: 0
Tests: 6

X

Mercury Dissolved

All

NDPs: 0
Tests: 6

X

pH Value

All

NDPs: 0
Tests: 6

X

Phosphate by Kone (w)

All

NDPs: 0
Tests: 6

X

Suspended Solids

All

NDPs: 0
Tests: 2

X

Total Metals by ICP-MS

All

NDPs: 0
Tests: 6

X

VOC MS (W)

All

NDPs: 0
Tests: 6

X



CERTIFICATE OF ANALYSIS

Validated

SDG: 240115-11
Client Ref.: 501.000180.65091

Report Number: 717607
Location: Cam Quarry

Superseded Report: 716930

Results Legend			Customer Sample Ref.		MW3	MW4	MW5	MW6	SW1	SW2
# ISO17025 accredited.			Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference		0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Surface Water (SW) 11/01/2024	0.00 - 0.00 Surface Water (SW) 11/01/2024
M mCERTS accredited.										
aq Aqueous / settled sample.										
diss.filt Dissolved / filtered sample.										
tot.unfiltTotal / unfiltered sample.										
* Subcontracted - refer to subcontractor report for accreditation status.										
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery										
(F) Trigger breach confirmed										
1-4*§@ Sample deviation (see appendix)										
Component	LOD/Units	Method								
Escherichia Coli (W)*		SUB			See Attached	See Attached	See Attached	See Attached		
Coliforms, Total*		SUB			See Attached	See Attached	See Attached	See Attached		
Suspended solids, Total	<2 mg/l	TM022							<2 #	<2 #
BOD, unfiltered	<1 mg/l	TM045							<1 @ #	<1 @ #
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099			<0.2 #	<0.2 #	<0.2 #	<0.2 #		
Ammoniacal Nitrogen as NH3	<0.2 mg/l	TM099			<0.2 #	<0.2 #	<0.2 #	<0.2 #		
Ammoniacal Nitrogen as NH4	<0.3 mg/l	TM099			<0.3 #	<0.3 #	<0.3 #	<0.3 #		
Sulphide	<0.01 mg/l	TM101			<0.01 #	<0.01 #	<0.01 #	<0.01 #		
Fluoride	<0.5 mg/l	TM104			<0.5 #	<0.5 #	<0.5 #	<0.5 #		
COD, unfiltered	<7 mg/l	TM107							18 #	11.7 #
Aluminium (diss.filt)	<10 µg/l	TM152			<10 #	<10 #	13.6 #	<10 #	<10 #	<10 #
Aluminium (tot.unfilt)	<10 µg/l	TM152			37500 #	202 #	12700 #	12300 #	<10 #	10.1 #
Arsenic (diss.filt)	<0.5 µg/l	TM152			<0.5 #	<0.5 #	<0.5 #	<0.5 #	<0.5 #	<0.5 #
Barium (diss.filt)	<0.2 µg/l	TM152			11 #	9.57 #	3.4 #	4.94 #	7.8 #	7.77 #
Boron (diss.filt)	<10 µg/l	TM152			<10 #	<10 #	<10 #	<10 #	<10 #	13.4 #
Cadmium (diss.filt)	<0.08 µg/l	TM152			<0.08 #	<0.08 #	<0.08 #	<0.08 #	<0.08 #	<0.08 #
Chromium (diss.filt)	<1 µg/l	TM152			<1 #	<1 #	<1 #	1 #	<1 #	<1 #
Copper (diss.filt)	<0.3 µg/l	TM152			0.33 #	0.589 #	0.708 #	0.915 #	0.312 #	<0.3 #
Manganese (tot.unfilt)	<1 µg/l	TM152			2190 #	177 #	697 #	692 #	14.5 #	13.5 #
Lead (diss.filt)	<0.2 µg/l	TM152			<0.2 #	<0.2 #	0.267 #	1.83 #	<0.2 #	<0.2 #
Nickel (diss.filt)	<0.4 µg/l	TM152			2.04 #	1.29 #	1 #	0.851 #	0.617 #	0.744 #
Phosphorus (diss.filt)	<10 µg/l	TM152			<10 #	13 #	21.4 #	<10 #	<10 #	<10 #
Selenium (diss.filt)	<1 µg/l	TM152			1.16 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium (diss.filt)	<1 µg/l	TM152			2.08 #	<1 #	<1 #	<1 #	<1 #	<1 #
Sodium (Dis.Filt)	<0.076 mg/l	TM152			8.4 #	28.2 #	4.31 #	6 #	6.57 #	6.57 #
Potassium (Dis.Filt)	<0.2 mg/l	TM152			1.34 #	0.716 #	0.45 #	0.907 #	2.08 #	2.03 #
Calcium (Dis.Filt)	<0.2 mg/l	TM152			115 #	96 #	60.3 #	88.4 #	94 #	93.4 #
Iron (Dis.Filt)	<0.019 mg/l	TM152			<0.019 #	<0.019 #	0.0227 #	0.0203 #	0.0606 #	0.0549 #
Magnesium (Tot. Unfilt.)	<0.05 mg/l	TM152			16.3 #	12.7 #	4.84 #	10.7 #	3.24 #	3.21 #
Mercury (diss.filt)	<0.01 µg/l	TM183			<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #
Nitrite as NO2	<0.05 mg/l	TM184			<0.25 #	0.269 #	0.062 #	<0.05 #		
Phosphate (Ortho as PO4)	<0.05 mg/l	TM184			<0.05 #	<0.05 #	<0.05 #	<0.05 #	<0.05 #	<0.05 #
Sulphate	<2 mg/l	TM184			5.2 #	6.5 #	14.2 #	5.7 #		



CERTIFICATE OF ANALYSIS

Validated

SDG: 240115-11
Client Ref.: 501.000180.65091

Report Number: 717607
Location: Cam Quarry

Superseded Report: 716930

VOC MS (W)

Results Legend			Customer Sample Ref. Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	MW3	MW4	MW5	MW6	SW1	SW2
# ISO17025 accredited.				0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Surface Water (SW) 11/01/2024	0.00 - 0.00 Surface Water (SW) 11/01/2024
M mCERTS accredited.									
aq Aqueous / settled sample.									
diss.filt Dissolved / filtered sample.									
tot.unfiltTotal / unfiltered sample.									
* Subcontracted - refer to subcontractor report for accreditation status.									
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery									
(F) Trigger breach confirmed									
1-4*§@ Sample deviation (see appendix)									
Component	LOD/Units	Method							
Dibromofluoromethane**	%	TM208	103	103	105	107	104	106	
Toluene-d8**	%	TM208	98.9	99.6	98.6	99.4	99.1	99.4	
4-Bromofluorobenzene**	%	TM208	103	102	101	102	98.7	102	
Dichlorodifluoromethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Chloromethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Vinyl chloride	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Bromomethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Chloroethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Trichlorofluoromethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
1,1-Dichloroethene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Carbon disulphide	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Dichloromethane	<3 µg/l	TM208	<3	<3	<3	<3	<3	<3	
Methyl tertiary butyl ether (MTBE)	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
trans-1,2-Dichloroethene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
1,1-Dichloroethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
cis-1,2-Dichloroethene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
2,2-Dichloropropane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Bromochloromethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Chloroform	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
1,1,1-Trichloroethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
1,1-Dichloropropene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Carbontetrachloride	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
1,2-Dichloroethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Benzene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Trichloroethene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
1,2-Dichloropropane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Dibromomethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Bromodichloromethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
cis-1,3-Dichloropropene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Toluene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
trans-1,3-Dichloropropene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
1,1,2-Trichloroethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
1,3-Dichloropropane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	



CERTIFICATE OF ANALYSIS

Validated

SDG: 240115-11
Client Ref.: 501.000180.65091

Report Number: 717607
Location: Cam Quarry

Superseded Report: 716930

VOC MS (W)

Results Legend			Customer Sample Ref.		MW3	MW4	MW5	MW6	SW1	SW2
#	ISO17025 accredited.		Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference		0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Ground Water (GW) 11/01/2024	0.00 - 0.00 Surface Water (SW) 11/01/2024	0.00 - 0.00 Surface Water (SW) 11/01/2024
M	mCERTS accredited.									
aq	Aqueous / settled sample.									
diss.filt	Dissolved / filtered sample.									
tot.unfilt	Total / unfiltered sample.									
* Subcontracted - refer to subcontractor report for accreditation status.					15/01/2024 240115-11 29208014	15/01/2024 240115-11 29208025	15/01/2024 240115-11 29208037	15/01/2024 240115-11 29208050	15/01/2024 240115-11 29207994	15/01/2024 240115-11 29208005
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery										
(F) Trigger breach confirmed										
1-4* Sample deviation (see appendix)										
Component	LOD/Units	Method								
Tetrachloroethene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Dibromochloromethane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2-Dibromoethane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Chlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,1,1,2-Tetrachloroethane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Ethylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
m,p-Xylene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
o-Xylene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Styrene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Bromoform	<1 µg/l	TM208			<2	<2	<2	<1	<1	<1
					#	#	#	#	#	#
Isopropylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,1,2,2-Tetrachloroethane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2,3-Trichloropropane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Bromobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Propylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
2-Chlorotoluene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,3,5-Trimethylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
4-Chlorotoluene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
tert-Butylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2,4-Trimethylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
sec-Butylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
4-iso-Propyltoluene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,3-Dichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,4-Dichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
n-Butylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2-Dichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2-Dibromo-3-chloropropane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2,4-Trichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Hexachlorobutadiene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
tert-Amyl methyl ether (TAME)	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Naphthalene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2,3-Trichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,3,5-Trichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#



CERTIFICATE OF ANALYSIS

Validated

SDG: 240115-11
Client Ref.: 501.000180.65091

Report Number: 717607
Location: Cam Quarry

Superseded Report: 716930

Table of Results - Appendix

Method No	Description
TM107	Determination of Chemical Oxygen Demand using COD Dr Lange Kit
TM178	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters
TM439	Determination of Extractable Petroleum Hydrocarbons (EPH) CWG banding by GC-FID on liquids
TM022	Determination of total suspended solids in waters
TM045	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids
TM099	Determination of Ammonium in Water Samples using the Kone Analyser
TM101	Determination of Sulphide in soil and water samples using the Kone Analyser
TM259	Determination of Phenols in Waters and Leachates by HPLC
TM104	Determination of Fluoride using the Kone Analyser
TM183	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM245	Determination of GRO by Headspace in waters
SUB	Subcontracted Test
TM152	Analysis of Aqueous Samples by ICP-MS
TM208	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters
TM227	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate
TM256	Determination of pH, EC, TDS and Alkalinity in Aqueous samples

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).



CERTIFICATE OF ANALYSIS

Validated

SDG: 240115-11
Client Ref.: 501.000180.65091

Report Number: 717607
Location: Cam Quarry

Superseded Report: 716930

Test Completion Dates

Lab Sample No(s)
Customer Sample Ref.

AGS Ref.

Depth

Type

	29208014	29208025	29208037	29208050	29207994	29208005
	MW3	MW4	MW5	MW6	SW1	SW2
	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water	Surface Water
Ammoniacal Nitrogen	17-Jan-2024	17-Jan-2024	17-Jan-2024	17-Jan-2024		
Anions by Kone (w)	17-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024
BOD True Total					20-Jan-2024	20-Jan-2024
COD Unfiltered					20-Jan-2024	20-Jan-2024
Coliforms (W)	15-Jan-2024	15-Jan-2024	15-Jan-2024	15-Jan-2024		
Cyanide Comp/Free/Total/Thiocyanate	18-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024		
Dissolved Metals by ICP-MS	16-Jan-2024	18-Jan-2024	19-Jan-2024	18-Jan-2024	16-Jan-2024	16-Jan-2024
EPH and CWG by FID	22-Jan-2024	19-Jan-2024	22-Jan-2024	19-Jan-2024	19-Jan-2024	19-Jan-2024
Fluoride	17-Jan-2024	17-Jan-2024	17-Jan-2024	17-Jan-2024		
GRO by GC-FID (W)	17-Jan-2024	17-Jan-2024	17-Jan-2024	17-Jan-2024	17-Jan-2024	17-Jan-2024
Mercury Dissolved	18-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024
Nitrite by Kone (w)	16-Jan-2024	17-Jan-2024	17-Jan-2024	17-Jan-2024		
PAH Spec MS - Aqueous (W)	19-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024		
pH Value	18-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024	17-Jan-2024	17-Jan-2024
Phenols by HPLC (W)	19-Jan-2024	19-Jan-2024	19-Jan-2024	19-Jan-2024		
Phosphate by Kone (w)	18-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024
Sulphide	19-Jan-2024	19-Jan-2024	19-Jan-2024	19-Jan-2024		
Suspended Solids					16-Jan-2024	16-Jan-2024
Total Metals by ICP-MS	22-Jan-2024	18-Jan-2024	18-Jan-2024	18-Jan-2024	19-Jan-2024	19-Jan-2024
TPH CWG (W)	22-Jan-2024	19-Jan-2024	22-Jan-2024	19-Jan-2024	19-Jan-2024	19-Jan-2024
VOC MS (W)	16-Jan-2024	16-Jan-2024	16-Jan-2024	16-Jan-2024	16-Jan-2024	16-Jan-2024



ALS Life Sciences Ltd trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Telephone: +353 (0) 52 617 8100



Report No: ALSH-717120124

Document No: EF0011

CERTIFICATE OF ANALYSIS

Client	ALS Hawarden Units 7-8 Hawarden Business Park Manor Lane Hawarden CH5 3US	Date Submitted	12/01/2024
		Date Reported	13/01/2024
		Order Number	N/A
For the Attention of:	ALS Hawarden		
Sample Reception	4 sample(s) received in good condition.		
Comments	N/A		

Report Authorised by:

Ann-Marie Fitzgerald
Microbiology Manager

Conditions:

1. Results in this report relate only to the items tested
2. Reports may not be reproduced except in full without the approval of ALS Life Sciences Ltd
3. All queries regarding this report should be addressed to the Technical Manager at the above address
4. A * next to a method reference signifies that ALS Life Sciences Ltd is NOT INAB accredited for this method
5. Results reported as CFU/cm² are calculated based on information supplied by customer regarding area swabbed
6. SUBCON* indicates analysis subcontracted to approved subcontractors who do not hold accreditation for this test
7. SUBCON^ indicates analysis subcontracted to approved subcontractors who hold accreditation for this test
8. Where sampling is undertaken by ALS personnel, sampling activities are outside the scope of INAB accreditation
9. Dil next to a method reference indicates that a dilution of the water sample was undertaken during testing
10. Statement of conformity made against the result does not take into account the uncertainty of measurement associated with the method



ALS Life Sciences Ltd trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Telephone: +353 (0) 52 617 8100



Report No: ALSH-717120124

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Submitted 12/01/2024
Date Reported 13/01/2024
Order Number N/A

Sample Type Water
Client ID MW3 (11/01/2024 @ 10.53 am)
Date Tested 12/01/2024
ALS ID 5935685

Test	Result	Unit	Method
Coliforms	11	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)
Escherichia coli	1	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)

Sample Type Water
Client ID MW4 (11/01/2024 @ 13.59 pm)
Date Tested 12/01/2024
ALS ID 5935686

Test	Result	Unit	Method
Coliforms	11	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)
Escherichia coli	4	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)

Sample Type Water
Client ID MW5 (11/01/2024 @ 12.23 pm)
Date Tested 12/01/2024
ALS ID 5935687

Test	Result	Unit	Method
Coliforms	15	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)
Escherichia coli	8	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)

Sample Type Water
Client ID MW6 (11/01/2024 @ 9.50 am)
Date Tested 12/01/2024
ALS ID 5935688

Test	Result	Unit	Method
Coliforms	248	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)
Escherichia coli	0	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)

Report Authorised by:

Ann-Marie Fitzgerald

Ann-Marie Fitzgerald
Microbiology Manager



CERTIFICATE OF ANALYSIS

SDG: 240115-11
Client Ref: 501.000180.65091

Report Number: 717607
Location: Cam Quarry

Superseded Report: 716930

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of 15 days after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

General

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Matrix interference
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to late arrival of instructions or samples
§	Sampled on date not provided

20. Asbestos

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials and soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.



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SLR Consulting Ireland
CSA House
Unit 7
Dundrum Business Park
Windy Harbour
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Dublin14

Attention: Mairead Brown

CERTIFICATE OF ANALYSIS

Date of report Generation:	17 October 2024
Customer:	SLR Consulting Ireland
Sample Delivery Group (SDG):	241010-56
Your Reference:	501.000180.65091
Location:	Cam Quarry
Report No:	743901
Order Number:	1424

This report has been revised and directly supersedes 743360 in its entirety.

We received 6 samples on Thursday October 10, 2024 and 6 of these samples were scheduled for analysis which was completed on Thursday October 17, 2024. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.

Incorrect sampling dates and/or sample information will affect the validity of results.

The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Lauren Ellis

General Manager Western Europe Environmental





CERTIFICATE OF ANALYSIS

Validated

SDG: 241010-56
Client Ref.: 501.000180.65091

Report Number: 743901
Location: Cam Quarry

Superseded Report: 743360

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
30496536	MW3		0.00 - 0.00	08/10/2024
30496552	MW4		0.00 - 0.00	08/10/2024
30496567	MW5		0.00 - 0.00	08/10/2024
30496583	MW6		0.00 - 0.00	08/10/2024
30496517	SW1		0.00 - 0.00	08/10/2024
30496527	SW2		0.00 - 0.00	08/10/2024

Only received samples which have had analysis scheduled will be shown on the following pages.



CERTIFICATE OF ANALYSIS

Validated

SDG: 241010-56
Client Ref.: 501.000180.65091

Report Number: 743901
Location: Cam Quarry

Superseded Report: 743360

Results Legend X Test N No Determination Possible Sample Types - S - Soil/Solid UNS - Unspecified Solid GW - Ground Water SW - Surface Water LE - Land Leachate PL - Prepared Leachate PR - Process Water SA - Saline Water TE - Trade Effluent TS - Treated Sewage US - Untreated Sewage RE - Recreational Water DW - Drinking Water Non-regulatory UNL - Unspecified Liquid SL - Sludge G - Gas OTH - Other	Lab Sample No(s)		30496536										30496552										30496567									
	Customer Sample Reference		MW3										MW4										MW5									
	AGS Reference																															
	Depth (m)		0.00 - 0.00										0.00 - 0.00										0.00 - 0.00									
	Container		0.5l glass bottle (ALE227)										ZnAc (ALE246)										0.5l glass bottle (ALE227)									
	Sample Type		GW										GW										GW									
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 4				X																										
Anions by Kone (w)	All	NDPs: 0 Tests: 6				X																										
BOD True Total	All	NDPs: 0 Tests: 2																														
COD Unfiltered	All	NDPs: 0 Tests: 2																														
Coliforms (W)*	All	NDPs: 0 Tests: 4				X																										
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 4																														
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 7																														
EPH and CWG by FID	All	NDPs: 0 Tests: 6																														
Fluoride	All	NDPs: 0 Tests: 4				X																										
GRO by GC-FID (W)	All	NDPs: 0 Tests: 6																														
Mercury Dissolved	All	NDPs: 0 Tests: 6																														
Nitrite by Kone (w)	All	NDPs: 0 Tests: 4																														
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 4				X																										
pH Value	All	NDPs: 0 Tests: 6																														
Phenols by HPLC (W)	All	NDPs: 0 Tests: 4																														



CERTIFICATE OF ANALYSIS

Validated

SDG: 241010-56
Client Ref.: 501.000180.65091

Report Number: 743901
Location: Cam Quarry

Superseded Report: 743360

Results Legend



Test



No Determination Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Results Legend	Lab Sample No(s)		30496536		30496552		30496567	
	Customer Sample Reference		MM3		MM4		MM5	
Sample Types -	AGS Reference							
	Depth (m)		0.00 - 0.00		0.00 - 0.00		0.00 - 0.00	
Sample Types -	Container		0.5l glass bottle (ALE227)		ZnAc (ALE246)		Vial (ALE297)	
	Sample Type		GW		GW		GW	
Phosphate by Kone (w)	All	NDPs: 0 Tests: 6		X			X	
Sulphide	All	NDPs: 0 Tests: 4				X		X
Suspended Solids	All	NDPs: 0 Tests: 2						
Total Metals by ICP-MS	All	NDPs: 0 Tests: 6			X			X
TPH CWG (W)	All	NDPs: 0 Tests: 6	X			X		X
VOC MS (W)	All	NDPs: 0 Tests: 6					X	



CERTIFICATE OF ANALYSIS

Validated

SDG: 241010-56
Client Ref.: 501.000180.65091

Report Number: 743901
Location: Cam Quarry

Superseded Report: 743360

Results Legend



Test



No Determination Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)

30496517

30496527

Customer
Sample Reference

SW1

SW2

AGS Reference

Depth (m)

0.00 - 0.00

0.00 - 0.00

Container

Vial (ALE297)
HNO3 Unfiltered (ALE204)
HNO3 Filtered (ALE204)
500ml Plastic (ALE208)
250ml BOD (ALE212)
0.5l glass bottle (ALE227)
Vial (ALE297)

Sample Type

SW SW SW SW SW SW SW

Anions by Kone (w)

All

NDPs: 0
Tests: 6

X

BOD True Total

All

NDPs: 0
Tests: 2

X

COD Unfiltered

All

NDPs: 0
Tests: 2

X

Dissolved Metals by ICP-MS

All

NDPs: 0
Tests: 7

X

EPH and CWG by FID

All

NDPs: 0
Tests: 6

X

GRO by GC-FID (W)

All

NDPs: 0
Tests: 6

X

X

Mercury Dissolved

All

NDPs: 0
Tests: 6

X

pH Value

All

NDPs: 0
Tests: 6

X

Phosphate by Kone (w)

All

NDPs: 0
Tests: 6

X

Suspended Solids

All

NDPs: 0
Tests: 2

X

Total Metals by ICP-MS

All

NDPs: 0
Tests: 6

X

TPH CWG (W)

All

NDPs: 0
Tests: 6

X

VOC MS (W)

All

NDPs: 0
Tests: 6

X

X



CERTIFICATE OF ANALYSIS

Validated

SDG: 241010-56
Client Ref.: 501.000180.65091

Report Number: 743901
Location: Cam Quarry

Superseded Report: 743360

Results Legend		Customer Sample Ref.	MW3	MW4	MW5	MW6	SW1	SW2
# ISO17025 accredited. M mCERTS accredited. aq Aqueous / settled sample. diss.filt Dissolved / filtered sample. tot.unfiltTotal / unfiltered sample. * Subcontracted - refer to subcontractor report for accreditation status. ** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery (F) Trigger breach confirmed 1-4*5@ Sample deviation (see appendix)	Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference		0.00 - 0.00 Ground Water (GW) 08/10/2024 10/10/2024 241010-56 30496536	0.00 - 0.00 Ground Water (GW) 08/10/2024 10/10/2024 241010-56 30496552	0.00 - 0.00 Ground Water (GW) 08/10/2024 10/10/2024 241010-56 30496567	0.00 - 0.00 Ground Water (GW) 08/10/2024 10/10/2024 241010-56 30496583	0.00 - 0.00 Surface Water (SW) 08/10/2024 10/10/2024 241010-56 30496517	0.00 - 0.00 Surface Water (SW) 08/10/2024 10/10/2024 241010-56 30496527
Component	LOD/Units	Method						
Escherichia Coli (W)*		SUB	See Attached	See Attached	See Attached	See Attached		
Coliforms, Total*		SUB	See Attached	See Attached	See Attached	See Attached		
Suspended solids, Total	<2 mg/l	TM022					263	8.35
							#	#
BOD, unfiltered	<1 mg/l	TM045					2.04	<1
							#	#
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	<0.2	<0.2	<0.2	<0.2		
			#	#	#	#		
Ammoniacal Nitrogen as NH3	<0.2 mg/l	TM099	<0.2	<0.2	<0.2	<0.2		
			#	#	#	#		
Ammoniacal Nitrogen as NH4	<0.3 mg/l	TM099	<0.3	<0.3	<0.3	<0.3		
			#	#	#	#		
Sulphide	<0.01 mg/l	TM101	<0.01	<0.01	<0.01	<0.01		
			#	#	#	#		
Fluoride	<0.5 mg/l	TM104	<0.5	<0.5	<0.5	<0.5		
			#	#	#	#		
COD, unfiltered	<7 mg/l	TM107					105	30.4
							#	#
Aluminium (diss.filt)	<10 µg/l	TM152	<10	<10	<10	<10	<10	11
			#	#	#	#	#	#
Aluminium (tot.unfilt)	<10 µg/l	TM152	36200	241	9590	46.9	281	24.3
			#	#	#	#	#	#
Arsenic (diss.filt)	<0.5 µg/l	TM152	0.524	0.577	<0.5	<0.5	0.523	0.766
			#	#	#	#	#	#
Barium (diss.filt)	<0.2 µg/l	TM152	16.1	11	3.12	4.41	11.4	10.8
			#	#	#	#	#	#
Boron (diss.filt)	<10 µg/l	TM152	10.5	15.2	<10	10.2	18.6	14.2
			#	#	#	#	#	#
Cadmium (diss.filt)	<0.08 µg/l	TM152	0.167	<0.08	<0.08	<0.08	<0.08	<0.08
			#	#	#	#	#	#
Chromium (diss.filt)	<1 µg/l	TM152	<1	<1	<1	<1	<1	<1
			#	#	#	#	#	#
Copper (diss.filt)	<0.3 µg/l	TM152	1.99	1.25	1.82	1.37	1.51	1.01
			#	#	#	#	#	#
Manganese (tot.unfilt)	<1 µg/l	TM152	1340	50.9	416	<1	736	56.6
			#	#	#	#	#	#
Lead (diss.filt)	<0.2 µg/l	TM152	0.543	0.521	0.334	<0.2	<0.2	0.389
			#	#	#	#	#	#
Nickel (diss.filt)	<0.4 µg/l	TM152	4.38	0.801	0.565	<0.4	1.58	1.1
			#	#	#	#	#	#
Phosphorus (diss.filt)	<10 µg/l	TM152	<10	<10	11.3	<10	31.2	22.1
			#	#	#	#	#	#
Selenium (diss.filt)	<1 µg/l	TM152	2.71	<1	<1	<1	<1	<1
			#	#	#	#	#	#
Vanadium (diss.filt)	<1 µg/l	TM152	5.62	<1	<1	<1	<1	<1
			#	#	#	#	#	#
Sodium (Dis.Filt)	<0.076 mg/l	TM152	8.96	32.3	5.03	6.69	10.3	10.5
			#	#	#	#	#	#
Potassium (Dis.Filt)	<0.2 mg/l	TM152	1.91	0.726	0.227	0.835	3.52	3.3
			#	#	#	#	#	#
Calcium (Dis.Filt)	<0.2 mg/l	TM152	121	98.6	55.5	82.9	92.3	91.5
			#	#	#	#	#	#
Iron (Dis.Filt)	<0.019 mg/l	TM152	<0.019	<0.019	<0.019	<0.019	0.313	0.185
			#	#	#	#	#	#
Magnesium (Tot. Unfilt.)	<0.05 mg/l	TM152	13.2	14.2	3.42	2.23	3.07	3.05
			#	#	#	#	#	#
Mercury (diss.filt)	<0.01 µg/l	TM183	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
			#	#	#	#		
Nitrite as NO2	<0.05 mg/l	TM184	<0.25	<0.05	<0.05	<0.05		
			#	#	#	#		
Phosphate (Ortho as PO4)	<0.05 mg/l	TM184	<0.05	<0.05	<0.05	<0.05	<0.05	0.057
			#	#	#	#	#	#
Sulphate	<2 mg/l	TM184	4	4.6	21.2	7.3		
			#	#	#	#		



Superseded Report: 743360



CERTIFICATE OF ANALYSIS

Validated

SDG: 241010-56
Client Ref.: 501.000180.65091

Report Number: 743901
Location: Cam Quarry

Superseded Report: 743360

VOC MS (W)

Results Legend			Customer Sample Ref. Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	MW3	MW4	MW5	MW6	SW1	SW2
# ISO17025 accredited.				0.00 - 0.00 Ground Water (GW) 08/10/2024	0.00 - 0.00 Ground Water (GW) 08/10/2024	0.00 - 0.00 Ground Water (GW) 08/10/2024	0.00 - 0.00 Ground Water (GW) 08/10/2024	0.00 - 0.00 Surface Water (SW) 08/10/2024	0.00 - 0.00 Surface Water (SW) 08/10/2024
M mCERTS accredited.									
aq Aqueous / settled sample.									
diss.filt Dissolved / filtered sample.									
tot.unfiltTotal / unfiltered sample.									
* Subcontracted - refer to subcontractor report for accreditation status.									
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery									
(F) Trigger breach confirmed									
1-4+\$\$@ Sample deviation (see appendix)									
Component	LOD/Units	Method							
Dibromofluoromethane**	%	TM208	104	103	104	104	103	103	
Toluene-d8**	%	TM208	97.8	96.4	97.4	97.2	97.5	97.5	
4-Bromofluorobenzene**	%	TM208	93.8	94.2	93.3	93	92.9	93.5	
Dichlorodifluoromethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Chloromethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Vinyl chloride	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Bromomethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Chloroethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Trichlorofluoromethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
1,1-Dichloroethene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Carbon disulphide	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Dichloromethane	<3 µg/l	TM208	<3	<3	<3	<3	<3	<3	
			#	#	#	#	#	#	
Methyl tertiary butyl ether (MTBE)	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
trans-1,2-Dichloroethene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
1,1-Dichloroethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
cis-1,2-Dichloroethene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
2,2-Dichloropropane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
Bromochloromethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Chloroform	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
1,1,1-Trichloroethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
1,1-Dichloropropene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Carbontetrachloride	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
1,2-Dichloroethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Benzene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Trichloroethene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
1,2-Dichloropropane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Dibromomethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Bromodichloromethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
cis-1,3-Dichloropropene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
Toluene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
trans-1,3-Dichloropropene	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
1,1,2-Trichloroethane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	
1,3-Dichloropropane	<1 µg/l	TM208	<1	<1	<1	<1	<1	<1	
			#	#	#	#	#	#	



CERTIFICATE OF ANALYSIS

Validated

SDG: 241010-56
Client Ref.: 501.000180.65091

Report Number: 743901
Location: Cam Quarry

Superseded Report: 743360

VOC MS (W)

Results Legend			Customer Sample Ref.		MW3	MW4	MW5	MW6	SW1	SW2
#	ISO17025 accredited.		Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference		0.00 - 0.00 Ground Water (GW) 08/10/2024	0.00 - 0.00 Ground Water (GW) 08/10/2024	0.00 - 0.00 Ground Water (GW) 08/10/2024	0.00 - 0.00 Ground Water (GW) 08/10/2024	0.00 - 0.00 Surface Water (SW) 08/10/2024	0.00 - 0.00 Surface Water (SW) 08/10/2024
M	mCERTS accredited.									
aq	Aqueous / settled sample.									
diss.filt	Dissolved / filtered sample.									
tot.unfilt	Total / unfiltered sample.									
* Subcontracted - refer to subcontractor report for accreditation status.					10/10/2024 241010-56 30496536	10/10/2024 241010-56 30496552	10/10/2024 241010-56 30496567	10/10/2024 241010-56 30496583	10/10/2024 241010-56 30496517	10/10/2024 241010-56 30496527
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery										
(F) Trigger breach confirmed										
1-4* Sample deviation (see appendix)										
Component	LOD/Units	Method								
Tetrachloroethene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Dibromochloromethane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2-Dibromoethane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Chlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,1,1,2-Tetrachloroethane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Ethylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
m,p-Xylene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
o-Xylene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Styrene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Bromoform	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Isopropylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,1,2,2-Tetrachloroethane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2,3-Trichloropropane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Bromobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Propylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
2-Chlorotoluene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,3,5-Trimethylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
4-Chlorotoluene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
tert-Butylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2,4-Trimethylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
sec-Butylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
4-iso-Propyltoluene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,3-Dichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,4-Dichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
n-Butylbenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2-Dichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2-Dibromo-3-chloropropane	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2,4-Trichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Hexachlorobutadiene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
tert-Amyl methyl ether (TAME)	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
Naphthalene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,2,3-Trichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#
1,3,5-Trichlorobenzene	<1 µg/l	TM208			<1	<1	<1	<1	<1	<1
					#	#	#	#	#	#

08:47:18 17/10/2024



CERTIFICATE OF ANALYSIS

Validated

SDG: 241010-56
Client Ref.: 501.000180.65091

Report Number: 743901
Location: Cam Quarry

Superseded Report: 743360

Table of Results - Appendix

Method No	Description
SUB	Subcontracted Test
TM022	Determination of total suspended solids in waters
TM045	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids
TM099	Determination of Ammonium in Water Samples using the Kone Analyser
TM101	Determination of Sulphide in soil and water samples using the Kone Analyser
TM104	Determination of Fluoride using the Kone Analyser
TM107	Determination of Chemical Oxygen Demand using COD Dr Lange Kit
TM152	Analysis of Aqueous Samples by ICP-MS
TM178	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters
TM183	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM208	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters
TM227	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate
TM245	Determination of GRO by Headspace in waters
TM256	Determination of pH, EC, TDS and Alkalinity in Aqueous samples
TM259	Determination of Phenols in Waters and Leachates by HPLC
TM439	Determination of Extractable Petroleum Hydrocarbons (EPH) CWG banding by GC-FID on liquids

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).



CERTIFICATE OF ANALYSIS

Validated

SDG: 241010-56
Client Ref.: 501.000180.65091

Report Number: 743901
Location: Cam Quarry

Superseded Report: 743360

Test Completion Dates

Lab Sample No(s)
Customer Sample Ref.

AGS Ref.
Depth
Type

	30496536	30496552	30496567	30496583	30496517	30496527
	MW3	MW4	MW5	MW6	SW1	SW2
	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water	Surface Water
Ammoniacal Nitrogen	11-Oct-2024	11-Oct-2024	11-Oct-2024	11-Oct-2024		
Anions by Kone (w)	11-Oct-2024	11-Oct-2024	11-Oct-2024	11-Oct-2024	11-Oct-2024	11-Oct-2024
BOD True Total					15-Oct-2024	15-Oct-2024
COD Unfiltered					15-Oct-2024	15-Oct-2024
Coliforms (W)*	11-Oct-2024	11-Oct-2024	11-Oct-2024	11-Oct-2024		
Cyanide Comp/Free/Total/Thiocyanate	15-Oct-2024	16-Oct-2024	17-Oct-2024	16-Oct-2024		
Dissolved Metals by ICP-MS	16-Oct-2024	16-Oct-2024	16-Oct-2024	16-Oct-2024	16-Oct-2024	16-Oct-2024
EPH and CWG by FID	17-Oct-2024	17-Oct-2024	17-Oct-2024	16-Oct-2024	17-Oct-2024	16-Oct-2024
Fluoride	12-Oct-2024	12-Oct-2024	11-Oct-2024	11-Oct-2024		
GRO by GC-FID (W)	15-Oct-2024	14-Oct-2024	14-Oct-2024	14-Oct-2024	14-Oct-2024	14-Oct-2024
Mercury Dissolved	11-Oct-2024	11-Oct-2024	11-Oct-2024	10-Oct-2024	16-Oct-2024	10-Oct-2024
Nitrite by Kone (w)	11-Oct-2024	11-Oct-2024	11-Oct-2024	11-Oct-2024		
PAH Spec MS - Aqueous (W)	16-Oct-2024	16-Oct-2024	16-Oct-2024	16-Oct-2024		
pH Value	16-Oct-2024	16-Oct-2024	16-Oct-2024	16-Oct-2024	16-Oct-2024	17-Oct-2024
Phenols by HPLC (W)	15-Oct-2024	15-Oct-2024	15-Oct-2024	15-Oct-2024		
Phosphate by Kone (w)	11-Oct-2024	11-Oct-2024	11-Oct-2024	11-Oct-2024	11-Oct-2024	11-Oct-2024
Sulphide	14-Oct-2024	14-Oct-2024	14-Oct-2024	14-Oct-2024		
Suspended Solids					15-Oct-2024	15-Oct-2024
Total Metals by ICP-MS	16-Oct-2024	15-Oct-2024	15-Oct-2024	15-Oct-2024	15-Oct-2024	15-Oct-2024
TPH CWG (W)	17-Oct-2024	17-Oct-2024	17-Oct-2024	16-Oct-2024	17-Oct-2024	16-Oct-2024
VOC MS (W)	15-Oct-2024	15-Oct-2024	15-Oct-2024	15-Oct-2024	15-Oct-2024	15-Oct-2024



ALS Life Sciences Ltd trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
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Report No: ALSH-546091024

Document No: EF0011

CERTIFICATE OF ANALYSIS

Client	ALS Hawarden Units 7-8 Hawarden Business Park Manor Lane Hawarden CH5 3US	Date Submitted	09/10/2024
		Date Reported	10/10/2024
		Order Number	N/A
For the Attention of:	ALS Hawarden		
Sample Reception	4 sample(s) received in good condition.		
Comments	N/A		

Report Authorised by:

Mairead Gilmore
Microbiology Manager

Conditions:

1. Results in this report relate only to the items tested as received
2. Reports may not be reproduced except in full without the approval of ALS Life Sciences Ltd
3. All queries regarding this report should be addressed to the Technical Manager at the above address
4. A * next to a method reference signifies that ALS Life Sciences Ltd is NOT INAB accredited for this method
5. Results reported as CFU/cm² are calculated based on information supplied by customer regarding area swabbed
6. SUBCON* indicates analysis subcontracted to approved subcontractors who do not hold accreditation for this test
7. SUBCON^ indicates analysis subcontracted to approved subcontractors who hold accreditation for this test
8. Where sampling is undertaken by ALS personnel, sampling activities are outside the scope of INAB accreditation
9. Dil next to a method reference indicates that a dilution of the water sample was undertaken during testing
10. Statement of conformity made against the result does not take into account the uncertainty of measurement associated with the method



ALS Life Sciences Ltd trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Telephone: +353 (0) 52 617 8100



Report No: ALSH-546091024

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Submitted 09/10/2024
Date Reported 10/10/2024
Order Number N/A

Sample Type Water
Client ID MW3 (08/10/2024 @ 15.51
Date Tested 09/10/2024
ALS ID 6378763

Test	Result	Unit	Method
Coliforms	3	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)
Escherichia coli	10	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)

Sample Type Water
Client ID MW4 (08/10/2024 @ 10.57
Date Tested 09/10/2024
ALS ID 6378764

Test	Result	Unit	Method
Coliforms	49	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)
Escherichia coli	46	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)

Sample Type Water
Client ID MW5 (08/10/2024 @ 10.08
Date Tested 09/10/2024
ALS ID 6378765

Test	Result	Unit	Method
Coliforms	17	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)
Escherichia coli	3	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)

Sample Type Water
Client ID MW6 (08/10/2024 @ 12.20
Date Tested 09/10/2024
ALS ID 6378766

Test	Result	Unit	Method
Coliforms	11	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)
Escherichia coli	0	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)

Report Authorised by:

Mairead Gilmore

Mairead Gilmore
Microbiology Manager



CERTIFICATE OF ANALYSIS

SDG: 241010-56
Client Ref: 501.000180.65091

Report Number: 743901
Location: Cam Quarry

Superseded Report: 743360

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of 15 days after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

General

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Matrix interference
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to late arrival of instructions or samples
§	Sampled on date not provided

20. Asbestos

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials and soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.



Unit 7-8 Hawarden Business Park
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Deeside
CH5 3US

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SLR Consulting Ireland
CSA House
Unit 7
Dundrum Business Park
Windy Harbour
Dublin
Dublin14

Attention: Michelle Sherry

CERTIFICATE OF ANALYSIS

Date of report Generation:	05 August 2025
Customer:	SLR Consulting Ireland
Sample Delivery Group (SDG):	250721-35
Your Reference:	501.065512.00001
Location:	Cam Quarry, Co.Roscommon
Report No:	773233
Order Number:	1819

This report has been revised and directly supersedes 772477 in its entirety.

We received 3 samples on Monday July 21, 2025 and 3 of these samples were scheduled for analysis which was completed on Tuesday August 05, 2025. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.

Incorrect sampling dates and/or sample information will affect the validity of results.

The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Justin Keeton
Business Unit Leader - Land





CERTIFICATE OF ANALYSIS

Validated

SDG: 250721-35
Client Ref.: 501.065512.00001

Report Number: 773233
Location: Cam Quarry, Co.Roscommon

Superseded Report: 772477

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
31858937	SW1		0.00 - 0.00	17/07/2025
31858950	SW2		0.00 - 0.00	17/07/2025
31858964	SW3 (River Suck)		0.00 - 0.00	17/07/2025

Only received samples which have had analysis scheduled will be shown on the following pages.



CERTIFICATE OF ANALYSIS

Validated

SDG: 250721-35
Client Ref.: 501.065512.00001

Report Number: 773233
Location: Cam Quarry, Co.Roscommon

Superseded Report: 772477

Results Legend X Test N No Determination Possible Sample Types - S - Soil/Solid UNS - Unspecified Solid GW - Ground Water SW - Surface Water LE - Land Leachate PL - Prepared Leachate PR - Process Water SA - Saline Water TE - Trade Effluent TS - Treated Sewage US - Untreated Sewage RE - Recreational Water DW - Drinking Water Non-regulatory UNL - Unspecified Liquid SL - Sludge G - Gas OTH - Other	Lab Sample No(s)		31858937										31858950										31858964									
	Customer Sample Reference		SW1										SW2										SW3 (River Suck)									
	AGS Reference																															
	Depth (m)		0.00 - 0.00										0.00 - 0.00										0.00 - 0.00									
	Container		DO KIT + DO 250 ml glass (ALE208)	500ml Plastic (ALE208)	0.5l glass bottle (ALE227)	SW	SW	SW	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	NaOH (ALE245)	Vial (ALE297)	ZnAc (ALE246)	0.5l glass bottle (ALE227)	500ml Plastic (ALE208)	DO KIT + DO 250 ml glass (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	NaOH (ALE245)	Vial (ALE297)	ZnAc (ALE246)	0.5l glass bottle (ALE227)	500ml Plastic (ALE208)	DO KIT + DO 250 ml glass (ALE208)	SW	SW	SW	SW	SW	SW		
	Sample Type		SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
Ammonium Low	All	NDPs: 0 Tests: 3					X									X																
Anions by Kone (w)	All	NDPs: 0 Tests: 3		X										X											X							
BOD True Total	All	NDPs: 0 Tests: 3		X										X											X							
COD Unfiltered	All	NDPs: 0 Tests: 3		X										X											X							
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 3						X									X															
Dissolved Oxygen by Titration	All	NDPs: 0 Tests: 3				X									X														X			
EPH and CWG by FID	All	NDPs: 0 Tests: 3	X										X												X							
Fluoride	All	NDPs: 0 Tests: 3		X										X												X						
GRO by GC-FID (W)	All	NDPs: 0 Tests: 3								X									X													
Low Level Cyanide (W)	All	NDPs: 0 Tests: 3							X									X														
Mercury Dissolved	All	NDPs: 0 Tests: 3						X									X															
Nitrite by Kone (w)	All	NDPs: 0 Tests: 3							X									X														
pH Value	All	NDPs: 0 Tests: 3		X										X											X							
Phosphate by Kone (w)	All	NDPs: 0 Tests: 3		X										X											X							
Sulphide	All	NDPs: 0 Tests: 3										X								X												



CERTIFICATE OF ANALYSIS

Validated

SDG: 250721-35
Client Ref.: 501.065512.00001

Report Number: 773233
Location: Cam Quarry, Co. Roscommon

Superseded Report: 772477

Results Legend



Test



No Determination Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Results Legend X Test N No Determination Possible	Lab Sample No(s)		Customer Sample Reference		AGS Reference		Depth (m)		Container		Sample Type	
	31858964		SW3 (River Suck)				0.00 - 0.00		DO KIT + DO 250 ml glass (ALE208)	SW		
	31858950		SW2				0.00 - 0.00		0.5l glass bottle (ALE227)	SW		
									ZnAc (ALE246)	SW		
									Vial (ALE297)	SW		
									NaOH (ALE245)	SW		
									HNO3 Filtered (ALE204)	SW		
Sample Types - S - Soil/Solid UNS - Unspecified Solid GW - Ground Water SW - Surface Water LE - Land Leachate PL - Prepared Leachate PR - Process Water SA - Saline Water TE - Trade Effluent TS - Treated Sewage US - Untreated Sewage RE - Recreational Water DW - Drinking Water Non-regulatory UNL - Unspecified Liquid SL - Sludge G - Gas OTH - Other	31858937		SW1				0.00 - 0.00		H2SO4 (ALE244)	SW		
									DO KIT + DO 250 ml glass (ALE208)	SW		
									0.5l glass bottle (ALE227)	SW		
									ZnAc (ALE246)	SW		
									Vial (ALE297)	SW		
									NaOH (ALE245)	SW		
									HNO3 Filtered (ALE204)	SW		
									500ml Plastic (ALE208)	SW		
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								ZnAc (ALE246)	SW			
								Vial (ALE297)	SW			
								NaOH (ALE245)	SW			

31858964	SW3 (River Suck)		0.00 - 0.00	ZnAc (ALE246)	SW									
				Vial (ALE297)	SW									
				NaOH (ALE245)	SW									
				HNO3 Filtered (ALE204)	SW									
				H2SO4 (ALE244)	SW									



CERTIFICATE OF ANALYSIS

Validated

SDG: 250721-35
Client Ref.: 501.065512.00001

Report Number: 773233
Location: Cam Quarry, Co.Roscommon

Superseded Report: 772477

Results Legend			Customer Sample Ref.			SW1	SW2	SW3 (River Suck)			
# ISO17025 accredited. M mCERTS accredited. aq Aqueous / settled sample. diss.filt Dissolved / filtered sample. tot.unfilt Total / unfiltered sample. * Subcontracted - refer to subcontractor report for accreditation status. ** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery *** 6.2 FTAB (see appendix) 1-4\$@ Sample deviation (see appendix)			Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference			0.00 - 0.00 Surface Water (SW) 17/07/2025	0.00 - 0.00 Surface Water (SW) 17/07/2025	0.00 - 0.00 Surface Water (SW) 17/07/2025			
						21/07/2025 250721-35 31858937	21/07/2025 250721-35 31858950	21/07/2025 250721-35 31858964			
Component	LOD/Units	Method									
Suspended solids, Total	<2 mg/l	TM022	220				<2	4.7			
			#			#	#	#			
BOD, unfiltered	<1 mg/l	TM045	3.97				<1	<1			
			@ #			@ #	@ #	@ #			
Ammoniacal Nitrogen as N (low level)	<0.01 mg/l	TM099	0.037				0.027	0.033			
			#			#	#	#			
Ammoniacal Nitrogen Low as NH3	<0.01 mg/l	TM099	0.0449				0.0328	0.0401			
			#			#	#	#			
Ammoniacal Nitrogen Low as NH4	<0.01 mg/l	TM099	0.0476				0.0347	0.0424			
			#			#	#	#			
Sulphide	<0.01 mg/l	TM101	0.0125				<0.01	<0.01			
Fluoride	<0.5 mg/l	TM104	<0.5				<0.5	<0.5			
COD, unfiltered	<7 mg/l	TM107	258				55.3	30.5			
			@ #			@ #	@ #	@ #			
Aluminium (diss.filt)	<10 µg/l	TM152	33.4				<10	<10			
			#			#	#	#			
Antimony (diss.filt)	<1 µg/l	TM152	<1				<1	<1			
			#			#	#	#			
Arsenic (diss.filt)	<0.5 µg/l	TM152	0.941				0.879	1.04			
			#			#	#	#			
Barium (diss.filt)	<0.2 µg/l	TM152	10.9				8.59	27			
			#			#	#	#			
Boron (diss.filt)	<10 µg/l	TM152	10.8				14.4	18.1			
			#			#	#	#			
Cadmium (diss.filt)	<0.08 µg/l	TM152	<0.08				<0.08	<0.08			
			#			#	#	#			
Chromium (diss.filt)	<1 µg/l	TM152	<1				<1	<1			
			#			#	#	#			
Copper (diss.filt)	<0.3 µg/l	TM152	0.548				0.761	1.02			
			#			#	#	#			
Lead (diss.filt)	<0.2 µg/l	TM152	0.423				<0.2	0.237			
			#			#	#	#			
Manganese (diss.filt)	<3 µg/l	TM152	267				99.2	21.7			
			#			#	#	#			
Nickel (diss.filt)	<0.4 µg/l	TM152	8.67				7.33	1.21			
			#			#	#	#			
Phosphorus (diss.filt)	<10 µg/l	TM152	<10				<10	<10			
			#			#	#	#			
Selenium (diss.filt)	<1 µg/l	TM152	<1				<1	<1			
			#			#	#	#			
Vanadium (diss.filt)	<1 µg/l	TM152	<1				<1	<1			
			#			#	#	#			
Zinc (diss.filt)	<1 µg/l	TM152	6.41				5	4.87			
			#			#	#	#			
Sodium (Dis.Filt)	<0.076 mg/l	TM152	7.39				7.24	9.49			
			#			#	#	#			
Magnesium (Dis.Filt)	<0.036 mg/l	TM152	1.9				1.89	5.41			
			#			#	#	#			
Potassium (Dis.Filt)	<0.2 mg/l	TM152	1.83				1.83	1.8			
			#			#	#	#			
Calcium (Dis.Filt)	<0.2 mg/l	TM152	62.3				62.3	93.7			
			#			#	#	#			
Iron (Dis.Filt)	<0.019 mg/l	TM152	0.901				0.686	0.0852			
			#			#	#	#			
Mercury (diss.filt)	<0.01 µg/l	TM183	<0.01				<0.01	<0.01			
Nitrite as NO2	<0.05 mg/l	TM184	<0.05				<0.05	<0.05			
			#			#	#	#			
Sulphate	<2 mg/l	TM184	<2				<2	<2			
			#			#	#	#			
Chloride	<2 mg/l	TM184	14.3				14.6	18.7			
			#			#	#	#			
Phosphate (Ortho as P)	<0.02 mg/l	TM184	<0.02				<0.02	<0.02			
			#			#	#	#			



CERTIFICATE OF ANALYSIS

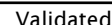
Validated

SDG: 250721-35
Client Ref.: 501.065512.00001

Report Number: 773233
Location: Cam Quarry, Co.Roscommon

Superseded Report: 772477

Results Legend			Customer Sample Ref.	SW1	SW2	SW3 (River Suck)			
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference		0.00 - 0.00 Surface Water (SW) 17/07/2025	0.00 - 0.00 Surface Water (SW) 17/07/2025	0.00 - 0.00 Surface Water (SW) 17/07/2025			
M	mCERTS accredited.								
aq	Aqueous / settled sample.								
diss.filt	Dissolved / filtered sample.								
tot.unfilt	Total / unfiltered sample.								
*	Subcontracted - refer to subcontractor report for accreditation status.								
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery								
***	6:2 FTAB (see appendix)								
1-4**	@ Sample deviation (see appendix)								
Component		LOD/Units	Method						
Nitrate as NO3		<0.3 mg/l	TM184	0.691	0.614	1.25			
				#	#	#			
Total Oxidised Nitrogen as N		<0.1 mg/l	TM184	0.156	0.139	0.283			
				#	#	#			
Oxygen, dissolved		<0.3 mg/l	TM187	3.57	6.25	6.13			
pH		<1 pH Units	TM256	7.47	7.84	8.1			
				#	#	#			
Conductivity @ 20 deg.C		<0.02 mS/cm	TM256	0.312	0.313	0.48			
				#	#	#			
Alkalinity, Total as CaCO3		<3 mg/l	TM256	157	153	248			
				#	#	#			
Cyanide, Total (low level)		<5 µg/l	TM279	<5	<5	<5			
				#	#	#			
Cyanide, Free (low level)		<2.5 µg/l	TM279	<2.5	<2.5	<2.5			
				#	#	#			
							</		



Superseded Report: 772477

Location: Cam Quarry, Co. Roscommon

SDG: 250721-35

Report Number: 773233

Superseded Report: 772477

Client Ref.: 501.065512.00001

Location: Cam Quarry, Co. Roscommon

VOC MS (W)

[illegible]



CERTIFICATE OF ANALYSIS

Validated

SDG: 250721-35
Client Ref.: 501.065512.00001

Report Number: 773233
Location: Cam Quarry, Co.Roscommon

Superseded Report: 772477

Table of Results - Appendix

Method No	Description
TM022	Determination of total suspended solids in waters
TM045	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids
TM099	Determination of Ammonium in Water Samples using the Kone Analyser
TM101	Determination of Sulphide in soil and water samples using the Kone Analyser
TM104	Determination of Fluoride using the Kone Analyser
TM107	Determination of Chemical Oxygen Demand using COD Dr Lange Kit
TM152	Analysis of Aqueous Samples by ICP-MS
TM183	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM187	Dissolved Oxygen in Natural and Waste Waters HMSO 1979 ISBN 011 751442
TM208	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters
TM245	Determination of GRO by Headspace in waters
TM256	Determination of pH, EC, TDS and Alkalinity in Aqueous samples
TM279	Determination of Low Level Easily Liberatable (Free) Cyanides and Total Cyanides in Waters using the Skalar SANS+ System Segmented Flow Analyser
TM439	Determination of Extractable Petroleum Hydrocarbons (EPH) CWG banding by GC-FID on liquids

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).



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Client Ref.: 501.065512.00001

Report Number: 773233
Location: Cam Quarry, Co. Roscommon

Superseded Report: 772477

Test Completion Dates

Lab Sample No(s)	31858937	31858950	31858964
Customer Sample Ref.	SW1	SW2	SW3 (River Suck)
AGS Ref.			
Depth	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
Type	Surface Water	Surface Water	Surface Water

Ammonium Low	23-Jul-2025	23-Jul-2025	23-Jul-2025
Anions by Kone (w)	23-Jul-2025	23-Jul-2025	23-Jul-2025
BOD True Total	05-Aug-2025	05-Aug-2025	05-Aug-2025
COD Unfiltered	31-Jul-2025	31-Jul-2025	31-Jul-2025
Dissolved Metals by ICP-MS	24-Jul-2025	24-Jul-2025	24-Jul-2025
Dissolved Oxygen by Titration	22-Jul-2025	22-Jul-2025	22-Jul-2025
EPH and CWG by FID	25-Jul-2025	25-Jul-2025	24-Jul-2025
Fluoride	23-Jul-2025	23-Jul-2025	23-Jul-2025
GRO by GC-FID (W)	28-Jul-2025	28-Jul-2025	28-Jul-2025
Low Level Cyanide (W)	25-Jul-2025	25-Jul-2025	25-Jul-2025
Mercury Dissolved	25-Jul-2025	24-Jul-2025	24-Jul-2025
Nitrite by Kone (w)	23-Jul-2025	23-Jul-2025	23-Jul-2025
pH Value	25-Jul-2025	25-Jul-2025	25-Jul-2025
Phosphate by Kone (w)	23-Jul-2025	23-Jul-2025	23-Jul-2025
Sulphide	23-Jul-2025	23-Jul-2025	23-Jul-2025
Suspended Solids	25-Jul-2025	25-Jul-2025	25-Jul-2025
TPH CWG (W)	28-Jul-2025	28-Jul-2025	28-Jul-2025
VOC MS (W)	27-Jul-2025	27-Jul-2025	27-Jul-2025



CERTIFICATE OF ANALYSIS

SDG: 250721-35
Client Ref: 501.065512.00001

Report Number: 773233
Location: Cam Quarry, Co. Roscommon

Superseded Report: 772477

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of 15 days after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur - e.g volatile mercury.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

General

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Matrix interference
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to late arrival of instructions or samples
§	Sampled on date not provided

20. Asbestos

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

If during the search of the two 'pinch' samples by PLM only 1 or 2 fibres or fibre bundles are seen and identified as asbestos, the term 'trace asbestos identified' is reported.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials and soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Potentially respirable fibres are identified by using a Phase Contrast Microscope.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

21. 6:2 FTAB

Recovery of 6:2 FTAB in the quality control samples has been observed to be <50% of the target value. Please note the 6:2 FTAB result is supplied as indicative only.



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SLR Consulting Ireland
CSA House
Unit 7
Dundrum Business Park
Windy Harbour
Dublin
Dublin14

Attention: Michelle Sherry

CERTIFICATE OF ANALYSIS

Date of report Generation:	25 September 2025
Customer:	SLR Consulting Ireland
Sample Delivery Group (SDG):	250919-102
Your Reference:	501.065512.00001
Location:	Cam Quarry
Report No:	778409
Order Number:	1888

We received 3 samples on Friday September 19, 2025 and 3 of these samples were scheduled for analysis which was completed on Thursday September 25, 2025. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.

Incorrect sampling dates and/or sample information will affect the validity of results.

The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Justin Keeton
Business Unit Leader - Land





CERTIFICATE OF ANALYSIS

Validated

SDG: 250919-102
Client Ref.: 501.065512.00001

Report Number: 778409
Location: Cam Quarry

Superseded Report:

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
32166072	Quarry Sump		0.00 - 0.00	16/09/2025
32166042	SW1		0.00 - 0.00	16/09/2025
32166058	SW2		0.00 - 0.00	16/09/2025

Only received samples which have had analysis scheduled will be shown on the following pages.

SDG: 250919-102
Client Ref.: 501.065512.00001

Report Number: 778409
Location: Cam Quarry

Superseded Report:

[illegible]



CERTIFICATE OF ANALYSIS

Validated

SDG: 250919-102
Client Ref.: 501.065512.00001

Report Number: 778409
Location: Cam Quarry

Superseded Report:

Results Legend



Test



No Determination Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Results Legend X Test N No Determination Possible Sample Types - S - Soil/Solid UNS - Unspecified Solid GW - Ground Water SW - Surface Water LE - Land Leachate PL - Prepared Leachate PR - Process Water SA - Saline Water TE - Trade Effluent TS - Treated Sewage US - Untreated Sewage RE - Recreational Water DW - Drinking Water Non-regulatory UNL - Unspecified Liquid SL - Sludge G - Gas OTH - Other	Lab Sample No(s)		32166058															
	Customer Sample Reference		SW2															
	AGS Reference																	
	Depth (m)		0.00 - 0.00															
	Container		H2SO4 (ALE244)															
	Sample Type		SW															
			0.5l glass bottle (ALE227)															
Sulphide	All	NDPs: 0 Tests: 3	32166072															
			Quarry Sump															
Suspended Solids	All	NDPs: 0 Tests: 3	32166042															
			SW1															
TPH CWG (W)	All	NDPs: 0 Tests: 3	0.00 - 0.00															
			0.00 - 0.00															
VOC MS (W)	All	NDPs: 0 Tests: 3	0.00 - 0.00															
			0.00 - 0.00															



CERTIFICATE OF ANALYSIS

Validated

SDG: 250919-102
Client Ref.: 501.065512.00001

Report Number: 778409
Location: Cam Quarry

Superseded Report:

Results Legend		Customer Sample Ref.	Quarry Sump	SW1	SW2			
#	ISO17025 accredited.							
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted - refer to subcontractor report for accreditation status.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
***	6.2 FTAB (see appendix)							
1-4**@	Sample deviation (see appendix)							
Component	LOD/Units	Method						
Suspended solids, Total	<2 mg/l	TM022	7.75	3.65	2.45			
			#	#	#			
BOD, unfiltered	<1 mg/l	TM045	<1	<1	<1			
			#	#	#			
Oxygen, dissolved	<0.3 mg/l	TM046			10.7			
Ammoniacal Nitrogen as N (low level)	<0.01 mg/l	TM099	0.065	0.044	0.052			
			#	#	#			
Ammoniacal Nitrogen Low as NH3	<0.01 mg/l	TM099	0.0789	0.0534	0.0631			
			#	#	#			
Ammoniacal Nitrogen Low as NH4	<0.01 mg/l	TM099	0.0836	0.0566	0.0669			
			#	#	#			
Sulphide	<0.01 mg/l	TM101	<0.01	<0.01	<0.01			
Fluoride	<0.5 mg/l	TM104	0.85	<0.5	<0.5			
COD, unfiltered	<7 mg/l	TM107	<7	56.5	60.8			
			#	#	#			
Aluminium (diss.filt)	<10 µg/l	TM152	<10	13.6	<10			
			#	#	#			
Antimony (diss.filt)	<1 µg/l	TM152	1.18	<1	<1			
			#	#	#			
Arsenic (diss.filt)	<0.5 µg/l	TM152	<0.5	0.733	0.651			
			#	#	#			
Barium (diss.filt)	<0.2 µg/l	TM152	7.75	9.7	8.7			
			#	#	#			
Boron (diss.filt)	<10 µg/l	TM152	24.2	<10	<10			
			#	#	#			
Cadmium (diss.filt)	<0.08 µg/l	TM152	<0.08	<0.08	<0.08			
			#	#	#			
Chromium (diss.filt)	<1 µg/l	TM152	<1	<1	<1			
			#	#	#			
Copper (diss.filt)	<0.3 µg/l	TM152	0.375	0.364	0.467			
			#	#	#			
Lead (diss.filt)	<0.2 µg/l	TM152	<0.2	<0.2	<0.2			
			#	#	#			
Manganese (diss.filt)	<3 µg/l	TM152	<3	57.5	25.4			
			#	#	#			
Nickel (diss.filt)	<0.4 µg/l	TM152	8.58	4.7	4.06			
			#	#	#			
Phosphorus (diss.filt)	<10 µg/l	TM152	<10	<10	<10			
			#	#	#			
Selenium (diss.filt)	<1 µg/l	TM152	2.54	<1	<1			
			#	#	#			
Vanadium (diss.filt)	<1 µg/l	TM152	<1	<1	<1			
			#	#	#			
Zinc (diss.filt)	<1 µg/l	TM152	2.81	3.47	2.46			
			#	#	#			
Sodium (Dis.Filt)	<0.076 mg/l	TM152	10.8	8.52	8.78			
			#	#	#			
Magnesium (Dis.Filt)	<0.036 mg/l	TM152	10.7	1.83	1.87			
			#	#	#			
Potassium (Dis.Filt)	<0.2 mg/l	TM152	0.823	1.58	1.64			
			#	#	#			
Calcium (Dis.Filt)	<0.2 mg/l	TM152	80.8	68.8	70.3			
			#	#	#			
Iron (Dis.Filt)	<0.019 mg/l	TM152	<0.019	0.367	0.29			
			#	#	#			
Mercury (diss.filt)	<0.01 µg/l	TM183	<0.01	<0.01	<0.01			
Nitrite as NO2	<0.05 mg/l	TM184	0.142	<0.25	<0.05			
			#	#	#			
Sulphate	<2 mg/l	TM184	102	<2	<2			
			#	#	#			
Chloride	<2 mg/l	TM184	22.8	19	18.7			
			#	#	#			



CERTIFICATE OF ANALYSIS

Validated

SDG: 250919-102
Client Ref.: 501.065512.00001

Report Number: 778409
Location: Cam Quarry

Superseded Report:

Results Legend			Customer Sample Ref.	Quarry Sump	SW1	SW2									
#	ISO17025 accredited.														
M	mCERTS accredited.														
aq	Aqueous / settled sample.														
diss.filt	Dissolved / filtered sample.														
tot.unfilt	Total / unfiltered sample.														
*	Subcontracted - refer to subcontractor report for accreditation status.														
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery														
***	6.2 FTAB (see appendix)														
1-4**	@Sample deviation (see appendix)														
Component	LOD/Units	Method	Depth (m)	Sample Type	Date Sampled	Sample Time	Date Received	SDG Ref	Lab Sample No.(s)	AGS Reference					
Phosphate (Ortho as P)	<0.02 mg/l	TM184	0.00 - 0.00	Surface Water (SW)	16/09/2025		0.00 - 0.00	Surface Water (SW)	16/09/2025	0.00 - 0.00	Surface Water (SW)	16/09/2025			
Nitrate as NO3	<0.3 mg/l	TM184	39.8				1.05			1.18					
Total Oxidised Nitrogen as N	<0.1 mg/l	TM184	9.02				0.237			0.265					
Oxygen, dissolved	<0.3 mg/l	TM187	9.2				5.84								
pH	<1 pH Units	TM256	8.11				7.72			7.84					
Conductivity @ 20 deg.C	<0.02 mS/cm	TM256	0.501				0.342			0.345					
Alkalinity, Total as CaCO3	<3 mg/l	TM256	112				166			165					
Cyanide, Total (low level)	<5 µg/l	TM279	<5				<5			<5					
Cyanide, Free (low level)	<2.5 µg/l	TM279	<2.5				<2.5			<2.5					
					</										



Superseded Report:

Location: Cam Quarry



CERTIFICATE OF ANALYSIS

Validated

SDG: 250919-102
Client Ref.: 501.065512.00001

Report Number: 778409
Location: Cam Quarry

Superseded Report:

Table of Results - Appendix

Method No	Description
TM046	Measurement of Dissolved Oxygen by Oxygen Meter
TM104	Determination of Fluoride using the Kone Analyser
TM152	Analysis of Aqueous Samples by ICP-MS
TM183	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM187	Dissolved Oxygen in Natural and Waste Waters HMSO 1979 ISBN 011 751442
TM208	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters
TM245	Determination of GRO by Headspace in waters
TM256	Determination of pH, EC, TDS and Alkalinity in Aqueous samples
TM279	Determination of Low Level Easily Liberatable (Free) Cyanides and Total Cyanides in Waters using the Skalar SANS+ System Segmented Flow Analyser
TM022	Determination of total suspended solids in waters
TM045	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids
TM099	Determination of Ammonium in Water Samples using the Kone Analyser
TM101	Determination of Sulphide in soil and water samples using the Kone Analyser
TM107	Determination of Chemical Oxygen Demand using COD Dr Lange Kit
TM439	Determination of Extractable Petroleum Hydrocarbons (EPH) CWG banding by GC-FID on liquids

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).



CERTIFICATE OF ANALYSIS

Validated

SDG: 250919-102
Client Ref.: 501.065512.00001

Report Number: 778409
Location: Cam Quarry

Superseded Report:

Test Completion Dates

Lab Sample No(s)	32166072	32166042	32166058
Customer Sample Ref.	Quarry Sump	SW1	SW2
AGS Ref.			
Depth	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
Type	Surface Water	Surface Water	Surface Water

Ammonium Low	23-Sep-2025	22-Sep-2025	22-Sep-2025
Anions by Kone (w)	22-Sep-2025	22-Sep-2025	22-Sep-2025
BOD True Total	24-Sep-2025	24-Sep-2025	24-Sep-2025
COD Unfiltered	22-Sep-2025	22-Sep-2025	22-Sep-2025
Dissolved Metals by ICP-MS	23-Sep-2025	23-Sep-2025	23-Sep-2025
Dissolved Oxygen by Probe			24-Sep-2025
Dissolved Oxygen by Titration	21-Sep-2025	21-Sep-2025	
EPH and CWG by FID	24-Sep-2025	24-Sep-2025	24-Sep-2025
Fluoride	23-Sep-2025	23-Sep-2025	23-Sep-2025
GRO by GC-FID (W)	23-Sep-2025	23-Sep-2025	23-Sep-2025
Low Level Cyanide (W)	23-Sep-2025	24-Sep-2025	24-Sep-2025
Mercury Dissolved	23-Sep-2025	23-Sep-2025	23-Sep-2025
Nitrite by Kone (w)	21-Sep-2025	21-Sep-2025	19-Sep-2025
pH Value	23-Sep-2025	23-Sep-2025	23-Sep-2025
Phosphate by Kone (w)	22-Sep-2025	22-Sep-2025	22-Sep-2025
Sulphide	24-Sep-2025	24-Sep-2025	24-Sep-2025
Suspended Solids	25-Sep-2025	25-Sep-2025	25-Sep-2025
TPH CWG (W)	24-Sep-2025	24-Sep-2025	24-Sep-2025
VOC MS (W)	22-Sep-2025	22-Sep-2025	22-Sep-2025



CERTIFICATE OF ANALYSIS

SDG: 250919-102
Client Ref: 501.065512.00001

Report Number: 778409
Location: Cam Quarry

Superseded Report:

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of 15 days after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur - e.g volatile mercury.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

General

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Matrix interference
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to late arrival of instructions or samples
§	Sampled on date not provided

20. Asbestos

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

If during the search of the two 'pinch' samples by PLM only 1 or 2 fibres or fibre bundles are seen and identified as asbestos, the term 'trace asbestos identified' is reported.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials and soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Potentially respirable fibres are identified by using a Phase Contrast Microscope.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

21. 6:2 FTAB

Recovery of 6:2 FTAB in the quality control samples has been observed to be <50% of the target value. Please note the 6:2 FTAB result is supplied as indicative only.

Appendix 7-G Biological Q Survey Data

Water (Hydrology & Hydrogeology) 7

Table 7-19: Freshwater Macroinvertebrate Taxa and Abundance (March 2025)

Taxon/Order	Family	Genus / Species	EPA Pollution Sensitivity Group	No. of organisms	Total abundance of EPA Groups	% of EPA Group abundance	Abundance category
Plecoptera (Stonefly)	<i>Perlidae</i>	sp.indet	A	2	2	1.72	Few / Present
Trichoptera (Caddisfly)	Cased Caddisfly <i>Limnephilidae</i>	sp.indet	B	9	9	7.76	Fair
	Caseless Caddisfly <i>Hydropsychidae</i>	sp.indet	C	4	96	82.76	Dominant / Excessive
Ephemeroptera (Mayfly)	<i>Baetidae</i>	<i>Baetis rhodani</i>	C	21			
Coleoptera (Beetle)	<i>Elmidae</i>		C	8			
Amphipoda (Shrimp)	<i>Gammaridae</i>	<i>Gammarus duebeni</i>	C	63			
Isopoda (Hoglice)	<i>Asellidae</i>	<i>Asellus aquaticus</i>	D	6	13	8.62	Fair
		sp.indet		4			
Annelida (Worms)	<i>Oligochaeta</i>	sp.indet	E or N/A	1	1	0.86	Scarce / present
Diptera (Fly Larvae)	<i>Chironomidae</i>	sp.indet	C if non-chironomus spp, E if Chironomus spp	1	1	0.86	Scarce / present
Total no. of taxa				10			
Total no. of organisms				116			
Q Score				Q3-4 Moderate			

Water (Hydrology & Hydrogeology) 7

Table 7-20: Freshwater Macroinvertebrate Taxa and Abundance (July 2025)

Order	Family	EPA Pollution Sensitivity Group	SW1		SW2	
			No.	%	No.	%
Ephemeroptera (Mayfly)	Baetidae (<i>Baetis muticus</i>)	B	-	4.67	1	1.41
Trichoptera (Cased Caddis)	Limnephilidae (<i>sp.indet</i>)	B	7			
Trichoptera (Cased Caddis)	<i>Sericostoma personatum</i>	B	-		1	
Trichoptera (Caseless caddis)	Hydropsychidae (<i>sp. Indet</i>))	C	2	38.00	-	93.66
Gastropoda (Snails & Limpets)	Gastropoda (<i>sp.indet</i>)	C	1		-	
Ephemeroptera (Mayfly)	Ephemerellidae (<i>Ephemerella excrucians</i>)	C	-		1	
Amphipoda (Shrimps)	<i>Gammarus duebeni</i>	C	52		132	
Trombidiformes (Water Mite)	Hydracarina (<i>sp.indet</i>)	C			-	
Coleoptera (Beetle)	Elmidae (<i>sp.indet</i>)	C			-	
Isopoda (Hoglice)	Asellidae (<i>Asellus aquaticus</i>)	D		3.33	2	1.41
Diptera (Fly Larvae)	Blood worms (<i>sp.indet</i>)	E	73	48.67	-	0
	Unable to identify is non-Chironomus or Chironomus	N/A	8	N/A	5	N/A
Total Number of Organisms excluding <i>Potamopyrgus antipodarum</i>			150		142	
Total Number of Taxa			8		6	
Q Score			Q2-3 Poor		Q3 Poor	

Table 7-21: Description of Sampling Locations (July 2025)

Monitoring Site	Description						
<u>SW1</u> Plate 2: Sampling Location SW1 	Survey site SW1 is situated on the section of the Ballyglass River at the R363 road. As seen in Plate 4, there is a piped outflow entering the sample location and the source of this water is unknown. The watercourse has a mean channel width of c. 1.5m at normal water level with banks up to 3m in height and at angle of c. 90° on the northern bank and c. 45° on the southern bank. The substrata consisted of a mixture of consolidated cobbles and gravel and unconsolidated fine silt and sand (up to 20cm deep). This sediment may be as a result of the outflow pipe carrying excess sediment. This sediment produced a sewage like odour when disturbed. The presence of sewage fungus was also detected. An accumulation of metal wire, decaying leaves and logs created a slight dam in the river, seen in Plate 3. The water conditions at the time of the survey on the 17th July 2025 were: <table><tr><td>Mean Depth</td><td>Flow Rate</td><td>Turbidity</td></tr><tr><td>20cm</td><td>Moderate</td><td>Moderate</td></tr></table> The channel is slightly sheltered by overhanging hawthorn (<i>Crataegus monogyna</i>) and beech trees (<i>Fagus sylvatica</i>). Common ivy, bramble and cotoneaster spp. was observed climbing up these trees and along the banks. The channel itself was devoid of any aquatic vegetation. Several fern species were noted growing along the banks including Hart's tongue (<i>Asplenium scolopendrium</i>) and Hard Shield (<i>Polystichum aculeatum</i>).	Mean Depth	Flow Rate	Turbidity	20cm	Moderate	Moderate
Mean Depth	Flow Rate	Turbidity					
20cm	Moderate	Moderate					

Plate 3 SW1 sampling location habitat



Plate 4 Pipe outflow at SW1 sampling location



Site SW2 is situated on the Ballyglass River downstream of the SW1 sampling location. The river passes under the R363 road into agricultural lands before being culverted again under the R357 into another agricultural field where the SW2 sampling location is located. Livestock were located in the

Water (Hydrology & Hydrogeology) 7

Monitoring Site	Description						
SW2 Plate 5: Sampling Location SW2 	field beside the sampling location on the day of sampling but there was evidence of cows drinking from and walking through this river previously. The southern banks of the river were visibly damaged as a result of livestock entering in and out of the river, see Plate 7. The stream at the survey site had a mean channel width of 1m at normal water level. The banks on the northern banks were up to a height of 1m at an angle of 90° while the southern bank was flat. The channel bed consisted of layers of consolidated cobbles and gravels. The water conditions at the time of the survey on the 17th of July 2025 were: <table><tr><td>Mean Depth</td><td>Flow Rate</td><td>Turbidity</td></tr><tr><td>5 cm</td><td>Moderate</td><td>Low-Moderate</td></tr></table> The southern bank was devoid of any vegetation due to damage caused by livestock but the northern bank displayed brambles, thistles and common gorse (<i>Ulex europaeus</i>). The channel itself was sparsely populated with Fool's Water-cress (<i>Helosciadium nodiflorum</i>) but was mostly devoid of aquatic vegetation.	Mean Depth	Flow Rate	Turbidity	5 cm	Moderate	Low-Moderate
Mean Depth	Flow Rate	Turbidity					
5 cm	Moderate	Low-Moderate					

Monitoring Site	Description
Plate 6: SW2 sampling location 	

Monitoring Site	Description
Plate 7 Banks of SW2 damaged by livestock trampling 	

Appendix 7-H Surface Water Quality Results Screened

Table 7-22: Surface Water Quality Results Screened

Parameter	EQS Inland Surface Waters (MACs)	Units	SW1	SW2	SW1	SW2	SW1	SW2	SW1	SW2	SW3	SW1	SW2	Sump
			05/08/2023		01/01/2024		08/10/2024		17/07/2025			16/09/2025		
Inorganics														
Suspended solids		mg/l	189	8.6	<2	<2	263	8.35	220	<2	4.7	3.65	2.45	7.75
BOD	High status ≤ 1.3 (mean) or ≤ 2.2 (95%ile) Good status ≤ 1.5 (mean) or ≤ 2.6 (95%ile)"	mg/l	2.36	<1	<1	<1	2.04	<1	-	-	-	<1	<1	<1
COD		mg/l	108	50.2	18	11.7	105	30.4				56.5	60.8	<7
pH	Soft water (<100mg/l CaCO ₃): 4.5-9.0. Hard water (>100mg/l CaCO ₃): 6.0-9.0	pH Units	7.75	8.23	7.92	7.94	8.01	8.12	7.47	7.84	8.1	7.72	7.84	8.11
Phosphate (Ortho as PO ₄)		mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	0.057	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Alkalinity, as CaCO ₃	Soft water (<100mg/l CaCO ₃): 4.5-9.0. Hard water (>100mg/l CaCO ₃): 6.0-9.0	mg/l	244	209	242	248	242	234	157	153	248	166	165	112

Water (Hydrology & Hydrogeology) 7

Parameter	EQS Inland Surface Waters (MACs)	Units	SW1	SW2	SW1	SW2	SW1	SW2	SW1	SW2	SW3	SW1	SW2	Sump
Total Oxidised Nitrogen as N		mg/l	-	-	0.46	0.553	0.59	0.768	0.156	0.139	0.283	0.237	0.265	9.02
Filtered (Dissolved) Metals														
Aluminium		µg/l	<10	<10	<10	<10	281	24.3	33.4	<10	<10	13.6	<10	<10
Arsenic	25	µg/l	0.791	0.841	<0.5	<0.5	0.523	0.766	0.941	0.879	1.04	0.733	0.651	<0.5
Barium		µg/l	10.2	9.56	7.8	7.77	11.4	10.8	10.9	8.59	27	9.7	8.7	7.75
Boron		µg/l	<10	<10	<10	13.4	18.6	14.2	10.8	14.4	18.1	<10	<10	24.2
Cadmium	0.45 - 1.5	µg/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Calcium		µg/l	87.9	88.6	94	93.4	92.3	91.5	62.3	62.3	93.7	68.8	70.3	80.8
Chromium	32	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	5	µg/l	0.403	0.416	0.312	<0.3	1.51	1.01	0.548	0.761	1.02	0.364	0.467	0.375
Iron		µg/l	0.507	0.457	0.0606	0.0549	0.313	0.185	0.901	0.686	0.0852	0.367	0.29	<0.019
Lead	7.2	µg/l	<0.2	<0.2	<0.2	<0.2	<0.2	0.389	0.423	<0.2	0.237	<0.2	<0.2	<0.2
Mercury	0.07	µg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	20	µg/l	1.54	1.27	0.617	0.744	1.58	1.1	8.67	7.33	1.21	4.7	4.06	8.58
Phosphorus	High status ≤ 10 (mean). Good status ≤ 25(mean)	µg/l	12.2	10.1	<10	<10	31.2	22.1	<10	<10	<10	<10	<10	<10
Potassium		µg/l	1.37	1.38	2.08	2.03	3.52	3.3	1.83	1.83	1.8	1.58	1.64	0.823
Selenium		µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.54

Water (Hydrology & Hydrogeology) 7

Parameter	EQS Inland Surface Waters (MACs)	Units	SW1	SW2	SW1	SW2	SW1	SW2	SW1	SW2	SW3	SW1	SW2	Sump
Sodium		µg/l	8.09	8.31	6.57	6.57	10.3	10.5	7.39	7.24	9.49	8.52	8.78	10.8
Vanadium		µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc		µg/l	2.72	2.74	-	-	-	-	6.41	5	4.87	3.47	2.46	2.81
Unfiltered (Total) Metals														
Aluminium		µg/l	151	24.8	<10	10.1	281	24.3	33.4	<10	<10	13.6	<10	<10
Magnesium		mg/l	2.52	2.54	3.24	3.21	3.07	3.05	1.9	1.89	5.41	1.83	1.87	10.7
Manganese (		µg/l	218	192	14.5	13.5	736	56.6	267	99.2	21.7	57.5	25.4	<3
Hydrocarbons														
Mineral oil >C10 C40 (aq)		µg/l	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Exceedances in bold														

Appendix 7-I Water Framework Directive Assessment



Water Framework Directive Assessment Cam, Co. Roscommon

Continuance of Use of Existing Cam Quarry

Roadstone Ltd.

Fortunestown, Belgard, Dublin 24, D24 PKK2

Prepared by:

SLR Environmental Consulting (Ireland) Ltd

7 Dundrum Business Park, Windy Arbour, Dublin, D14
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SLR Project No.: 501.065512.00001

14 May 2026

Revision: Final

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
0	14 May 2026	MS	SMcD/PG	PG
	Click to enter a date.			
	Click to enter a date.			
	Click to enter a date.			

Basis of Report

This document has been prepared by SLR Environmental Consulting (Ireland) Ltd (SLR) with reasonable skill, care and diligence, and taking account of the timescales and resources devoted to it by agreement with Roadstone Ltd (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

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Table of Contents

Basis of Report	i
1.0 Introduction	1
1.1 Site location and details.....	1
1.2 Development overview	1
1.3 Water Framework Directive Assessment report.....	2
1.4 Supporting documents.....	2
1.5 Statement of Authority	2
1.6 Zone of influence	3
2.0 Water Framework Directive	4
2.1 River Basin Management Plans	5
2.1.1 River Basin Management Plan for Ireland 2022-2027	6
2.2 WFD Surface Water Bodies and catchments.....	6
2.3 WFD Groundwater bodies	6
2.4 Source Protection Areas.....	6
2.5 Designated Areas.....	6
3.0 WFD Assessment Methodology	7
4.0 Stage 1 - WFD assessment screening	7
4.1 Screening exercise.....	7
4.1.1 Surface Water	7
4.1.2 Groundwater	7
4.1.3 Drinking water Schemes.....	8
4.1.4 Designations	8
4.2 Screening outcomes.....	8
5.0 Stage 2 - WFD Assessment Scoping	9
5.1 Identified potential risks from the proposed development	9
5.2 Identification of potential receptors	9
5.3 Source Pathway Receptor Model	9
5.4 Potential Pollution Sources.....	10
5.5 Pathways.....	10
5.6 WFD receptors for assessment	10
5.6.1 Surface Water	11
5.6.2 Groundwater	11
5.6.3 Public Water Supplies	11
5.6.4 Groundwater Dependant Environments.....	11
5.6.5 Ecological Designation	11



5.7 Findings from the scoping	11
6.0 Stage 3 - WFD impact assessment.....	12
6.1 Baseline Environmental Conditions	12
6.1.1 WFD identified pressures on waterbodies	12
6.1.2 Baseline Aquatic Survey.....	12
6.2 Designated areas	13
6.3 WFD impact assessment methodology	13
6.4 Sensitivity of WFD receptors	14
6.5 Mitigation measures	15
6.6 Potential impacts on WFD receptors	15
6.7 Risk of deterioration in status	19
7.0 WFD compliance findings.....	19

Tables in Text

Table 1 Site WFD Catchment Areas	3
Table 2 Site WFD Groundwater Body	3
Table 3. WFD screening outcome	8
Table 4: Identified potential receptors within the development potential zone of influence	9
Table 5: Sensitivity and Significance of WFD Environmental Receptors.....	14
Table 6. WFD Impact Assessment – significance of effects with embedded mitigation measures.....	16
Table 7: Risk of deterioration in status of identified WFD receptors as a result of Proposed Development	19

Figures

Figure WFD-1: Site Location and Zone of Influence.....	
Figure WFD-2: River Sub Basins and Surface Water Bodies	
Figure WFD-3: Groundwater Bodies	
Figure WFD-4: Public Water Supply Zones.....	
Figure WFD-5: Ecological Designations and Zone of Influence.....	

Appendices

Appendix A	WFD Catchments, Watercourses and Groundwater Bodies in Study Area
Appendix B	Surface Waters Classification
Appendix C	Ecological Status Classification
Appendix D	WFD Stage 1 Screening for surface water bodies and WFD details



Appendix E	WFD Stage 1 Screening for groundwater bodies and WFD details
Appendix F	Designated Areas
Appendix G	Drinking Water Protected Areas
Appendix H	Hydrogeological Report by OGE



1.0 Introduction

SLR Environmental Consulting (Ireland) Ltd. (SLR) has been appointed by Roadstone Limited to prepare a Water Framework Directive (WFD) Assessment report for Cam Quarry, Co. Roscommon and is submitted in support of a Planning Application and accompanying Environmental Impact Assessment Report (EIAR) for the proposed continued use of the existing permitted quarry, and ancillary facilities.

In the absence of specific Irish guidance on undertaking WFD Assessments, this assessment and report has been undertaken with regard to the following guidelines:

- Nationally Significant Infrastructure Projects - Advice Note Eighteen: The Water Framework Directive, Planning Inspectorate for England and Wales (Rev.1, June 2017).

This WFD assessment report sets out the potential implications of the existing Quarry development for the objectives of the WFD, identifies relevant water bodies which may be impacted, and identifies whether the requirements of the WFD are being met and the development will not result in a deterioration in status.

1.1 Site location and details

The application Site is located within the townlands of Curry / Cloonacaltry, Co. Roscommon and approximately 4 km to the west of Brideswell, and c. 12 km west of Athlone. The landholding comprises c. 68 hectares (c.168 acres) of lands, see **Figure WFD-1**.

The proposed development site is located within the Upper Shannon (ID 26D) Catchment.

1.2 Development overview

The proposed development at Cam Quarry will consist of:

- Permission for continued use of the existing quarry development currently permitted by P. Ref. 04/1479 and ABP PL20.215417 for a further period of 10 years, within an application area of c. 66.3 hectares, with an extraction area of c. 12.9 hectares and permanent overburden storage area of c. 2.9 hectares;
- Permission for continued use of the permitted facilities consisting of: ESB substation (26m²), portacabin office facilities including canteen and washroom facilities (91m²), bunded fuel storage, vehicle circulation/access including wheelwash and weighbridge, settlement tanks/hydrocarbon interceptors for treatment of water, construction of overburden and screening mounds, all other associated site works and ancillary activities;
- Permission for continued extraction of limestone using conventional blasting techniques and processing of rock using crushing and screening plant;
- Upgrade of the existing Wastewater Treatment System (WwTS) and percolation area to new Secondary WwTS and constructed soil polishing filter area;
- Provision of the permitted concrete batching plant, truck washdown facility with wash water recycled via a closed settlement tank system, the storage of aggregates; and
- Restoration of the overall application site to a natural habitat including a seasonal waterbody.

In terms of the water environment and the WFD, the key aspects of the proposed development which relate to potential impacts on water are:



- there is currently no discharge (and none proposed) of water from the Site to any watercourses.
- there will be no surface water abstraction from any watercourses;
- a truck washdown facility with wash water recycled via a closed settlement tank system;
- the existing fuel storage is within a bunded tank, and the hard stand refuelling area has a hydrocarbon interceptor; and
- a new packaged Secondary WwTS and constructed soil polishing filter area will be installed at the site to replace the existing WwTS.

1.3 Water Framework Directive Assessment report

This WFD Assessment report has been prepared for the Proposed Development and includes the following stages:

- **Stage 1** - WFD Screening (Section 4.0 of this report);
- **Stage 2** - WFD Scoping (Section 5.0 of this report); and
- **Stage 3** - WFD Impact Assessment (Section 6.0 of this report).

This report will demonstrate how the requirements of WFD have been complied with and provides information on how the objectives of the River Basin Management Plan (RBMP) have been met.

1.4 Supporting documents

A number of documents have been prepared for the Proposed Development in support of the planning application. This WFD Assessment report has been prepared with regard to the following documents and should be read in conjunction with them, the documents include:

- The Environmental Impact Assessment Report (EIAR) for the planning application, specifically Chapter 5 Biodiversity and Chapter 7 Hydrology and Hydrogeology, prepared by SLR (November, 2025) and updated May 2026. The EIAR includes details of the Geophysical ground investigation as well as the borehole ground investigation and groundwater level monitoring; and
- The Appropriate Assessment Screening and Natura Impact Assessment Report, prepared by SLR (November, 2025) and updated May 2026.

1.5 Statement of Authority

This WFD Assessment report was prepared by SLR Environmental Consulting (Ireland) Ltd. The project team consists of:

- Michelle Sherry - BSc. (Environmental Bioscience);
- Dominica Baird - Technical Director (Hydrogeology) BSc. (Earth Science), MSc (Hydrogeology), CGeol, EurGeol, MIAH; and
- Peter Glanville - Technical Director (Hydrology) BA (Geography), PhD (Geomorphology), PGeo, EurGeol.

Michelle is Graduate Hydrogeologist with the Hydrology and Hydrogeology team based in SLR Consulting Dublin. Since joining SLR, some of her roles and responsibilities have included undertaking groundwater and surface quality monitoring, collecting and analysing logger data from a variety of sites, compiling site monitoring data and preparing reports on said data to be sent to clients. She also has contributed to the preparation of Environmental Impact



Assessment Reports and of Water Framework Directive reports. A First Class Honours degree in Environmental Bioscience (BSc) has provided a solid foundational knowledge in hydrology and the Water Framework Directive plus the ability to collect, handle and analysis various sets of data and write scientific reports.

Dominica is a Chartered Hydrogeologist with twenty-two years' consultancy experience. Dominica has practised hydrogeology, groundwater risk and contaminated land assessment in London, Edinburgh and Dublin and leads groundwater monitoring, water resources and due diligence projects. Key competencies include hydrogeological assessments and aquifer characterisation, developing conceptual site models, quantitative and qualitative groundwater risk assessments and groundwater investigations. Dominica has presented findings of hydrogeological assessments at oral hearings and prepared briefs of evidence. She has project managed numerous water assessments for EIARs, which have predicted potential impacts on the water environment.

Peter is a technical and project Director in the Water (Hydrology and Hydrogeology) team in SLR's Dublin office. He has over 20 years' experience in environmental consulting including hydrology, geomorphology and geology and is a Professional Geologist (PGeo. EurGeol.) with the Institute of Geologists of Ireland. Peter's specialist experience is in the field of water assessments, hydrological monitoring (hydrology and hydrogeology) and hydromorphology. He has overseen the design and practical implementation of a number of field scientific monitoring programmes, supported the management, analysis and interpretation of the scientific data collected, and written and reviewed the resultant technical reports. Peter has worked on a wide range of projects in the minerals and mining, power, commercial and infrastructure sectors. He leads as project manager on multi-disciplinary projects and also acts as project director for multi-disciplinary teams.

1.6 Zone of influence

The zone of influence, or study area, for the purpose of this WFD Assessment is taken to be a 15 km radius from the Site boundary, see **Figure WFD-1**. This zone of influence is consistent with the standard zone of influence radius used in the Appropriate Assessment and Natura Impact Assessment. The zone of influence can extend beyond 15 km radius from the Site in certain circumstances where there is a direct hydrological link to a designated site and if it is considered that the Proposed Development has the potential to impact on a waterbody.

The Site WFD catchment hierarchy is shown in **Table 1** below. The Catchments, Sub-Catchments and River Sub Basins within the study area are listed in **Appendix A**. The application Site itself is located in the Suck South Groundwater Body (GWB), see **Table 2** and GWBs located within the wider study area are listed in **Appendix A**.

Table 1 Site WFD Catchment Areas

WFD Catchment Hierarchy	WFD Catchment Name
Catchment	Upper Shannon - Catchment ID. No. 26D
Sub-catchment	Suck_SC_090 Sub-catchment ID. 26D_5
River Sub-Basin	Sub-basin ID. BALLYGLASS_010

Table 2 Site WFD Groundwater Body

WFD Groundwater Body	WFD Groundwater Body Name
Suck South GWB	IE_SH_G_225



2.0 Water Framework Directive

The Water Framework Directive (WFD) (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy) (the 'Water Framework Directive') was adopted and came into force in 2000 and sought to align provisions for water resource protection in response to emerging scientific data on widespread degradation of quality. It establishes a legislative framework for the protection of surface waters (including rivers, lakes, transitional waters (Article 2 of 2000/60/EC defines 'Transitional waters' which for the purposes of this Advice Note are referred to as estuarine waters) and coastal waters) and groundwater throughout the EU.

The EU Water Framework Directive¹ (WFD) became EU law in December 2000 and provides for a single European approach to assessing water quality (Ecological status) and allows for the comparison of results across Europe.

The WFD requires all Member States to protect and improve water quality in all waters so that we achieve good ecological status by 2015 or, at the latest, by 2027. It was given legal effect in Ireland by the European Communities (Water Policy) Regulations². The Directive requires that management plans be prepared on a river basin basis and specifies a structured method for developing these plans.

Surface waters are classified into five quality classes (Ecological status) under the WFD; High, Good, Moderate, Poor and Bad Ecological status. Groundwater is classified into just two quality classes, Good and Poor Ecological status. High Ecological status is when the water is unpolluted, while at the opposite end of the classification Bad Ecological status is when the water is highly polluted.

The Ecological Status is assessed based on a combination of biological, chemical and hydromorphological quality parameters. The overall status sought for all waterbodies under the objectives of the WFD by 2027, at the latest, is based on the combined analysis of these three variables is Good or High ecological status and Good chemical status for surface waters and Good chemical and quantitative status for groundwaters.

The overall aims and objectives of the WFD are to:

- enhance the status and prevent further deterioration of surface water bodies, groundwater bodies and their ecosystems;
- ensure progressive reduction of groundwater pollution;
- reduce pollution of water, especially by Priority Substances and Certain Other Pollutants (Annex II, Environmental Quality Standards (EQS) Directive (2008/105/EC) as amended);
- contribute to mitigating the effects of floods and droughts;
- all water bodies must reach at least 'Good' overall status by 2027, at the latest. For surface waters, good overall status is a combination of good ecological status (or potential) and good chemical status;
- the status of each water body, including all the quality elements which make up the overall status, must not deteriorate relative to the baseline reported in the relevant RBMP; and
- to promote sustainable water use.

¹ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

² European Communities (Water Policy) regulations 2003 (SI No. 722 of 2003).



The WFD identifies where actions are required to achieve Good Ecological status or maintain waterbodies which are already Good or High Ecological status. Waterbodies can be restored to Good and High Ecological status by using targeted actions and measures to reduce the impact of human activities on them.

For heavily modified or artificial water bodies, which are incapable of achieving Good Ecological status without impairing an existing specified water use, the environmental objective is to achieve Good Ecological potential.

The WFD requires that management plans are prepared on a river basin basis and specifies a structured method for developing these plans.

The WFD surface waters classification is shown in **Appendix B** and the ecological status classification is shown in **Appendix C**.

2.1 River Basin Management Plans

The WFD requires the consideration of a single system of water resource management through characterisation, protection and enhancement of water resources considered within the context of a river basin district (RBD) with the production of a River Basin Management Plan (RBMP) by the Environmental Protection Agency (EPA).

The RBMPs describe the current state of the water environment for each RBD, the pressures effecting the water environment, the objectives for protecting and improving it, and the programme of measures needed to achieve the statutory environmental objectives of the WFD. RBMPs are subject to a six year planning cycle and are to be routinely reviewed and updated to ensure compliance with the overall WFD objectives.

The RBMPs provide a single system of water management based on the natural delineation of river catchments and is the method by which the aims of the WFD are implemented.

For each river basin district in Ireland a RBMP plan needs to be established and updated every six years, to provide the context for the co-ordination requirements of the WFD, key aims of which are to:

- provide for protection to all waters, surface waters and groundwater;
- achieving Good Ecological status for all waters by 2027;
- establish water management measures based on river basin catchment areas;
- establish a combined approach of emission limit values and quality standards for waters;
- involving citizens more closely in the WFD and RBMP; and
- streamlining and aligning national legislation.

The RBMP provides a detailed account of how the objectives set for each river basin in terms of ecological status, quantitative status, chemical status and protected area objectives are to be reached within the timescale of the plan. The plans include the results of the catchment analysis including the river basin's characteristics, a review of the impact of human activity on the status of waters in the basin, estimation of the effect of existing legislation and the remaining gap to meeting these objectives; and establish a set of measures designed to meet the objectives.



2.1.1 River Basin Management Plan for Ireland 2022-2027

The current RMBP report for Ireland is at the draft stage³. The draft report states that while substantial progress has been made in the management of water services and how we work together to protect, restore and improve water quality with the improvement in some areas and aspects of water quality, many waterbodies are still subject to mounting environmental pressures and overall water quality is in decline primarily due to nutrient pollution.

The RMBP states that due to the overall decline in water quality, stronger measures are now required which will improve overall water quality. The sustainable management of water resources is important to address and adapt to the impacts of climate change, with many of the required measures having co-benefits for climate mitigation and biodiversity. Protecting and restoring water quality in Ireland will most of all need measures to address:

- the loss of agricultural nutrients to water;
- continue to improve waste water treatment; and
- to re-establish natural free-flowing conditions in more rivers.

The plan states that Ireland's water resources and services face challenges on a number of fronts including a continued need for investment in infrastructure and increasing demand for water services due to urbanisation, population and economic growth. These challenges are set against a backdrop of widespread, rapid and intensifying climate change.

2.2 WFD Surface Water Bodies and catchments

The local surface water bodies and catchments within the potential zone of influence for rivers and the river catchments are identified in **Figure WFD-2**.

2.3 WFD Groundwater bodies

The WFD groundwater bodies within the potential zone of influence are identified in **Figure WFD-3**.

2.4 Source Protection Areas

Public water supply source protection areas in the vicinity of the site are shown in **Figure WFD-4**.

2.5 Designated Areas

The designated areas within the potential zone of influence are identified in **Figure WFD-5**.

³ Draft River Basin Management Plan for Ireland 2022-2027, Government of Ireland



3.0 WFD Assessment Methodology

The WFD impacts have been considered in a three-stage assessment process the stages in the assessment process are set out as follows:

- Stage 1 WFD screening.** To determine if there are any activities associated with the Proposed Development that don't require further consideration, for example activities which have been ongoing since before the current RBMP plan cycle and which have thus formed part of the baseline;
- Stage 2 WFD scoping.** To identify risks of the Proposed Development's activities to receptors based on the relevant designations and hydrological link using a source-pathway-receptor approach; and
- Stage 3 WFD impact assessment.** An assessment of water bodies and their quality elements that are considered likely to be impacted by the Proposed Development, identification of any areas of noncompliance; consideration of mitigation measures and contributions to the WFD objectives to achieve Good Status

Any mitigation measures relied upon to demonstrate compliance at any of the above stages needs to be appropriately defined in order to ensure securement through any Planning Permission conditions for the Proposed Development.

Preplanning consultations were undertaken with statutory consultees including Roscommon Co. Council during the EIA process undertaken for the Proposed Development. In response to the consultation, an Aquatic Survey of the Ballyglass River was undertaken. The survey was requested by Roscommon Co. Council at the time of the initial planning application on the basis that there would be dewatering and discharge off site to the Ballyglass River. However, the proposed scheme has been subsequently amended; the revised scheme will eliminate the requirement to dewater and also discharge water off site to the Ballyglass River

4.0 Stage 1 - WFD assessment screening

The WFD catchments, surface waterbodies and groundwater bodies in the 15 km zone of influence of the Site are shown in **Figure WFD-2** and **Figure WFD-3**. The drinking water supplies are shown in **Figure WFD-4** and ecological designation within the 15 km zone of influence of the Site are shown in **Figure WFD-5**.

4.1 Screening exercise

4.1.1 Surface Water

Screening for WFD surface water bodies has been carried out, identifying all WFD surface water bodies within a 15 km of the Site or the potential zone of influence, see **Appendix D**. A 15 km area for the zone of influence is used here as this is in line with the study area used for the Appropriate Assessment and Natura Impact Statement undertaken for the Proposed Development and submitted in support of the planning application.

The identified surface water bodies within the potential zone of influence and their details are set out in **Appendix D**.

4.1.2 Groundwater

Screening for WFD groundwater bodies has been carried out, identifying all WFD groundwater bodies within a 15 km of the Site or the zone of influence, see **Appendix E**. A 15 km radius for the zone of influence is used here as this is consistent with the study area used for the



Appropriate Assessment and Natura Impact Statement undertaken for the Proposed Development and submitted in support of the planning application.

The identified groundwater bodies within the potential zone of influence and their details are set out in **Appendix E**.

4.1.3 Drinking water Schemes

Screening for drinking water supplies schemes and source protection areas has been undertaken to identify sites within a 15 km of the Site or the potential zone of influence, see **Appendix G**. A 15 km radius for the zone of influence is used here as this is consistent with the study area used for the Appropriate Assessment and Natura Impact Statement undertaken for the Proposed Development and submitted in support of the planning application.

The identified designated areas within the potential zone of influence and their details are set out in **Appendix G**.

4.1.4 Designations

Screening for designated areas has been undertaken to identify sites within a 15 km of the Site or the potential zone of influence, see **Appendix F**. A 15 km radius for the zone of influence is used here as this is consistent with the study area used for the Appropriate Assessment and Natura Impact Statement undertaken for the Proposed Development and submitted in support of the planning application.

The identified designated areas within the potential zone of influence and their details are set out in **Appendix F**.

4.2 Screening outcomes

Based on the identified potential zone of influence for the Proposed Development and hydrological links, the following WFD waterbodies in **Table 3** are screened in for the purpose of this assessment.

The remainder of the waterbodies identified in **Appendix D** and **Appendix E**, and the designations in **Appendix F** are therefore screened out from further consideration as part of this WFD Assessment as there is no hydrological link to the Proposed Development Site.

Table 3. WFD screening outcome

No.	WFD Feature	Reason for Screening in
1	Ballyglass River and Cross River	Potential hydrological link to river given the Site is in the Ballyglass river sub basin catchment, located c.1.1km northwest of Site. Cross River has potential hydrological link to Site as there is a high degree of interaction between surface water and groundwater due to numerous karst features in this area.
2	River Suck	Potential hydrological link to river given the river is downstream of the Ballyglass river.
3	Killeglan Public Water Supply (PWS) or Killeglan River Sub Basin	Potential hydrological link as groundwater flows naturally from the Ballyglass River Sub Basin to that of the Killeglan Public Water Supply.
4	Corkip Lough SAC and Feacle Lough pNHA (Turloughs)	Groundwater dependent features which are hydrological link to the site as both turloughs are groundwater controlled.



No.	WFD Feature	Reason for Screening in
5	Suck South groundwater body (GWB)	Site is located within the Suck South groundwater body

5.0 Stage 2 - WFD Assessment Scoping

This section of the assessment identifies the risks from the Proposed Development's activities to receptors based on the relevant water bodies and their water quality elements and includes the following:

- identify the potential risks from the proposed development on WFD waterbody receptors, PWS and designated areas within the zone of influence, based on hydrological linkages; and
- identification of those water bodies where a more detailed WFD impact assessment is required.

5.1 Identified potential risks from the proposed development

In terms of identified potential impacts on WFD receptors, the key aspects of the proposed development which relate to water are set out here:

- There will be no abstraction of surface water from any adjoining water courses;
- The development will continue to be worked dry above the water;
- There will be no dewatering and no discharge of waters to any adjoining water courses;
- Wastewater currently treated using an existing septic tank and;
- All hydrocarbons at the Site are bunded to 110% of the maximum tank capacity and a hard standing refuelling area with hydrocarbon interceptor will be provided.

5.2 Identification of potential receptors

Receptors within the potential zone of influence of the quarry development have been identified here in this Stage 2 Scoping. The potential receptors are set out in **Table 4** below.

Table 4: Identified potential receptors within the development potential zone of influence

Receptor Type	Figure	List of Identified Receptors
WFD surface water bodies	Figure WFD-2	Appendix D
WFD groundwater bodies	Figure WFD-3	Appendix E
Public water supply areas	Figure WFD-4	Appendix G
Designated areas	Figure WFD-5	Appendix F

5.3 Source Pathway Receptor Model

Potential impacts from the quarry development on identified receptors can be identified using the Source-Pathway-Receptor (SPR) model.



Risk can be defined as “the chance of a defined hazard occurring and achieving its potential”. Reference to documentation (CLR 11)⁴ by the Environment Agency in the UK indicates that there must be a pollutant linkage between the source of pollution and the receptor, in order for harm to human beings or the environment to occur. The pollutant linkage comprises:

- A **Source** of potential pollution (contaminant);
- A **Pathway** for the pollutant to move from source to receptor. This can include the transport of contamination via groundwater, and
- A **Receptor** (target), which is affected by the pollutant. According to the EPA, key receptors include groundwater, surface water and protected ecological sites.

This scoping assessment is based on the ‘source-pathway-receptor’ pollution linkage concept. For a potential risk to arise each stage of the pollution linkage must be present.

5.4 Potential Pollution Sources

Potential pollution sources from the Proposed Development are the decrease in groundwater quality from potential increase in suspended solids and accidental fuel leakage / spillage during construction and operational stages. Migration of a pollution source in the shallow groundwater could then migrate laterally to surface water or could migrate vertically to the underlying bedrock aquifer.

Accidental fuel leakage/spillage at the Site is a potential impact and could also infiltrate into the underlying groundwater body.

The construction stage is taken to be the establishment of the concrete batching plant.

The operational stage will consist of continued limestone extraction being carried out over an overall extraction area. The quarry is currently worked dry above the underlying groundwater table.

5.5 Pathways

Pathways are the means by which a receptor is likely to come into contact with a source.

As noted above, suspended solids could migrate laterally in the shallow groundwater to the nearby surface water bodies, including the Ballyglass River and Cross River. Suspended solids could then migrate from the stream to further surface water bodies downstream i.e. River Suck.

Suspended solids in shallow groundwater could also migrate vertically to the underlying bedrock aquifer and groundwater body.

If an accidental spillage occurred, hydrocarbons could also migrate laterally to nearby surface water bodies and further downstream surface water bodies and could migrate vertically to the underlying bedrock aquifer.

5.6 WFD receptors for assessment

Based on the screening exercise undertaken in Section 4.0 above and scoping exercise undertaken here the following surface water, groundwater, public water supplies, groundwater dependant environments and designated areas are included in this assessment.

⁴ Environment Agency (UK). Model Procedures for the Management of Land Contamination (CLR 11)



5.6.1 Surface Water

The WFD surface water receptors identified and scoped in for this assessment are:

- The Site is located within the BALLYGLASS_010 WFD River Sub Basins. The Ballyglass River is located c. 1.1 km northwest of the Site from the entrance of the quarry and flows downstream in a southwesterly direction towards River Suck. This confluence occurs c. 6.2 km southwest of Site.
- The Cross River may be hydrologically linked to the Site via shallow groundwater flow discharging to local rivers and streams.

5.6.2 Groundwater

The WFD groundwater receptor identified and scoped in for this assessment is:

- The bedrock aquifer is within the Suck South GWB which has a good status (2016 - 2021).

The Suck South GWB is classified as being a regionally important karstified bedrock aquifer.

5.6.3 Public Water Supplies

The public water supply identified as a receptor and scoped in for this assessment is

- The Killeglan Public Water Supply (PWS) which is supplied by the Tobermore Spring.

The Killeglan PWS supplies over 5,300 homes and has a reported abstraction rate of c. 9,090 m³/d.

5.6.4 Groundwater Dependant Environments

The groundwater dependant environment receptors identified and scoped in for this assessment are:

- Corkip Lough SAC (Site Code 002339); and
- Feacle Lough pNHA (Site Code 001634).

While these turloughs are not designated as Groundwater Dependent Terrestrial Environments (GWDTE) under the WFD, they are environments that are dependent on groundwater levels. Hence, they have been scoped in as a receptor for this assessment.

5.6.5 Ecological Designation

The identified ecological designated sites which are hydrologically linked to the Site are:

- The River Suck Callows SPA (Site Code 004097) and Suck River Callows NHA (Site Code 000222) is downstream of the Ballyglass stream and is located c. 4.6km southwest of the Site.
- Corkip Lough SAC (Site Code 002339) and Feacle Lough pNHA (Site Code 001634) which are both turloughs fed by groundwater in the area.

5.7 Findings from the scoping

Based on the Proposed Development outlined above and investigations undertaken at the Site the following statements can be made in terms of the scoping of local surface water and groundwater in the vicinity of the Site:

- i. there is no direct hydrological pathway between the Proposed Development and the adjacent surface water courses as there will be no abstraction of surface water or discharge to surface water courses. **There is no direct hydrological linkage.**



- ii. there are several turloughs in the area which are fed by groundwater. However, O'Neill Groundwater Engineering (OGE) undertook a pump test in 2004 as part of the EIS for Cam Quarry, see Appendix H for copy of hydrogeological report written up by OGE. In this pump test, they tested the permeability of the karstified areas of the bedrock below the Site. The results suggest that the permeability of the karst features below the Site is relatively low. Hence, although the turloughs (in particular Corkip Lough) may be located above zones of deeper karstification, the contribution of groundwater from the deeper karst is likely to be very limited. Therefore, while **there is a direct hydrogeological linkage** with the turloughs, it is considered unlikely that continued use of the quarry development will have a significant impact on the turloughs in the surrounding areas.
- iii. There is a **direct hydrogeological link** pathway via the groundwater underlying the Site and the Killeglan Spring as demonstrated by OGE in their report. The report found that the groundwater below the site discharges to both the Killeglan Spring catchment and the Cross River (Corkip Lough). Based on the Proposed Development activities and investigations undertaken at the Site, there is no direct pathway to surface water courses and to the underlying bedrock aquifer.

Therefore, with mitigation measures in place, the Cross River, the bedrock aquifer and the Suck South GWB can be scoped out here as there are no hydrogeological pathways present.

6.0 Stage 3 - WFD impact assessment

This impact assessment includes a detailed assessment of the Proposed Site activities and water bodies identified at the WFD screening and scoping Stages 1 and 2 above.

6.1 Baseline Environmental Conditions

The baseline hydrological and hydrogeological conditions at the Site have been identified from the geophysical surveys and ground investigations undertaken at the Site and are presented in Chapters 6 and 7 of the EIAR.

The baseline aquatic ecology (Q Survey) in the surrounding watercourses is outlined in the Aquatic Survey which is included in Chapter 7 of the EIAR.

6.1.1 WFD identified pressures on waterbodies

The baseline conditions in the identified surface water bodies and groundwater bodies are set out in **Appendix D** and **Appendix E**, including the identification of pressures on the waterbodies and the WFD Third-Cycle risk rating for the water bodies not achieving Good Status by 2027.

A number of pressures have been identified downstream of the Ballyglass River for the River Suck from the WFD Second-Cycle, these are set out in **Appendix D** and are included here:

- SUCK_140 and SUCK_150 identified issues are Hydrological and Morphological from Hydromorphology pressures (such as changes in the flow, channels, sediment or riparian zone of a river) and Peat drainage/extraction.

6.1.2 Baseline Aquatic Survey

The aquatic baseline survey included an invertebrate survey, the findings of which are presented here.



Biological water quality & pressures

A biological water quality assessment was undertaken at surface water sampling locations SW1 and SW2. Two rounds of Q survey monitoring were conducted on the Ballyglass River. In April 2025, a kick sample could not be taken at SW1 for health and safety reasons. Sampling site SW2 received a Moderate status (Q3-4). In July 2025, a kick sample could safely be undertaken at both sampling sites. The results revealed that SW1 achieved a Q value score of Q2-3 (Poor status) and SW2 received a Q value score of Q3 (Poor status) which is a decrease in status from the April 2025 Q survey.

According to CORINE Land Cover mapping (2018), the surrounding land use of the Ballyglass River comprises of agricultural pastures. SW1 is inaccessible to livestock, however, there is a storm drain present at the sample location which feeds into the river after heavy rainfall. Previous surface water chemical quality sampling rounds reveal that after heavy rainfall, the colour and silt levels of the Ballyglass River is impacted. SW2 is located in a pasture field and cows have direct access to the river and it is considered they use the river as a drinking water source.

Therefore, it is considered the main pressure on the Ballyglass River currently is agriculture and surface run-off.

6.2 Designated areas

The identified designated areas which have a hydrological link to the Site are as follows:

- Feacle Turlough pNHA (Site Code 001634) is located c. 550m southeast of Site; and
- Ballynamona Bog and Corkip Lough SAC (Site Code 002339) is located c. 2km southeast of Site

The BALLYGLASS_010, CROSS (ROSCOMMON)_010 and SUCK_130 are not drinking water protected rivers under the WFD but they are designated as SPA's.

Killeglan Public Water Supply (PWS) is a receptor that is hydrologically linked to the Site and provides drinking water to over 5,300 homes in the vicinity of the Site.

All Groundwater bodies in Ireland have been designated as Drinking Water Protected Areas under the WFD. This designation is based on the possibility of meeting the criteria for water abstraction for human consumption, as defined in Article 7 of the WFD. These Drinking Water Protected Areas encompass the complete extent of each WFD groundwater body. The Suck South GWB is classified as a regionally important karstic bedrock aquifer and therefore, is considered as capable of supplying regionally important water supplies.

6.3 WFD impact assessment methodology

The methodology used here to assess the nature, scale and magnitude of impact in terms of WFD potential receptors is the same as that used in the EIAR Chapter 7 for Hydrology and Hydrogeology. The methodology applied here is a qualitative risk assessment methodology in which the nature of the potential impacts is described in terms of the character, magnitude, duration, probability and consequence of the impact are considered.

First the significance and sensitivity of the receptor is classified and then the description of the potential impact is then screened against the significance and sensitivity of the receiving environment to establish the overall significance of the potential impact. The classification of the impact significance is determined using the matrix from the EPA Guidelines (2022).

The following sections identify the sensitivity of the WFD environmental receptors and potential impacts of the Proposed Development during the Construction Stage (concrete batching plant), the Operation Stage (extraction and processing) and Post Operational Stage (Site restoration).



6.4 Sensitivity of WFD receptors

The sensitivity and significance of the identified WFD environmental receptors are outlined in **Table 5** below.

Table 5: Sensitivity and Significance of WFD Environmental Receptors

No.	WFD Environment Receptor	Significance	Sensitivity	Existing Environment Significance / Sensitivity Rating (H/M/L/N)
1	Local Rivers and Streams	Surface watercourses: Ballyglass river and Cross River are located within c. 2km of Site.	Ballyglass river has a Good WFD status and is under review. Cross River is of Moderate WFD status and at risk. High degree of interaction between surface water and groundwater due to numerous karst features (e.g. turloughs, swallow holes, springs etc). surface and groundwater quality are closely linked.	Medium – Attribute has a medium quality or value on a local and regional scale due to regionally important karstic aquifer.
2	Killeglan PWS located directly south of the Site	Killeglan PWS supplies water to over 5300 homes in the area.	The PWS is hydrogeologically linked to the Site as the groundwater under the Site discharges to the PWS.	High – Attribute is considered to be of High quality or value on a regional or national scale as it is a regionally important aquifer that supplies > 5300 homes with drinking water.
3	Feacle Turlough pNHA, located c.550m southeast of Site and Corkip Lough SAC, located c. 2km southeast of Site	pNHA is a designated area of protection due to its habitat and wildlife. SAC is a European designated Natura 2000 site. The turloughs are fed by groundwater. In wintertime, when regional groundwater levels rise, the turloughs fill with water.	The groundwater levels at the turloughs will not be affected as there will be no dewatering at the site and therefore no reduction in groundwater levels.	High - Attribute has a high quality or value on an international (SAC status) and regional scale (pNHA status)



6.5 Mitigation measures

In terms of the identified WFD receptors and the potential impacts from the Proposed Development, the existing embedded mitigation measures at the development will continue in place during the proposed continued use of the quarry. The existing mitigation measures are as follows:

- There will be no abstraction of surface water from any adjoining water courses;
- There will be no discharge of surface or process waters to any adjoining water courses;
- The development will continue to be worked dry above the groundwater table;
- The development will not go below the underlying bedrock aquifer (the Suck South GWB);
- A new packaged Secondary WwTS and constructed soil polishing filter area will be installed at the site to upgrade the existing WwTS; and
- All hydrocarbons at the Site will continue to be bunded to 110% of the maximum tank capacity and the hard standing refuelling area has a hydrocarbon interceptor provided.

These mitigation measures for the Proposed Development will be secured via any future planning permission and associated conditions relating to an approval.

6.6 Potential impacts on WFD receptors

The potential impacts on the identified WFD receptors are set out in **Table 6** below with the embedded mitigation measures in place.

Based on the Proposed Development and with the identified mitigation measures in place it is considered that the potential impacts on the identified WFD receptors will be Not Significant.



Table 6. WFD Impact Assessment – significance of effects with embedded mitigation measures

No.	WFD Receptor	WFD Receptor Significance / Sensitivity Rating	WFD Status	WFD Risk Status	Potential Impacts	Description of Effects	Significance of Effects
1	Ballyglass River Surface watercourse located c. 1.1km northwest of Site Cross River surface watercourse located c. 2km northeast of the Site	Medium - Attribute is considered to be of high quality or value under the WFD as it currently meets Good Status requirements and is upstream from an SPA/pNHA designation.	Good Status BALLYGLASS_010 river is Good status (WFD 2016-2021). Moderate status CROSS (ROSCOMMON)_010 river is of Moderate WFD status	Ballyglass Rive is still Under review for its risk status. Cross River is At risk due to morphological issues and excess nutrients as a result of agriculture and hydromorphological pressures.	Potential to effect surface water quality in the Ballyglass River, through potential migration of hydrocarbons laterally to nearby surface water bodies High degree of groundwater and surface water interactions in the vicinity of the Site	Negligible. Indirect effect from a pollution incident at the Site. The extent of any effect from a pollution incident at the Site will be over a small area only, if pollution entered the watercourse, it would extend downstream. The duration of any pollution event would be brief lasting less than a day. The probability of a pollution event occurring is considered unlikely given existing and future embedded mitigation measures. The quality of the effect is considered to be neutral on the waters of the Ballyglass River.	Not Significant



No.	WFD Receptor	WFD Receptor Significance / Sensitivity Rating	WFD Status	WFD Risk Status	Potential Impacts	Description of Effects	Significance of Effects
2	Killeglan PWS located directly south of Site	High – Attribute is considered to be of High quality or value on a regional or national scale as it is a regionally important aquifer that supplies > 5300 homes with drinking water.	N/A	N/A	PWS is hydrogeologically linked to Site as groundwater underneath the Site discharges to the PWS.	Low Indirect effect from a pollution incident that has the potential to affect groundwater quality through lateral migration in underlying aquifer. The extent of any effect from a pollution incident at the Site will be over a small area only, The duration of any pollution event at the Site would be brief lasting less than a day. The probability of a pollution event occurring is considered unlikely given embedded mitigation measures. The quality of the effect therefore is considered to be neutral on the Killeglan PWS.	Not Significant
3	Feacle Turlough pNHA is located c.550m southeast of Site	High - Attribute is considered to be of high quality or value as it has pNHA designation and the turlough and fen is fed by groundwater.	N/A	N/A	Potential to effect groundwater quality by migration is limited by low permeability in deeper karstic structures. While	Negligible. Indirect effect from a pollution incident at the Site. The extent of any effect from a pollution incident at the Site will be over a	Not Significant



No.	WFD Receptor	WFD Receptor Significance / Sensitivity Rating	WFD Status	WFD Risk Status	Potential Impacts	Description of Effects	Significance of Effects
					groundwater flows in a southeasterly direction from Site towards Feacle Lough, it is via deeper karstic channels and cavities while Feacle Lough is fed by groundwater in the shallower epikarst.	small area only, if pollution entered the groundwater, it would not extend to Feacle Lough due to the turlough only being fed by shallow epikarst groundwater. The duration of any pollution event at the Site would be brief lasting less than a day. The probability of a pollution event occurring is considered unlikely given embedded mitigation measures. The quality of the effect is considered to be neutral on the waters of the Feacle Lough.	



6.7 Risk of deterioration in status

The potential risk to the identified WFD receptors as a result of the Proposed Development is considered to be Not Significant as set out in **Table 6** above.

This section of the assessment identifies any risk of deterioration of WFD status as a result of the Proposed Development with all embedded mitigation measures in place, see **Table 7** below. Based on the project design and mitigation measures, the WFD screening, WFD scoping and WFD assessment, it is predicted that there will be no risk of deterioration in the status of the identified WFD receptors.

Table 7: Risk of deterioration in status of identified WFD receptors as a result of Proposed Development

WFD Receptor Details				Embedded mitigation measures	Risk of deterioration in Status
No.	WFD Receptor	WFD Status	Identified Existing Pressures		
1	Ballyglass River and Cross River	Ballyglass: Good Status	Ballyglass River: Still under review	Yes	No
2	Killeglan PWS	N/A	N/A	Yes	No
3	Feacle Turlough	N/A	N/A	Yes	No

It is considered here, that based on the nature of the Proposed Development and the designed embedded mitigation measures in place then the Proposed Development will not result in a deterioration in the status of the identified WFD receptors.

7.0 WFD compliance findings

Based on the findings from the WFD screening, scoping and assessment undertaken here, it is considered that the Proposed Development, with the mitigation measures in place, will not result in a deterioration of the existing status of the identified WFD receptors.

It is not considered that the Proposed Development will be a contributing risk factor in any of the identified WFD receptors failing to achieve their status objectives in future.



FIGURES

Figure WFD-1: Site Location and Zone of Influence

Figure WFD-2: River Sub Basins and Surface Water Bodies

Figure WFD-3: Groundwater Bodies

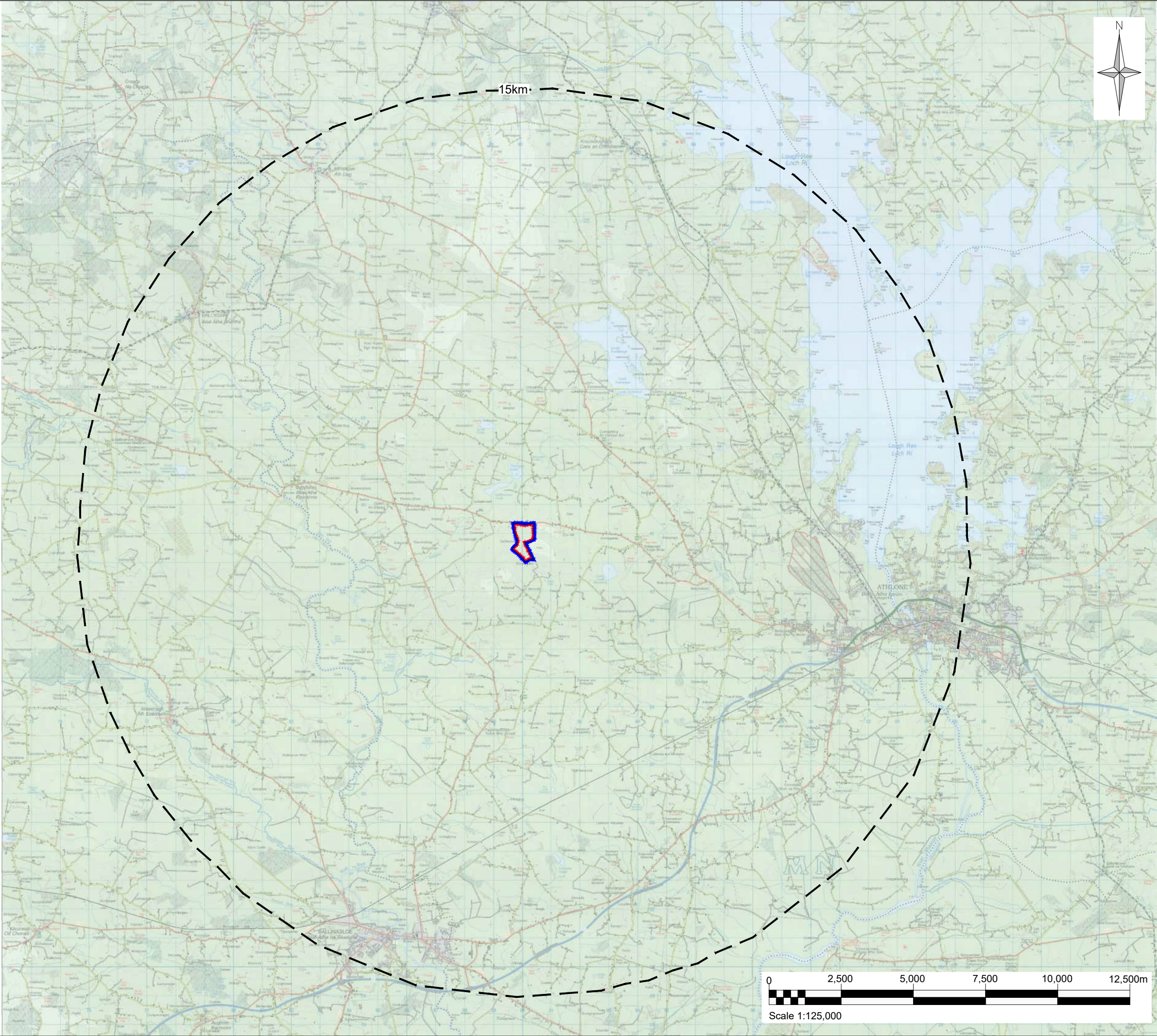
Figure WFD-4: Public Water Supply Zones

Figure WFD-5: Ecological Designations and Zone of Influence



04/11/2023

\\slr-local\au\Offices\IE\Dublin\SLR DATA\SLR Projects\00180A\Roadstone Limited\065512 Cam Quarry EIA\R3 EIA\R3 EIA\Waters\DaysCAD\WingWFD Dwg\00180.065512 Cam WFD Fig-1 Site Location.dwg



Notes:

1. Based on 50,000 scale Discovery Series Tailte Eireann maps 40 & 47

Legend:

Landholding (c. 66.3 hectares)

Planning Application Area (c. 66.3 hectares)

15km Off-Set from Site Boundary

Rev	Amendments	Date	By	Chk	Auth

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Figure Title

Site Location and Zone of Influence

Water Framework Directive (WFD) Assessment

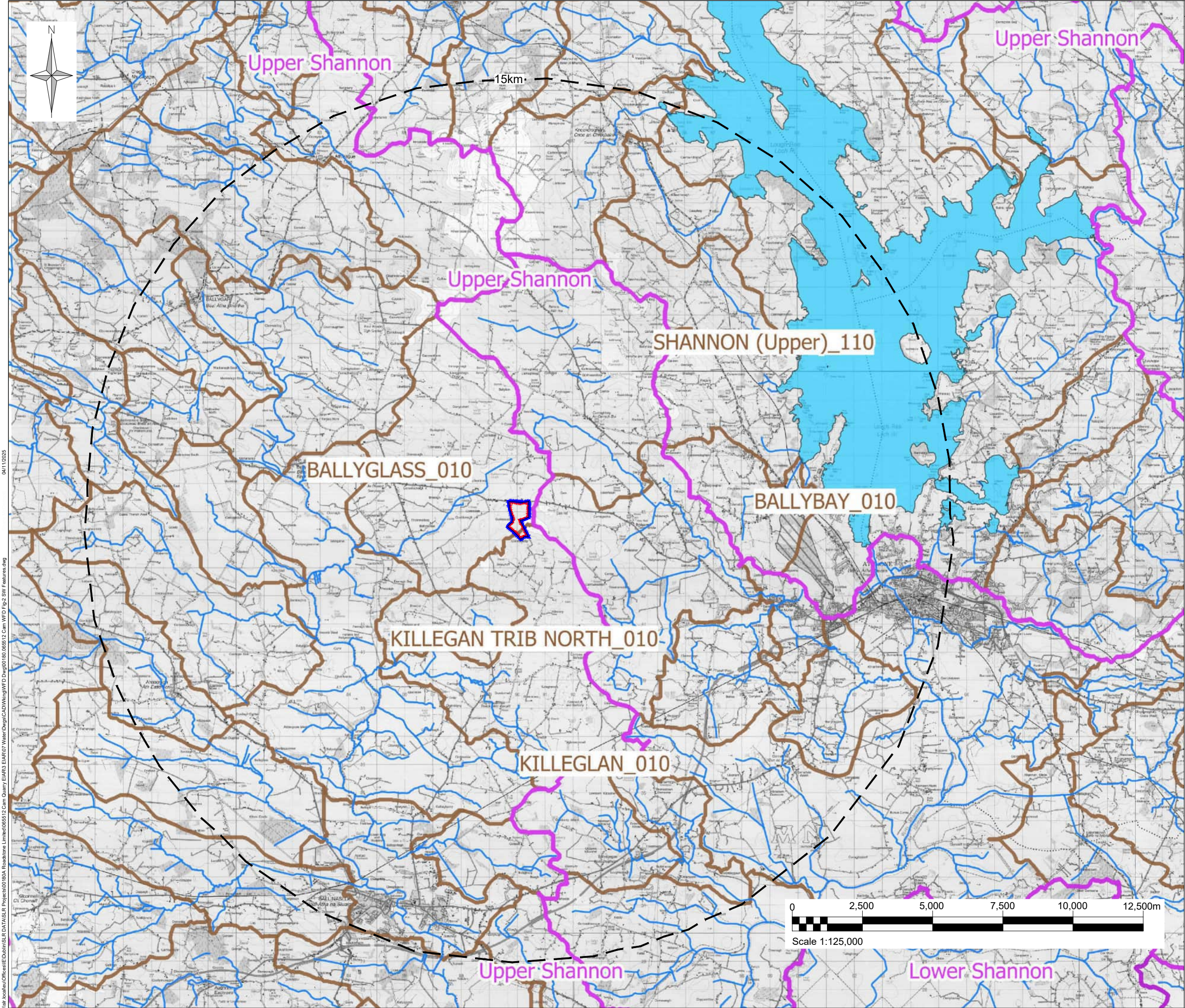
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Figure Number

Figure WFD-1

Rev.

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Notes:

1. Based on 50,000 scale Discovery Series Tailte Eireann maps 40 & 47

Legend:

Landholding (c. 66.3 hectares)

Planning Application Area (c. 66.3 hectares)

15km Off-Set from Site Boundary

WFD River Catchment

- Lower Shannon
- Upper Shannon
- WFD Lake Waterbodies
- Surface Watercourse
- WFD Sub-Catchment

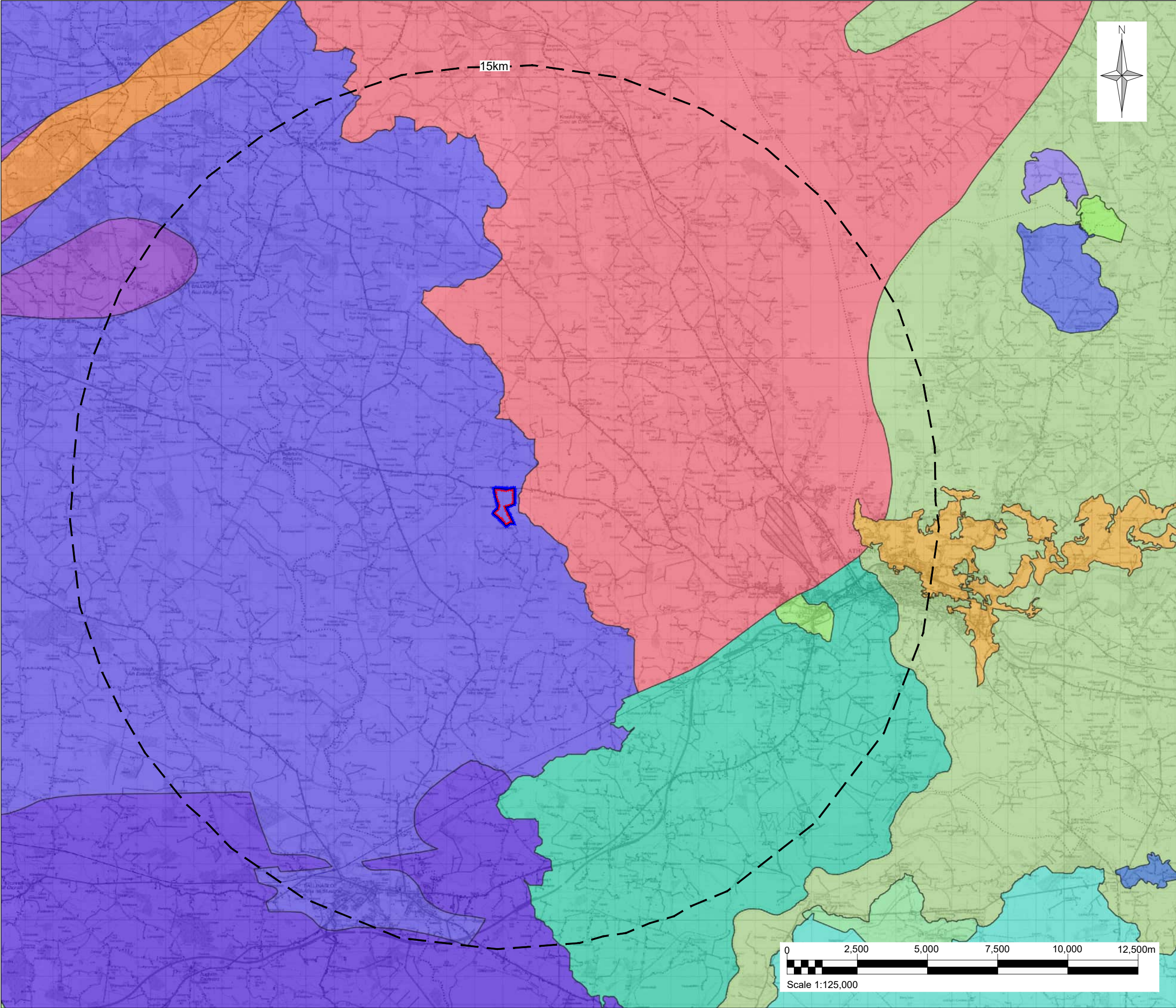
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Figure Title River Basins & Surface Water Features					
Water Framework Directive (WFD) Assessment					
Scale 1:125,000 @ A3		SLR Project No. 501.065512.00001			
Designed mcob	Drawn mcob	Checked pg	Authorised pg		
Date 03/25	Date 03/25	Date 10/25	Date 10/25		
Figure Number Figure WFD-2					Rev. 0

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Notes:

1. Based on 50,000 scale Discovery Series Tailte Eireann maps 40 & 47

Legend:

Landholding (c. 66.3 hectares)

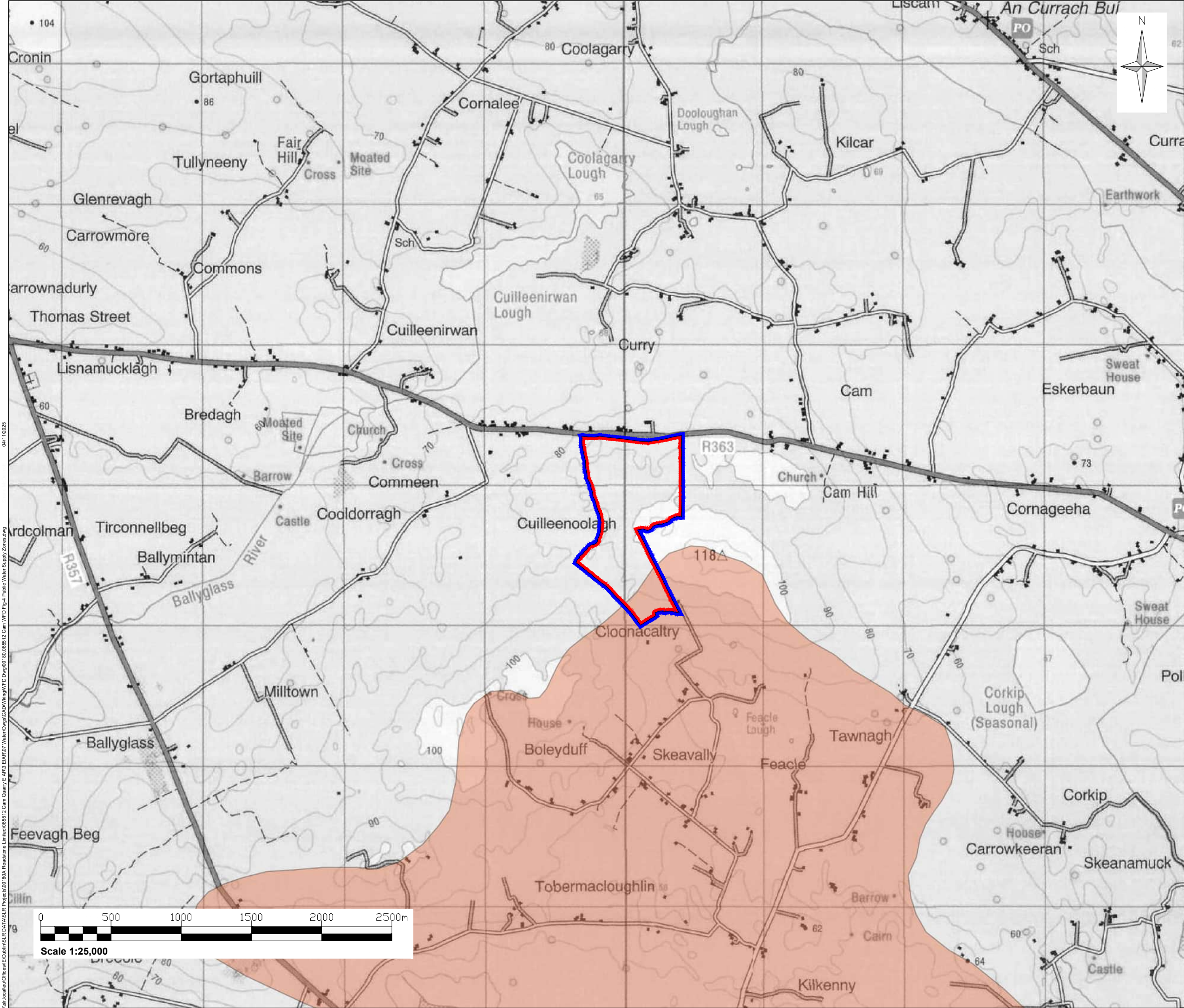
Planning Application Area (c. 66.3 hectares)

15km Off-Set from Site Boundary

Ground Water bodies

- Athlone Gravels
- Athlone West
- Aughrim
- Ballygar
- Boor Gravels
- Clara
- Ferbane
- Funshinagh
- Gageborough-Brosna Gravels Group 3
- GWDTE-Lough Ree Fen 10
- GWDTE-Lough Ree Fen 12
- GWDTE-Lough Ree Fen 9
- GWDTE-Rahasane Turlough
- Industrial Facility
- Inny
- Mount Mary
- Suck South

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Project Continued Use of Existing Cam Quarry at Curry & Cloonacaltry townlands, Co. Roscommon					
Figure Title Groundwater Bodies					
Water Framework Directive (WFD) Assessment					
Scale 1:125,000 @ A3		SLR Project No. 501.065512.00001			
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Date 03/25	Date 03/25	Date 10/25	Date 10/25		
Figure Number Figure WFD-3					Rev. 0



Notes:

1. Based on 6 inch scale Tailte Eireann Discovery raster mapping RN047, RN048, RN050, RN051

Legend:

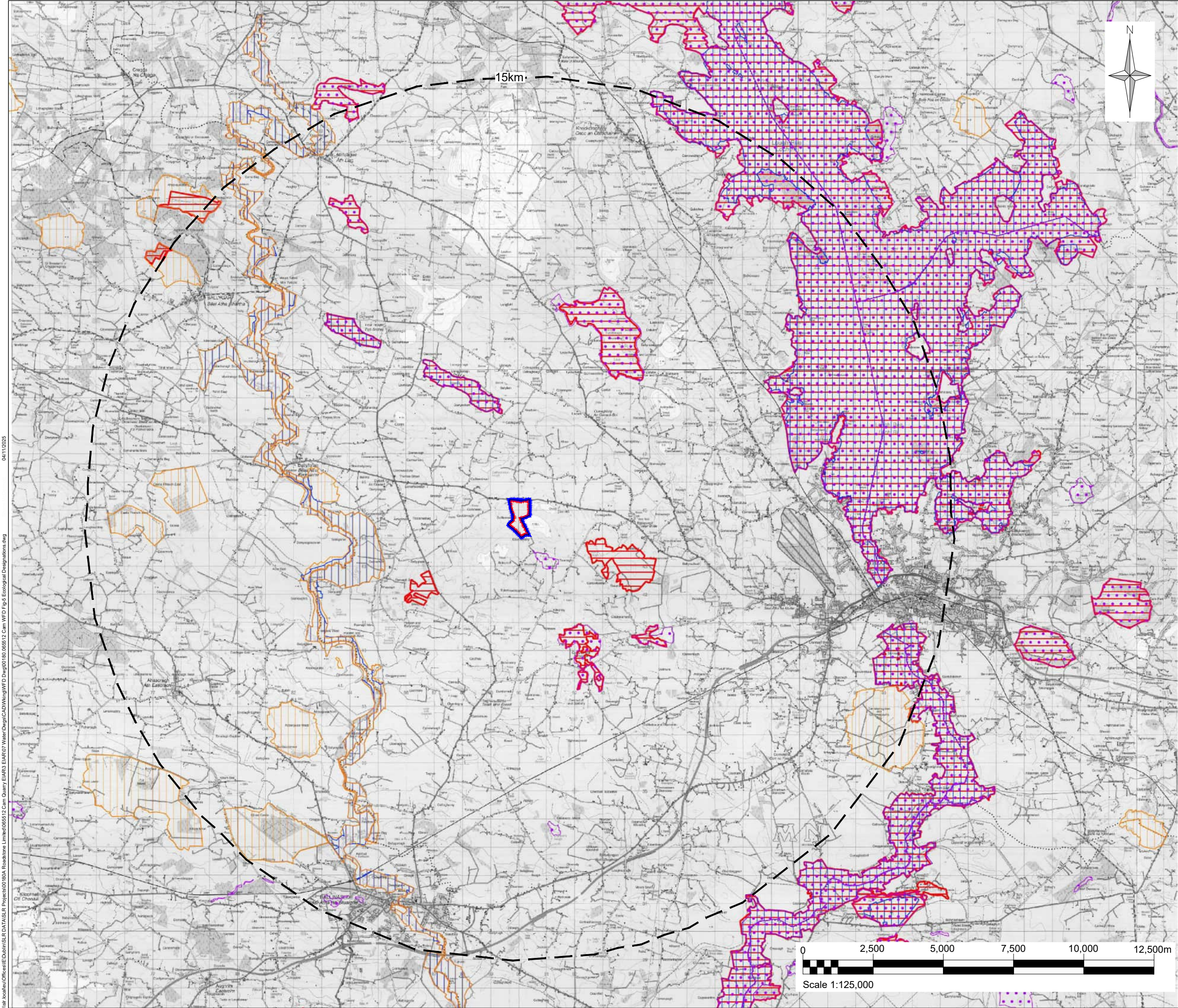
Landholding (c. 66.3 hectares)

Planning Application Area (c. 66.3 hectares)

Public Water Supply Source Protection Area
Killeglan PWS Tobermore Spring

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Client Roadstone Limited					
Project Continued Use of Existing Cam Quarry at Curry & Cloonacaltry townlands, Co. Roscommon					
Figure Title Source Protection Areas					
Water Framework Directive (WFD) Assessment					
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Date 03/25	Date 03/25	Date 10/25	Date 10/25		
Figure Number Figure WFD-4					Rev. 0

\\slr-local\au\Offices\IE\Dublin\SLR Data\SLR Projects\00180A Roadstone Limited\065512 Cam Quarry EIA\R3 EIA\R3 CAD\WFD Dwg\00180.065512 Cam WFD Fig-4 Public Water Supply Zones.dwg 04/11/2025



Notes:
1. Based on 50,000 scale Discovery Series Tailte Eireann maps 40 & 47

Legend:

Landholding (c. 66.3 hectares)

Planning Application Area (c. 66.3 hectares)

15km Off-Set from Site Boundary

Natural Heritage Area (NHA)

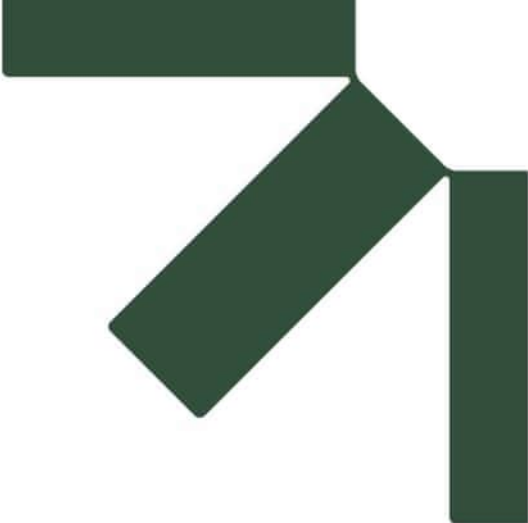
Proposed Natural Heritage Area (pNHA)

Special Protected Area (SPA)

Special Area of Conservation (SAC)

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Project Continued Use of Existing Cam Quarry at Curry & Cloonacaltry townlands, Co. Roscommon					
Figure Title Ecological Designations					
Water Framework Directive (WFD) Assessment					
Scale 1:125,000 @ A3		SLR Project No. 501.065512.00001			
Designed mcob	Drawn mcob	Checked pg	Authorised pg		
Date 03/25	Date 03/25	Date 10/25	Date 10/25		
Figure Number Figure WFD-5					Rev. 0

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Appendix A WFD Catchments, Watercourses and Groundwater Bodies in Study Area

**Water Framework Directive Assessment Cam, Co.
Roscommon**

Roadstone Ltd

SLR Project No.: 501.065512.00001

Study Area Catchments and Surface Water Bodies (within 15 km of the site)

WFD Catchment Hierarchy	WFD Catchment Name	Distance from Site
Catchments	Upper Shannon, Catchment ID. No. 26D	Site is within catchment
	Upper Shannon, Catchment ID. No. 26G	c. 300m east of the proposed development site
	Upper Shannon, Catchment ID. No. 26E	c. 9.4km north of proposed development site
Sub Catchments	Suck_SC_090	Site is within sub catchment
	Shannon[Upper]SC_100	c. 300m east of the proposed development site
	Shannon[Upper]_SC_090	c. 7.6km east of the proposed development site
	Suck_SC_070	c. 6.8km west of the proposed development site
	Suck_SC_060	c. 6km northwest of site
	Suck_SC_050	c. 9.4km northwest of site
	Knockcroghery_SC_010	c. 9.2km north of site
	Shannon[Lower]_SC_010	c. 13.7km southeast of site
	Shannon[Lower]_SC_020	c. 10.3km south of site
	Suck_SC_080	c. 12.2km southeast of site
River Sub Basins	BALLYGLASS_010	Site is within river sub basin
	CROSS (ROSCOMMON)_020	c. 300m east of the proposed development site
	CROSS (ROSCOMMON)_010	c.2km northeast of site
	KILLEGAN TRIB NORTH_010	c. 3.5km southwest of site
	KILLEGLAN_010	c. 600m south of site
	SUCK_130	c. 4.8km southwest of site
	BALLYDANGAN_010	c. 9.9km south of site
	SHANNON (Upper)_130	c. 13.7km south of site



WFD Catchment Hierarchy	WFD Catchment Name	Distance from Site
	Culliaghbeg_010	c. 14.1km south of site
	SUCK_140	c. 11.6km southwest of site
	AHASCRAUGH_040	c. 12km southwest of site
	AHASCRAUGH_030	c. 13.2km southwest of site
	SHIVEN (SOUTH)_040	c. 12.4km west of site
	SHIVEN (SOUTH)_050	c. 11.1km northwest of site
	SHIVEN (SOUTH)_060	c. 10km northwest of site
	SUCK_120	c. 5.9km northwest of site
	SUCK_110	c. 9.3km northwest of site
	SUCK_090	c. 7.9km north of site
	Knockcroghery_010	c. 8.7km north of site
	CARROWPHADEEN_010	c. 8.7km northeast of site
	LECARROW (LOUGH REE)_010	c. 10.7km northeast of site
	SHANNON (Upper)_110	c. 13.3km northeast of site
	BALLYBAY_010	c. 7km east of site
	CROSS (ROSCOMMON)_030	c. 9.2km southeast of site
	CROSS (ROSCOMMON)_040	c. 11.7km southeast of site
	MIHANBOY_010	c. 8.3km southeast of site
	SHANNON (Upper)_120	c. 9km southwest of site
	BALLYDANGAN_020	c. 10.5km southwest of site
	HIND_030	c. 13.9km north of site



WFD Catchment Hierarchy	WFD Catchment Name	Distance from Site
	HIND_020	c. 12.7km north of site
	ROCKSAVAGE_010	c. 13.4km northwest of site
Surface Water Bodies	BALLYGLASS_010	c. 1.1km northwest of site
	CROSS (ROSCOMMON)_010	c. 2.5km northeast of the site
	SUCK_120	c. 6.9km northwest of the site
	SUCK_130	c. 7.5km west of site
	Killaderry stream_010	c. 7.9km southwest of the site
	LUGHANAGH_010	c. 8.6km southwest of the site
	KILLEGAN TRIB NORTH_010	c. 4.1km south of site
	KILLEGLAN_010	c. 6.1km southwest of site
	CUILLEEN STREAM_010	c. 11.5km southwest of site
	SUCK_140	c. 11.6km southwest of site
	AHASCRAUGH_040	c.13.6km southwest of site
	AHASCRAUGH_030	c. 13.7km southwest of site
	DERRYMULLAN STREAM_020	c. 14.7km southwest of site
	Culliaghbeg_010	c. 14.5km south of site
	BALLYDANGAN_010	c. 10.4km southeast of the site
	BALLYDANGAN_020	c. 10.3km southeast of the site
	SHANNON (Upper)_120	c. 8.7km southeast of the site
	MIHANBOY_010	c. 7.9km southeast of the site
	CROSS (ROSCOMMON)_020	c. 4.5km east of site

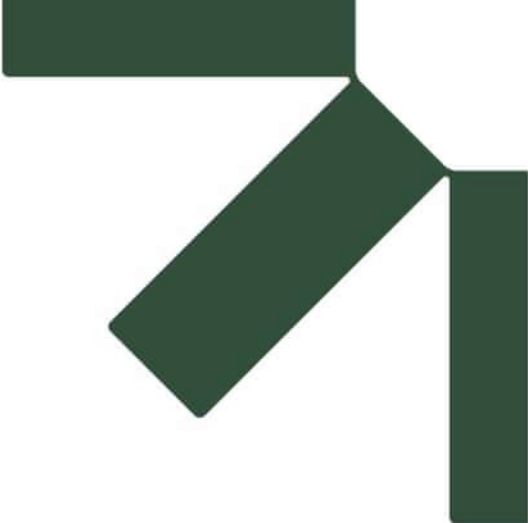


WFD Catchment Hierarchy	WFD Catchment Name	Distance from Site
	CROSS (ROSCOMMON)_030	c. 9.3km southeast of the site
	CROSS (ROSCOMMON)_040	c. 12.1km southeast of the site
	SHANNON (Upper)_130	c. 14.5km south of the site
	SHANNON (Upper)_110	c. 12.7km east of the site
	BALLYBAY_010	c. 8.1km east of the site
	Lake Ree	c. 11.9km east of the site
	SHIVEN (SOUTH)_040	c. 12.6km west of the site
	SHIVEN (SOUTH)_050	c. 11.9km northwest of the site
	SHIVEN (SOUTH)_060	c. 9.3km northwest of the site
	SUCK_090	c. 11.1 northwest of the site
	ROCKSAVAGE_010	c. 14.9km northwest of the site
	Knockcroghery_010	c. 10.8km northeast of the site
	LECARROW (LOUGH REE)_010	c. 11.2km northwest of the site
	CARROWPHADEEN_010	c. 10.54km northwest of the site
Groundwater Bodies	Suck South	Site is within
	Funshinagh	c. 840m east of the site
	Aughrim	c.9.7km south of the site
	Athlone West	c. 9.8km south of the site
	Industrial Facility (P0110-01)	c. 10.6km southeast of the site
	Athlone Gravels	c. 12.7km west of the site
	Inny	c. 14km west of the site



WFD Catchment Hierarchy	WFD Catchment Name	Distance from Site
	Ballygar	c. 14km northwest of the site





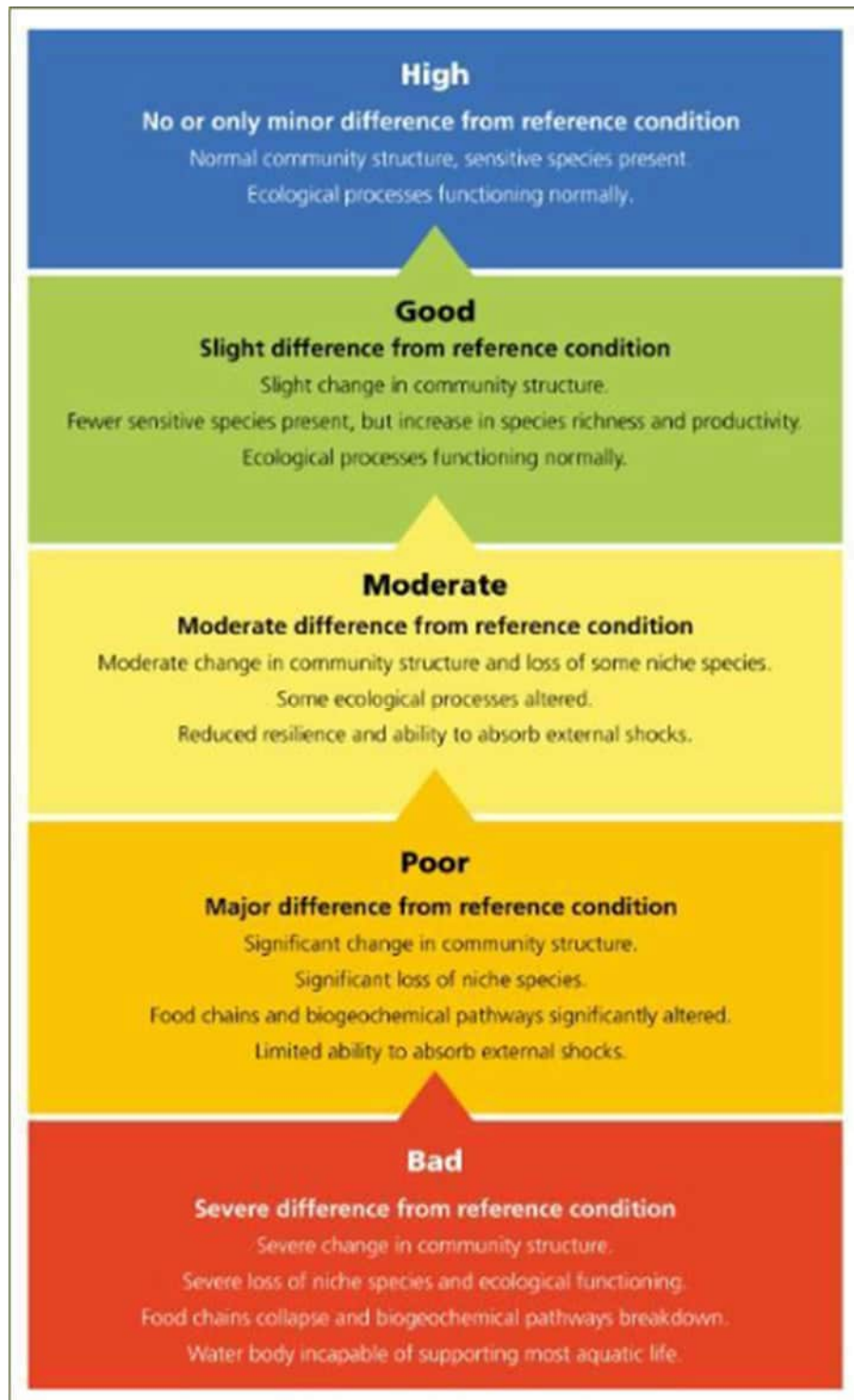
Appendix B Surface Waters Classification

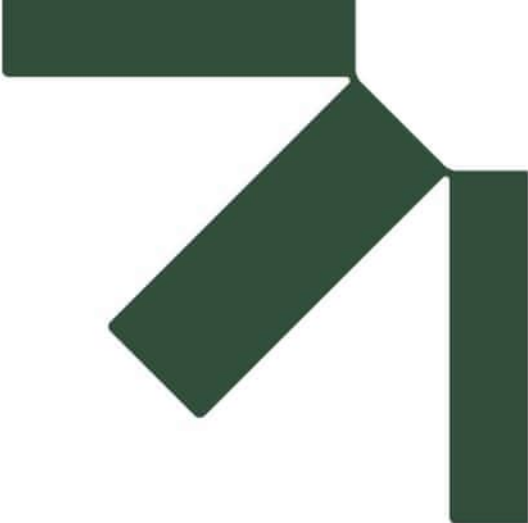
**Water Framework Directive Assessment Cam, Co.
Roscommon**

Roadstone Ltd

SLR Project No.: 501.065512.00001

WFD surface waters classification (Ecological Status).





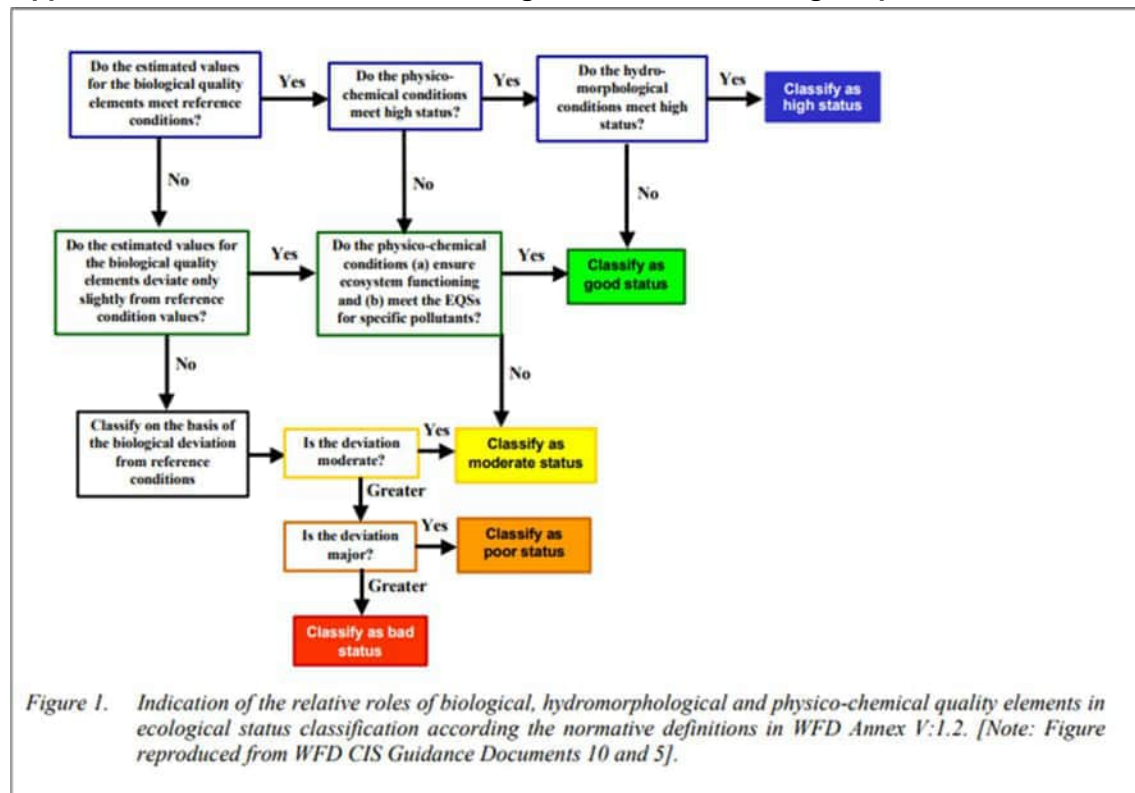
Appendix C Ecological Status Classification

**Water Framework Directive Assessment Cam, Co.
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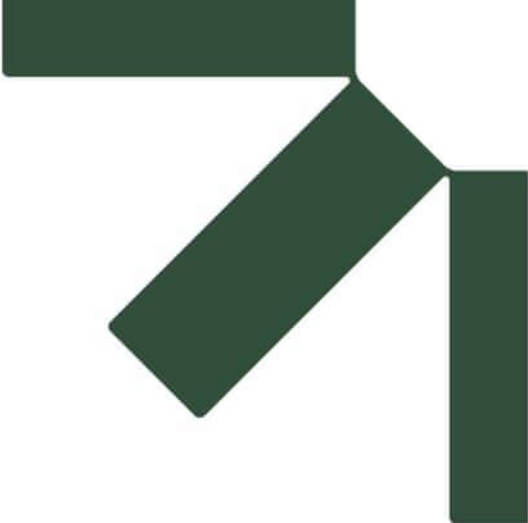
SLR Project No.: 501.065512.00001

Approach to the classification of ecological status and ecological potential



Source: Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance document No. 13 Overall approach to the classification of ecological status and ecological potential





Appendix D WFD Stage 1 Screening for surface water bodies and WFD details

**Water Framework Directive Assessment Cam, Co.
Roscommon**

Roadstone Ltd

SLR Project No.: 501.065512.00001

WFD Stage 1 Screening for surface water bodies and WFD details.

Surface water body	Distance from Site	Ecological Status (2009 - 2015)	Ecological Status (2013 - 2018)	Ecological Status (2016 - 2021)	WFD Second Cycle Pressures (2016 - 2021)	WFD Third Cycle Risk (2022 - 2027)	Catchment (ID)
Ballyglass River (BALLYGLASS_010)	Surface water is located c. 1.1km northwest of site	Unassigned	Good	Good	N/A	Under review	Upper Shannon (26D)
CROSS (ROSCOMMON)_010	c. 2.5km northeast of the site	Poor	Poor	Moderate	Morphological, Organic, Other Significant Impacts from Hydromorphology and Industry	At risk	Upper Shannon (26G)
SUCK_120	c. 6.9km northwest of the site	Moderate	Moderate	Moderate	Hydrological, Morphological from Hydromorphology	At risk	Upper Shannon (26D)
SUCK_130	c. 7.5km west of site	Good	Good	Good	N/A	Not at risk	Upper Shannon (26D)
Killaderry stream_010	c. 7.9km southwest of the site	Unassigned	Moderate	Moderate	N/A	Under review	Upper Shannon (26D)
LUGHANAGH_010	c. 8.6km southwest of the site	Unassigned	Good	Good	N/A	Under review	Upper Shannon (26D)
KILLEGAN TRIB NORTH_010	c. 4.1km south of site	Unassigned	Moderate	Good	N/A	Under review	Upper Shannon (26D)



Surface water body	Distance from Site	Ecological Status (2009 - 2015)	Ecological Status (2013 - 2018)	Ecological Status (2016 - 2021)	WFD Second Cycle Pressures (2016 - 2021)	WFD Third Cycle Risk (2022 - 2027)	Catchment (ID)
KILLEGLAN_010	c. 6.1km southwest of site	Poor	Moderate	Good	N/A	Not at risk	Upper Shannon (26D)
CUILLEEN STREAM_010	c. 11.5km southwest of site	Poor	Moderate	Good	Sediments and Nutrients from Agriculture	At risk	Upper Shannon (26D)
SUCK_140	c. 11.6km southwest of site	Moderate	Moderate	Moderate	Hydrological, Morphological from Hydromorphology	At risk	Upper Shannon (26D)
AHASCRAGH_040	c. 13.6km southwest of site	Good	Good	Good	N/A	Not at risk	Upper Shannon (26D)
AHASCRAGH_030	c. 13.7km southwest of site	Moderate	Poor	Poor	Sediment, Morphological, Nutrients, Organic from Hydromorphology, Agriculture and Urban Waste Water	At risk	Upper Shannon (26D)
DERRYMULLA N STREAM_020	c. 14.7km southwest of site	Moderate	Moderate	Moderate	Unknown Impact Type	At risk	Upper Shannon (26D)
Culliaghbeg_010	c. 14.5km south of site	Unassigned	Moderate	Moderate	N/A	Under review	Upper Shannon (26D)



Surface water body	Distance from Site	Ecological Status (2009 - 2015)	Ecological Status (2013 - 2018)	Ecological Status (2016 - 2021)	WFD Second Cycle Pressures (2016 - 2021)	WFD Third Cycle Risk (2022 - 2027)	Catchment (ID)
BALLYDANGAN_010	c. 10.4km southeast of the site	Good	Good	Moderate	N/A	Under review	Upper Shannon (26G)
BALLYDANGAN_020	c. 10.3km southeast of the site	Poor	Poor	Poor	Morphological, Organic, Other Significant Impacts from Hydromorphology and Industry	At risk	Upper Shannon (26G)
SHANNON (Upper)_120	c. 8.7km southeast of the site	Poor	Poor	Poor	Hydrological, Morphological, Nutrients from Hydromorphology and Peat	At risk	Upper Shannon (26G)
MIHANBOY_010	c. 7.9km southeast of the site	Moderate	Moderate	Moderate	Morphological from Hydromorphology and Peat	At risk	Upper Shannon (26G)
CROSS (ROSCOMMON)_020	c. 4.5km east of site	Good	Good	Moderate	Sediment, Morphological, Nutrients, Organic from Hydromorphology	At risk	Upper Shannon (26G)
CROSS (ROSCOMMON)_030	c. 9.3km southeast of the site	Good	Moderate	Moderate	Sediment, Morphological, Nutrients, Organic from Hydromorphology,	At risk	Upper Shannon (26G)



Surface water body	Distance from Site	Ecological Status (2009 - 2015)	Ecological Status (2013 - 2018)	Ecological Status (2016 - 2021)	WFD Second Cycle Pressures (2016 - 2021)	WFD Third Cycle Risk (2022 - 2027)	Catchment (ID)
					Agriculture and Urban Waste Water		
CROSS (ROSCOMMON)_040	c. 12.1km southeast of the site	Moderate	Moderate	Moderate	Hydrological, Morphological, Nutrients from Hydromorphology and Peat	At risk	Upper Shannon (26G)
SHANNON (Upper)_130	c. 14.5km south of the site	Unassigned	Poor	Moderate	N/A	Under review	Upper Shannon (26G)
SHANNON (Upper)_110	c. 12.7km east of the site	Unassigned	Poor	Poor	Morphological, Nutrients from Agriculture, Hydromorphology and Atmospheric	At risk	Upper Shannon (26E)
BALLYBAY_010	c. 8.1km east of the site	Unassigned	Poor	Moderate	N/A	Under review	Upper Shannon (26E)
Lake Ree	c. 11.9km east of the site	Moderate	Good	Good	N/A	Not at risk	Upper Shannon (26G)
SHIVEN (SOUTH)_040	c. 12.6km west of the site	Good	Good	Good	N/A	Not at risk	Upper Shannon (26D)

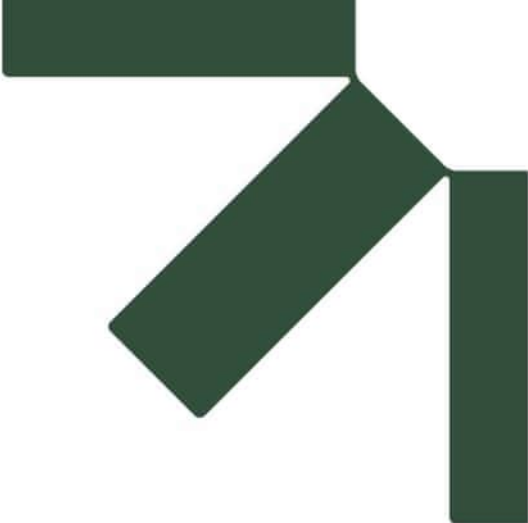


Surface water body	Distance from Site	Ecological Status (2009 - 2015)	Ecological Status (2013 - 2018)	Ecological Status (2016 - 2021)	WFD Second Cycle Pressures (2016 - 2021)	WFD Third Cycle Risk (2022 - 2027)	Catchment (ID)
SHIVEN (SOUTH)_050	c. 11.9km northwest of the site	Good	Good	Good	Hydrological, Morphological from Hydromorphology	At risk	Upper Shannon (26D)
SHIVEN (SOUTH)_060	c. 9.3km northwest of the site	Unassigned	Good	Good	N/A	Not at risk	Upper Shannon (26D)
SUCK_090	c. 11.1 northwest of the site	Good	Moderate	Poor	Sediment, Morphological, Nutrients, Organic from Hydromorphology and Agriculture	At risk	Upper Shannon (26D)
ROCKSAVAGE_010	c. 14.9km northwest of the site	Moderate	Moderate	Moderate	Morphological, Nutrients, Organic from Hydromorphology and Agriculture	At risk	Upper Shannon (26E)
Knockcroghery_010	c. 10.8km northeast of the site	Unassigned	Good	Moderate	N/A	Not at risk	Upper Shannon (26E)
LECARROW (LOUGH REE)_010	c. 11.2km northwest of the site	Unassigned	Moderate	Moderate	N/A	Under review	Upper Shannon (26E)



Surface water body	Distance from Site	Ecological Status (2009 - 2015)	Ecological Status (2013 - 2018)	Ecological Status (2016 - 2021)	WFD Second Cycle Pressures (2016 - 2021)	WFD Third Cycle Risk (2022 - 2027)	Catchment (ID)
CARROWPHAD EEN_010	c. 10.54km northwest of the site	Unassigned	Moderate	Moderate	N/A	Under review	Upper Shannon (26E)





Appendix E WFD Stage 1 Screening for groundwater bodies and WFD details

**Water Framework Directive Assessment Cam, Co.
Roscommon**

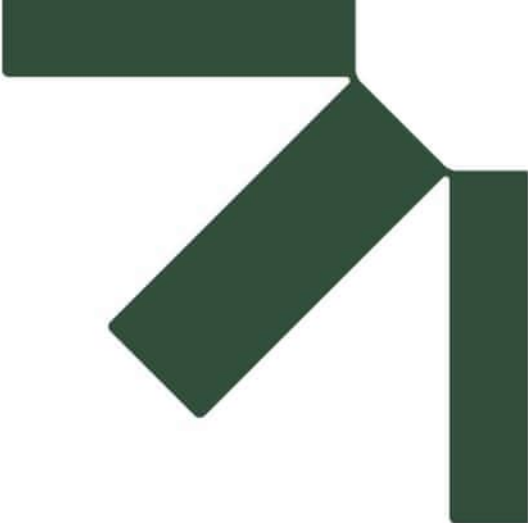
Roadstone Ltd

SLR Project No.: 501.065512.00001

WFD Stage 1 Screening for groundwater bodies WFD Details.

Groundwater Body	Distance from Site	Overall Status (2010 - 2015)	Overall Status (2013 - 2018)	Overall Status (2016 - 2021)	WFD Second Cycle Pressures (2016 - 2021)	WFD Third Cycle Risk (2022 - 2027)
Suck South	Site is within GWB	Good	Good	Good	N/A	Not at risk
Funshinagh	c. 840m east of the site	Good	Good	Good	N/A	Not at risk
Aughrim	c.9.7km south of the site	Good	Good	Good	N/A	Not at risk
Athlone West	c. 9.8km south of the site	Good	Good	Good	N/A	Not at risk
Industrial Facility (P0110-01)	c. 10.6km southeast of the site	Good	Good	Good	N/A	Under review
Athlone Gravels	c. 12.7km west of the site	Good	Good	Good	N/A	Not at risk
Inny	c. 14km west of the site	Good	Good	Good	N/A	Not at risk
Ballygar	c. 14km northwest of the site	Good	Good	Good	N/A	Not at risk





Appendix F Designated Areas

**Water Framework Directive Assessment Cam, Co.
Roscommon**

Roadstone Ltd

SLR Project No.: 501.065512.00001

Designated Areas – including European Sites within the Zone of Influence of the Project.

Designated Site	Site Code	Location at Closest Point to the Project Site ⁵	Zone of Influence
Feacle Lough pNHA	001634	c. 550m southeast of site	Proposed Development is within the 15 km Zone of Influence and has hydrogeological link to the Site.
Ballynamona Bog and Corkip Lough SAC	002339	c. 2km southeast of site	Proposed Development is within the 15 km Zone of Influence and has hydrogeological link to the Site.
Lough Croan Turlough SAC, SPA and pNHA	SAC/pNHA: 000610 SPA: 004139	c.3.1km north of the proposed application site	Proposed Development is within the 15 km Zone of Influence and has hydrogeological link to the Site.
Lough Funshinagh SAC and pNHA	000611	c. 5.3km northeast of site	Proposed Development is within the 15 km Zone of Influence.
Four Roads Turlough SPA, SAC and pNHA	SAC/pNHA: 001637 SPA: 004140	c. 7.15km northwest of site	Proposed Development is within the 15 km Zone of Influence.
Lough Ree SPA, SAC and pNHA	SAC/pNHA: 000440 SPA: 004064	c. 9.4km northeast of site	Proposed Development is within the 15 km Zone of Influence.
Castlesampson Esker SAC and pNHA	001625	c. 3.6km southeast of site	Proposed Development is within the 15 km Zone of Influence.
Killeglan Grassland SAC	002214	c. 3.6km southwest of site	Proposed Development is within the 15 km Zone of Influence.
River Suck Callows SPA and NHA	SPA: 004097 NHA: 000222	c. 4.6km southwest of site	Proposed Development is within the 15 km Zone of Influence and has hydrological link (downstream) to the Site.
Castle Ffrench East and West Bog NHA	East: 001244 West: 000280	c.11.4km west of site	Proposed Development is within the 15 km Zone of Influence.

⁵ When measured in a straight line over the shortest distance between the Site and European site



Designated Site	Site Code	Location at Closest Point to the Project Site5	Zone of Influence
Ballygar (Aghrane) Bog SAC and NHA	SAC : 002199 NHA: 000229	c. 14.1km northwest of site	Proposed Development is within the 15 km Zone of Influence.
Lisduff Turlough SAC and pNHA	000609	c. 10.8km northwest of site	Proposed Development is within the 15 km Zone of Influence.
Carrickynaghtan Bog NHA	001623	c. 14km southeast of site	Proposed Development is within the 15 km Zone of Influence.
River Shannon Callows SAC and pNHA / Middle Shannon Callows SPA	SAC/pNHA: 000216 SPA: 004096	c. 12.9km southeast of the site	Proposed Development is within the 15 km Zone of Influence and has hydrological link (downstream) to the Site.
Annaghbeg Bog NHA	002344	c. 9.65km southwest of site	Proposed Development is within the 15 km Zone of Influence.
Killure Bog NHA	001283	c. 13.9km southwest of site	Proposed Development is within the 15 km Zone of Influence.





Appendix G Drinking Water Protected Areas

**Water Framework Directive Assessment Cam, Co.
Roscommon**

Roadstone Ltd

SLR Project No.: 501.065512.00001

Drinking Water Protected Area	Location at Closest Point to Project Site	Hydrological Connectivity to Site (i.e. same SW catchment, Aquifer or in PWS Zone of Contribution)
Killeglan PWS	Located directly south of southern boundary of Site	Within 15km potential zone of influence and is hydraulically linked to Site
Mount Talbot PWS	Located c. 7.75km northwest of Site	Within 15km potential zone of influence and is not hydraulically linked to Site
Roscommon Ballinagard RWSS	Located c. 13km north of Site	Within 15km potential zone of influence and is not hydraulically linked to Site
Knockcroghery Lecarrow PWS	Located c. 14.7km north of Site	Within 15km potential zone of influence and is not hydraulically linked to Site
Lowville No. 1 GWS	Located c. 14.5km southwest of Site	Within 15km potential zone of influence and is not hydraulically linked to Site



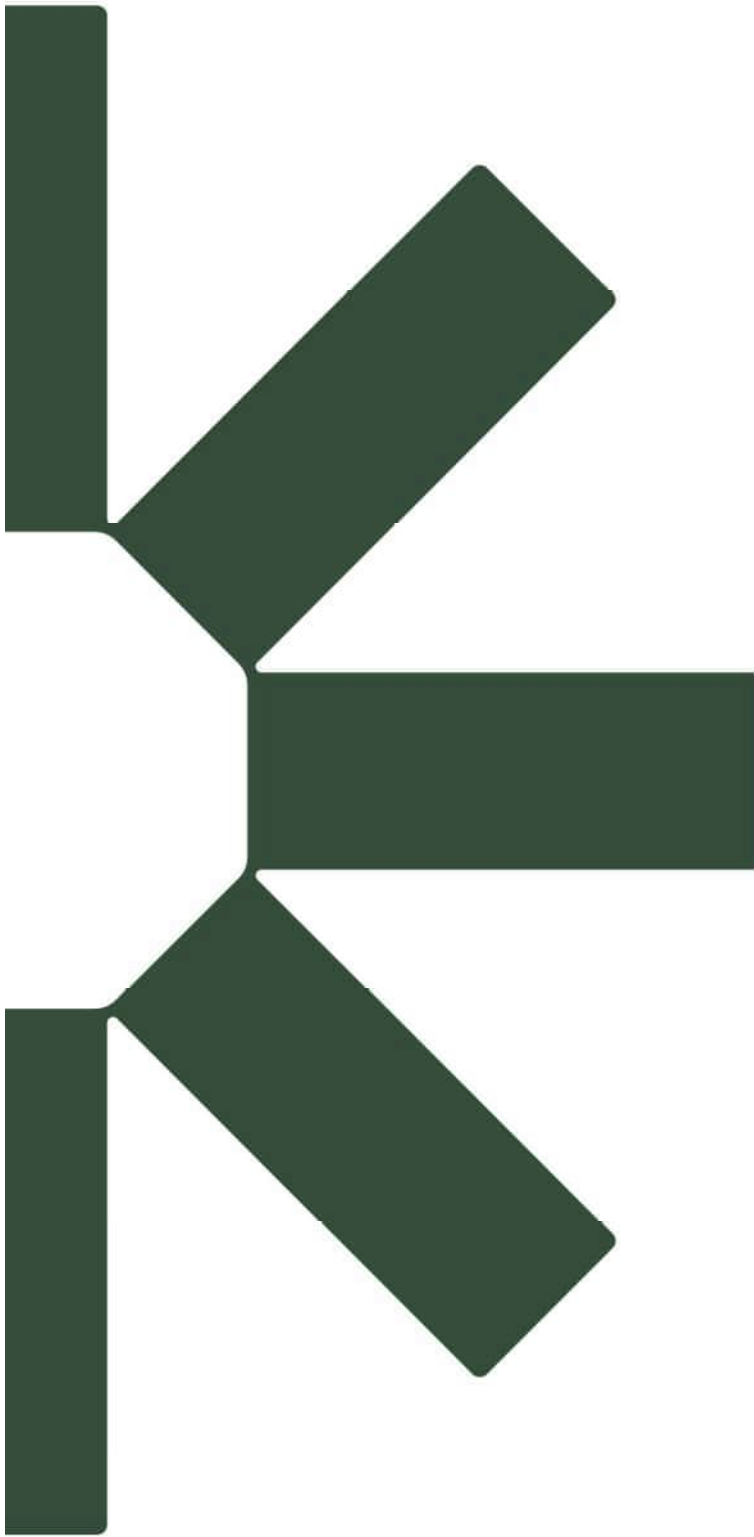


Appendix H Hydrogeological Report by OGE

**Water Framework Directive Assessment Cam, Co.
Roscommon**

Roadstone Ltd

SLR Project No.: 501.065512.00001



Making Sustainability Happen

Appendix 7-J 2004 Environmental Impact Assessment (EIS) Water Chapter



**ENVIRONMENTAL IMPACT STATEMENT - WATER SECTION FOR THE PROPOSED
QUARRY AT CURRY/CLOONACALTRY, NR BRIDESWELL, CO. ROSCOMMON FOR
ROADSTONE PROVINCES LIMITED.**

CONTENTS

INTRODUCTION	5
SOURCES OF DATA	6
METHODOLOGY	7
THE EXISTING ENVIRONMENT	8
Topography	8
Bedrock Geology	8
Karstification	9
Geophysical Survey and Bedrock Structure of the Application Site	10
Quaternary Geology	11
Soils	12
Depth to Bedrock	12
Conclusions on Site Geology from a Hydrogeological Perspective	14
HYDROLOGY	14
Regional Hydrology	14
Local Hydrology	16
Water Balance	16
Designated Hydrological Sites Significant to the Hydrogeology of Site and Adjoining Areas	20
Interim Conclusions of Hydrology	21
Regional Surface Water Quality	22
Theoretical Flows and Bankfull Capacities in the Ballyglass River at the Proposed Quarry Water Discharge Point	23
Dry Weather Flow (DWF)	23
Catchment mean flow	24
Determination of Q Mean (Annual Maximum Flood) from Catchment Characteristics of Ballyglass River at the point of proposed quarry water discharge	26
Determination of Q ₅₀ and Q ₁₀₀ from Q Mean of the Ballyglass River	27
Mixing Proportion of the Ballyglass River discharge and potential quarry water discharge	28

Capacity of channel & Instantaneous Discharge Readings	28
Quarry Water Management.....	30
HYDROGEOLOGY	34
Well Data	34
Ground Water Flow Directions	35
Recalculated Water Balance for Application Site	36
Ground recharge and discharge	37
Aquifer Classification	38
Ground water Vulnerability and Resource Protection.....	39
Bedrock Aquifer Properties	40
Existing Potential Contamination.....	40
Site Water Chemistry	41
Impact of Quarry Discharge on Killeglan Public Water Supply	42
Impact of Quarry Discharge on Corkip Lough	43
Impact of Quarry Discharge on Feacle Lough	44
Assimilative Capacity of Ballyglass River at the Proposed Discharge Point of the Quarry Water ..	45
IMPACT OF PROPOSED DEVELOPMENT	48
Ground Water	48
Surface Waters	48
MITIGATION MEASURES FOR WATER RESOURCES	49
Ground water	49
Surface Waters	50
References.....	51

Tables

Table No. 3.4.1: Depth to bedrock within the application area

Table No. 3.4.2: Depth to bedrock within study area based on well data supplied by the GSI and other sources

Table No. 3.4.3: Annual Average Rainfall Data adjacent to Site

Table No. 3.4.4: River Water Quality data from selected locations on the River Sick and Killeglan River upstream and downstream of the site (Data supplied from the Environmental Protection Agency website)

Table No. 3.4.5: Hydrochemical data of river water samples from selected locations on the River Suck from 1995 to 2000 (EPA website) and from Killeglan Public Water Supply (Roscommon County Council) 2002 to 2004

Table No. 3.4.6: Summary of Likely Flows in the Ballyglass River at the Proposed Quarry Water Discharge Point

Table No. 3.4.7: Relative Proportions of Proposed Quarry Discharge Water in the Ballyglass River During Different Discharge Conditions

Table 3.4.8: Percentage of Bank Full Capacity of the Ballyglass River under Various Flow Conditions



Table No. 3.4.9: Predicted run-off from areas of hardstanding on site

Table No. 3.4.10: Summary of Quarry Water Management System

Table No 3.4.11: Summary of Site and Third Party Wells

Table No. 3.4.12: Summary of Ground Water and Surface Water Catchments within Different Sub-divisions of the Application Site

Table No. 3.4.13: Revised Water Balance for the Application Site

Table No. 3.4.14: Vulnerability Mapping Guideline (Adapted from DELG, 1999)

Table No.3.4.15: Hydrochemical Results of the Ground Water Sample from the site and Surface Water Sample from the Ballyglass River

Table No. 3.4.16: Predicted Hydrochemistry of Receiving Water Following Mixing with Discharge Water

Figures

Figure No. 3.4.1: Site Location, Study Area and Topographic Trends

Figure No. 3.4.2: Quaternary Geology and Karst Features

Figure No. 3.4.3: Ground Water Contours and Significant Hydrogeological Features on the Application Site

Figure No. 3.4.4: Bedrock Quality and Topography of the Application Site

Figure No. 3.4.5a: Conceptual Hydrogeological Model of Application Site

Figure No. 3.4.5b: Hydrogeological Cross Section

Figure No. 3.4.6: Location of Meteorological Stations and Regional Hydrology(including EPA Water Quality Sampling Points and Location of Proposed Quarry Water Discharge)

Figure No. 3.4.7: Location Map of Wells

Figure No. 3.4.8: Aquifer Vulnerability and Depth to Bedrock Map

Appendices

Appendix 3.4.1: Hydrogeological Report Compiled by OGE for Roadstone Provinces Limited

Appendix 3.4.2: GSI Karst Database

Appendix 3.4.3: Borehole Records

Appendix 3.4.4: Hydrochemical and Abstraction Data from the Killeglan Public Water Supply (Roscommon County Council

Appendix 3.4.5: 50 and 100 Year Return Period Storm Event Calculations for Proposed Development



Appendix 3.4.6: Bank Full Capacity of the Ballyglass River

Appendix 3.4.7: Quarry Water Treatment System Design

Appendix 3.4.8: Site Assessment for Waste Water Treatment System

INTRODUCTION

3.4.1 This report focuses on the surface water and ground water components of the Environmental Impact Statement (EIS).

Personnel involved in the assessment were:

Dr. Cameron Latimer BSc PhD

EurGeol Shane O'Neill MSc PGeo DipCECLA

3.4.2 The objectives of this chapter of the EIS are to:

- Characterise the current hydrological and hydrogeological systems within the area of study;
- Assess the impact of the present activities and proposed development on the following:
 - Soils and geology in the context of the water environment;
 - Surface water flows;
 - Surface water hydrochemistry and quality;
 - Ground water flows and local wells;
 - Ground water hydrochemistry and quality;
 - Management of water within the quarry;
 - Aquifer vulnerability, with regard to potential increases in vulnerability during operation of the proposed quarry;
 - Resource Protection, and,
 - The impacts of the proposed quarry water discharge on the Ballyglass River.
- Provide mitigation solutions to minimise the impact and maintain a good water quality status for all waters which may be potentially impacted upon by the proposed development.

- 3.4.3 The site is located on lands at Curry/Cloonacaltry; some 3.5 kilometres west of Brideswell, Co. Roscommon. The centre of the site is located at approximate National Grid Reference E 190050 N 244850, see *Figure No. 3.4.1*. The site occupies an area of approximately 68 Ha (c. 168 acres) and is currently utilized as rough pasture. The site is approximately irregular in shape and measures approximately 1350 metres north to south and a maximum 480 metre east to west. Roadstone Provinces Limited is seeking planning permission for the development of a limestone quarry.
- 3.4.4 The primary study area is shown on *Figure No. 3.4.1* and represents a radius of study of approximately 2 kilometres from the centre of the site. The northern limit of the study area is Cuilleenirwan Lough, the eastern limit is Cam village, the southern limit is the townlands of Boleyduff, Skeavally, Feacle and Tawnagh, and the western limit is the Ballyglass River. Since a portion of the southern part of the application site falls within the Zone of Contribution to the Killeglan Public Water Supply aspects of the hydrology and hydrogeology relating to this water supply are also considered.

SOURCES OF DATA

- 3.4.5 Background data on the site was compiled by OGE. Further information and data was collected on site by OGE during the course of the field visits. OGE were contracted by Roadstone Provinces Limited to produce a Hydrogeological Report assessing the ground water conditions of the site. The aim of the hydrogeological investigation was to produce a conceptual ground water model for the site and adjacent areas. In addition to the information sources the hydrogeological investigation utilized the following data sources:

- Nine (9) cored holes (on the site) completed with ground water monitoring standpipes;
- A geophysical survey of the site with accompanying report;
- Long term ground water monitoring data compiled by OGE and Roadstone Provinces Limited;
- Two (2) additional ground water monitoring wells and a production well for the purposes of undertaking a pump test; and
- A 3 day pumping test.

3.4.6 The Factual Hydrogeological Report compiled by OGE is included as *Appendix 3.4.1*. The conclusions of the conceptual ground water model are detailed later in this chapter.

3.4.7 All other relevant data was compiled and collated by OGE, from data sourced at Roscommon County Council (Water Services Department), Geological Survey of Ireland (GSI), Environmental Protection Agency (EPA), Ordnance Survey of Ireland (OSI), Teagasc and Met. Éireann.

METHODOLOGY

3.4.8 There were three stages to this investigation:

- A desk study and analysis where data was collected from the GSI and Roscommon County Council. Data from the EPA, Teagasc, Met Éireann and the OSI was also reviewed at the offices of OGE.
- The undertaking of a hydrogeological investigation with accompanying report (*Appendix 3.4.1*).
- Site visits and fieldwork (for the Environmental Impact Statement) which included:
 - An assessment of the surface drainage patterns within the study area;
 - Ground water monitoring of the existing site boreholes;
 - An assessment of the bedrock and quaternary geology and geomorphology of the study area and the relationship of these to surface and groundwater flow patterns;
 - Collection of surface and ground water samples for chemical analysis;
 - An assessment of the projected water management of the site;
 - Compilation of third party well data from the GSI and fieldwork;
 - An assessment of the potential surface water and ground water hazards within the study area; and,
 - Design of proposed waste water treatment system;

THE EXISTING ENVIRONMENT

Topography

- 3.4.9 The proposed development is located within an area of undulating and hummocky topography varying in elevation from approximately 80 metres O.D along the north, eastern and southeastern margins of the application site and rising in the central and western portion of the site to approximately 110 metres O.D. The northern edge zone of contribution to the Killeglan Public Water Supply has been delimited by Kelly and Lee (2003) to fall in the southern part of the application area along a topographic divide. This topographic divide is shown on *Figure No. 3.4.1*.
- 3.4.10 Within the site are a number of bowl-shaped structures on the order of 10's of metres in diameter which probably represent enclosed depressions related to the karstification of the area.
- 3.4.11 A number of possible lineaments can be determined when the topography of the application site and environs are examined. The possible lineament trending north-west to south-east may link Corkip Lough with a linear valley structure to the north-west and probable enclosed depression in the north part of the application site. This lineament may represent a fault that has undergone preferential weathering and karstification and is marked as *Lineament 1* on *Figure No. 3.4.1*. The hill forming the central upland area of the site has a north-west to south trend although this swings to north-northwest-south-southeast trend southwards. Although less well developed than *Lineament 1*, this feature, marked *Lineament 2* on *Figure No. 3.4.1* may also be indicative of a fault structure along the south-western flank of the hill. The north-western faces of the hill form the uplands of the application site, Cam Hill and a hill to north of the townland of Boleyduff form a general south-west to north-east trend and are identified as *Lineament 3* on *Figure No. 3.4.1*.

Bedrock Geology

- 3.4.12 The site is underlain by Lower Carboniferous age Undifferentiated Visean Limestone. Logged rock core from the site indicate that the limestone is a grey, crystalline and bioclastic with corals, brachiopods and crinoid fragments.
- 3.4.13 These rocks have undergone partial karstification and locally have many clay filled fractures and fissures. These fissures and fractures probably follow the main faulting and jointing pattern of the area which is inferred to be orientated south-west to north-east and north-west to south-east reflecting the more regional faulting pattern around the site. The regional faulting pattern can be seen on Sheet 12 (Geology of Longford - Roscommon) of 1:100,000 scale GSI bedrock geology maps.

Karstification

- 3.4.14 The formation of karst features exploit structural weaknesses or faults in the rock, and these features can be greatly enhanced by chemical weathering. Substantial falls in sea-level during the Triassic, Tertiary and most recently the Holocene glacial periods and the related drop in ground water levels below the present ground water levels facilitated the deep weathering of these limestones by meteoric waters and the creation of a network of fissures/cavities through which water could move. The formation of karst features occurs where the bedrock limestone is unsaturated. In Ireland today ground water tables are generally high so active karst formation is only occurring in limited geographical areas. Permeabilities in the karstified rocks are extremely variable, although they are generally highest in the upper (more weathered) part of the aquifer. The upper highly weathered karstified limestone is referred to as *Epikarst*.
- 3.4.15 Within this part of County Roscommon karst features are common. A list of karst features as recorded by the GSI are presented in *Appendix 3.4.2*. A map of those which fall within the study area is shown on *Figure No. 3.4.2*. In addition to the karst features identified by GSI three possible karst features (enclosed depressions) identified on the application site, but not recorded by the GSI are also shown on *Figure No. 3.4.2*. From information in the GSI karst database only Corkip Lough (turlough) and Feacle Lough (turlough) which are discussed later in this chapter, Tobermore Spring (Killeglan Public Water Supply) which is discussed throughout this chapter, and Cuilleenirwan Lough (turlough) are considered significant to this study. Cuilleenirwan Lough feeds the Ballyglass River. Hydrological calculations on the Ballyglass River are presented later in this chapter, although it is likely that water depth within the Cuilleenirwan Lough does not vary significantly seasonally unlike Corkip Lough and Feacle Lough. The surface water level of Coolagarry Lough which is in connection with Cuilleenirwan Lough is 65 metres O.D.
- 3.4.16 In this report additional karst features identified as significant in the context of the hydrogeology of the application site are summarised below:
- 3 No. circular depressions in the northern part of the application area which represent potential sinks of surface run-off to ground water; the locations of these circular depressions are shown on *Figure No. 3.4.2*;
 - A pond located at approximate NGR E189800 E246080 possibly representing a spring and therefore sourced by ground water. This potential spring lies up hydraulic gradient from Cuilleenirwan Lough and to the north of the application site. The approximately reduced level of this pond is 69 metres O.D.; and,

- Three approximately linear areas of broken bedrock have been identified during the geophysical survey conducted by Apex Geoservices Limited. A discussion of the fracturing within the bedrock derived from the finds of the Apex Geoservices Limited report is presented in the next section.

3.4.17 During the exploratory drilling for the Hydrogeological Investigation programme a number of cavities were encountered below the site on selected boreholes. In general significant cavities were not found during the drilling works with the exception of production well PW2A. Where cavities have been identified these were either clay-filled or had relatively poor yields of ground water. Details of these cavities are found in the borehole records in *Appendix 3.4.3*.

Geophysical Survey and Bedrock Structure of the Application Site

3.4.18 Apex Geoservices Limited undertook various geophysical surveys while a programme of exploratory hole drilling at the application site was undertaken between 2001 and 2003. This information was used to produce an interpretative map of the bedrock quality underlying the site. This interpretative map based on the geophysics and the drilling was reproduced in the project scoping document dated January 2004, and reproduced as *Figure No. 3.4.4* in this report. The bedrock is classified into 4 zones:

- Zone 1 – Area of thicker overburden (3-16m) and probably highly fissured and karstified bedrock;
- Zone 2 – Area of variable overburden (1-10) and highly to moderately fissured/weathered bedrock;
- Zone 3- Area of medium thickness overburden (1-10m) overlying moderate to slightly fissured good rock quality limestone; and,
- Zone 4 – Area of shallower overburden (0-4m) overlying generally strong, clean, slightly fissured, thickly bedded limestone.

3.4.19 For simplicity, OGE have grouped both Zone 1 and Zone 2 (of the Apex Geosciences Limited definitions) into areas of fractured and karstified rock and Zone 3 and Zone 4 into areas of relatively unfractured and unkarstified rock. This interpretation is shown on *Figure No. 3.4.5a* and from this the fractured and karstified areas of the site bedrock form two approximately north-west to south-

east trending lineaments. Although not shown in Apex Geoservices Limited December 2003 report additional geophysical investigative works were carried out to the east of the application site. These works suggested a third zone of broken and karstified rock trending north-northwest to south-south-east. Borehole BH5 is located close to this karstified zone.

- 3.4.20 A 2-D Resistivity Profile (Profile No. 5 of Apex Geoservices Limited December 2003 Report) identified an area of deep weathering and fracturing representing a probable fault. Boreholes BH10 and PW2A were drilled through this fault zone. The fault appears to trend south-west to north-east and dips at around 70° to the south-east. The results of the exploratory boreholes undertaken during the initial phase of investigative works and those undertaken for the hydrogeological investigation are consistent with the findings of the geophysical investigation in terms of depth to bedrock and overall bedrock quality. On the basis of the geophysical investigations the planned area of extraction was located in areas that had been assessed as relatively unfractured. The exploratory boreholes in confirming the veracity of the geophysical investigations indicate that the assumptions upon which the initial quarry design were based are valid.

Quaternary Geology

- 3.4.21 Based upon the evidence of the exploratory boreholes undertaken at the site, overburden deposits comprise a sandy Glacial Till with frequent cobbles and boulders. Locally this may be absent and the overburden comprises highly weathered bedrock. Within areas of karstification broken bedrock with sand and clay infilling may be present to some depth. These above deposit types are difficult to distinguish by rotary drilling techniques. Overburden thickness generally varies from approximately 3 metres to 12 metres, although is locally reported to be up to 16 metres in thickness. In selected locations overburden thickness is however 2 metres or less. According to the records of the GSI the high ground of the site (above approximately 80 metres) is covered by peat lying directly over bedrock. The lower ground has a covering of glacial till dominated by limestone clasts. Evidence from the exploratory holes suggests that thin or patchy glacial till covers a greater area of, and persists to a greater elevation on, the site than indicated by the records of the GSI. To the south of site there are two ridges formed of glacial sand and gravel. These ridges have north-west to south-east orientation. An area of marl is shown in the locality of Feacle Lough. A map of the Quaternary Geology of the study area reproduced from the records of the GSI is presented as *Figure No. 3.4.2*.

Soils

- 3.4.22 The soil type of the site is typical of that developed from Glacial Till parent material namely minimal grey-brown podzolics. The ground surface is generally boulder strewn and soil development is probably very patchy.

Depth to Bedrock

- 3.4.23 Depth to bedrock information has been compiled from the following sources:

- Nine cored boreholes drilled on the site in June 2003 for Roadstone Provinces Limited
- Five boreholes (including 2 which were terminated and backfilled) drilled as part of the Hydrogeological investigation;
- 2D Resistivity survey lines undertaken as part of a large geophysical survey of the site and surrounding areas in January 2003;
- Well data supplied by the GSI;

- 3.4.24 The available information on the depth to bedrock in the areas within and immediately adjacent to the application area is presented below (*Table Nos. 3.4.1 and 3.4.2*). As part of a Geological and Geophysical Report compiled by Apex Geoservices Limited for Roadstone Provinces Limited a geological classification of the application site was produced combining information from the cored boreholes and resistivity survey with other geophysical techniques. The map produced by Apex Geoservices Limited classified the site in terms of overburden thickness and the degree of bedrock fracturing. This interpretation has been used with other information to produce an interpretative hydrogeological map of the site.

Table No. 3.4.1: Depth to bedrock within the application area

Data Source	Location NGR	Depth to Rockhead (metres) and Nature of Drift (if known)
Site Borehole BH-03	E 190099 N 244700	3 metres (overburden type not recorded)
Site Borehole BH-06	E 190211 N 244403	5.5 metres (overburden type not recorded)
Site Borehole BH-07	E 189939 N 244576	8 metres (overburden type recorded as rock and boulders)
Site Borehole BH-08	E 189933 N244912	3 metres (overburden type recorded as boulders and clay)

Data Source	Location NGR	Depth to Rockhead (metres) and Nature of Drift (if known)
Site Borehole BH-09	E 190273 N 244912	3 metres (overburden type not recorded)
Site Borehole BH-10	E 189894 N 245238	9 metres (overburden type recorded as boulders and clay to 7.40m bgl)
Site Borehole BH-11	E 190056 N 244348	2.5 metres (overburden type not recorded)
Monitoring Borehole MW1	E 190427 N 245328	7.50m (Glacial Till/Highly Weathered Limestone)
Monitoring Borehole MW2	E 190281 N 244897	4.20m (Glacial Till/Highly Weathered Limestone)
Pumping Well PW2A (Roadstone Provinces Ltd)	E 190281 N 244897	7.00m (Glacial Till/Highly Weathered Limestone)
Abandoned Well PW1	E 190174 N 244806	2.00m (Glacial Till/Highly Weathered Limestone)
2D - Resistivity Survey line 5 (Apex Geoservices)	SSE and NNW of Borehole BH10	c.2.0m-c.4.0m (high boulder and low clay content overburden) SSE part of line and c 7.0m-c.16.0m (low boulder and high clay content overburden) NNW part of site
2D - Resistivity Survey line 6 (Apex Geoservices)	From Borehole BH9 to SE	c.4.0m-c.9.0m (medium to high boulder and medium to low clay content overburden)
2D - Resistivity Survey line 7 (Apex Geoservices)	From Borehole BH3 to the NW	c. 1.0m-c.2.0m (high boulder and low clay content overburden)
2D - Resistivity Survey line 8 (Apex Geoservices)	SSE and NNW of Borehole BH 6	c. 1.0m-c.3.0m (high boulder and low clay content overburden)
2D - Resistivity Survey line 9 (Apex Geoservices)	From Borehole BH7 to ENE	c. 2.0m->10.0m (high boulder and low clay content overburden)
2D - Resistivity Survey line 10 (Apex Geoservices)	SW corner of application site	c. 2.0m-c.7.0m (high boulder and low clay content overburden)
Various Resistivity Surveys in NE of site (Apex Geoservices)	NE of application site	c. 2.0m-c.12.0m (high boulder and low clay content overburden)

3.4.25 The GSI Geodata database (of well records) provided depth to bedrock information for the study area, which is summarized in *Table No. 3.4.2* below. Details of the known rock outcrops (or areas of shallow rock) are shown in map format on *Figure No. 3.4.2*.

Table No. 3.4.2: Depth to bedrock within study area based on well data supplied by the GSI and other sources

Data Source	Location (NGR)	Depth to Bedrock
Site Borehole BH-01	E 190455 N 244044	3 metres (overburden type not recorded)
Site Borehole BH-05	E 190606 N 244222	6 metres (overburden type not recorded)
Resistivity Survey	Lands immediately south of application site	c. 1.0m-c.2.0m (medium boulder and medium clay content overburden)
Resistivity Survey	Lands immediately southeast of application site	Variable c. 1.0m-c.5.0 of (low boulder and high clay content overburden and high boulder and low clay content overburden)
GSI Database	E 189000 N 245000	2 metres (overburden not recorded)
GSI Database	E 189100 N 242950	6 metres (overburden not recorded)
GSI Database	E 189700 N 242940	39 metres (overburden not recorded)
GSI Database	E 189750 N 243060	33 metres (overburden not recorded)
GSI Database	E189850 N 243140	11 metres (overburden not recorded)
GSI Database	E190000 N 243000	15 metres (overburden not recorded)
GSI Database	E 190000 N 243000	48 metres (overburden not recorded)
GSI Database	E 190000 N 244000	8.5 metres (overburden not recorded)
GSI Database	E 190000 N 246000	6 metres (overburden not recorded)

Data Source	Location (NGR)	Depth to Bedrock
GSI Database	E 190930 N 243540	2 metres (overburden not recorded)
GSI Database	E 191000 N 243000	9 metres (overburden not recorded)
GSI Database	E 191270 N 242830	24 metres (overburden not recorded)
GSI Database	E 191300 N 242800	24 metres (overburden not recorded)

- 3.4.26 Based upon the depth to bedrock data for the site and environs its likely that over the higher ground the bedrock is less than 5 metres below the surface. In other areas depth to bedrock is generally between 5 metres and 10 metres, although it may exceed 10 metres in localised areas. The overburden type is generally relatively permeable.

Conclusions on Site Geology from a Hydrogeological Perspective

- 3.4.27 The topographical evidence, regional bedrock structure, palaeo-drainage pattern and the location of karst features suggest that the geology of the application site and its environs is controlled by two sets of faults. The primary faulting trend is north-west or north-northwest to south-east or south-southeast. The secondary fault set trends north-east to south-west. These faults may have been preferentially weathered and karstified. The primary conduits for ground water flow beneath the site will be along these conduits. The implication is that the directions of ground water flow beneath the site will be determined by a combination of topography and structural bedrock geology. Surface water catchment areas will not accurately delimit ground water catchment areas. Ground water can be transferred from one surface water catchment to another along ground water conduits. The significance of this conclusion will be demonstrated in the following sections.

HYDROLOGY

Regional Hydrology

- 3.4.28 For the purposes of this report OGE have divided the regional hydrology into three systems as shown on *Figure No. 3.4.6*:
- Killeglan System which covers the zone of contribution to the Killeglan Public Water Supply at the Tobermore Spring as well as other springs and water courses;
 - Ballyglass System which includes the surface water catchment for the Ballyglass River, Coolagarry Lough and Cuilleenirwan Lough (turlough); and,
 - Cross River System which includes all the land to the west of the application site and to the north-east and east of the zone of contribution to the Killeglan Public Water Supply.

3.4.29 The approximate watersheds for these surface water systems are shown on Figure No. 3.4.6.

Killeglan System

3.4.30 The hydrology of the zone of contribution to the Killeglan Public Water Supply is quoted directly from the work of Kelly and Lee (2003):

"The surface water regime is closely interconnected with the groundwater regime. There are several springs, swallow holes and numerous collapse features that are linked to the main surface water bodies in the area.

There are four main stream networks in the vicinity of Tobermore Spring. These are as follows:

- 1. Just north of Taghmaconnell, a stream rises in the townland of Bellaneeny. This stream flows west for approximately 4 km, to join the Killeglan River, which then discharges in the River Suck.*
- 2. A stream network exists to the south of Taghmaconnell, in the townlands of Knock and Sraduff. These streams flow to a turlough in the townland of Glennanea. This turlough appears to take all the flow from the stream network. Another section of stream rises east of this network and then disappears after flowing approximately 1 km to the north-east.*
- 3. An intermittent, seasonal stream is located to the east of the Tobermore Spring. This stream rises in the townland of Carrowduff and Garbally, and travels first north and then east. During wet weather the upper parts of the stream are flowing. Groundwater from the Tobermore Spring and discharge area joints this channel to form the head of the Killeglan River (Figure 1)*
- 4. A small stream network is located in the townland of Esker. This stream network is recorded as having permanent flow, but has no apparent surface outlet. It is therefore likely that this area of surface water feeds into the groundwater system.*

The majority of outflow from this area is via the Killeglan River, which includes the Tobermore Spring discharge. A second smaller outflow is through the stream at Bellaneeny, south of the springs."

3.4.31 Killeglan River flows in a west-southwesterly direction and is joined by the water from the stream emanating at Bellaneeny and then discharges to the River Suck. Feacle Lough is located within this system and is discussed later in this chapter.

Ballyglass System

- 3.4.32 The Ballyglass River rises from the Coolagarry Lough and Cuilleenirwan Lough (turlough) where the water flows south-west to discharge to the River Suck.

Cross River System

- 3.4.33 This system which includes Corkip Lough (discussed later in this chapter) drains the land to the northeast and east of the application area. The Cross River discharges to the River Shannon.

Local Hydrology

- 3.4.34 Based upon topographic considerations the majority of the site falls within the surface water catchment to the Ballyglass System. The northeast of the application area is within the surface water catchment area of the Ballyglass system above the discharge point of the Cuilleenirwan Lough to the Ballyglass River. Theoretically run-off should eventually enter either Coolagarry Lough or Cuilleenirwan Lough. The east of the site is within the surface water catchment of the Ballyglass System although surface run-off should discharge directly to the Ballyglass River, down gradient of the proposed quarry water discharge point unlike the northern part of the application site whose surface run-off should enter the Ballyglass System above the proposed discharge point. The southern part of the site is within the Killeglan System.

- 3.4.35 Kelly and Lee (2003) studying the hydrology and hydrogeology of the Killeglan Public Water Supply (Tobermore Spring) concluded that only 80% of the water available from run-off goes to ground water. Based upon the permeable nature of the overburden and the probable presence of sinkholes this figure may be an underestimate and all available water may recharge the bedrock aquifer.

Water Balance

- 3.4.36 The following water balance calculations are based on topographic considerations, i.e., based upon the surface water catchments. As previously explained the surface water catchments in karstified terrains may not accurately reflect the ground water catchments. Since most (if not all) water

available for run-off or ground water recharge probably soaks to ground water within the application site the 'actual' water balance (in terms of partition of this water to different catchments) for the site should be based on the ground water catchments and not the surface water catchments. Approximate ground water catchments below the site can be determined from the interpreted ground water flow directions. OGE will show within following sections of this chapter that the ground water catchments are indeed different to the surface water catchments of the application site and the 'true' water balance for the site is recalculated later in this chapter.

3.4.37 Rainfall and evaporation data was sourced from Met Éireann. The average annual rainfall (AAR), based on data from four rainfall stations in the area, was determined to be 950.33mm (Table No. 3.3.3). The locations of these meteorological stations are shown on Figure No.3.4.6. All the stations are now closed. Met Éireann have estimated that the climate change in the recent past is less than 1% and therefore, the data from 1941-1993 is still relevant.

3.4.38 The closest synoptic stations to the site are at Claremorris and Mullingar. The Average Potential Evaporation (PE) for Claremorris and Mullingar is 428.75mm/yr. This value is used as a best estimate of the site PE. Actual Evaporation (AE) at the site is estimated as 407.31mm/yr (0.95 PE). An ER figure of 697mm/yr is used in Groundwater Source Protection Zone assessment for the Killeglan Water Supply Scheme, Lee and Kelly, 2003. The ER determined by OGE and that used by Lee and Kelly, 2003 are different owing to a difference in assumed precipitation.

The Effective Rainfall (ER) for the site is determined from:-

$$ER = AAR - AE.$$

$$= 950.3\text{mm/yr} - 407.3\text{mm/yr}$$

$$ER = 543\text{mm/yr (OGE)}$$

$$ER = 697\text{mm/yr (Kelly and Lee, 2003 for Killeglan Spring)}$$

Table No. 3.4.3: Annual Average Rainfall Data adjacent to Site

Station		Grid Ref.		Ht (m O.D.)		Opened		Closed				
Athleague G.S.		M833576		53		1951		1988				
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
101	70	78	59	66	62	59	87	86	102	96	96	961

Station		Grid Ref.		Ht (m O.D.)		Opened		Closed				
Ballyforan G.S.		M824466		50		1944		1983				
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
99	68	75	56	68	65	59	88	88	100	95	97	958



Station		Grid Ref.		Ht (m O.D.)		Opened		Closed				
Taughmaconnell G.S.		M898389		59		1941		1993				
<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>July</i>	<i>Aug</i>	<i>Sept</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Annual</i>
94	68	73	56	64	62	63	87	84	96	90	95	932
average												950.33

3.4.39 ER represents the water available for run-off and ground water recharge in a catchment. A preliminary surface water balance for the site can be determined from this data.

3.4.40 The total area of the application site 68 Ha (168 acres). Therefore the total effective precipitation falling on the site available for run-off and ground water recharge is therefore;

$$\text{Application area} = (680,000\text{m}^2)(0.543\text{m/yr})(\text{OGE figures})$$

$$\text{Application area} = (680,000\text{m}^2)(0.697\text{m/yr})(\text{Kelly and Lee, 2003})$$

$$=369,240\text{m}^3/\text{yr} (1,011\text{m}^3/\text{day})(\text{OGE})$$

$$=473,969\text{m}^3/\text{yr} (1,298\text{m}^3/\text{day})(\text{Kelly and Lee, 2003})$$

3.4.41 The surface catchment divide for the Killeglan Public Water Supply at the Tobermore Spring is located across the southernmost part of the application area. The area of the application within the Zone of Contribution to the Killeglan Public Water Supply is approximately 8.8Ha (21.8 acres) the total effective precipitation falling on area of the site with the Zone of Contribution to the Killeglan Public Water Supply is therefore estimated at:

$$\text{Application area within Killeglan ZOC} = (88,370\text{m}^2)(0.543\text{m/yr})(\text{OGE figures})$$

$$\text{Application area Killeglan ZOC} = (88,370\text{m}^2)(0.697\text{m/yr})(\text{Kelly and Lee, 2003})$$

$$=47,985\text{m}^3/\text{yr} (131.4\text{m}^3/\text{day})(\text{OGE})$$

$$=61,594\text{m}^3/\text{yr} (168.6\text{m}^3/\text{day})(\text{Kelly and Lee, 2003})$$

3.4.42 The surface water catchment contributing to (and including) the application area representing the potential source of *all* water infiltrating into the application has been estimated to be 982,000m²,



Figure No. 3.4.6. This is based upon the local topographic surface water catchment to the quarry area.

$$\text{Contribution to application area} = (982,000\text{m}^2)(0.543\text{m/yr})(\text{OGE figures})$$

$$\text{Contribution to application area} = (982,000\text{m}^2)(0.697\text{m/yr})(\text{Kelly and Lee, 2003})$$

$$=533,226\text{m}^3/\text{yr} (1,460\text{m}^3/\text{day})(\text{OGE})$$

$$=684,454\text{m}^3/\text{yr} (1,874\text{m}^3/\text{day})(\text{Kelly and Lee, 2003})$$

- 3.4.43 The proportion of this surface water catchment contributing to (and including) the application area representing the potential source of all water infiltrating into the application area that falls within the Zone of Contribution to the Killeglan Public Water Supply is 18% which equates to:

$$=95,981\text{m}^3/\text{yr} (263\text{m}^3/\text{day})(\text{OGE})$$

$$=123,202\text{m}^3/\text{yr} (337\text{m}^3/\text{day})(\text{Kelly and Lee, 2003})$$

- 3.4.44 The total planned extractive area is approximately 23.7 Ha. Therefore the total effective precipitation falling on the planned quarry footprint and available for run-off and ground water recharge is therefore:

$$\text{Footprint of proposed quarry} = (237,000\text{m}^2)(0.543\text{m/yr})(\text{OGE figures})$$

$$\text{Footprint of proposed quarry} = (237,000\text{m}^2)(0.697\text{m/yr})(\text{Kelly and Lee, 2003})$$

$$=128,691\text{m}^3/\text{yr} (352\text{m}^3/\text{day})(\text{OGE})$$

$$=165,189\text{m}^3/\text{yr} (452\text{m}^3/\text{day})(\text{Kelly and Lee, 2003})$$

- 3.4.45 The surface water catchment contributing to (and including) the proposed quarry footprint representing the potential source of all water infiltrating into that footprint has been estimated to be 318,000m², Figure No. 3.4.6. This is based upon the local topographic surface water catchment to the quarry area.

$$\text{Contribution to proposed quarry footprint} = (318,000\text{m}^2)(0.543\text{m/yr})(\text{OGE figures})$$

$$\text{Contribution to proposed quarry footprint} = (318,000\text{m}^2)(0.697\text{m/yr})(\text{Kelly and Lee, 2003})$$

$$=172,674\text{m}^3/\text{yr} (473\text{m}^3/\text{day})(\text{OGE})$$

=221,646m³/yr (607m³/day)(Kelly and Lee, 2003)

- 3.4.46 The zone of contribution to the Killeglan Public Water Supply at the Tobermore Spring was determined by Lee and Kelly, 2003, and the aerial extent of this zone has been estimated by OGE to cover approximately 41.7 km². Using the figures of Lee and Kelly (2003), then the average daily recharge to the zone of contribution of the Tobermore Spring is 80,000m³/day. The discharge in the vicinity of the Tobermore Spring is approximately 35,000m³/day. Kelly and Lee (2003) noted the following:

"To date, the discharge data (from the area of the Tobermore Spring) are not comprehensive enough to undertake a water balance and thus accurately estimate the catchment area for the discharge at the head of Killeglan River. However an approximation of the average discharge data and recharge data indicate that the delineated catchment is (sic) area is large enough to meet the discharge from the springs."

Designated Hydrological Sites Significant to the Hydrogeology of Site and Adjoining Areas

Corkip Lough

- 3.4.47 Corkip Lough is a turlough located approximately 2.5 kilometres (NGR E192840 N243470) to east-southeast of the application site, see Figure No. 3.4.1. The turlough is a Special Area of Conservation (SAC), Ref: 002339 and National Heritage Area (NHA), Ref: 001628. The site is described thus:

"Corkip Lough is a turlough-type lake located 2km southwest of Brideswell, County Roscommon, in low-lying agricultural land. This site is important for both its flora and fauna. As the actual area of open water has been reduced considerably in recent years due to drainage activities, this site is more appropriately termed a turlough now."

The lake retains a small area of open water in the summer and is surrounded by lowland wet grassland which is flooded in winter."

- 3.4.48 The site is significant to the hydrogeological regime of the area since a turlough is fed by ground water. Rising ground water levels in winter result in the filling of the turlough.

Feacle Lough

- 3.4.49 Feacle Lough is a turlough located some 800 metres (NGR E190790 N243390) south-east of the southern boundary of the application area, see *Figure No. 3.4.1*. The turlough is a proposed National Heritage Area (pNHA) Ref: 001634. The site is described thus:

"Feacle turlough lies approximately 12km west of Athlone in an uneven terrain of glacial deposits. The basin, which runs roughly east-west, but whose edges are sinuous because of encroaching mounds, has an even floor with a number of discrete hollows. Outcrop is visible at the western end – elsewhere there is some loose rock. A permanent pond occurs at the north-western end, but there is no apparent inflow."

- 3.4.50 OGE visited the turlough in June 2004 and found the only open water was within the pond described above. The water in this pond appears perched above the ground water table. Towards the western end of the turlough area (close to the road) is a circular depression and possible swallow-hole. A hand dug well with pump house is located on the end of this depression. Local knowledge suggested that during winter when maximum filling of the turlough occurs the pump house is just above the high water mark. OGE measured the ground water level in this well and found it to be approximately 6 metres below the pump house level. This suggests that ground water levels in the area rise by approximately 5 to 6 metres above the June level in winter.

Interim Conclusions of Hydrology

- 3.4.51 Both Feacle Lough and Corkip Lough are turloughs and by definition, fed by ground water. Significant rises in ground water levels during winter months cause these turloughs to flood. The primary conduits for ground water flow are fissures and fractures in the bedrock enhanced by karstification. The karstified conduits are generally related to structural features such as faults. Corkip Lough, as previously stated is probably located along a fault line which continues into the northern part of the application area. However, it is generally accepted that the majority of turloughs are fed by ground water from the *epikarst*. Both Corkip Lough and Feacle Lough are lower in elevation than the application area, such that the ground water table in these areas is within the *epikarst*. In the pump test, the results of which are shown in Appendix One, the permeability of the karstified areas of the bedrock below the site were tested. Within karstified aquifers 'deeper' karst features can be the primary ground water conduits. The results of the pump test carried out at the site suggest however that permeability of the karst features below the site is relatively low. As such, although the turloughs (in particular Corkip Lough) may be located above zones of deeper karstification the contribution of ground water from the deeper karst to these features is probably very limited.

Regional Surface Water Quality

3.4.52 Details of the Biological River Water Quality for two locations on the River Suck and a location on the Killeglan River are presented as *Table No. 3.4.4*; the locations of these sampling points are shown on *Figure No. 3.4.6*. The two sampling stations on the River Suck are at points up and down stream on the confluence of the Ballyglass River. As the proposed development progresses it is proposed to discharge ground water and surface run-off inflows into the quarry to the Ballyglass River. These stations would therefore represent potential up and down gradient locations to the confluence of the Ballyglass River which will be receiving the proposed quarry discharge and direct it to the River Suck.

Table No. 3.4.4: River Water Quality data from selected locations on the River Suck upstream and downstream of the site and Killeglan River (Data supplied from the Environmental Protection Agency website)

Year	Killeglan River – Bridge upstream from confluence with River Suck. Station No. 0200 (River Code 26K04)	River Suck – Bridge West of Feevagh (downstream from confluence with Ballyglass River. Station No. 1125 (River Code 26S07)	River Suck – Ballyforan Bridge (upstream from confluence with the Ballyglass River. Station No. 1100 (River Code 26S07)
1999	4	4	4
1996	4	4	4
1992	4	4	4
1987	4	4	4
1984	-	-	4
1983		4	-
1980			4
1978			4-5
1974			5
1971			5

Where a value of, 4, 4-5, 5 = Unpolluted; 3-4 = slightly polluted; 2-3, 3 = moderately polluted; 1, 1-2, 2 = seriously polluted.

3.4.53 In terms of water quality, the River Suck and Killeglan River at the three sampling locations is/has been unpolluted.

3.4.54 Chemical parameters were measured at the two above locations on the River Suck during the year 1995 to 2000 and collated by the EPA. This data is presented in *Table No 3.4.5* together with a summary of data collected by Roscommon County Council for the Killeglan Public Water Supply. Full details of the chemical analyses carried out on the pre-treatment Killeglan Public Water Supply are presented in *Appendix 3.4.4* together with abstraction data for the water supply.

Table No. 3.4.5: Hydrochemical data of river water samples from selected locations on the River Suck from 1995 to 2000 (EPA website) and from Killeglan Public Water Supply (Roscommon County Council) 2002 to 2004

Chemical Parameter	River Suck - Bridge West of Feevagh (downstream from confluence with Ballyglass River. Station No. 1125 (River Code 26S07) 1999-2000		River Suck - Ballyforan Bridge (upstream from confluence with the Ballyglass River. Station No. 1100 (River Code 26S07) 1995-1997		Killeglan Public Water Supply from date supplied by Roscommon County sample dates FEB 02 to FEB 04	
	Min	Median	Min	Median	Min	Median
B.O.D (mg/1 O ₂)	0.6	1.3	0.5	1.7	-	-
Chloride (mg/1 Cl)	-	-	15	19	-	-
Colour (Hazen)	19	76	30	70	4	21
Conductivity (µS/cm)	283	529	348	506	392	597
Dissolved Oxygen (mg/1 O ₂)	7.1	10.6	9.1	10.4	-	-
Dissolved Oxygen (% saturation)	69	93	81	90	-	-
Ortho-Phosphate (Mg/1 P)	0.00	0.02	0.01	0.03	0.002	0.005
Oxidised Nitrogen (mg/1 N)	0.1	0.8	0.2	1.0	1.414	3.184
pH	7.7	8.0	7.6	7.9	7.06	7.38
Temperature	3.3	9.0	0.3	9.5	-	-
Total Ammonia (mg/1 N)	0.0	0.02	0.01	0.03	0.002	0.007
Un-ionised Ammonia (mg/1 NH ₃)	0.000	0.000	0.000	0.001	-	-

- 3.4.55 The general chemistry indicates that, the minimum and median values of the samples generally met the European Communities (Quality of Water Intended for the Abstraction of Drinking Water) Regulations, 1989 standards, although colour may be of concern towards the upper range of the samples.

Theoretical Flows and Bankfull Capacities in the Ballyglass River at the Proposed Quarry Water Discharge Point

Dry Weather Flow (DWF)

- 3.4.56 Dry Weather Flow (DWF) is the annual minimum daily mean flow rate with a return period of 50 years.

Catchment Low Flow (q_{50})

3.4.57 There is no information available about the flow regime of the Ballyglass River at the point of the proposed quarry water discharges. The proposed discharge point is adjacent to the bridge on the R363 to Ballyforan where the road crosses the Ballyglass River. OGE estimated minimum flows in the catchment using the methodology outlined in *Analysis and Prediction of Low Flow and Drought Volumes for Selected Irish Rivers* (Martin & Cunnane, 1976).

3.4.58 Calculation of the low flow was determined as follows: The area of the catchment (A) to the bridge was calculated as being 7.97km^2 . Using this, a value for q_{50} could be determined. q_{50} is the estimated low flow with a recurrence interval of 50 years. This is also referred to as the Dry Weather Flow (DWF).

$$q_{50} = 14.5A^{1.6} \times 10^{-6} \text{ m}^3/\text{s}$$

This equation is empirical and based upon a 'best fit' curve for modelled data from 18 catchments where the relationship between q_{50} is plotted against catchment area

$$q_{50} = 14.5(7.97)^{1.6} \times 10^{-6} \text{ m}^3/\text{s}$$

$$q_{50} = 4.02 \times 10^{-4} \text{ m}^3/\text{s} (0.402\text{l/s})$$

3.4.59 A 66% confidence interval for this result (derived from statistical analysis) extends an amount of 0.41 on either side of the predicted value. In other words if a value of q_{50} is estimated (by this method) the 66% confidence interval extends from $q_{50}/2.5$ to $2.5q_{50}$. Therefore we can be 66% confident that the value of q_{50} is in the range of 0.161 - 1.004 l/s.

3.4.60 This range of values represents the minimum flows in the catchment. These values are often over-conservative, and can be checked against the estimated catchment mean flow, F .

Catchment mean flow

3.4.61 Martin & Cunnane suggest that the minimum flow in a catchment with an area less than 800km^2 is always greater than 2 percent of F . The mean catchment flow F can be obtained in two ways:

Mean flow from rainfall and losses

3.4.62 The mean rainfall (R) for this catchment was determined to be $950\text{mm}/\text{year}$ (OGE) and $1039\text{mm}/\text{year}$ (Kelly and Lee, 2003). An evaporation loss of $450\text{mm}/\text{year}$ is assumed. The equation uses an evaporation rate of 450mm rather than actual evaporation rates.

$F = (R - 450) \times A / 31536$ (seconds in a year, based on 365 days divided by 1000 since rainfall is expressed in mm and needs to be converted to metres)

$$F = (950 - 450) \times 7.97 / 31536 \text{ (OGE)}$$

$$F = 0.126 \text{ m}^3/\text{s} \text{ (126.4 l/s)} \text{ (OGE)}$$

$$F = (1039 - 450) \times 7.97 / 31536 \text{ (Kelly and Lee, 2003)}$$

$$F = 0.149 \text{ m}^3/\text{s} \text{ (148.9 l/s)} \text{ (Kelly and Lee, 2003)}$$

Specific mean flow from rainfall

$$F = A \times (1.9R^{1.3} \times 10^{-6})$$

This equation is empirical and based upon a 'best fit' curve for modelled data where F/A (mean catchment flow/area) is plotted against R (Rainfall)

$$F = 7.97 \times (1.9 \times (950)^{1.3} \times 10^{-6}) \text{ (OGE)}$$

$$F = 0.113 \text{ m}^3/\text{s} \text{ (112.6 l/s)} \text{ (OGE)}$$

$$F = 7.97 \times (1.9 \times (1039)^{1.3} \times 10^{-6}) \text{ (Kelly and Lee, 2003)}$$

$$F = 0.126 \text{ m}^3/\text{s} \text{ (126.4 l/s)} \text{ (Kelly and Lee, 2003)}$$

A conservative estimate of mean flow is 112.6 l/s.

$$2\%F = (0.02) \times (0.113 \text{ m}^3/\text{s}) = 2.25 \times 10^{-3} \text{ m}^3/\text{s} \text{ or } 2.25 \text{ l/s} \text{ (OGE)}$$

$$2\%F = (0.02) \times (0.126 \text{ m}^3/\text{s}) = 2.53 \times 10^{-3} \text{ m}^3/\text{s} \text{ or } 2.53 \text{ l/s} \text{ (Kelly and Lee, 2003)}$$

- 3.4.63 Compared to the q_{50} values determined above this value is larger than the upper range. Martin and Cunnane point out that the equations must be used with great care in small catchments. The relationship between F and q_{50} is less well defined in smaller catchments (less than 800km²) but the estimates of flow can be generally relied upon.

- 3.4.64 So for the purposes of this EIS the conservative value $1.61 \times 10^{-4} \text{ m}^3/\text{s}$ will be used for Dry Weather Flow (DWF).

Determination of Q Mean (Annual Maximum Flood) from Catchment Characteristics of Ballyglass River at the point of proposed quarry water discharge

- 3.4.65 In the absence of flow data it is possible to determine the annual maximum flood using catchment characteristics, as outlined in the Flood Studies Report. *This is not the average flow.* The annual maximum flood is larger than the mean flow, and statistically it exceeds the one-year flood by approximately 15 percent. This flow is used as a basis for determining larger flows of a greater return period.

The equation is:

$$Q \text{ Mean} = 0.00042A^{0.95}F_s^{0.22}G^{1.18}R^{1.05}w^{-0.93}s^{0.19}$$

Where:

A = catchment area (km^2) = 7.97

F_s = channel network = 0.681

G = winter rainfall acceptance potential = 0.150

R = average annual rainfall = 1039 (worst case)

w = storage index = 1.84

s = slope of main channel = 1.23 m/km

- 3.4.66 The area of the catchment to the confluence with the unnamed stream was determined to be 7.97 km^2 . OGE used the 1:50 000 Discovery Series map (Sheet 47) to determine the area.

The values of the parameters above were determined using the methods outlined in the Flood Studies Report and the resulting equation for the area was found to be:

$$Q \text{ Mean} = (0.00042)(7.97)^{0.95}0.681^{0.22}0.150^{1.18}1039^{1.05}1.84^{-0.93}1.23^{0.19}$$

$$Q \text{ Mean} = 0.256 \text{ m}^3/\text{s} \text{ (256.4 l/s)}$$

- 3.4.67 The mean of the annual maximum flood flow of the receiving stream immediately upstream of the discharge point is only $0.256 \text{ m}^3/\text{s}$ (since the effects of the flooding are buffered by the large area of lake upstream), based on the characteristics of the catchment.

3.4.68 Coolagarry Lough is in hydraulic connectivity with the ground water table. All the run-off and ground water recharge within the surface water catchment of the lake will collect in the lake. The lake will buffer the discharge to the Ballyglass River such that there is little variation in dry weather and flood flow conditions in the river immediately downstream on the lake discharge point. A preliminary water balance for the catchment of the Ballyglass River above the proposed quarry water discharge point suggests that the maximum average discharge should be approximately 176l/s (based on the recharge figures of Kelly and Lee, 2003). Estimates of the catchment mean flow using the recharge figures of Kelly and Lee (2003) range from 126l/s to 149l/s. The average mean flood discharge for the Ballyglass River at the proposed discharge point is therefore around 85% greater than the mean discharge.

Determination of Q_{50} and Q_{100} from Q Mean of the Ballyglass River

3.4.69 A series of growth factors for flood flows of varying recurrence intervals was determined for Ireland (Cunnane & Lynn, 1976). The Q_{50} and Q_{100} multipliers are, respectively, 1.77 and 1.96. (These values are determined from the relationship between Q_T/Q Mean and the Extreme Value Type 1 Reduced Variate)

3.4.70 For the receiving stream above the discharge point, the 50-year and 100-year floods would be expected to be:

$$Q_{50} = (0.256\text{m}^3/\text{s})(1.77) = 0.454\text{m}^3/\text{s} (454 \text{ l/s})$$

$$Q_{100} = (0.256\text{m}^3/\text{s})(1.96) = 0.503\text{m}^3/\text{s} (503 \text{ l/s})$$

3.4.71 The buffering effect of the lake is marked since the predicted precipitation (based upon the *Flood Studies Report* Methodologies) within the catchment during a 24 hour duration 50 and 100 year return period storm event are 6,550l/s and 7,400l/s respectively.

In Summary:

Table No. 3.4.6: Summary of Likely Flows in the Ballyglass River at the Proposed Quarry Water Discharge Point

Discharge Conditions in Ballyglass River	Lower Value (l/s)	Upper Value (l/s)
Dry Weather Flow	0.16	2.5
Mean Flow	113	149
Annual Maximum Flood Flow (Q)	233	256
Q_{50}	413	454
Q_{100}	458	503

Mixing Proportion of the Ballyglass River discharge and potential quarry water discharge

3.4.72 OGE have calculated the likely discharge of water from the proposed quarry when developed to a elevation of 40 metres O.D. as 2600m³/day or 30l/s. The calculations of the likely quarry water discharges are presented in the Factual Hydrogeological Report as Appendix 3.4.1. In Table No. 3.4.7 the portion of the likely total discharge in the Ballyglass River at the quarry water discharge point is shown under different flow regimes in the river. During dry flow conditions the quarry discharge water is likely to comprise between 92.3% and 99.5% of the total discharge in the Ballyglass River at the proposed discharge point. During mean flow conditions the quarry discharge water is likely to comprise between 16.6% and 21% of the total discharge in the Ballyglass River at the proposed discharge point. During average flood flow conditions the quarry discharge water is likely to comprise between 10.5% and 11.4% of the total discharge in the Ballyglass River at the proposed discharge point. If the quarry were to discharge the maximum potential of the effluent treatment system of 10Ml/day (115l/s) during a flooding event this would increase the discharge in the Ballyglass River (during a typical annual flooding event) by approximately 50%, i.e., the discharge would comprise approximate 33% of the total volume of water in the river. This figure is just above the discharge component during mean flow when the quarry discharge will be 2.6Ml/day.

Table No. 3.4.7: Relative Proportions of Proposed Quarry Discharge Water in the Ballyglass River during Different Discharge Conditions

Discharge Conditions in Ballyglass River	% of total discharge derived from potential quarry water management using lower value of river discharge (l/s)	% of total discharge derived from potential quarry water management using upper value of river discharge (l/s)
Dry Weather Flow	99.5	92.3
Mean Flow	21	16.6
Annual Maximum Flood Flow (Q)	11.4	10.5
Q ₅₀	6.8	6.2
Q ₁₀₀	6.1	5.6

Capacity of channel & Instantaneous Discharge Readings

3.4.73 OGE collected measurements of the Ballyglass River at the proposed quarry water discharge point to estimate its carrying capacity (bank-full capacity).

3.4.74 The proposed quarry water discharge point is immediately south of the bridge over the Ballyglass River on the R343 at Cuilleenirwan, see Figure No. 3.4.6. The Ballyglass River is culverted into a 1200mm diameter concrete pipe at the bridge crossing. On the 1st September 2004 the average flow rate in this pipe was measured at 0.139m/s using a hand-held impellor flow meter. The water depth in the pipe was 0.27 metres. Using a simple velocity/area calculation the discharge at the

downstream end of the culvert was approximately 271/s. This is towards the lower end of the predicted flows in the Ballyglass River and not inconsistent with expected river levels in late summer being below the predicted mean flow but above dry weather flow.

- 3.4.75 The dimensions of the channel were recorded at two locations, one location 8 metres downstream from the culvert and a second a further 25 metres downstream from the first measurement point. As a visual assessment the eastern bank of the Ballyglass River was found to be lower than that of the western bank. The channel appears to have two components at these locations, a lower more incised channel and a more gently sloping upper profile. As a worst case scenario of the bank full capacity only the lower more incised channel was used in the calculations. As such the actual bank full capacities of the Ballyglass River at the study locations will probably exceed that calculated. The channel is locally overgrown. The water level in the stream was approximately 0.15 metres above the bed (1st September 2004). Based upon the high tide mark on the vegetation, the average annual flood level in the stream is approximately 0.35 metres above the level recorded on the 1st September 2004. The stream bed is rough and stoney. As of 15th August 2004 OGE have been unable to clarify with the Shannon Regional Fisheries Board whether the Ballyglass River is classified as salmonid. The predicted chemistry of the Ballyglass River after the addition of the proposed quarry discharge is however compared with the required chemistry for such rivers. The information collated was processed in a channel modelling programme *Flowmaster V6.1* to determine the bank full capacities. The bank full capacities of the Ballyglass River at the study locations are as follows; the results of the *Flowmaster v6.1* analyses are presented in *Appendix 3.4.6*.

Location 1, 8 metres south of culvert bank full capacity (based on a slope of 0.00123) = 4m³/s or 4,000l/s

Location 2, 33 metres south of culvert bank full capacity (based on a slope of 0.00123) = 3.3m³/s or 3,300l/s

- 3.4.76 Using *Flowmaster V6.1* and the assumed annual flood level in the Ballyglass River then the predicted discharge in the channel during such events can be calculated. The predicted annual average flood discharge in the Ballyglass River at the two locations ranged from 280l/s – 295 l/s, see *Appendix 3.4.9*. These values are consistent with modelled values of the annual mean flood flow of 233l/s - 256l/s. The water depth as recorded on the 1st September 2004 was approximately 0.15 metres. Using *Flowmaster V6.1* the calculated discharge in the Ballyglass River at the two study points on the 1st September 2004 ranged from 14l/s – 16l/s. These values are consistent with the discharge as measures on the downstream end of the culvert. The predicted flows in the Ballyglass River under various conditions are compared to the bank full capacity of the stream with and without the additional load of the proposed quarry water discharge in *Table No. 3.4.8*. If the quarry were to

discharge the potential maximum from the effluent discharge system on 10MI/day, then during a flooding event of 100 year return period the Channel of the Ballyglass River would be at less than 20% capacity.

Table 3.4.8: Percentage of Bank Full Capacity of the Ballyglass River under Various Flow Conditions

Discharge Conditions in Ballyglass River	Upper Value of River Discharge without Additional Quarry Water (l/s)	% of Channel Filled at Proposed Discharge Point (worst case bank full capacity 3.3m ³ /s)	Upper Value of River Discharge with Additional Quarry Water at 2.6MI/d (30l/s) (l/s)	% of Channel Filled at Proposed Discharge Point with Quarry Discharge (worst case bank full capacity 3.3m ³ /s)
Dry Weather Flow	2.5	0.08	32.5	0.99
Mean Flow	149	4.5	179	5.4
Annual Maximum Flood Flow (Q)	256	7.6	286	8.7
Q ₅₀	454	13.6	484	14.7
Q ₁₀₀	503	15.2	533	16.2

Quarry Water Management

3.4.77 The quarry will be developed in three benches with a maximum bench height of 19.8 metres to a total estimated elevation of 40 metres O.D. Ground water levels varied across the site from around 55 metres to 70 metres O.D in February 2004 and from around 60 metres to 75 metres O.D in June 2004. Ground water levels are generally lower within the karstified bedrock and higher in the relatively unkarstified bedrock forming the central area of the site. As the quarry is developed water collecting in the quarry void will have to be managed.

3.4.78 OGE compiled a Factual Hydrogeological Report on the site to calculate the likely amount of water that will need to be managed.

3.4.79 It is proposed that water from the quarry will be pumped via a pipeline to be discharged to the Ballyglass River some 1300 metres to the west of the site. The estimated fall between the north-western corner of the site and the Ballyglass River is approximately 20 metres. The fall on the pipeline is therefore approximately 0.016. Assuming the estimated average daily discharge rate of 2,600m³/day (30l/s) at the end of the life of the quarry and a welded uPVC pipeline, then the minimum pipe diameter that is required is 150mm. In *Appendix 3.4.7* the proposed settlement lagoon will have a capacity of 10MI/day. To discharge this amount of water would require a pipe of up to 255mm diameter. This pipe diameter is based upon an unpressurised system, the diameter would decrease if the system was pressurised and this would be determined in the final design. A pipe diameter of 255mm would therefore represent the maximum pipe diameter required. OGE propose that the discharge pipe is constructed to a diameter of 255mm to facilitate potential additional capacity although these levels of discharge are unlikely to ever be required. The likely

maximum daily discharges from the quarry would be 2.6ML/day. The potential impacts on the Ballyglass River are based upon these figures. Roadstone Provinces Limited will however seek a discharge licence based upon the theoretical maximum discharge from the quarry of 10ML/day. The likely impact on the river chemistry of such a discharge would however be less than those during dry flow conditions since such a level of discharge may only be required during periods of very heavy rainfall when discharges in the Ballyglass River are high. The bank full capacity of the Ballyglass River will accommodate such an increased discharge.

- 3.4.80 A discharge licence for the quarry water will be sought by Roadstone Provinces Limited from the Environment Section of Roscommon County Council.
- 3.4.81 In the above Local Hydrology section OGE have calculated the different flows in the Ballyglass River during different conditions in the river. All the calculations of likely flows within the Ballyglass River at the proposed discharge point are based on an estimate of the surface water catchment to the system above that point. In this report OGE have shown that the ground water and surface water catchments in the environs of the application site are probably not synonymous. In the Factual Hydrogeological Report that is reproduced as *Appendix 3.4.1*, OGE have calculated the likely discharges from the quarry to maintain dry working conditions as the extraction of limestone progresses. At a final bench level of 40.00m O.D. estimated discharges of ground water are likely to be of the order of 2.6 ML/day or 30 l/s based on a worst case estimate. This figure would represent the additional load on the Ballyglass River owing to the proposed quarrying activities. Within this OGE demonstrate that the ground water below the site discharges to both the Killeglan Spring catchment and that of the Cross River (Corkip Lough). The discharge of the quarry water to the Ballyglass River would therefore represent an increase in the discharge in this river. In *Table No. 3.4.7* the relative proportion of the predicted water likely to be discharged from the proposed development is compared to that of the predicted flows during different conditions in the river.
- 3.4.82 From *Table No. 3.4.7* it can be demonstrated that quarry discharges would only add an additional 6% to the total flow of the Ballyglass River (at the point of discharge) during a 100 year return period storm event. During such a storm event discharges from the quarry would remain constant as the lower parts of the working quarry would be allowed to flood owing to the volume of water accumulating in the quarry through direct precipitation. The volumes of water that would potentially accumulate in the quarry during a 50 year and 100 year return period event were calculated and the tabulated figures presented as *Appendix 3.4.5*. The mean direct precipitation to the proposed quarry over a 24 hour period during a 50 year return period storm event is estimated to be 0.559m³/s for the application area and 0.193m³/s for the quarry footprint. The mean direct

precipitation to the proposed quarry over a 24 hour period during a 100 year return period storm event is estimated to be 0.631m³/s for the application area and 0.218m³/s for the quarry footprint.

- 3.4.83 Dust suppression water will be sourced initially from ground water and surface run-off water may be utilised as the quarry develops. A production well (BH-PW2A) drilled during the hydrogeological investigation could be utilised as a water supply for the quarry operations. A safe yield of 30m³/day could currently be abstracted from this well. Water consumption for dust suppression measures is unlikely to exceed 5m³/day.
- 3.4.84 A wheel wash facility will be located within the quarry management area of the proposed development. Water to top-up the facilities to account for evaporitic losses will be sourced from ground water. OGE contend that water consumption for the wheel-wash facility would be less than 1m³/day. The site production well could be constructed to meet this need. The water used within the system will be re-cycled to minimize water usage.
- 3.4.85 Within the quarry management and concrete making areas, workshops and re-fuelling areas will be located on concrete surfaces. The drainage system for the areas of hardstanding including the block yard will be such that all run-off is collected within a central sump/reservoir and initially processed through an oil trap and klargestser system prior to being directed to the main quarry sump. In Table No. 3.4.9 OGE have calculated the likely daily mean and 1, 50, and 100 year return period storm event run-off from all areas of hardstanding (including surfaced roads) and roofs. The central sump/reservoir will have a volume of 300m³ (approximately 7 days of annual run-off) and the Klargestser oil inceptor should be capable of treating 20 l/s of water.

Table No. 3.4.9: Predicted run-off from areas of hardstanding on site

Quarry Management Area (hardstanding and roofs)	
Area of concrete slab in block yard	12,800m ²
Estimated area of hardstanding (including roads)	9,250m ²
Area of roofs (office and workshop)	534m ²
Total Area	22,584m²
Predicted run-off conditions	Volume of run-off m ³ /day (l/s)
Average daily mean	43.1m ³ (0.5l/s)
1 yr return period 24 hr event	833m ³ (9.6l/s)
50 yr return period 24 hr event	1604m ³ (18.5l/s)
100 yr return period 24 hr event	1812m ³ (21.1l/s)
Maximum short duration event based on Department of the Environment guidelines (applicable to drain design and not storage lagoon)	317 l/s

- 3.4.86 Water for drinking and to service the toilet facilities (located within the site office) will be supplied from the bored supply. Water consumption for these services is unlikely to exceed 3m³/day. The chemistry of the ground water meets drinking water standards, for those parameters tested. A UV filter will be installed to treat the water prior to consumption.
- 3.4.87 Waste water from the welfare facilities will be treated via a septic tank and percolation area located within the site boundaries. A separate site assessment has been carried out for the installation of the waste treatment system. Details of the site assessment which will included the location of the proposed percolation area are included *Appendix 3.4.8*. This facility is providing for forty-five permanent and temporary site employees.
- 3.4.88 The development will also comprise concrete making facilities. It is proposed to produce 50,000m³ of readymix concrete per annum. Each 1m³ of readymix concrete requires 150-170 litres of water. This level of production would require a water consumption of 8,500m³/yr or 30m³/day based on 5.5 day working week. This water will be sourced from the treated effluent that has passed through the effluent treatment system and is available for discharge and the surface run-off central storage sump/reservoir located in the quarry management area. In addition to the readymix concrete it is proposed to produce 5 million concrete blocks per annum. This would equate to approximately 40,000m³ of blocks and require 3,200m³/yr or 8.7m³/day of water to produce.

Table No: 3.4.10: Summary of Quarry Water Management System

Water inputs and abstraction relevant to the development	Water consumption	Water discharges to ground, water courses or other losses
Surface run-off and ground inputs to quarry 2,600m ³ /day	Concrete Block Making 8.7m ³ /day	Discharge to Ballyglass River daily average following treatment by the effluent treatment system 2,561.7m ³ /day
	Readymix Concrete 30m ³ /day	
Ground water abstraction from borehole 9m ³ /day	Dust suppression measures 5m ³ /day	Evaporitic losses 6m ³ /day
	Wheel-wash facility 1m ³ /day	
	Welfare facilities 3m ³ /day	Discharges to ground through effluent treatment system 3m ³ /day
Run-off on areas of hardstanding on site including block yard	Variable dependent on availability	43.1 m ³ Discharge to quarry sump and eventual discharge to Ballyglass River

HYDROGEOLOGY

Well Data

3.4.89 Well data was available in the records of the GSI, and water levels were obtained wherever possible from the wells local to, or within the proposed quarry. Water levels recorded by OGE are tabulated in Table No. 3.4.11; the locations of the wells are shown of Figure No. 3.4.7. The majority of the residences within the study area are on public water mains supply, so there is little reliance on ground water. All the houses and farms in the local area use septic tanks. Detailed ground water observations from the site wells are included within the Factual Hydrogeological Report (Appendix 3.4.1).

Table No 3.4.11: Summary of Site and Third Party Wells

Well No. and Owner	Ground Level m O.D.	Grid Reference	Depth of Well (m bgl)	Depth to water (m bgl)	Depth to Water (m O.D.)	Date Measured	Remarks
1. Site Monitoring BH1 (Roadstone Provinces Ltd)	84.20	E 190455 N 244044	46.00	16.51	67.70	26/06/04	
2. Site Monitoring BH3 (Roadstone Provinces Ltd)	101.58	E 190099 N 244700	61.40?	46.86	54.72	26/06/04	
3. Site Monitoring BH5 (Roadstone Provinces Ltd)	95.99	E 190606 N 244222	84.50	41.85	54.14	26/06/04	
4. Site Monitoring BH6 (Roadstone Provinces Ltd)	99.48	E 190211 N 244403	60.00	28.73	70.75	26/06/04	
5. Site Monitoring BH8 (Roadstone Provinces Ltd)	91.00	E 189939 N 244576	61.40?	35.36	55.64	26/06/04	
6. Site Monitoring BH9 (Roadstone Provinces Ltd)	96.48	E 189933 N244912	62.00	28.40	68.09	26/06/04	
7. Site Monitoring BH10 (Roadstone Provinces Ltd)	96.71	E 190273 N 244912	61.80?	41.89	54.82	26/06/04	
8. Site Monitoring BH11 (Roadstone Provinces Ltd)	87.35	E 189894 N 245238	56.00	26.04	61.31	26/06/04	
9. Site Monitoring MW1 (Roadstone Provinces Ltd)	88.40	E 190056 N 244348	39.00	34.61	53.79	26/06/04	
10. Site Monitoring MW2 (Roadstone Provinces Ltd)	90.28	E 190427 N 245328	39.00	27.26	63.02	26/06/04	

11. Pumping Well PW2A (Roadstone Provinces Ltd)	96.84	E 190281 N 244897	80.00	42.60	60.40	26/06/04	
12. Mr. John-Joe Kelly	NR	E 190132 N 242893*	NR	20.21	-	29/06/04	8" steel casing still useable Mains supply
13. Mrs. Donaghue	NR	E 190275 N 242770*	NR	15.40	-	29/06/04	6" steel casing, not used - Mains supply
14. Mrs. Bulter	NR	E189816 N 245464*	NR	26.92	-	23/06/04	6" steel casing, not used - Mains supply
15. Mr. Daley	NR	E 188664 N 244819*	NR	12.45	-	23/06/04	6" steel casing, not used - Mains supply
16. Mr. Keogh	NR	E 191247 N 242831*	NR	11.40	-	29/06/04	Not used but serviceable
17. Mr. Cooney	NR	E 190690 N 243349*	NR	6.15	-	29/06/04	Old hand dug well in Feacle Turlough

Ground Water Flow Directions

3.4.90 OGE have integrated the bedrock quality map (Apex Geoservices Limited), topographic information, site karst features and the ground water contours for June 2004 to assess the likely directions of ground water flow beneath the site. This information is presented on *Figures Nos. 3.4.3 and 3.4.4*. Using this information the primary bedrock structures and therefore the main ground water conduits can be determined. This interpretative map of the ground water flow directions is presented in *Figure No. 3.4.5a*. Three ground water areas beneath the application site have been determined. Essentially ground water flow directions have two components; where the rock is relatively unfractured, the permeability of the bedrock is low and ground water directions follow topographic contours. The water levels in the unfractured rock are elevated relative to those within the main ground water conduits:

Area 1 – northern and northeastern application site

3.4.91 Below Area 1 ground water generally flows from the areas of less fractured bedrock into a central fractured and karstified zone. Ground water discharges under the site in a southeasterly direction into the Cross River catchment. Rises in ground water levels in the central fractured zone of the site during the winter appear to correspond to the maximum flood levels in Corkip Lough (turlough).



Ground water therefore flows naturally from the Ballyglass surface water catchment to that of the Cross River catchment. Since most of the water available for recharge in this part of the site soaks to ground water most of the precipitation falling on this area of site will enter the Cross River system and not the Ballyglass system which is at odds with the surface water catchments for these systems.

Area 2 –western application site

- 3.4.92 It is likely that ground water beneath this part of the site flows from the topographically higher and less fractured rock from the east and then in south-southeasterly direction along a fractured zone. Ground water flows naturally from the Ballyglass surface water catchment to that of the Killeglan Public Water Supply. Since most of the water available for recharge in this part of this site soaks to ground water most of the precipitation falling on this area of site will enter the Killeglan system and not the Ballyglass system which is at odds with the surface water catchments for these systems.

Area 3 –southern application site

- 3.4.93 Ground water beneath this area of the site flows in south-southeasterly direction. This area is within the Zone of Contribution to the Killeglan Public Water Supply. It is not planned to extract any bedrock from this area. A wayleave of approximately 50 metres is designed between the most southern part of the planned extraction and the northern boundary of this area.

Recalculated Water Balance for Application Site

- 3.4.94 OGE have shown in the proceeding sections of this chapter that between 80% and 100% of all water falling on the site and available for run-off or recharge to the aquifer will in fact soak to ground water. OGE have also demonstrated that the ground water catchments within the application site differ from the surface water catchments on site (based upon topography). In the above section OGE have delineated the probable ground water catchments of the site. Using the Effective Rainfall data determined by OGE and Kelly and Lee (2003) the water balance for the site can be recalculated to determine the average annual volume of water soaking down into each ground water catchment and run-off to surface catchment within the site. *Table No. 3.4.12* shows the different ground water and surface catchment areas of the site and to which ground water and surface water system the effective rainfall for that area discharges to.

Table No. 3.4.12: Summary of Ground Water and Surface Water Catchments within Difference Sub-divisions of the Application Site

Application site area	Total Area m ²	Extractive Area m ²	Surface Water Catchment	Ground Water Catchment
Area 1 (northern site)	342,070	109,360	Ballyglass (north of discharge from Cuilleenirwan Lough)	Cross River (Corkip Lough)
Area 2 (western site)	249,560	127,640	Ballyglass (south of discharge from Cuilleenirwan Lough)	Killeglan
Area 3 (southern site)	88,370	n/a	Killeglan Public Water Supply Zone of Contribution	
	680,000	237,000		

3.4.95 The annual average effective rainfall figures for the site have been calculated as 543mm/yr (OGE) and 687mm/yr (Kelly and Lee, 2003). Assuming a 20% run-off figure, the partition of the water falling on the site to ground water and surface water within each area is calculated and presented in Table No. 3.4.13. For Areas 1 and 2 the water balance for the extractive areas within these site sub-divisions is also calculated.

Table No. 3.4.13: Revised Water Balance for the Application Site

Application site area	Average annual run-off volume and to which system (OGE ER figures) m ³	Average annual run-off volume and to which system (Kelly and Lee, 2003 ER figures) m ³	Average annual ground water recharge volume and to which system (OGE ER figures) m ³	Average annual ground water recharge volume and to which system (Kelly and Lee, 2003 ER figures) m ³
Area 1 all (northern site)	37,148 (yr) 101.7 (day) Ballyglass System	47,685 (yr) 130.5 (day) Ballyglass System	148,595 (yr) 406.8 (day) Cross River (Corkip Lough)	190,738 (yr) 522.2 (day) Cross River (Corkip Lough)
Area 1 (Extractive area)	[11,876 (yr) 32.5 (day) Ballyglass System]	[15,244 (yr) 41.7 (day) Ballyglass System]	[47,506 (yr) 130 (day) Cross River (Corkip Lough)]	[60,979 (yr) 167 (day) Cross River (Corkip Lough)]
Area 2 all (western site)	27,102 (yr) 74.2 (day) Ballyglass System	34,789 (yr) 95.2 (day) Ballyglass System	108,409 (yr) 296.8 (day) Killeglan	139,155 (yr) 381.0 (day) Killeglan
Area 2 (Extractive area)	[13,862 (yr) 38 (day) Ballyglass System]	[17,793 (yr) 48.7 (day) Ballyglass System]	55,447 (yr) 151.8 (day) Killeglan	71,172 (yr) 194.9 (day) Killeglan
Area 3 (southern site)	47,985 (yr) to 61,594 (yr) or 131.4 (day) to 168.6 (day) Killeglan			

Ground recharge and discharge

3.4.96 Recharge to the bedrock aquifer occurs at all points on the study site. In the central and western areas of the site, the bedrock aquifer is either exposed or underlain by relatively thin (< 3 metres) of overburden and highly weathered rock. There are no surface water courses either on or immediately adjacent to the site, and therefore majority of the precipitation falling on the site will recharge the bedrock aquifer. Where the overburden cover is thicker (3.00 to 10.00 metres) the permeability of the drift is such that diffuse aquifer recharge is possible. Within these areas of thicker overburden are areas of internal drainage some of which are probably related to karst collapse structures in the bedrock and thus represent swallow holes and points of discrete recharge. Kelly and Lee (2003) estimated that approximately 20% of the water available for potential run-off

within the zone of contribution to Killeglan Public Water Supply fails to recharge the aquifer. OGE would contend that this figure is probably also applicable to the application site.

- 3.4.97 Based upon observation taken during the constant rate pumping test during longer term monitoring of water levels in selected boreholes from the application site ground water recharge response times are rapid on the scale of a few hours.
- 3.4.98 As previously discussed the inferred limit of the zone of contribution to the Killeglan Public Water Supply is located within the southern part of the site. Ultimately ground water within the zone of contribution to Killeglan Public Water Supply will either discharge locally to the head of the Killeglan River or from other surface water discharge points within this ground water catchment (see Hydrology Section). Ground water below the eastern part of the application site will also discharge to the Zone of Contribution to the Killeglan Public Water Supply although this is to the north of the Zone of Contribution as defined by Lee and Kelly (2003). Ground water below the north part of the site will discharge towards Cross River catchment, although this area is located within the surface water catchment to the Ballyglass River.

Aquifer Classification

- 3.4.99 As discussed in Soils (and Geology) Section of this EIS, the site is underlain by Undifferentiated Visean Limestone. Rock core retrieved from the nine cored exploratory boreholes drilled on the site (and adjacent lands) do not contradict this interpretation. The County Roscommon Groundwater Protection Scheme, 2002 (Draft) classifies this aquifer as Rf – a regional important aquifer - fissure flow dominant and describes it thus:

“Overall, the Undifferentiated Visean Limestone generally comprises clean, highly karstified rocks, which are capable of sustaining significant yields, including six public water supply schemes.”

- 3.4.100 Evidence from the site geology confirms that the bedrock is indeed ‘clean’, i.e., generally lacking in clastic clays and shale beds and evidence of karstification, particularly in parts of the northern and eastern parts of the site is noted. However, in the areas of the bedrock that are karstified the majority of the fractures and fissures that would provide ground water conduits are clay-filled. Therefore although the permeability of the fractured and karstified zones is higher than the unfractured bedrock they are relatively low for karstified limestones. The Killeglan Public Supply Scheme located approximately 4 kilometres south-southwest is major public water supply sourced from the Undifferentiated Visean Limestone. However, the OGE Factual Hydrogeological Report (Appendix 3.4.1) suggests that potential yields in the bedrock aquifer below the application site are not significant.

3.4.101 The overburden deposits of the study area are not considered as potential aquifers.

Ground water Vulnerability and Resource Protection

3.4.102 The vulnerability of an aquifer is dependent upon the permeability of the overlying sub-soils and their thickness. In Table No. 3.4.14 the guidelines for assessing the vulnerability of an aquifer are defined.

Table No. 3.4.14: Vulnerability Mapping Guideline (Adapted from DELG, 1999)

Unsaturated Zone	Sub-soil Thickness	Hydrogeological Conditions (Diffuse Recharge: Sub-soil Permeability and Type)		
Sand and gravel aquifers only		High Permeability (sand/gravel)	Moderate Permeability (e.g. sandy sub-soil)	Low Permeability (e.g. Clayey sub-soil, clay, peat)
Extreme	0 – 3.0 m	Extreme	Extreme	Extreme
High	3.0 – 5.0 m	High	High	High
High	5.0 – 10.0 m	High	High	Moderate
High	> 10.0 m	High	Moderate	Low

3.4.103 The vulnerability (of the bedrock aquifer) is reproduced from that of the GSI and is shown as Figure No 3.4.8 as part of a resource protection classification map. The map (as reproduced from the records of the GSI) shows that over the majority of the site the bedrock aquifer is classified of **extreme** vulnerability, i.e., bedrock is relatively shallow (< 3 metres below ground level), although the geophysical evidence from the application site suggests the overburden is thicker than this under many areas. The sections of the eastern and northeastern parts of the site would be classified of **high** vulnerability based upon the records of the GSI. This interpretation is partly co-incident with the observed site geology where the areas of the northern and eastern parts of the site are underlain by thicker overburden and more fractured bedrock.

3.4.104 Based upon the site geology alone and incorporating depth to bedrock information from this chapter the central and western areas of the application site are characterised by shallow relatively unfractured bedrock and would be classified as being of **extreme** vulnerability. All other areas of the site would be classified of **high** vulnerability, since the overburden is probably of moderate permeability and ranges in thickness from approximately 3.00 to 10.00 metres.

3.4.105 As a consequence of the proposed development the topsoil and sub-soils will be stripped from the proposed extractive areas and stored as site screening bunds. The vulnerability of the bedrock aquifer will therefore become **extreme** (within the proposed extractive areas) during the quarrying operations.

- 3.4.106 Based upon the classifications of the aquifer underlying the site and the vulnerability of that aquifer, a resource protection classification for the aquifer can be assigned. The bedrock aquifer below the site would therefore generally have a resource protection classification of **Rf/H - Regionally Important Aquifer - fissure flow dominant of High Vulnerability**, locally **Rf/E - Regionally Important Aquifer - fissure flow dominant of Extreme Vulnerability**. As a consequence of the proposed development the resource protection classification of the bedrock aquifer in the extractive areas would become **Rf/E - Regionally Important Aquifer - fissure flow dominant of Extreme Vulnerability**.

Bedrock Aquifer Properties

- 3.4.107 As part of a hydrogeological investigation a pumping test was commenced at 12:32hrs on the 28th June 2004, and completed at 12:30hrs on the 1st July 2004, a period of 71.97hrs (4318 minutes). A hydrogeological report based upon the findings of the pump test was compiled by OGE, a copy of which is enclosed as Appendix 3.4.1 to this Section of the Environmental Impact Statement.
- 3.4.108 The bedrock aquifer is fractured and unconfined. Hydraulic gradients in the less fractured bedrock are approximately 0.07 whereas in the fractured and karstified bedrock the hydraulic gradient falls to approximately 0.007.
- 3.4.109 Analyses of the time/drawdown graphs for nearest monitoring well (Borehole BH10) during the pumping test suggested a Transmissivity (T) value of 12m²/d, and a storativity value of 1.4×10^{-4} . Assuming an aquifer thickness of 38 metres, then the Hydraulic Conductivity of the aquifer in this location is 0.14m/d (1.66×10^{-6} m/s). This Hydraulic Conductivity value would be considered medium to low.
- 3.4.110 The Pumping Well (PW2A) is located within a zone of fractured bedrock. The value of Hydraulic Conductivity recorded is therefore likely to be at the upper range of values for the bedrock beneath the site as a whole.

Existing Potential Contamination

- 3.4.111 None of the houses, farms and other commercial enterprises are served by mains sewerage and waste water is treated by septic tanks. Effluent from septic tanks is a potential point source of ground water contamination. OGE have assumed that all these residences have septic tanks and provide potential point sources for contamination. Farm yard waste also provides a probable point

source of ground water contamination. The other industrial, agricultural and commercial activities also provide possible point sources of contamination from spillages of fuel or other chemicals.

3.4.112 The proposed development would provide the following additional potential sources of surface and ground water contamination

- Septic tank servicing the on-site toilet facilities, located adjacent to the office;
- A bunded diesel tank to refuel mobile plant to be located within the quarry management area;
- Waste oils from the workshop to be located within the quarry management area;
- Accidental fuel or leaks from mobile plant;
- Potentially contaminated wash-down water within the workshop yard;
- The steam cleaning of plant in the workshop area may also produce potentially contaminated surface water run-off; and
- Potential contaminated run-off from precipitation and dust suppression measures.

Site Water Chemistry

3.4.113 A sample of the ground water was collected at the end of the pumping test and sent to Alcontrol Laboratories, Ballycoolin to be analysed for the list of parameters present in *Table No. 3.4.13*. A water sample from the Ballyglass River was collected on the 31st August 2004 and also analysed for the same parameters. The results of these analyses are also presented in *Table No. 3.4.13*.

Table No.3.4.15: Hydrochemical Results of the Ground Water Sample from the site and Surface Water Sample from the Ballyglass River

Parameter	Units	Ground Water Sample at end of pump test	Surface Water Sample from the Ballyglass River	Killeglan Public Water Supply from date supplied by Roscommon County sample dates FEB 02 to FEB 04 – median value	I/PV value	IGV values
pH		7.1	8.0	7.15	5.5-8.5*	$\geq 6.5 \leq 9.5$
Conductivity	($\mu\text{S}/\text{cm}$)	537	518	597	1000	1000
Dissolved Oxygen	(mg/l)	12.8	NR	-		
Total Dissolved Solids	mg/l	383	304	-	n/a	1,000
Ammoniacal Nitrogen	mg/l N	<0.2	<0.2	0.007 (Ammonia)	n/a	n/a

Parameter	Units	Ground Water Sample at end of pump test	Surface Water Sample from the Ballyglass River	Killeglan Public Water Supply from date supplied by Roscommon County sample dates FEB 02 to FEB 04 – median value	I/PV value	IGV values
Calcium	mg/l Ca	107.7	106.6	-	n/a	200
Chloride	mg/l Cl	10	13	-	200	30
Iron	mg/l Fe	0.017	0.132	0.048	0.1	0.2
Magnesium	mg/l Mg	3.95	3.10	-	n/a	50
Manganese	mg/l Mn	0.016	0.014	0.006	0.05	0.05
Potassium	mg/l K	0.2	2.0	-	n/a	5
Sodium	mg/l Na	5.8	7.3	-	200	150
Sulphate	mg/l SO ₄	4	<3	-	250	200
Total Alkalinity	mg/l CaCO ₃	240	310	-	n/a	n/a
Nitrate as NO ₃	mg/l	3.1	1.0	3.33	50	25
Nitrite as NO ₂	mg/l	<0.05	0.47	0.002	0.5	0.1
Phosphorus	mg/l P	<0.05	<0.05	-	n/a	n/a
Orthophosphate	mg/l PO ₄	<0.03	<0.03	0.005		
Colour	Hazen	1	93	21		
Total Suspended Solids	mg/l	10	<10	-		
Minerals Oils	µg/l	<10	<10	-		
Total Phenols	mg/l	<0.01	<0.01	0.01 (G/A3)		
Total PAH's (16 EPA species)	mg/l	<0.2	0.0003	-		
Oils, Fats and Greases	mg/l	<1	<1	-		
NSO/Resins	mg/l	<1	<1			
BOD unfiltered	mg/l	<2	3	<3 (G/A1)		
COD settled	mg/l	<15	44	30 (G/A3)		

* 75/44EEC "Surface Water Directive" guideline value for A1 waters

3.4.114 surface water quality results are given relative to the I/PV values set out in 75/44/EEC Council Directive of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States. This directive is informally referred to as the Surface Water Directive. The ground water results are being measured against the proposed standards for ground water as published by the EPA in the Interim Guideline Values for Groundwater.

3.4.115 The ground water and surface water samples were found to be a calcium-bicarbonate type typical of limestone terrains. The ground water sample does not exceed any of the Interim Guideline Values for Groundwater, nor since the water is intended for discharge to the Ballyglass River, does any of the parameters measured exceed the standards for surface water intended for drinking. Where the ground water sample from the site and the hydrochemical results of the on-going monitoring at the Killeglan have parameters in common the chemistry of both waters is similar.

Impact of Quarry Discharge on Killeglan Public Water Supply



3.4.116 OGE have estimated the likely daily discharges of surface run-off and ground water inflow to the quarry and proposed for discharge to the Ballyglass River is 2.6 MI/day. Higher discharges would be extremely infrequent and for short durations only. Some of this water is ground water from the Cross River system and other water would have naturally run-off to the Ballyglass River. The estimated worst case scenario of ground water inflow to the proposed development when the quarry floor is at an elevation of 40 m O.D is 1.3 MI/d. Of this worst case figure of 1.3 MI/day of ground water ingress, around 50% should be taken from the Cross River system. Therefore the worst case scenario of ground water loss and potential impact on the Killeglan source is around 650m³/day. The average daily amount of precipitation available for run-off and recharge in the zone of contribution to the Killeglan Public Water Supply is estimated as 80MI/day. The potential impact of the quarry development on the Killeglan source is therefore estimated at less than 1%.

Impact of Quarry Discharge on Corkip Lough

3.4.117 Corkip Lough was originally a turlough-type lake being feed by ground water and surface run-off. Drainage works have resulted in the lake becoming a turlough fed predominantly by ground water. As previously discussed the majority of precipitation falling within a catchment to a river or lake within this area soaks to ground water (c. 80%). Therefore the primary component of recharge to the lake will be from ground water. The majority of turloughs are fed by relatively shallow ground water emanating from the *epikarst*. Based upon the evidence presented in this report Corkip Lough lies at the down gradient end of a deep karst structure (and ground water conduit) that also underlies the northern part of the application site. Corkip Lough is therefore likely to have three recharge components:

- Ground water recharge from deeper karstified bedrock which is sourced from the north-west;
- Run-off within the surface water catchment to the lough; and,
- Shallow ground water from the *epikarst* also sourced from the surface water catchment.

3.4.118 The Working Group on Turloughs (formed as part of the Water Framework Directive) on which OGE are represented identifies the following pressures on turloughs:

- Changes to water inputs to the turlough by abstractive activities;
- Changes in drainage; and

- Changes in land use which could potential alter nutrient and/or sediment loads on the turlough.

3.4.119 Based upon the hydrogeological evidence, although Corkip Lough is probably located above an area of deep karstification, the lower karst probably provides little recharge to the turlough. The vast majority of the ground water recharge to the turlough will emanate from the *epikarst*. The quarry is only to be developed in the unfractured bedrock of the application site and the cone of depression formed as the quarry is developed to full depth is likely to be of limited extent. Furthermore, the cavities within area of fractured and karstified bedrock underlying the northern application area (and which may share a structure connection with Corkip Lough) are clay-filled and the permeability within the bedrock relatively low. It is likely therefore that the proposed quarry development will have little or no impact on Corkip Lough.

Impact of Quarry Discharge on Feacle Lough

3.4.120 Feacle Lough has been classified by the Working Group on Turloughs as a Mesotrophic turlough. This classification is based on the work of R. Goodwillie and the Duchas Ellenburgh classification. In ecological terms the turlough is therefore moderately productive but not sensitive within the terms of the Water Framework Directive. The turlough has already been impacted by other activities.

3.4.121 Most turloughs are fed by ground water from the *epikarst*. Based on the ground water levels in June 2004, Feacle Lough is up gradient from the karstified bedrock of Area 2 (Western Application Site). The ground water level in Borehole MW2 was approximately 54.00m O.D. in June 2004 whereas the water level below Feacle Lough was approximately 60.00 m O.D. The karstified bedrock below Area 2 of the Application site represents deep karst, whereas Feacle Lough is likely to be fed by shallow ground water from the *epikarst*. In general the relative ground water levels are lower in more karstified bedrock and this suggests that Feacle Lough is not fed by deep karst structures. Therefore, although ground water beneath the western and southern parts of the application site flow south-southeasterly in the general direction of Feacle Lough, the ground water that feeds this turlough is up gradient from the main ground water conduits below the site and as such the proposed quarry development will not impact the turlough.

Assimilative Capacity of Ballyglass River at the Proposed Discharge Point of the Quarry Water

3.4.122 OGE used *AquaChem v4.0* software to calculate the expected concentrations of each chemical parameter within the receiving water below the confluence with the discharge water under dry weather, mean flow and mean annual flood conditions. These mixing calculations are based upon a daily quarry discharge of 2.6Ml/day.

3.4.123 From the discharge and mixing calculations presented earlier in this chapter we can show that the receiving stream below the confluence with the discharge waters will comprise the following ratios of original receiving water and discharge water (based upon maximum discharge) under the following stream flow conditions:

- Dry Weather Conditions = 1 part original receiving water to 187.5 parts discharge water (0.00533:1 or 0.5% to 99.5%)
- Mean Flow Conditions = 3.77 part original receiving water to 1 part discharge water (1:0.265 or 79% to 21%)
- Mean Annual Flood Flow Conditions = 7.77 part receiving water to 1 part discharge water (1:0.129 or 88.6% to 11.4%)

3.4.124 The model calculates the resulting concentration by mixing the different solutions according to the equation below (*Aquachem v.4.0*, 2003):

$$C_z = \frac{\sum_{x,y} Q_x C_x + Q_y C_y}{\sum_{x,y} Q_x + Q_y}$$

Where C_z = Resultant concentration in stream (mg/l)

Q_x = Discharge rate of effluent (l/s)

C_x = Concentration of parameter in effluent (mg/l)

Q_y = Discharge rate of stream (l/s)

C_y = Concentration of parameter in stream (mg/l)

The predicted mixed waters are presented in *Table No. 3.4.16*.

Table No. 3.4.16: Predicted Hydrochemistry of Receiving Water Following Mixing with Discharge Water

Parameter	Units	Known		Predicted			Water Quality Standards		
		Discharge Water	Receiving Water above proposed discharge point	Dry Weather Conditions (lower flow limit)	Mean Flow (lower flow limit)	Mean Annual Flood Flow (lower flow limit)	Standard for surface water intended for drinking 75/440/EEC G-value	Standard for drinking water 80/778/EEC	Salmonid Waters Regulations (1988)
Values Calculated by AquaChem 4.0									
pH		7.1	8.0	7.1	7.6	7.7	6.5-8.5 (G/A1)		≥6 and ≤9
Electrical Conductivity	µs/cm	537	518	537	522	520	1000 (G/A1)		-
Total Dissolved Solids	Mg/l	383	304	383	321	313	-		-
Total Ammoniacal Nitrogen	mg/l N	<0.2	<0.2	<0.2	<0.2	<0.2	3.1 (l/A3) (as N)		≤0.821 (as N) Total Ammonium
Calcium	mg/l Ca	107.7	106.6	107.7	106.8	106.7	-	100 (G)	-
Chloride	mg/l Cl	10	13	10	12.4	12.6	200 (G/A1)	-	-
Magnesium	mg/l Mg	3.95	3.1	3.94	3.27	3.19	-	30 (G)	-
Potassium	mg/l K	0.2	2.0	0.2	1.6	1.	-	10 (G)	-
Sodium	mg/l Na	5.8	7.3	5.8	7.0	7.1	-	20 (G)	-
Sulphate	mg/l SO ₄	4	<3	4	3.2	3.1	150 (G/A1)		-
Total Alkalinity	mg/l CaCO ₃	240	310	240	295	302	-	-	-
Nitrate as NO ₃	mg/l	3.1	1.0	3.09	1.44	1.24	50 (l/A1-A3)		-
Total Suspended Solids	mg/l	10	<10	10	10	10	25 (G/A1)		≤25
Temperature	°C	11.1	NR	n/a	n/a	n/a	22 (G/A1)		-
Dissolved Oxygen	mg/l	12.8	NR	n/a	n/a	n/a	>30% (G/A3)		≥9%
Iron	mg/l Fe	0.017	0.132	0.021	0.107	0.117	0.1 (G/A1)		-
Manganese	mg/l Mn	0.016	0.014	0.020	0.012	0.011	0.05 (G/A1)		-

Parameter		Known		Predicted			Water Quality Standards		
Parameter	Units	Discharge Water	Receiving Water above proposed discharge point	Dry Weather Conditions (lower flow limit)	Mean Flow (lower flow limit)	Mean Annual Flood Flow (lower flow limit)	Standard for surface water intended for drinking 75/440/EEC G-value	Standard for drinking water 80/778/EEC	Salmonid Waters Regulations (1988)
Values Calculated by AquaChem 4.0									
Nitrite as NO ₂	mg/l	<0.05	0.47	0.05	0.38	0.42	-	0.1 (l)	≤0.05
Phosphorus	mg/l P	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-
BOD (unfiltered)	mg/l	<2	3	2	2.8	2.9	<3 (G/A1)	-	≤5
Total Phenols	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01 (G/A3)	-	-
COD (settled)	mg/l	<15	44	15	38	41	30 (G/A3)	-	-
Mineral Oils Screen (Mineral Oils or Hydrocarbons of Petroleum Origin)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	1.0 (l/A3)	-	-
NSO, Resins Screen (Mineral Oils or Hydrocarbons of Petroleum Origin)	mg/l	<1	<1	<1	<1	<1	1.0 (l/A3)	-	-
Total PAH Screen (Mineral Oils or Hydrocarbons of Petroleum Origin)	mg/l	<0.2	0.0003	<0.2	<0.2	<0.2	0.001 (l/A3)	-	-
Colour	Hazen Units	1	93	2	74	83	10 (G/A1)	-	-
Oils fats and Greases	mg/l	<1	<1	<1	<1	<1	1.0 (l/A3)	-	-
Orthophosphate as PO ₄	mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	0.09 (G/A1) mg/l P as P ₂ O ₅	-	-

¹ Assumes all in form of Ammonium (NH₄⁺) not Ammonia (NH₃)

Figures in italics are assumed.

Water Standards for Salmonid Rivers are quoted since the ecological status of Ballyglass River has not been confirmed



IMPACT OF PROPOSED DEVELOPMENT

Ground Water

Negative Impacts

- 3.4.125 The local ground water table in the immediate area of the quarry will be lowered during extraction to approximately 40 metres O.D. The evidence from the Hydrogeological Report (Appendix 3.4.1) is that the permeability of the bedrock aquifer (particularly in the planned extractive area) is relatively low and that relatively steep gradients will develop on the cone of drawdown around the site. The majority of the residences in the study area have access to mains water supply. The cone of depression is unlikely to impact third party wells adjacent to the site.
- 3.4.126 The likely impact on the Killeglan source from discharges of ground water that will ingress into the quarry are negligible, probably less than 1%.
- 3.4.127 The extractive area of the quarry is located within the unfractured bedrock where the permeability is low and steep hydraulic gradient is likely to develop behind the quarry faces. Limited seepage of ground water may occur from the areas more fractured and karstified bedrock. However since Feacle Lough and Corkip Lough are fed by ground water predominantly from the *epikarst* the proposed development is unlikely to significantly impact on these.
- 3.4.128 The local ground water quality may be affected by accidental spillages on the exposed limestone within the quarry if mitigating measures are not put into place. Domestic effluent will be collected and treated on site through a septic tank system as there is no mains sewerage scheme in the area.

Neutral or Indirect Impacts

- 3.4.129 Following completion of the extraction (to an elevation of 40 metres O.D.) the central section of the site will form a large void space.
- 3.4.130 Following completion of the extraction the void space within the central section of the quarry will fill with water to a surface level of around 55 metres O.D. (summer) and 60 metres O.D. (winter). The level of the quarry lake will fluctuate seasonally not unlike the neighbouring turloughs.
- 3.4.131 In the event of storm rainfall events, the water level in the quarry would not rise significantly because of the very large storage capacity provided by the flooded quarry.

Surface Waters

Neutral or Indirect Impacts

- 3.4.132 Discharge from the site will be to the Ballyglass River located to the west of the site. The discharge of quarry water will lead to an increase in the flow of the Ballyglass River of approximately 20% during mean flow conditions. The channel of the Ballyglass River is relatively large and will accommodate this increase in discharge. During a 100 year return period storm event the discharge will represent an increase of 6% above the predicted discharge for the Ballyglass River during such an event.

MITIGATION MEASURES FOR WATER RESOURCES

Ground water

- 3.4.133 A number of ground water monitoring boreholes have been constructed in the fractured bedrock beneath the application site adjacent to the extractive area. A programme of regular monitoring will be undertaken on these boreholes, the well at Feacle Lough and surface water levels in Corkip Lough. This will ensure that these designated sites are not being impacted by the operation.
- 3.4.134 If it is discovered that the excavation at the quarry is having an adverse affect on any local wells then an alternative water supply will be provided. However, based the hydrogeological evidence any impact on any third party well is unlikely and mains supply is available to the residences within the environs of the proposed development.
- 3.4.135 Measures will be taken at site to ensure that water entering the quarry does not become contaminated. The following procedures will be adhered to:
- All petroleum products and chemicals will be stored in paved and bunded areas. In particular all diesel tanks will be set upon concrete hardstanding and potential spillages contained within a bund wall with a minimum capacity of 110% of the total tank(s) volume. A sloping pre-fabricated galvanized roof will be added to the bund structures to prevent rainwater collecting within the bund and potentially becoming contaminated;
 - All waste oils and chemicals will be stored inside a workshop and disposed of off-site by a specialist contractor;
 - Refueling and maintenance of plant will take place in a designated facility which will be provided with a concrete surface. All run-off will be collected within a central sump/reservoir and initially processed through an oil trap and klargester system prior to being directed to the main quarry sump.

- The drainage system of the quarry management and concrete making areas will be designed so that all run-off and any potential spills will drain to a central point. This water will then pass through an oil interceptor prior to being directed to the main quarry sump.
- All other surface run-off, ground water ingress and dust suppression water (not lost through evaporation) will be discharged off site through the effluent treatment system. The settlement lagoon and klargest system will be located in the north-western part of the site as shown in the operation section of this EIS. Details of the effluent treatment system are presented in *Appendix 3.4.7*.

3.4.136 Effluent from the toilet facilities on site will be collected and treated in an on-site septic tank. A separate site suitability assessment has been carried out and this is presented as *Appendix 3.4.8*. The proposed location of the effluent percolation area is also shown on the site assessment form.

Surface Waters

3.4.137 The quality of the waters being discharged off site will be controlled by a licence to discharge trade effluent which will be sought under a separate application. The chemical compatibility of the Ballyglass River water and discharge water is assessed in this report and will also be presented in the discharge licence application. The assimilative capacity of the receiving water has also been assessed and the capacity of the channel to take the increased flow. The channel capacity of the Ballyglass River was found to be adequate to incorporate the projected increased flow. The projected quarry water discharge will not adversely impact the water chemistry of the Ballyglass River.

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Section 3.4 - Figures

APPENDIX 3.4.1

HYDROGEOLOGICAL REPORT COMPILED BY OGE FOR ROADSTONE PROVINCES LIMITED



HYDROGEOLOGICAL REPORT FOR PROPOSED QUARRY AT CURRY/CLOONACALTRY CO. ROSCOMMON FOR ROADSTONE PROVINCES LIMITED

Introduction

O'Neill Ground Water Engineering Limited (OGE) were engaged by Roadstone Provinces Limited to undertake a hydrogeological investigation for a proposed quarry site at Curry/Cloonacaltry, Co. Roscommon. The objective of that work was to establish the hydrogeological constraints to the full development of the proposed quarry. Essentially two questions were required to be answered.

- Can the quarry be developed to the maximum planned depth of approximately 40 to 70 metres bgl (40 metres O.D.);
- How much water would require to be managed and discharged as the quarry is deepened.

This report summarises the findings of a constant discharge rate pumping test carried out on the site between the 28th June 2004 and 1st July 2004, an Airlifting Test carried out on the 11th May 2004, and combines ground water information collected by OGE and Roadstone Provinces Limited over a six month period to provide answers to the above questions. All the data compiled during the constant discharge pumping test and ground water reading taken prior to the test is presented in tabular and graphic form in the Data Sheets at the end of this report. OGE installed pressure transducers in two boreholes (MW1 and MW2) to monitor trends within the ground water at these locations. This information is presented in tabular form within the Data Sheets at the end of this report. Ground water data from the other monitoring points compiled by OGE and Roadstone Provinces Limited is also presented within the Data Sheets at the end of this report. These two data sets are combined in graphical form with the rainfall data (sourced from Met Éireann) from the nearest weather station over this period to illustrate the medium term ground water trends below the site. This graph is also included in the Data Sheets.

Constant Discharge Pumping Test – Methodology

The pumping test was commenced at 12:32:00 on the 28th June 2004 and completed at 12:30:00 on the 1st July 2004, a period of 72 hours (4318 minutes). The recovery was measured from 12:30:00 on the 1st July 2004 to 12:35:00 on the 2nd July 2004, a period of 24 hours (1445 minutes).

Excluding the production well (PW2A) there were ten boreholes monitored during the test. The production well (PW2A) and two monitoring wells (MW1 and MW2) were drilled specifically for the undertaking of the hydrogeological investigation between March and May 2004. The production well was located within a central location of the application site within fractured bedrock probably associated with a fault zone. Details of the boreholes drilled for this investigation are contained within the appendices to the EIS Water Section. Eight other ground water monitoring boreholes previously constructed by Roadstone Provinces Limited either on the application site or in adjacent land were also monitored during the test. A location map of the site boreholes is contained within the EIS Water Section.

An Airlift test was carried out on the Production Well (PW2A) on the 11th May 2004. The maximum short term yield of the well was assessed at 0.56l/s. Details of the Airlift Test are contained within Data Sheets at the end of this report. Although the bedrock encountered within the production well was fractured the majority of these fractures appeared clay-filled. OGE assessed the predominant water making feature within the well was a cavity located at between 47.00 and 50.20 metres O.D. Only small inflows occurred from other levels.

On the basis of the observations of the Airlift Test, a pump was selected that could potentially abstract close to that of the maximum yield of the well. OGE assessed that if the water level in the production well was drawn down below the main cavity then the maximum safe yield of the well would be exceeded and the water level in the borehole would then rapidly drawdown. The initial flow rate from the production well at the start of the test was 0.265l/s, less than originally intended. The drawdown in the production well after a period of 22 hours (1344 minutes) was 1.40 metres from a rest level of 44.24 m below datum. A second pump was installed and started at 10:54:00 on the 29th June 2004. The discharge from the production well was increased to 0.41 l/s, approximately 75% of the estimated maximum yield of the well. After a period of 24.6 hours (1477 minutes) the second pump failed, however, a drawdown of 2.55 metres was achieved. The water level within the production well was therefore less than 1 metre above the main water bearing feature. The test was continued for a further 25.45 hours (1527 minutes) at the reduced pumping rate of 0.265 l/s. Details

of the data obtained during the test are presented in tabular form in the Data Sheets. A graph illustrating the drawdown in, and discharge from, the production well during the test is also shown in graphical form within the Data Sheets.

The water levels within the monitoring wells are detailed in tabular form within the Data Sheets. This information is also shown in graphical form in the Data Sheets. Maximum drawdown values within the monitoring wells are taken from the level of maximum drawdown in the production well approximately 47 hours from the start of the test. These details are summarised in *Table No. 1*.

Table No 1. Summary of Observed Pumping Test Results

Borehole	Static Water Level 28/06/04 prior to 12:32:00 m O.D.	Abstraction rate	Duration (minutes since start of the test)	Change in Water Level over Duration of Pumping Test (m)	Distance from Production Well (m)
Production Well PW2A	54.24	0.265 – 0.410 l/s		-2.55	-
BH1	67.70		2917	+0.730	871
BH3	54.72		2898	-0.035	268
BH5	54.14		2923	-0.085	749
BH6	70.75		2906	-0.24	499
BH8	55.64		2955	-0.055	469
BH9	68.09		2978	-0.30	354
BH10	54.82		2758	-0.89	17
BH11	61.31		2988	0.16	516
MW1	53.79		2948	-0.05	593
MW2	63.02		2736	0.04	455

Values in RED are drawdown, black values represent recovery during test

Rainfall

Periodic showers occurred during the pump test allowing limited recharge.

Hydrochemistry

The hydrochemical parameters of the discharge were monitored during the test. The results are presented with the main pump test data of the data sheet and also presented in graphical form in the Data Sheets. A water sample was taken at the end of the test and sent for analysis. The results of this analysis are presented in the EIS Water Section.

Ground Water Storage in the Bedrock

Based upon the medium term ground water monitoring results the average annual fluctuation in the ground water level below the site is approximately 10 metres. A probable upper range estimate of average interconnected porosity in the bedrock is around 4%. OGE would contend that effective porosity and storage will generally decrease with depth and in areas where the rock is less fractured.

As a first pass OGE have assumed that the average (of the whole rock mass to a final elevation of 40m O.D.) effective porosity and storativity in relatively unfractured limestone is around 1%. Karstified limestone can potentially have interconnected porosity of 15%, but the indications from the drilling work is that many of the fractures are clay filled. As a worst case scenario OGE have assumed that the highly fractured areas of limestone have interconnected porosity of approximately 10%. Moderately fractured limestones are assumed to have interconnected porosity of 2% - 5%. The quarry is to be located within the relatively unfractured bedrock. Based upon the estimates of the effective porosity of the bedrock and the planned area of extraction, OGE calculate a worst case scenario would require approximately 6,000m³ of ground water from storage to be managed per annum or 16.5m³ per day.

Ground Water Inflow and Drawdown under the Proposed Development

Based on the findings of the constant discharge rate pumping test a distance/drawdown relationship for the bedrock during the test can be constructed. A graph of the distance drawdown relationship for the pump test is shown in the Data Sheets. The regression line of the distance/drawdown curve was determined as the following:

$$y = 0.297\ln(x) - 1.85$$

The integral of the above equation is

$$= 0.297(\ln(x).x-x) - 1.85(x)$$

Since the maximum drawdown is at 0m from the pumping well and the zero drawdown point is 507m from the pumping well, the average drawdown can be estimated by integrating the above equation between the known limits. The integral of the above equation between the limits of 0 and 507 is thus



$$\begin{aligned} &= (0.297(\ln(507)507-507) -1.85(507))-(0.297(\ln(0)0-0) -1.85(0)) \\ &= (-1387.71+1675.24)-(0) \\ &= -150.65\text{m}^2 \end{aligned}$$

The average drawdown is therefore

$$150.65\text{m}^2/507\text{m} = 0.297\text{m}$$

The average calculated drawdown above is based upon a theoretical cone of drawdown with a circular plan. In reality the cone of drawdown would be elliptical and these calculations again represent a worst case scenario. The aerial extent of this theoretical cone of drawdown will be approximately 807,545m². The total rock volume within this cone of drawdown will therefore be 239,840m³.

Since an average discharge volume of 36.9m³/d, for the first 46.5 hours, produced 0.297m of drawdown over an area of an area of 807,545m², this discharge rate should therefore produce a theoretical 1 metre of drawdown over an area of 239,840m². Since the quarry footprint is believed to be 237,000m² the discharge rate to produce 1 metre of drawdown over the planned quarry area will be 36.5m³/d. Since the average summer ground water table in the proposed extractive area is 60m O.D. and therefore 20 metres of drawdown is required to maintain dry conditions in the quarry to an elevation of 40m O.D., then a discharge rate of 665m³/day should achieve this. Since the quarry is to be developed only in relatively unfractured bedrock and the there was evidence of recharge of the aquifer during the constant discharge rate pump test this figure should be considered a worst case scenario. It would be prudent however to build into any calculation of potential ground water inflow a safety margin of 100%. OGE would therefore contend that the likely ground water in flow to the quarry at a working level of 40 m O.D will be less than 1330m³/day.

Quarry Development and Discharges

Discharges from the quarry will have three components, effective rainfall, ground water released from storage and ground water inflow to retain dry conditions in the quarry. The level of effective rainfall requiring management is based upon the average daily effective rainfall falling on the application site. The amount of run-off requiring management (and discharge) as presented below is therefore the worst case scenario. Detailed water balance calculations for the site are presented in the EIS Water Section. The likely ground water discharges from the site as the quarry is developed are summarised in the *Table No. 2*.

Table No. 2: Summary of Likely Quarry Discharges

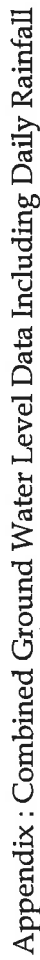
Bench No.	Precipitation daily average		Storage		Ground Water Inflow	
	Best Case	Worst Case	Best Case	Worst Case	Best Case	Worst Case
Bench 1 80m-110m O.D.	297 m ³ /day	1,297 m ³ /day	-	-	-	-
Bench 2 60m-80m O.D.	297 m ³ /day	1,297 m ³ /day	-	Localised small quantities	-	Limited and intermittent
Bench 3 40m-60m O.D.	297 m ³ /day	1,297 m ³ /day	5.5 m ³ /day	16.5 m ³ /day	<665 m ³ /day	1330 m ³ /day

Based upon the above table the worst case scenario for quarry water management when the quarry has been developed to an elevation of 40m O.D. is approximately 2.6ML/day, i.e., precipitation, water from storage and ground water inflow.

DATA SHEETS

7, South Main Street, Naas, Co. Kildare.

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email: info@groundwatereng.ie



Cam, Co. Roscommon for Roadstone Provinces

Contract Number: 060201/2

Compiled by : CDL 12/05/04

[illegible]

Date	Approximate Time of		Elapsed time days	Elapsed time	Rain	MW1	MW2	BH1	BH3	BH5	BH6	BH8	BH9	BH10	BH11
	Ground Water Readings														
13/03/04	12:00:00	23.00		hours	mm/day	O.D.	O.D.	O.D.	O.D.	O.D.	O.D.	O.D.	O.D.	O.D.	O.D.
14/03/04	12:00:00	24.00		552	4.9										
15/03/04	12:00:00	25.00		576	0.9										
16/03/04	12:00:00	26.00		600	2.3										
17/03/04	12:00:00	27.00		624	4.5										
18/03/04	12:00:00	28.00		648	2.5										
19/03/04	12:00:00	29.00		672	10.0										
20/03/04	12:00:00	30.00		696	9.50			13.42	41.60	35.81	24.86	31.24	23.87	36.82	20.52
21/03/04	12:00:00	31.00		720	10.00										
22/03/04	15:00:00	32.13		744	2.60										
22/03/04	18:30:00	32.27		771			27.74		41.08						
22/03/04	22:30:00	32.44		774.5			27.74								
23/03/04	2:30:00	32.60		778.5	4.00		27.74								
23/03/04	6:30:00	32.77		782.5			27.74								
23/03/04	10:30:00	32.94		786.5			27.72								
23/03/04	14:30:00	33.10		790.5			27.74								
23/03/04	18:30:00	33.27		798.5			27.72								
23/03/04	22:30:00	33.44		802.5	0.00		27.69								
24/03/04	2:30:00	33.60		806.5			27.69								
24/03/04	6:30:00	33.77		810.5			27.65								
24/03/04	10:30:00	33.94		814.5			27.62								
24/03/04	14:30:00	34.10		818.5			27.65								
24/03/04	18:30:00	34.27		822.5			27.65								
24/03/04	22:30:00	34.44		826.5	0.00		27.60								
25/03/04	2:30:00	34.60		830.5			27.57								
25/03/04	6:30:00	34.77		834.5			27.55								
25/03/04	10:30:00	34.94		838.5			27.55								
25/03/04	14:30:00	35.10		842.5			27.53								
25/03/04	18:30:00	35.27		846.5			27.53								
25/03/04	22:30:00	35.44		850.5	0.00		27.50								
26/03/04	2:30:00	35.60		854.5			27.51								
26/03/04	6:30:00	35.77		858.5			27.51								
26/03/04	10:30:00	35.94		862.5			27.53								
26/03/04	14:30:00	36.10		866.5			27.56								
26/03/04	18:30:00	36.27		870.5			27.56								
26/03/04	22:30:00	36.44		874.5	0.00		27.58								
27/03/04	2:30:00	36.60		878.5			27.61								
27/03/04	6:30:00	36.77		882.5			27.63								

Date	Approximate Time of Ground Water Readings	Elapsed time days	Elapsed time	Rain mm/day	MW1 Ground Water Level m O.D.	MW2 Ground Water Level m O.D.	BH1 Ground Water Level m O.D.	BH3 Ground Water Level m O.D.	BH5 Ground Water Level m O.D.	BH6 Ground Water Level m O.D.	BH8 Ground Water Level m O.D.	BH9 Ground Water Level m O.D.	BH10 Ground Water Level m O.D.	BH11 Ground Water Level m O.D.
27/03/04	10:30:00	36.94	886.5			27.65								
27/03/04	14:30:00	37.10	890.5			27.66								
27/03/04	18:30:00	37.27	894.5			27.70								
27/03/04	22:30:00	37.44	898.5	0.00		27.73								
28/03/04	2:30:00	37.60	902.5			27.75								
28/03/04	6:30:00	37.77	906.5			27.75								
28/03/04	10:30:00	37.94	910.5			27.75								
28/03/04	14:30:00	38.10	914.5			27.75								
28/03/04	18:30:00	38.27	918.5			27.75								
28/03/04	22:30:00	38.44	922.5	0.00		27.75								
29/03/04	2:30:00	38.60	926.5			27.78								
29/03/04	6:30:00	38.77	930.5			27.78								
29/03/04	10:30:00	38.94	934.5			27.78								
29/03/04	14:30:00	39.10	938.5			27.81								
29/03/04	18:30:00	39.27	942.5			27.83								
29/03/04	22:30:00	39.44	946.5	0.00		27.86								
30/03/04	2:30:00	39.60	950.5			27.88								
30/03/04	6:30:00	39.77	954.5			27.93								
30/03/04	10:30:00	39.94	958.5	0.00		27.93								
30/03/04	14:30:00	40.10	962.5			27.98								
30/03/04	18:30:00	40.27	966.5			27.98								
30/03/04	22:30:00	40.44	970.5	0.00		28.00								
31/03/04	2:30:00	40.60	974.5			28.02								
31/03/04	6:30:00	40.77	978.5			28.05								
31/03/04	10:30:00	40.94	982.5			28.08								
31/03/04	14:30:00	41.10	986.5			28.08								
31/03/04	18:30:00	41.27	990.5			28.08								
31/03/04	22:30:00	41.44	994.5	0.00		28.08								
01/04/04	2:30:00	41.60	998.5			28.10								
01/04/04	6:30:00	41.77	1002.5			28.13								
01/04/04	10:30:00	41.94	1006.5			28.13								
01/04/04	14:30:00	42.10	1010.5			28.15								
01/04/04	18:30:00	42.27	1014.5			28.17								
01/04/04	22:30:00	42.44	1018.5	1.20		28.18								
02/04/04	2:30:00	42.60	1022.5			28.16								
02/04/04	6:30:00	42.77	1026.5			28.15								
02/04/04	10:30:00	42.94	1030.5			28.15								
02/04/04	14:30:00	43.10	1034.5			28.15								
02/04/04	18:30:00	43.27	1038.5			28.16								

Date	Approximate Time of Ground Water Readings	Elapsed time days	Elapsed time hours	Rain mm/day	MW1 Ground Water Level m O.D.	MW2 Ground Water Level m O.D.	BH1 Ground Water Level m O.D.	BH3 Ground Water Level m O.D.	BH5 Ground Water Level m O.D.	BH6 Ground Water Level m O.D.	BH8 Ground Water Level m O.D.	BH9 Ground Water Level m O.D.	BH10 Ground Water Level m O.D.	BH11 Ground Water Level m O.D.
02/04/04	22:30:00	43.44	1042.5	5.40		28.15								
03/04/04	2:30:00	43.60	1046.5			28.16								
03/04/04	6:30:00	43.77	1050.5			28.18								
03/04/04	10:30:00	43.94	1054.5			28.16								
03/04/04	14:30:00	44.10	1058.5			28.13								
03/04/04	18:30:00	44.27	1062.5			28.13								
03/04/04	22:30:00	44.44	1066.5	2.90		28.09								
04/04/04	2:30:00	44.60	1070.5			28.09								
04/04/04	6:30:00	44.77	1074.5			28.09								
04/04/04	10:30:00	44.94	1078.5			28.09								
04/04/04	14:30:00	45.10	1082.5			28.09								
04/04/04	18:30:00	45.27	1086.5			28.04								
04/04/04	22:30:00	45.44	1090.5	4.60		28.07								
05/04/04	2:30:00	45.60	1094.5			28.07								
05/04/04	6:30:00	45.77	1098.5			28.07								
05/04/04	10:30:00	45.94	1102.5			28.06								
05/04/04	14:30:00	46.10	1106.5			28.04								
05/04/04	11:00:00	45.96	1103		29.63		13.24	41.70	35.99	24.57	31.12	20.68	36.47	19.00
05/04/04	15:05:00	46.13	1107.0833			28.04								
05/04/04	18:30:00	46.27	1110.5	1.50	29.63	27.98								
06/04/04	22:30:00	47.44	1138.5		29.65	27.98								
06/04/04	2:30:00	46.60	1118.5		29.65	27.98								
06/04/04	6:30:00	46.77	1122.5		29.70	27.98								
06/04/04	10:30:00	46.94	1126.5		29.70	28.01								
06/04/04	14:30:00	47.10	1130.5		29.72	27.99								
06/04/04	18:30:00	47.27	1134.5	1.40	29.75	27.99								
06/04/04	22:30:00	47.44	1138.5		29.77	27.99								
07/04/04	2:30:00	47.60	1142.5		29.77	28.00								
07/04/04	6:30:00	47.77	1146.5		29.77	28.00								
07/04/04	10:30:00	47.94	1150.5		29.79	28.00								
07/04/04	14:30:00	48.10	1154.5		29.82	27.98								
07/04/04	18:30:00	48.27	1158.5		29.84	27.93								
07/04/04	22:30:00	48.44	1162.5	0.00	29.84	27.96								
08/04/04	2:30:00	48.60	1166.5		29.86	27.96								
08/04/04	6:30:00	48.77	1170.5		29.86	27.98								
08/04/04	10:30:00	48.94	1174.5		29.89	27.98								
08/04/04	14:30:00	49.10	1178.5		29.93	27.99								
08/04/04	18:30:00	49.27	1182.5		29.93	28.01								
08/04/04	22:30:00	49.44	1186.5	2.10	29.96	28.02								

Date	Approximate Time of Ground Water Readings	Elapsed time days	Elapsed time	Rain mm/day	MW1 Ground Water Level m O.D.	MW2 Ground Water Level m O.D.	BH1 Ground Water Level m O.D.	BH3 Ground Water Level m O.D.	BH5 Ground Water Level m O.D.	BH6 Ground Water Level m O.D.	BH8 Ground Water Level m O.D.	BH9 Ground Water Level m O.D.	BH10 Ground Water Level m O.D.	BH11 Ground Water Level m O.D.
09/04/04	2:30:00	49.60	1190.5		29.93	28.04								
09/04/04	6:30:00	49.77	1194.5		29.98	28.02								
09/04/04	10:30:00	49.94	1198.5		30.00	28.02								
09/04/04	14:30:00	50.10	1202.5		30.03	28.07								
09/04/04	18:30:00	50.27	1206.5		30.05	28.07								
09/04/04	22:30:00	50.44	1210.5	0.00	30.05	28.05								
10/04/04	2:30:00	50.60	1214.5		30.05	28.08								
10/04/04	6:30:00	50.77	1218.5		30.07	28.11								
10/04/04	10:30:00	50.94	1222.5		30.10	28.08								
10/04/04	14:30:00	51.10	1226.5		30.12	28.11								
10/04/04	18:30:00	51.27	1230.5		30.14	28.11								
10/04/04	22:30:00	51.44	1234.5	0.00	30.14	28.09								
11/04/04	2:30:00	51.60	1238.5		30.16	28.12								
11/04/04	6:30:00	51.77	1242.5		30.16	28.14								
11/04/04	10:30:00	51.94	1246.5		30.19	28.12								
11/04/04	14:30:00	52.10	1250.5		30.24	28.14								
11/04/04	18:30:00	52.27	1254.5		30.21	28.15								
11/04/04	22:30:00	52.44	1258.5	0.60	30.23	28.15								
12/04/04	2:30:00	52.60	1262.5		30.26	28.15								
12/04/04	6:30:00	52.77	1266.5		30.25	28.15								
12/04/04	10:30:00	52.94	1270.5		30.28	28.15								
12/04/04	12:00:00	53.00	1272				13.35	42.90	37.25	24.80	32.37	22.72	37.51	20.48
12/04/04	14:30:00	53.10	1274.5		30.28	28.15								
12/04/04	18:30:00	53.27	1278.5		30.27	28.16								
12/04/04	22:30:00	53.44	1282.5	0.00	30.37	28.18								
13/04/04	2:30:00	53.60	1286.5		30.42	28.19								
13/04/04	6:30:00	53.77	1290.5		30.46	28.21								
13/04/04	10:30:00	53.94	1294.5		30.51	28.24								
13/04/04	14:30:00	54.10	1298.5		30.56	28.26								
13/04/04	18:30:00	54.27	1302.5		30.58	28.29								
13/04/04	22:30:00	54.44	1306.5	0.80	30.63	28.32								
14/04/04	2:30:00	54.60	1310.5		30.65	28.34								
14/04/04	6:30:00	54.77	1314.5		30.69	28.39								
14/04/04	10:30:00	54.94	1318.5		30.72	28.39								
14/04/04	14:30:00	55.10	1322.5		30.77	28.44								
14/04/04	18:30:00	55.27	1326.5		30.79	28.47								
14/04/04	22:30:00	55.44	1330.5	9.50	30.82	28.45								
15/04/04	2:30:00	55.60	1334.5		30.84	28.47								
15/04/04	6:30:00	55.77	1338.5		30.86	28.47								

Date	Approximate Time of Ground Water Readings	Elapsed time days	Elapsed time	Rain mm/day	MW1 Ground Water Level m O.D.	MW2 Ground Water Level m O.D.	BH1 Ground Water Level m O.D.	BH3 Ground Water Level m O.D.	BH5 Ground Water Level m O.D.	BH6 Ground Water Level m O.D.	BH8 Ground Water Level m O.D.	BH9 Ground Water Level m O.D.	BH10 Ground Water Level m O.D.	BH11 Ground Water Level m O.D.
15/04/04	10:30:00	55.94	1342.5		30.88	28.45								
15/04/04	14:30:00	56.10	1346.5		30.90	28.48								
15/04/04	18:30:00	56.27	1350.5		30.93	28.48								
15/04/04	22:30:00	56.44	1354.5	2.70	30.93	28.51								
16/04/04	2:30:00	56.60	1358.5		30.95	28.49								
16/04/04	6:30:00	56.77	1362.5		30.97	28.51								
16/04/04	10:30:00	56.94	1366.5		30.99	28.53								
16/04/04	14:30:00	57.10	1370.5		31.02	28.56								
16/04/04	18:30:00	57.27	1374.5		31.02	28.59								
16/04/04	22:30:00	57.44	1378.5	2.40	31.07	28.59								
17/04/04	2:30:00	57.60	1382.5		31.09	28.64								
17/04/04	6:30:00	57.77	1386.5		31.14	28.71								
17/04/04	10:30:00	57.94	1390.5		31.18	28.77								
17/04/04	14:30:00	58.10	1394.5		31.23	28.82								
17/04/04	18:30:00	58.27	1398.5		31.23	28.84								
17/04/04	22:30:00	58.44	1402.5	9.60	31.25	28.84								
18/04/04	2:30:00	58.60	1406.5		31.30	28.87								
18/04/04	6:30:00	58.77	1410.5		31.30	28.89								
18/04/04	10:30:00	58.94	1414.5		31.35	28.90								
18/04/04	14:30:00	59.10	1418.5		31.39	28.87								
18/04/04	18:30:00	59.27	1422.5		31.39	28.88								
18/04/04	22:30:00	59.44	1426.5	0.00	31.39	28.88								
19/04/04	2:30:00	59.60	1430.5		31.41	28.88								
19/04/04	6:30:00	59.77	1434.5		31.46	28.93								
19/04/04	10:30:00	59.94	1438.5		31.46	28.93								
19/04/04	14:30:00	60.10	1442.5		31.48	28.96								
19/04/04	18:30:00	60.27	1446.5		31.48	28.86								
19/04/04	22:30:00	60.44	1450.5	1.90	31.48	28.84								
20/04/04	2:30:00	60.60	1454.5		31.51	28.87								
20/04/04	6:30:00	60.77	1458.5		31.53	28.89								
20/04/04	10:30:00	60.94	1462.5		31.53	28.89								
20/04/04	14:30:00	61.10	1466.5		31.55	28.94								
20/04/04	18:30:00	61.27	1470.5		31.62	28.99								
20/04/04	22:30:00	61.44	1474.5	3.50	31.62	29.02								
21/04/04	2:30:00	61.60	1478.5		31.65	29.00								
21/04/04	6:30:00	61.77	1482.5		31.67	29.02								
21/04/04	10:30:00	61.94	1486.5		31.64	29.03								
21/04/04	14:30:00	62.10	1490.5		31.65	29.00								
21/04/04	18:30:00	62.27	1494.5		31.67	29.01								

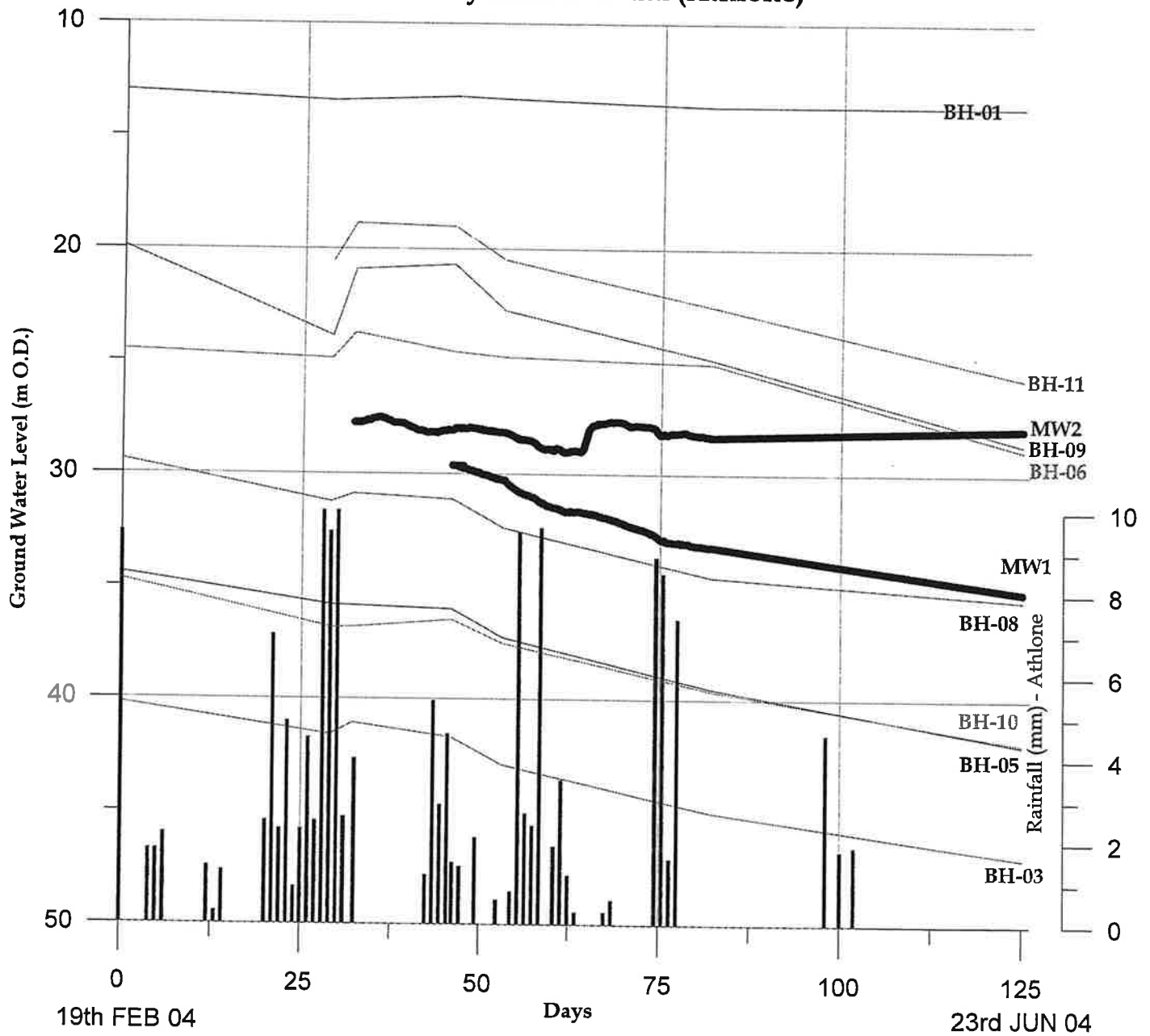
Date	Approximate Time of Ground Water Readings	Elapsed time days	Elapsed time	Rain mm/day	MW1 Ground Water Level m	MW2 Ground Water Level m	BH1 Ground Water Level m	BH3 Ground Water Level m	BH5 Ground Water Level m	BH6 Ground Water Level m	BH8 Ground Water Level m	BH9 Ground Water Level m	BH10 Ground Water Level m	BH11 Ground Water Level m
21/04/04	22:30:00	62.44	1498.5	1.20	31.62	28.96	O.D.	O.D.	O.D.	O.D.	O.D.	O.D.	O.D.	O.D.
22/04/04	23:00:00	62.60	1502.5		31.64	28.96								
22/04/04	6:30:00	62.77	1506.5		31.64	28.96								
22/04/04	10:30:00	62.94	1510.5		31.67	28.94								
22/04/04	14:30:00	63.10	1514.5		31.65	28.95								
22/04/04	18:30:00	63.27	1518.5		31.65	28.97								
22/04/04	22:30:00	63.44	1522.5	0.30	31.65	28.97								
23/04/04	2:30:00	63.60	1526.5		31.64	28.98								
23/04/04	6:30:00	63.77	1530.5		31.67	29.00								
23/04/04	10:30:00	63.94	1534.5		31.67	28.95								
23/04/04	14:30:00	64.10	1538.5		31.69	28.91								
23/04/04	18:30:00	64.27	1542.5		31.69	28.76								
23/04/04	22:30:00	64.44	1546.5	0.00	31.69	28.60								
24/04/04	2:30:00	64.60	1550.5		31.69	28.43								
24/04/04	6:30:00	64.77	1554.5		31.72	28.24								
24/04/04	10:30:00	64.94	1558.5		31.74	28.03								
24/04/04	14:30:00	65.10	1562.5		31.72	27.93								
24/04/04	18:30:00	65.27	1566.5		31.76	27.91								
24/04/04	22:30:00	65.44	1570.5	0.00	31.74	27.84								
25/04/04	2:30:00	65.60	1574.5		31.76	27.81								
25/04/04	6:30:00	65.77	1578.5		31.78	27.79								
25/04/04	10:30:00	65.94	1582.5		31.78	27.79								
25/04/04	14:30:00	66.10	1586.5		31.81	27.75								
25/04/04	18:30:00	66.27	1590.5		31.83	27.75								
25/04/04	22:30:00	66.44	1594.5	0.00	31.85	27.73								
26/04/04	2:30:00	66.60	1598.5		31.85	27.75								
26/04/04	6:30:00	66.77	1602.5		31.88	27.73								
26/04/04	10:30:00	66.94	1606.5		31.90	27.74								
26/04/04	14:30:00	67.10	1610.5		31.90	27.73								
26/04/04	18:30:00	67.27	1614.5		31.90	27.71								
26/04/04	22:30:00	67.44	1618.5	0.30	31.93	27.69								
27/04/04	2:30:00	67.60	1622.5		31.95	27.67								
27/04/04	6:30:00	67.77	1626.5		31.95	27.67								
27/04/04	10:30:00	67.94	1630.5		31.97	27.65								
27/04/04	14:30:00	68.10	1634.5		31.99	27.67								
27/04/04	18:30:00	68.27	1638.5		32.02	27.68								
27/04/04	22:30:00	68.44	1642.5	0.60	32.02	27.66								
28/04/04	2:30:00	68.60	1646.5		32.02	27.66								
28/04/04	6:30:00	68.77	1650.5		32.04	27.66								

Date	Approximate Time of Ground Water Readings	Elapsed time days	Elapsed time hours	Rain mm/day	MW1 Ground Water Level m	MW2 Ground Water Level m	BH1 Ground Water Level m	BH3 Ground Water Level m	BH5 Ground Water Level m	BH6 Ground Water Level m	BH8 Ground Water Level m	BH9 Ground Water Level m	BH10 Ground Water Level m	BH11 Ground Water Level m
28/04/04	10:30:00	68.94	1654.5		32.07	27.66								
28/04/04	14:30:00	69.10	1658.5		32.09	27.66								
28/04/04	18:30:00	69.27	1662.5		32.11	27.66								
28/04/04	22:30:00	69.44	1666.5	0.00	32.13	27.67								
29/04/04	2:30:00	69.60	1670.5		32.13	27.70								
29/04/04	6:30:00	69.77	1674.5		32.16	27.70								
29/04/04	10:30:00	69.94	1678.5		32.20	27.72								
29/04/04	14:30:00	70.10	1682.5		32.20	27.75								
29/04/04	18:30:00	70.27	1686.5		32.25	27.80								
29/04/04	22:30:00	70.44	1690.5	0.00	32.25	27.80								
30/04/04	2:30:00	70.60	1694.5		32.27	27.85								
30/04/04	6:30:00	70.77	1698.5		32.30	27.85								
30/04/04	10:30:00	70.94	1702.5		32.32	27.86								
30/04/04	14:30:00	71.10	1706.5		32.32	27.83								
30/04/04	18:30:00	71.27	1710.5		32.34	27.84								
30/04/04	22:30:00	71.44	1714.5	0.00	32.34	27.81								
01/05/04	2:30:00	71.60	1718.5		32.36	27.84								
01/05/04	6:30:00	71.77	1722.5		32.37	27.84								
01/05/04	10:30:00	71.94	1726.5		32.39	27.82								
01/05/04	14:30:00	72.10	1730.5		32.41	27.84								
01/05/04	18:30:00	72.27	1734.5		32.41	27.85								
01/05/04	22:30:00	72.44	1738.5	0.0	32.43	27.82								
02/05/04	2:30:00	72.60	1742.5		32.46	27.85								
02/05/04	6:30:00	72.77	1746.5		32.46	27.85								
02/05/04	10:30:00	72.94	1750.5		32.48	27.85								
02/05/04	14:30:00	73.10	1754.5		32.51	27.85								
02/05/04	18:30:00	73.27	1758.5		32.53	27.86								
02/05/04	22:30:00	73.44	1762.5	0.0	32.55	27.86								
03/05/04	2:30:00	73.60	1766.5		32.60	27.88								
03/05/04	6:30:00	73.77	1770.5		32.60	27.89								
03/05/04	10:30:00	73.94	1774.5		32.62	27.89								
03/05/04	14:30:00	74.10	1778.5		32.65	27.94								
03/05/04	18:30:00	74.27	1782.5		32.69	27.96								
03/05/04	22:30:00	74.44	1786.5	8.9	32.74	28.06								
04/05/04	2:30:00	74.60	1790.5		32.78	28.14								
04/05/04	6:30:00	74.77	1794.5		32.83	28.19								
04/05/04	10:30:00	74.94	1798.5		32.85	28.23								
04/05/04	14:30:00	75.10	1802.5		32.90	28.24								
04/05/04	18:30:00	75.27	1806.5		32.90	28.20								

Date	Approximate Time of		Elapsed time days		Elapsed time	Rain	MW1	MW2	BH1	BH3	BH5	BH6	BH8	BH9	BH10	BH11
	Ground Water Readings		time													
04/05/04	22:30:00	75.44	1810.5	8.5		32.87	28.17									
05/05/04	2:30:00	75.60	1814.5			32.92	28.20									
05/05/04	6:30:00	75.77	1818.5			32.95	28.22									
05/05/04	10:30:00	75.94	1822.5			32.97	28.22									
05/05/04	14:30:00	76.10	1826.5			32.97	28.20									
05/05/04	18:30:00	76.27	1830.5			32.97	28.18									
05/05/04	22:30:00	76.44	1834.5	1.6		32.97	28.16									
06/05/04	2:30:00	76.60	1838.5			32.99	28.18									
06/05/04	6:30:00	76.77	1842.5			32.99	28.16									
06/05/04	10:30:00	76.94	1846.5			33.01	28.17									
06/05/04	14:30:00	77.10	1850.5			33.01	28.17									
06/05/04	18:30:00	77.27	1854.5			32.99	28.17									
06/05/04	22:30:00	77.44	1858.5	7.4		32.99	28.15									
07/05/04	2:30:00	77.60	1862.5			33.01	28.15									
07/05/04	6:30:00	77.77	1866.5			33.04	28.15									
07/05/04	10:30:00	77.94	1870.5			33.01	28.13									
07/05/04	14:30:00	78.10	1874.5			33.04	28.13									
07/05/04	18:30:00	78.27	1878.5			33.04	28.13									
07/05/04	22:30:00	78.44	1882.5	0.0		33.04	28.13									
08/05/04	2:30:00	78.60	1886.5			33.04	28.16									
08/05/04	6:30:00	78.77	1890.5			33.04	28.18									
08/05/04	10:30:00	78.94	1894.5			33.08	28.19									
08/05/04	14:30:00	79.10	1898.5			33.11	28.21									
08/05/04	18:30:00	79.27	1902.5			33.11	28.21									
08/05/04	22:30:00	79.44	1906.5	0.0		33.11	28.24									
09/05/04	2:30:00	79.60	1910.5			33.13	28.24									
09/05/04	6:30:00	79.77	1914.5			33.13	28.24									
09/05/04	10:30:00	79.94	1918.5			33.13	28.27									
09/05/04	14:30:00	80.10	1922.5			33.15	28.25									
09/05/04	18:30:00	80.27	1926.5			33.15	28.28									
09/05/04	22:30:00	80.44	1930.5	0.0		33.15	28.25									
10/05/04	2:30:00	80.60	1934.5			33.15	28.25									
10/05/04	6:30:00	80.77	1938.5			33.17	28.26									
10/05/04	10:30:00	80.94	1942.5			33.18	28.28									
10/05/04	14:30:00	81.10	1946.5			33.18	28.31									
10/05/04	18:30:00	81.27	1950.5			33.20	28.31									
10/05/04	22:30:00	81.44	1954.5	0.0		33.20	28.31									
11/05/04	2:30:00	81.60	1958.5			33.20	28.32									
11/05/04	6:30:00	81.77	1962.5			33.20	28.34									

Date	Approximate Time of Ground Water Readings	Elapsed time days	Elapsed time hours	Rain mm/day	MW1 Ground Water Level m O.D.	MW2 Ground Water Level m O.D.	BH1 Ground Water Level m O.D.	BH3 Ground Water Level m O.D.	BH5 Ground Water Level m O.D.	BH6 Ground Water Level m O.D.	BH8 Ground Water Level m O.D.	BH9 Ground Water Level m O.D.	BH10 Ground Water Level m O.D.	BH11 Ground Water Level m O.D.
11/05/04	10:30:00	81.94	1966.5		33.20	28.34	13.66	45.01	39.51	25.09	34.55	24.89	39.60	22.54
11/05/04	13:00:00	82.04	1969	0.0	33.20	28.34								
12/05/04	12:00:00	83.0	1992	0.0										
13/05/04	12:00:00	84.0	2016	0.0										
14/05/04	12:00:00	85.0	2040	0.0										
15/05/04	12:00:00	86.0	2064	0.0										
16/05/04	12:00:00	87.0	2088	0.0										
17/05/04	12:00:00	88.0	2112	0.0										
18/05/05	12:00:00	454.0	10896	0.0										
19/05/04	12:00:00	90.0	2160	0.0										
20/05/04	12:00:00	91.0	2184	0.0										
21/05/04	12:00:00	92.0	2208	0.0										
22/05/04	12:00:00	93.0	2232	0.0										
23/05/04	12:00:00	94.0	2256	0.0										
24/05/04	12:00:00	95.0	2280	0.0										
25/05/04	12:00:00	96.0	2304	0.0										
26/05/04	12:00:00	97.0	2328	0.0										
27/05/04	12:00:00	98.0	2352	4.6										
28/05/04	12:00:00	99.0	2376	0.0										
29/05/04	12:00:00	100.0	2400	1.8										
30/05/04	12:00:00	101.0	2424	0.0										
31/05/04	12:00:00	102.0	2448	1.9										
23/06/04	12:00:00	125.0	3000		35.21	27.98	13.68	47.03	42.02	28.91	35.56	28.66	41.94	25.74

Long Term Ground Water Level and Daily Rainfall Data (Athlone)



O'Neill Ground Water Engineering

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Appendix : Pumping Test Data (MW1 long term monitoring)

Cam, Co. Roscommon for Roadstone Provinces

Contract Number: 060201/2

Compiled by : CDL 12/05/04

Date and Time	Elapsed		Elapsed		Elapsed		Logger reading bar	Logger Temp °C	Total Pressure Head	Manual	Corrected for drop	Water level m bd	Drift Correction	Water Level Corrected for drift
	Hours	Days	Mins	Seconds	Seconds	Seconds								
05.04.2004 11:48:00										29.63				
05.04.2004 18:35:25	336	14.00	20160.00		1209600.00		0.6961	9.7607	7.11		7.11	29.63	0.00	29.63
05.04.2004 22:35:25	340	14.17	20400.00		1224000.00		0.694	9.7759	7.09		7.09	29.65	0.00	29.65
06.04.2004 02:35:25	344	14.33	20640.00		1238400.00		0.6938	9.7607	7.09		7.09	29.65	0.00	29.65
06.04.2004 06:35:25	348	14.50	20880.00		1252800.00		0.6896	9.79	7.04		7.04	29.70	0.00	29.70
06.04.2004 10:35:25	352	14.67	21120.00		1267200.00		0.6894	9.7759	7.04		7.04	29.70	0.00	29.70
06.04.2004 14:35:25	356	14.83	21360.00		1281600.00		0.6871	9.7759	7.02		7.02	29.72	0.00	29.72
06.04.2004 18:35:25	360	15.00	21600.00		1296000.00		0.6847	9.7607	6.99		6.99	29.75	0.00	29.75
06.04.2004 22:35:25	364	15.17	21840.00		1310400.00		0.6826	9.7759	6.97		6.97	29.77	0.00	29.77
07.04.2004 02:35:25	368	15.33	22080.00		1324800.00		0.6824	9.7607	6.97		6.97	29.77	0.00	29.77
07.04.2004 06:35:25	372	15.50	22320.00		1339200.00		0.6826	9.7759	6.97		6.97	29.77	0.00	29.77
07.04.2004 10:35:25	376	15.67	22560.00		1353600.00		0.68	9.7451	6.95		6.95	29.79	0.00	29.79
07.04.2004 14:35:25	380	15.83	22800.00		1368000.00		0.6779	9.7607	6.92		6.92	29.82	0.00	29.82
07.04.2004 18:35:25	384	16.00	23040.00		1382400.00		0.6758	9.7759	6.90		6.90	29.84	0.00	29.84
07.04.2004 22:35:25	388	16.17	23280.00		1396800.00		0.6759	9.79	6.90		6.90	29.84	0.00	29.84
08.04.2004 02:35:25	392	16.33	23520.00		1411200.00		0.6735	9.7759	6.88		6.88	29.86	0.00	29.86
08.04.2004 06:35:25	396	16.50	23760.00		1425600.00		0.6731	9.7451	6.87		6.87	29.87	0.00	29.86

Date and Time	Elapsed		Elapsed		Elapsed	Logger reading	Logger Temp °C	Total Pressure Head	Manual	Corrected		Drift	Water level m	Water Level Corrected for drift
	Hours	Days	Mins	Seconds						for drop	bd			
08.04.2004 10:35:25	400	16.67	24000.00	1440000.00		0.671	9.7607	6.85		6.85	29.89	0.00	29.89	29.89
08.04.2004 14:35:25	404	16.83	24240.00	1454400.00		0.6663	9.7451	6.81		6.81	29.93	0.00	29.93	29.93
08.04.2004 18:35:25	408	17.00	24480.00	1468800.00		0.6663	9.7451	6.81		6.81	29.93	0.00	29.93	29.93
08.04.2004 22:35:25	412	17.17	24720.00	1483200.00		0.6642	9.7607	6.78		6.78	29.96	0.00	29.96	29.96
09.04.2004 02:35:25	416	17.33	24960.00	1497600.00		0.6663	9.7451	6.81		6.81	29.93	0.00	29.93	29.93
09.04.2004 06:35:25	420	17.50	25200.00	1512000.00		0.6621	9.7759	6.76		6.76	29.98	0.00	29.98	29.98
09.04.2004 10:35:25	424	17.67	25440.00	1526400.00		0.6598	9.7759	6.74		6.74	30.00	0.00	30.00	30.00
09.04.2004 14:35:25	428	17.83	25680.00	1540800.00		0.6572	9.7451	6.71		6.71	30.03	0.00	30.03	30.03
09.04.2004 18:35:25	432	18.00	25920.00	1555200.00		0.6549	9.7451	6.69		6.69	30.05	0.00	30.05	30.05
09.04.2004 22:35:25	436	18.17	26160.00	1569600.00		0.6549	9.7451	6.69		6.69	30.05	0.00	30.05	30.05
10.04.2004 02:35:25	440	18.33	26400.00	1584000.00		0.6553	9.7759	6.69		6.69	30.05	0.00	30.05	30.05
10.04.2004 06:35:25	444	18.50	26640.00	1598400.00		0.6528	9.7607	6.67		6.67	30.07	0.00	30.07	30.07
10.04.2004 10:35:25	448	18.67	26880.00	1612800.00		0.6504	9.7451	6.64		6.64	30.10	0.00	30.10	30.10
10.04.2004 14:35:25	452	18.83	27120.00	1627200.00		0.6484	9.7759	6.62		6.62	30.12	0.00	30.12	30.12
10.04.2004 18:35:25	456	19.00	27360.00	1641600.00		0.6458	9.7451	6.60		6.60	30.14	0.00	30.14	30.14
10.04.2004 22:35:25	460	19.17	27600.00	1656000.00		0.646	9.7607	6.60		6.60	30.14	0.00	30.14	30.14
11.04.2004 02:35:25	464	19.33	27840.00	1670400.00		0.6437	9.7607	6.57		6.57	30.17	0.00	30.16	30.16
11.04.2004 06:35:25	468	19.50	28080.00	1684800.00		0.6436	9.7451	6.57		6.57	30.17	0.00	30.16	30.16
11.04.2004 10:35:25	472	19.67	28320.00	1699200.00		0.6414	9.7607	6.55		6.55	30.19	0.00	30.19	30.19
11.04.2004 14:35:25	476	19.83	28560.00	1713600.00		0.6367	9.7451	6.50		6.50	30.24	0.00	30.24	30.24
11.04.2004 18:35:25	480	20.00	28800.00	1728000.00		0.6392	9.7607	6.53		6.53	30.21	0.00	30.21	30.21
11.04.2004 22:35:25	484	20.17	29040.00	1742400.00		0.6369	9.7607	6.51		6.51	30.23	0.00	30.23	30.23
12.04.2004 02:35:25	488	20.33	29280.00	1756800.00		0.6346	9.7607	6.48		6.48	30.26	0.00	30.26	30.26
12.04.2004 06:35:25	492	20.50	29520.00	1771200.00		0.6349	9.79	6.48		6.48	30.26	0.00	30.25	30.25
12.04.2004 10:35:25	496	20.67	29760.00	1785600.00		0.6324	9.7607	6.46		6.46	30.28	0.00	30.28	30.28
12.04.2004 14:35:25	500	20.83	30000.00	1800000.00		0.6324	9.7607	6.46		6.46	30.28	0.00	30.28	30.28
12.04.2004 18:35:25	504	21.00	30240.00	1814400.00		0.8805	9.7759	8.99		6.46	30.28	0.00	30.27	30.27
12.04.2004 22:35:25	508	21.17	30480.00	1828800.00		0.8709	9.73	8.90		6.37	30.37	0.00	30.37	30.37
13.04.2004 02:35:25	512	21.33	30720.00	1843200.00		0.8664	9.73	8.85		6.32	30.42	0.00	30.42	30.42
13.04.2004 06:35:25	516	21.50	30960.00	1857600.00		0.8622	9.7607	8.81		6.28	30.46	0.00	30.46	30.46
13.04.2004 10:35:25	520	21.67	31200.00	1872000.00		0.8576	9.7607	8.76		6.23	30.51	0.00	30.51	30.51

Date and Time	Elapsed		Elapsed		Elapsed	Seconds	Logger reading	Logger Temp °C	Total Pressure Head	Manual	Corrected for drop	Water level m	Drift Correction	Water Level Corrected for drift
	Hours	Days	Mins	Seconds										
13.04.2004 14:35:25	524	21.83	31440.00	1886400.00	0.8529	9.7451	8.71		6.18		30.56	0.00		30.56
13.04.2004 18:35:25	528	22.00	31680.00	1900800.00	0.8506	9.7451	8.69		6.16		30.58	0.00		30.58
13.04.2004 22:35:25	532	22.17	31920.00	1915200.00	0.8461	9.7451	8.64		6.11		30.63	0.00		30.63
14.04.2004 02:35:25	536	22.33	32160.00	1929600.00	0.8439	9.7607	8.62		6.09		30.65	0.00		30.65
14.04.2004 06:35:25	540	22.50	32400.00	1944000.00	0.8396	9.7759	8.58		6.05		30.69	0.00		30.69
14.04.2004 10:35:25	544	22.67	32640.00	1958400.00	0.837	9.7451	8.55		6.02		30.72	0.00		30.72
14.04.2004 14:35:25	548	22.83	32880.00	1972800.00	0.8324	9.7451	8.50		5.97		30.77	0.00		30.77
14.04.2004 18:35:25	552	23.00	33120.00	1987200.00	0.83	9.73	8.48		5.95		30.79	0.00		30.79
14.04.2004 22:35:25	556	23.17	33360.00	2001600.00	0.8275	9.7168	8.45		5.92		30.82	0.00		30.82
15.04.2004 02:35:25	560	23.33	33600.00	2016000.00	0.8254	9.73	8.43		5.90		30.84	0.00		30.84
15.04.2004 06:35:25	564	23.50	33840.00	2030400.00	0.8236	9.7759	8.41		5.88		30.86	0.00		30.86
15.04.2004 10:35:25	568	23.67	34080.00	2044800.00	0.8212	9.7607	8.39		5.86		30.88	0.00		30.88
15.04.2004 14:35:25	572	23.83	34320.00	2059200.00	0.8189	9.7607	8.36		5.83		30.91	0.00		30.90
15.04.2004 18:35:25	576	24.00	34560.00	2073600.00	0.8167	9.7607	8.34		5.81		30.93	0.00		30.93
15.04.2004 22:35:25	580	24.17	34800.00	2088000.00	0.8167	9.7607	8.34		5.81		30.93	0.00		30.93
16.04.2004 02:35:25	584	24.33	35040.00	2102400.00	0.8144	9.7607	8.32		5.79		30.95	0.00		30.95
16.04.2004 06:35:25	588	24.50	35280.00	2116800.00	0.8121	9.7607	8.29		5.76		30.98	0.00		30.97
16.04.2004 10:35:25	592	24.67	35520.00	2131200.00	0.8102	9.79	8.28		5.75		30.99	0.00		30.99
16.04.2004 14:35:25	596	24.83	35760.00	2145600.00	0.8077	9.7759	8.25		5.72		31.02	0.00		31.02
16.04.2004 18:35:25	600	25.00	36000.00	2160000.00	0.8074	9.7451	8.25		5.72		31.02	0.00		31.02
16.04.2004 22:35:25	604	25.17	36240.00	2174400.00	0.803	9.7607	8.20		5.67		31.07	0.00		31.07
17.04.2004 02:35:25	608	25.33	36480.00	2188800.00	0.8006	9.7451	8.18		5.65		31.09	0.00		31.09
17.04.2004 06:35:25	612	25.50	36720.00	2203200.00	0.796	9.7451	8.13		5.60		31.14	0.00		31.14
17.04.2004 10:35:25	616	25.67	36960.00	2217600.00	0.7918	9.7759	8.09		5.56		31.18	0.00		31.18
17.04.2004 14:35:25	620	25.83	37200.00	2232000.00	0.7872	9.7759	8.04		5.51		31.23	0.00		31.23
17.04.2004 18:35:25	624	26.00	37440.00	2246400.00	0.7871	9.7607	8.04		5.51		31.23	0.00		31.23
17.04.2004 22:35:25	628	26.17	37680.00	2260800.00	0.7846	9.7451	8.01		5.48		31.26	0.00		31.25
18.04.2004 02:35:25	632	26.33	37920.00	2275200.00	0.7802	9.7607	7.97		5.44		31.30	0.00		31.30
18.04.2004 06:35:25	636	26.50	38160.00	2289600.00	0.7802	9.7607	7.97		5.44		31.30	0.00		31.30
18.04.2004 10:35:25	640	26.67	38400.00	2304000.00	0.7755	9.7451	7.92		5.39		31.35	0.00		31.35
18.04.2004 14:35:25	644	26.83	38640.00	2318400.00	0.771	9.7451	7.87		5.34		31.40	0.00		31.39

Date and Time	Elapsed		Elapsed	Elapsed	Elapsed	Logger reading	Logger	Total Pressure	Manual	Corrected	Water level m	Drift	Water Level Corrected
	Hours	Days	Mins	Seconds	bar	Temp °C	Head	for drop	bd	Correction	for drift		
18.04.2004 18:35:25	648	27.00	38880.00	2332800.00	0.771	9.7451	7.87	5.34	31.40	0.00	31.39		
18.04.2004 22:35:25	652	27.17	39120.00	2347200.00	0.771	9.7451	7.87	5.34	31.40	0.00	31.39		
19.04.2004 02:35:25	656	27.33	39360.00	2361600.00	0.7689	9.7607	7.85	5.32	31.42	0.00	31.41		
19.04.2004 06:35:25	660	27.50	39600.00	2376000.00	0.7645	9.7759	7.81	5.28	31.46	0.00	31.46		
19.04.2004 10:35:25	664	27.67	39840.00	2390400.00	0.7643	9.7607	7.81	5.28	31.46	0.00	31.46		
19.04.2004 14:35:25	668	27.83	40080.00	2404800.00	0.762	9.7607	7.78	5.25	31.49	0.00	31.48		
19.04.2004 18:35:25	672	28.00	40320.00	2419200.00	0.7619	9.7451	7.78	5.25	31.49	0.00	31.48		
19.04.2004 22:35:25	676	28.17	40560.00	2433600.00	0.7622	9.7759	7.78	5.25	31.49	0.00	31.48		
20.04.2004 02:35:25	680	28.33	40800.00	2448000.00	0.7598	9.7607	7.76	5.23	31.51	0.00	31.51		
20.04.2004 06:35:25	684	28.50	41040.00	2462400.00	0.7573	9.7451	7.73	5.20	31.54	0.00	31.53		
20.04.2004 10:35:25	688	28.67	41280.00	2476800.00	0.7575	9.7607	7.74	5.21	31.53	0.00	31.53		
20.04.2004 14:35:25	692	28.83	41520.00	2491200.00	0.7552	9.7607	7.71	5.18	31.56	0.00	31.55		
20.04.2004 18:35:25	696	29.00	41760.00	2505600.00	0.7484	9.7607	7.64	5.11	31.63	0.00	31.62		
20.04.2004 22:35:25	700	29.17	42000.00	2520000.00	0.7484	9.7607	7.64	5.11	31.63	0.00	31.62		
21.04.2004 02:35:25	704	29.33	42240.00	2534400.00	0.7461	9.7607	7.62	5.09	31.65	0.00	31.65		
21.04.2004 06:35:25	708	29.50	42480.00	2548800.00	0.7438	9.7607	7.60	5.07	31.67	0.00	31.67		
21.04.2004 10:35:25	712	29.67	42720.00	2563200.00	0.7463	9.7759	7.62	5.09	31.65	0.00	31.64		
21.04.2004 14:35:25	716	29.83	42960.00	2577600.00	0.7458	9.73	7.62	5.09	31.65	0.00	31.65		
21.04.2004 18:35:25	720	30.00	43200.00	2592000.00	0.7438	9.7607	7.60	5.07	31.67	0.00	31.67		
21.04.2004 22:35:25	724	30.17	43440.00	2606400.00	0.7484	9.7607	7.64	5.11	31.63	0.00	31.62		
22.04.2004 02:35:25	728	30.33	43680.00	2620800.00	0.7461	9.7607	7.62	5.09	31.65	0.00	31.64		
22.04.2004 06:35:25	732	30.50	43920.00	2635200.00	0.7461	9.7607	7.62	5.09	31.65	0.00	31.64		
22.04.2004 10:35:25	736	30.67	44160.00	2649600.00	0.7437	9.7451	7.60	5.07	31.67	0.00	31.67		
22.04.2004 14:35:25	740	30.83	44400.00	2664000.00	0.7459	9.7451	7.62	5.09	31.65	0.00	31.65		
22.04.2004 18:35:25	744	31.00	44640.00	2678400.00	0.7459	9.7451	7.62	5.09	31.65	0.00	31.65		
22.04.2004 22:35:25	748	31.17	44880.00	2692800.00	0.7459	9.7451	7.62	5.09	31.65	0.00	31.65		
23.04.2004 02:35:25	752	31.33	45120.00	2707200.00	0.7461	9.7607	7.62	5.09	31.65	0.00	31.64		
23.04.2004 06:35:25	756	31.50	45360.00	2721600.00	0.7438	9.7607	7.60	5.07	31.67	0.00	31.67		
23.04.2004 10:35:25	760	31.67	45600.00	2736000.00	0.7437	9.7451	7.60	5.07	31.67	0.00	31.67		
23.04.2004 14:35:25	764	31.83	45840.00	2750400.00	0.7414	9.7451	7.57	5.04	31.70	-0.01	31.69		
23.04.2004 18:35:25	768	32.00	46080.00	2764800.00	0.7414	9.7451	7.57	5.04	31.70	-0.01	31.69		

Date and Time	Elapsed		Elapsed		Logger reading	Logger Temp °C	Total Pressure Head	Manual	Corrected for drop	Water level m	Drift Correction	Water Level Corrected for drift
	Hours	Days	Mins	Seconds								
23.04.2004 22:35:25	772	32.17	46320.00	2779200.00	0.7414	9.7451	7.57		5.04	31.70	-0.01	31.69
24.04.2004 02:35:25	776	32.33	46560.00	2793600.00	0.7412	9.73	7.57		5.04	31.70	-0.01	31.69
24.04.2004 06:35:25	780	32.50	46800.00	2808000.00	0.739	9.73	7.55		5.02	31.72	-0.01	31.72
24.04.2004 10:35:25	784	32.67	47040.00	2822400.00	0.737	9.7607	7.53		5.00	31.74	-0.01	31.74
24.04.2004 14:35:25	788	32.83	47280.00	2836800.00	0.739	9.73	7.55		5.02	31.72	-0.01	31.72
24.04.2004 18:35:25	792	33.00	47520.00	2851200.00	0.7344	9.73	7.50		4.97	31.77	-0.01	31.76
24.04.2004 22:35:25	796	33.17	47760.00	2865600.00	0.7368	9.7451	7.53		5.00	31.74	-0.01	31.74
25.04.2004 02:35:25	800	33.33	48000.00	2880000.00	0.7346	9.7451	7.50		4.97	31.77	-0.01	31.76
25.04.2004 06:35:25	804	33.50	48240.00	2894400.00	0.7323	9.7451	7.48		4.95	31.79	-0.01	31.78
25.04.2004 10:35:25	808	33.67	48480.00	2908800.00	0.7323	9.7451	7.48		4.95	31.79	-0.01	31.78
25.04.2004 14:35:25	812	33.83	48720.00	2923200.00	0.73	9.7451	7.46		4.93	31.81	-0.01	31.81
25.04.2004 18:35:25	816	34.00	48960.00	2937600.00	0.7279	9.7607	7.43		4.90	31.84	-0.01	31.83
25.04.2004 22:35:25	820	34.17	49200.00	2952000.00	0.7256	9.7607	7.41		4.88	31.86	-0.01	31.85
26.04.2004 02:35:25	824	34.33	49440.00	2966400.00	0.7255	9.7451	7.41		4.88	31.86	-0.01	31.85
26.04.2004 06:35:25	828	34.50	49680.00	2980800.00	0.7232	9.7451	7.39		4.86	31.88	-0.01	31.88
26.04.2004 10:35:25	832	34.67	49920.00	2995200.00	0.7207	9.73	7.36		4.83	31.91	-0.01	31.90
26.04.2004 14:35:25	836	34.83	50160.00	3009600.00	0.7211	9.7607	7.37		4.84	31.90	-0.01	31.90
26.04.2004 18:35:25	840	35.00	50400.00	3024000.00	0.7209	9.7451	7.36		4.83	31.91	-0.01	31.90
26.04.2004 22:35:25	844	35.17	50640.00	3038400.00	0.7185	9.73	7.34		4.81	31.93	-0.01	31.93
27.04.2004 02:35:25	848	35.33	50880.00	3052800.00	0.7164	9.7451	7.32		4.79	31.95	-0.01	31.95
27.04.2004 06:35:25	852	35.50	51120.00	3067200.00	0.7165	9.7607	7.32		4.79	31.95	-0.01	31.95
27.04.2004 10:35:25	856	35.67	51360.00	3081600.00	0.7143	9.7607	7.30		4.77	31.97	-0.01	31.97
27.04.2004 14:35:25	860	35.83	51600.00	3096000.00	0.7118	9.7451	7.27		4.74	32.00	-0.01	31.99
27.04.2004 18:35:25	864	36.00	51840.00	3110400.00	0.7095	9.7451	7.25		4.72	32.02	-0.01	32.02
27.04.2004 22:35:25	868	36.17	52080.00	3124800.00	0.7097	9.7607	7.25		4.72	32.02	-0.01	32.02
28.04.2004 02:35:25	872	36.33	52320.00	3139200.00	0.7095	9.7451	7.25		4.72	32.02	-0.01	32.02
28.04.2004 06:35:25	876	36.50	52560.00	3153600.00	0.7073	9.7451	7.22		4.69	32.05	-0.01	32.04
28.04.2004 10:35:25	880	36.67	52800.00	3168000.00	0.7047	9.7168	7.20		4.67	32.07	-0.01	32.07
28.04.2004 14:35:25	884	36.83	53040.00	3182400.00	0.7027	9.7451	7.18		4.65	32.09	-0.01	32.09
28.04.2004 18:35:25	888	37.00	53280.00	3196800.00	0.7006	9.7607	7.16		4.63	32.11	-0.01	32.11
28.04.2004 22:35:25	892	37.17	53520.00	3211200.00	0.6983	9.7607	7.13		4.60	32.14	-0.01	32.13

Date and Time	Elapsed		Elapsed		Elapsed	Seconds	Logger reading bar	Logger Temp °C	Total Pressure Head	Manual	Corrected for drop	Water level m bd	Drift Correction	Water Level Corrected for drift
	Hours	Days	Mins											
29.04.2004 02:35:25	896	37.33	53760.00			3225600.00	0.6982	9.7451	7.13		4.60	32.14	-0.01	32.13
29.04.2004 06:35:25	900	37.50	54000.00			3240000.00	0.6959	9.7451	7.11		4.58	32.16	-0.01	32.16
29.04.2004 10:35:25	904	37.67	54240.00			3254400.00	0.6913	9.7451	7.06		4.53	32.21	-0.01	32.20
29.04.2004 14:35:25	908	37.83	54480.00			3268800.00	0.6913	9.7451	7.06		4.53	32.21	-0.01	32.20
29.04.2004 18:35:25	912	38.00	54720.00			3283200.00	0.6887	9.7607	7.02		4.49	32.25	-0.01	32.25
29.04.2004 22:35:25	916	38.17	54960.00			3297600.00	0.6887	9.7607	7.02		4.49	32.25	-0.01	32.25
30.04.2004 02:35:25	920	38.33	55200.00			3312000.00	0.6845	9.7451	6.99		4.46	32.28	-0.01	32.27
30.04.2004 06:35:25	924	38.50	55440.00			3326400.00	0.6822	9.7451	6.97		4.44	32.30	-0.01	32.30
30.04.2004 10:35:25	928	38.67	55680.00			3340800.00	0.6797	9.7168	6.94		4.41	32.33	-0.01	32.32
30.04.2004 14:35:25	932	38.83	55920.00			3355200.00	0.68	9.7451	6.95		4.42	32.32	-0.01	32.32
30.04.2004 18:35:25	936	39.00	56160.00			3369600.00	0.6779	9.7607	6.92		4.39	32.35	-0.01	32.34
30.04.2004 22:35:25	940	39.17	56400.00			3384000.00	0.6779	9.7607	6.92		4.39	32.35	-0.01	32.34
01.05.2004 02:35:25	944	39.33	56640.00			3398400.00	0.6754	9.7451	6.90		4.37	32.37	-0.01	32.36
01.05.2004 06:35:25	948	39.50	56880.00			3412800.00	0.6752	9.73	6.90		4.37	32.37	-0.01	32.37
01.05.2004 10:35:25	952	39.67	57120.00			3427200.00	0.6728	9.7168	6.87		4.34	32.40	-0.01	32.39
01.05.2004 14:35:25	956	39.83	57360.00			3441600.00	0.6709	9.7451	6.85		4.32	32.42	-0.01	32.41
01.05.2004 18:35:25	960	40.00	57600.00			3456000.00	0.6707	9.73	6.85		4.32	32.42	-0.01	32.41
01.05.2004 22:35:25	964	40.17	57840.00			3470400.00	0.6686	9.7451	6.83		4.30	32.44	-0.01	32.43
02.05.2004 02:35:25	968	40.33	58080.00			3484800.00	0.6663	9.7451	6.81		4.28	32.46	-0.01	32.46
02.05.2004 06:35:25	972	40.50	58320.00			3499200.00	0.6662	9.73	6.80		4.27	32.47	-0.01	32.46
02.05.2004 10:35:25	976	40.67	58560.00			3513600.00	0.6637	9.7168	6.78		4.25	32.49	-0.01	32.48
02.05.2004 14:35:25	980	40.83	58800.00			3528000.00	0.6616	9.73	6.76		4.23	32.51	-0.01	32.51
02.05.2004 18:35:25	984	41.00	59040.00			3542400.00	0.6595	9.7451	6.74		4.21	32.53	-0.01	32.53
02.05.2004 22:35:25	988	41.17	59280.00			3556800.00	0.6572	9.7451	6.71		4.18	32.56	-0.01	32.55
03.05.2004 02:35:25	992	41.33	59520.00			3571200.00	0.6525	9.73	6.66		4.13	32.61	-0.01	32.60
03.05.2004 06:35:25	996	41.50	59760.00			3585600.00	0.6525	9.73	6.66		4.13	32.61	-0.01	32.60
03.05.2004 10:35:25	1000	41.67	60000.00			3600000.00	0.6502	9.73	6.64		4.11	32.63	-0.01	32.62
03.05.2004 14:35:25	1004	41.83	60240.00			3614400.00	0.6478	9.7168	6.62		4.09	32.65	-0.01	32.65
03.05.2004 18:35:25	1008	42.00	60480.00			3628800.00	0.6436	9.7451	6.57		4.04	32.70	-0.01	32.69
03.05.2004 22:35:25	1012	42.17	60720.00			3643200.00	0.6388	9.73	6.52		3.99	32.75	-0.01	32.74
04.05.2004 02:35:25	1016	42.33	60960.00			3657600.00	0.6345	9.7451	6.48		3.95	32.79	-0.01	32.78

Date and Time	Elapsed		Elapsed		Elapsed	Elapsed		Logger reading	Logger	Total Pressure Head	Manual	Corrected for drop	Water level m	Drift	Water Level Corrected for drift
	Hours	Days	Mins	Seconds		bar	Temp °C								
04.05.2004 06:35:25	1020	42.50	61200.00	3672000.00	0.6299	9.7451	6.43					3.90	32.84	-0.01	32.83
04.05.2004 10:35:25	1024	42.67	61440.00	3686400.00	0.6275	9.73	6.41					3.88	32.86	-0.01	32.85
04.05.2004 14:35:25	1028	42.83	61680.00	3700800.00	0.6231	9.7451	6.36					3.83	32.91	-0.01	32.90
04.05.2004 18:35:25	1032	43.00	61920.00	3715200.00	0.6229	9.73	6.36					3.83	32.91	-0.01	32.90
04.05.2004 22:35:25	1036	43.17	62160.00	3729600.00	0.6255	9.7607	6.39					3.86	32.88	-0.01	32.87
05.05.2004 02:35:25	1040	43.33	62400.00	3744000.00	0.6206	9.73	6.34					3.81	32.93	-0.01	32.92
05.05.2004 06:35:25	1044	43.50	62640.00	3758400.00	0.6184	9.73	6.32					3.79	32.95	-0.01	32.95
05.05.2004 10:35:25	1048	43.67	62880.00	3772800.00	0.6161	9.73	6.29					3.76	32.98	-0.01	32.97
05.05.2004 14:35:25	1052	43.83	63120.00	3787200.00	0.616	9.7168	6.29					3.76	32.98	-0.01	32.97
05.05.2004 18:35:25	1056	44.00	63360.00	3801600.00	0.616	9.7168	6.29					3.76	32.98	-0.01	32.97
05.05.2004 22:35:25	1060	44.17	63600.00	3816000.00	0.6163	9.7451	6.29					3.76	32.98	-0.01	32.97
06.05.2004 02:35:25	1064	44.33	63840.00	3830400.00	0.614	9.7451	6.27					3.74	33.00	-0.01	32.99
06.05.2004 06:35:25	1068	44.50	64080.00	3844800.00	0.614	9.7451	6.27					3.74	33.00	-0.01	32.99
06.05.2004 10:35:25	1072	44.67	64320.00	3859200.00	0.6117	9.7451	6.25					3.72	33.02	-0.01	33.01
06.05.2004 14:35:25	1076	44.83	64560.00	3873600.00	0.6117	9.7451	6.25					3.72	33.02	-0.01	33.01
06.05.2004 18:35:25	1080	45.00	64800.00	3888000.00	0.614	9.7451	6.27					3.74	33.00	-0.01	32.99
06.05.2004 22:35:25	1084	45.17	65040.00	3902400.00	0.614	9.7451	6.27					3.74	33.00	-0.01	32.99
07.05.2004 02:35:25	1088	45.33	65280.00	3916800.00	0.6117	9.7451	6.25					3.72	33.02	-0.01	33.01
07.05.2004 06:35:25	1092	45.50	65520.00	3931200.00	0.6094	9.7451	6.22					3.69	33.05	-0.01	33.04
07.05.2004 10:35:25	1096	45.67	65760.00	3945600.00	0.6117	9.7451	6.25					3.72	33.02	-0.01	33.01
07.05.2004 14:35:25	1100	45.83	66000.00	3960000.00	0.6093	9.73	6.22					3.69	33.05	-0.01	33.04
07.05.2004 18:35:25	1104	46.00	66240.00	3974400.00	0.6093	9.73	6.22					3.69	33.05	-0.01	33.04
07.05.2004 22:35:25	1108	46.17	66480.00	3988800.00	0.6094	9.7451	6.22					3.69	33.05	-0.01	33.04
08.05.2004 02:35:25	1112	46.33	66720.00	4003200.00	0.6093	9.73	6.22					3.69	33.05	-0.01	33.04
08.05.2004 06:35:25	1116	46.50	66960.00	4017600.00	0.6093	9.73	6.22					3.69	33.05	-0.01	33.04
08.05.2004 10:35:25	1120	46.67	67200.00	4032000.00	0.605	9.7607	6.18					3.65	33.09	-0.01	33.08
08.05.2004 14:35:25	1124	46.83	67440.00	4046400.00	0.6026	9.7451	6.15					3.62	33.12	-0.01	33.11
08.05.2004 18:35:25	1128	47.00	67680.00	4060800.00	0.6023	9.7168	6.15					3.62	33.12	-0.01	33.11
08.05.2004 22:35:25	1132	47.17	67920.00	4075200.00	0.6024	9.73	6.15					3.62	33.12	-0.01	33.11
09.05.2004 02:35:25	1136	47.33	68160.00	4089600.00	0.6002	9.73	6.13					3.60	33.14	-0.01	33.13
09.05.2004 06:35:25	1140	47.50	68400.00	4104000.00	0.6002	9.73	6.13					3.60	33.14	-0.01	33.13

Date and Time	Elapsed		Elapsed		Elapsed	Seconds	Logger reading	Logger Temp °C	Total Pressure Head	Manual	Corrected for drop	Water level m	Drift Correction	Water Level Corrected for drift
	Hours	Days	Mins	Seconds										
09.05.2004 10:35:25	1144	47.67	68640.00	4118400.00			0.6002	9.73	6.13		3.60	33.14	-0.01	33.13
09.05.2004 14:35:25	1148	47.83	68880.00	4132800.00			0.5981	9.7451	6.11		3.58	33.16	-0.01	33.15
09.05.2004 18:35:25	1152	48.00	69120.00	4147200.00			0.5981	9.7451	6.11		3.58	33.16	-0.01	33.15
09.05.2004 22:35:25	1156	48.17	69360.00	4161600.00			0.5979	9.73	6.11		3.58	33.16	-0.01	33.15
10.05.2004 02:35:25	1160	48.33	69600.00	4176000.00			0.5979	9.73	6.11		3.58	33.16	-0.01	33.15
10.05.2004 06:35:25	1164	48.50	69840.00	4190400.00			0.5959	9.7607	6.09		3.56	33.18	-0.01	33.17
10.05.2004 10:35:25	1168	48.67	70080.00	4204800.00			0.5956	9.73	6.08		3.55	33.19	-0.01	33.18
10.05.2004 14:35:25	1172	48.83	70320.00	4219200.00			0.5956	9.73	6.08		3.55	33.19	-0.01	33.18
10.05.2004 18:35:25	1176	49.00	70560.00	4233600.00			0.5935	9.7451	6.06		3.53	33.21	-0.01	33.20
10.05.2004 22:35:25	1180	49.17	70800.00	4248000.00			0.5932	9.7168	6.06		3.53	33.21	-0.01	33.20
11.05.2004 02:35:25	1184	49.33	71040.00	4262400.00			0.5933	9.73	6.06		3.53	33.21	-0.01	33.20
11.05.2004 06:35:25	1188	49.50	71280.00	4276800.00			0.5932	9.7168	6.06		3.53	33.21	-0.01	33.20
11.05.2004 10:35:25	1192	49.67	71520.00	4291200.00			0.5933	9.73	6.06		3.53	33.21	-0.01	33.20
11.05.2004 14:11:00										33.20				

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Appendix : Pumping Test Data (MW2 long term monitoring)

Cam, Co. Roscommon for Roadstone Provinces

Contract Number: 060201/3

Compiled by : CDL 12/05/04

Date and Time	Elapsed Hours	Elapsed Days	Elapsed Mins	Elapsed Seconds	Logger reading bar	Logger Temp °C	Total Pressure Head	Manual	Water level m bd	Drift Correction	Water Level Corrected for drift
22.03.2004 15:28:00								27.74			
22.03.2004 18:35:00	0	0.00	0.00	0.00	0.5693	10.0127	5.81		27.74	0.00	27.74
22.03.2004 22:36:23	4	0.17	240.00	14400.00	0.5692	9.998	5.81		27.74	0.00	27.74
23.03.2004 02:36:23	8	0.33	480.00	28800.00	0.569	9.9834	5.81		27.74	0.00	27.74
23.03.2004 06:36:23	12	0.50	720.00	43200.00	0.5712	9.9688	5.83		27.72	0.00	27.72
23.03.2004 10:36:23	16	0.67	960.00	57600.00	0.569	9.9834	5.81		27.74	0.00	27.74
23.03.2004 14:36:23	20	0.83	1200.00	72000.00	0.5689	9.9688	5.81		27.74	0.00	27.74
23.03.2004 18:36:23	24	1.00	1440.00	86400.00	0.5712	9.9688	5.83		27.72	0.00	27.72
23.03.2004 22:36:23	28	1.17	1680.00	100800.00	0.5737	9.9834	5.86		27.69	0.00	27.69
24.03.2004 02:36:23	32	1.33	1920.00	115200.00	0.5739	9.998	5.86		27.69	0.00	27.69
24.03.2004 06:36:23	36	1.50	2160.00	129600.00	0.5785	9.9834	5.91		27.64	0.00	27.65
24.03.2004 10:36:23	40	1.67	2400.00	144000.00	0.581	9.998	5.93		27.62	0.00	27.62
24.03.2004 14:36:23	44	1.83	2640.00	158400.00	0.5783	9.9688	5.91		27.64	0.01	27.65
24.03.2004 18:36:23	48	2.00	2880.00	172800.00	0.5785	9.9834	5.91		27.64	0.01	27.65
24.03.2004 22:36:23	52	2.17	3120.00	187200.00	0.5832	9.9834	5.96		27.59	0.01	27.60
25.03.2004 02:36:23	56	2.33	3360.00	201600.00	0.5857	9.998	5.98		27.57	0.01	27.57
25.03.2004 06:36:23	60	2.50	3600.00	216000.00	0.5878	9.9688	6.00		27.55	0.01	27.55
25.03.2004 10:36:23	64	2.67	3840.00	230400.00	0.5879	9.9834	6.00		27.55	0.01	27.55
25.03.2004 14:36:23	68	2.83	4080.00	244800.00	0.5903	9.9834	6.03		27.52	0.01	27.53
25.03.2004 18:36:23	72	3.00	4320.00	259200.00	0.5903	9.9834	6.03		27.52	0.01	27.53
25.03.2004 22:36:23	76	3.17	4560.00	273600.00	0.5928	9.998	6.05		27.50	0.01	27.50

Date and Time	Elapsed		Elapsed		Elapsed		Logger reading bar	Logger Temp °C	Total Pressure Head	Manual	Water level m bd	Drift Correction	Water Level Corrected <i>for drift</i>
	Hours	Days	Mins	Seconds	bar	Temp °C							
26.03.2004 02:36:23	80	3.33	4800.00	288000.00	0.5926	9.9834	6.05				27.50	0.01	27.51
26.03.2004 06:36:23	84	3.50	5040.00	302400.00	0.5928	9.998	6.05				27.50	0.01	27.51
26.03.2004 10:36:23	88	3.67	5280.00	316800.00	0.5905	10.0127	6.03				27.52	0.01	27.53
26.03.2004 14:36:23	92	3.83	5520.00	331200.00	0.5879	9.9834	6.00				27.55	0.01	27.56
26.03.2004 18:36:23	96	4.00	5760.00	345600.00	0.5878	9.9688	6.00				27.55	0.01	27.56
26.03.2004 22:36:23	100	4.17	6000.00	360000.00	0.5855	9.9834	5.98				27.57	0.01	27.58
27.03.2004 02:36:23	104	4.33	6240.00	374400.00	0.583	9.9688	5.95				27.60	0.01	27.61
27.03.2004 06:36:23	108	4.50	6480.00	388800.00	0.5807	9.9688	5.93				27.62	0.01	27.63
27.03.2004 10:36:23	112	4.67	6720.00	403200.00	0.5788	10.0127	5.91				27.64	0.01	27.65
27.03.2004 14:36:23	116	4.83	6960.00	417600.00	0.5785	9.9834	5.91				27.64	0.01	27.66
27.03.2004 18:36:23	120	5.00	7200.00	432000.00	0.5739	9.998	5.86				27.69	0.01	27.70
27.03.2004 22:36:23	124	5.17	7440.00	446400.00	0.5714	9.9834	5.84				27.71	0.01	27.73
28.03.2004 02:36:23	128	5.33	7680.00	460800.00	0.5689	9.9688	5.81				27.74	0.02	27.75
28.03.2004 06:36:23	132	5.50	7920.00	475200.00	0.5692	9.998	5.81				27.74	0.02	27.75
28.03.2004 10:36:23	136	5.67	8160.00	489600.00	0.569	9.9834	5.81				27.74	0.02	27.75
28.03.2004 14:36:23	140	5.83	8400.00	504000.00	0.5692	9.998	5.81				27.74	0.02	27.75
28.03.2004 18:36:23	144	6.00	8640.00	518400.00	0.5692	9.998	5.81				27.74	0.02	27.75
28.03.2004 22:36:23	148	6.17	8880.00	532800.00	0.5692	9.998	5.81				27.74	0.02	27.75
29.03.2004 02:36:23	152	6.33	9120.00	547200.00	0.5668	9.998	5.79				27.76	0.02	27.78
29.03.2004 06:36:23	156	6.50	9360.00	561600.00	0.5668	9.998	5.79				27.76	0.02	27.78
29.03.2004 10:36:23	160	6.67	9600.00	576000.00	0.5667	9.9834	5.79				27.76	0.02	27.78
29.03.2004 14:36:23	164	6.83	9840.00	590400.00	0.5642	9.9688	5.76				27.79	0.02	27.81
29.03.2004 18:36:23	168	7.00	10080.00	604800.00	0.5618	9.9688	5.74				27.81	0.02	27.83
29.03.2004 22:36:23	172	7.17	10320.00	619200.00	0.5594	9.9688	5.71				27.84	0.02	27.86
30.03.2004 02:36:23	176	7.33	10560.00	633600.00	0.5574	9.998	5.69				27.86	0.02	27.88
30.03.2004 06:36:23	180	7.50	10800.00	648000.00	0.5524	9.9688	5.64				27.91	0.02	27.93
30.03.2004 10:36:23	184	7.67	11040.00	662400.00	0.5525	9.9834	5.64				27.91	0.02	27.93
30.03.2004 14:36:23	188	7.83	11280.00	676800.00	0.5478	9.9834	5.60				27.95	0.02	27.98
30.03.2004 18:36:23	192	8.00	11520.00	691200.00	0.5478	9.9834	5.60				27.95	0.02	27.98
30.03.2004 22:36:23	196	8.17	11760.00	705600.00	0.5456	9.998	5.57				27.98	0.02	28.00
31.03.2004 02:36:23	200	8.33	12000.00	720000.00	0.5434	10.0127	5.55				28.00	0.02	28.02
31.03.2004 06:36:23	204	8.50	12240.00	734400.00	0.5407	9.9834	5.52				28.03	0.02	28.05
31.03.2004 10:36:23	208	8.67	12480.00	748800.00	0.5382	9.9688	5.50				28.05	0.03	28.08
31.03.2004 14:36:23	212	8.83	12720.00	763200.00	0.5384	9.9834	5.50				28.05	0.03	28.08

Date and Time	Elapsed		Elapsed		Elapsed		Logger reading bar	Logger Temp °C	Total Pressure Head	Manual	Water level m bd	Drift Correction	Water Level Corrected $\rho_{cor} \Delta_{drift}$
	Hours	Days	Mins	Seconds	Seconds								
31.03.2004 18:36:23	216	9.00	12960.00	777600.00	0.5384	9.9834	5.50	28.05	0.03		28.08		
31.03.2004 22:36:23	220	9.17	13200.00	792000.00	0.5382	9.9688	5.50	28.05	0.03		28.08		
01.04.2004 02:36:23	224	9.33	13440.00	806400.00	0.5359	9.9688	5.47	28.08	0.03		28.10		
01.04.2004 06:36:23	228	9.50	13680.00	820800.00	0.5336	9.9834	5.45	28.10	0.03		28.13		
01.04.2004 10:36:23	232	9.67	13920.00	835200.00	0.5335	9.9688	5.45	28.10	0.03		28.13		
01.04.2004 14:36:23	236	9.83	14160.00	849600.00	0.5314	9.998	5.43	28.12	0.03		28.15		
01.04.2004 18:36:23	240	10.00	14400.00	864000.00	0.5291	9.998	5.40	28.15	0.03		28.17		
01.04.2004 22:36:23	244	10.17	14640.00	878400.00	0.5288	9.9688	5.40	28.15	0.03		28.18		
02.04.2004 02:36:23	248	10.33	14880.00	892800.00	0.5311	9.9688	5.42	28.13	0.03		28.16		
02.04.2004 06:36:23	252	10.50	15120.00	907200.00	0.5313	9.9834	5.43	28.12	0.03		28.15		
02.04.2004 10:36:23	256	10.67	15360.00	921600.00	0.5313	9.9834	5.43	28.12	0.03		28.15		
02.04.2004 14:36:23	260	10.83	15600.00	936000.00	0.5314	9.998	5.43	28.12	0.03		28.15		
02.04.2004 18:36:23	264	11.00	15840.00	950400.00	0.5311	9.9688	5.42	28.13	0.03		28.16		
02.04.2004 22:36:23	268	11.17	16080.00	964800.00	0.5314	9.998	5.43	28.12	0.03		28.15		
03.04.2004 02:36:23	272	11.33	16320.00	979200.00	0.5311	9.9688	5.42	28.13	0.03		28.16		
03.04.2004 06:36:23	276	11.50	16560.00	993600.00	0.5286	9.9536	5.40	28.15	0.03		28.18		
03.04.2004 10:36:23	280	11.67	16800.00	1008000.00	0.5313	9.9834	5.43	28.12	0.03		28.16		
03.04.2004 14:36:23	284	11.83	17040.00	1022400.00	0.5336	9.9834	5.45	28.10	0.03		28.13		
03.04.2004 18:36:23	288	12.00	17280.00	1036800.00	0.5338	9.998	5.45	28.10	0.03		28.13		
03.04.2004 22:36:23	292	12.17	17520.00	1051200.00	0.5382	9.9688	5.50	28.05	0.04		28.09		
04.04.2004 02:36:23	296	12.33	17760.00	1065600.00	0.5379	9.9399	5.49	28.06	0.04		28.09		
04.04.2004 06:36:23	300	12.50	18000.00	1080000.00	0.5382	9.9688	5.50	28.05	0.04		28.09		
04.04.2004 10:36:23	304	12.67	18240.00	1094400.00	0.5381	9.9536	5.50	28.05	0.04		28.09		
04.04.2004 14:36:23	308	12.83	18480.00	1108800.00	0.5384	9.9834	5.50	28.05	0.04		28.09		
04.04.2004 18:36:23	312	13.00	18720.00	1123200.00	0.5431	9.9834	5.55	28.00	0.04		28.04		
04.04.2004 22:36:23	316	13.17	18960.00	1137600.00	0.5407	9.9834	5.52	28.03	0.04		28.07		
05.04.2004 02:36:23	320	13.33	19200.00	1152000.00	0.5406	9.9688	5.52	28.03	0.04		28.07		
05.04.2004 06:36:23	324	13.50	19440.00	1166400.00	0.5407	9.9834	5.52	28.03	0.04		28.07		
05.04.2004 10:36:23	328	13.67	19680.00	1180800.00	0.541	10.0127	5.53	28.02	0.04		28.06		
05.04.2004 14:36:23	332	13.83	19920.00	1195200.00	0.5431	9.9834	5.55	28.00	0.04		28.04		
05.04.2004 15:05:00	332.5							28.58			28.04		
05.04.2004 18:36:23	336	14.00	20160.00	1209600.00	0.5454	9.9834	5.57	27.98	0.00		27.98		
05.04.2004 22:36:23	340	14.17	20400.00	1224000.00	0.5453	9.9688	5.57	27.98	0.00		27.98		
06.04.2004 02:36:23	344	14.33	20640.00	1238400.00	0.5454	9.9834	5.57	27.98	0.00		27.98		

Date and Time	Elapsed		Elapsed		Elapsed		Logger reading	Logger Temp °C	Total Pressure Head	Manual	Water level m	Drift	Water Level Corrected
	Hours	Days	Mins	Seconds	bar	Temp °C							
06.04.2004 06:36:23	348	14.50	20880.00	1252800.00	0.5456	9.998	5.57				27.98	0.01	27.98
06.04.2004 10:36:23	352	14.67	21120.00	1267200.00	0.5429	9.9688	5.55				28.00	0.01	28.01
06.04.2004 14:36:23	356	14.83	21360.00	1281600.00	0.5454	9.9834	5.57				27.98	0.01	27.99
06.04.2004 18:36:23	360	15.00	21600.00	1296000.00	0.5453	9.9688	5.57				27.98	0.01	27.99
06.04.2004 22:36:23	364	15.17	21840.00	1310400.00	0.5453	9.9688	5.57				27.98	0.01	27.99
07.04.2004 02:36:23	368	15.33	22080.00	1324800.00	0.5452	9.9536	5.57				27.98	0.02	28.00
07.04.2004 06:36:23	372	15.50	22320.00	1339200.00	0.5454	9.9834	5.57				27.98	0.02	28.00
07.04.2004 10:36:23	376	15.67	22560.00	1353600.00	0.5454	9.9834	5.57				27.98	0.02	28.00
07.04.2004 14:36:23	380	15.83	22800.00	1368000.00	0.5478	9.9834	5.60				27.95	0.02	27.98
07.04.2004 18:36:23	384	16.00	23040.00	1382400.00	0.5524	9.9688	5.64				27.91	0.02	27.93
07.04.2004 22:36:23	388	16.17	23280.00	1396800.00	0.5499	9.9536	5.62				27.93	0.02	27.96
08.04.2004 02:36:23	392	16.33	23520.00	1411200.00	0.5502	9.9834	5.62				27.93	0.03	27.96
08.04.2004 06:36:23	396	16.50	23760.00	1425600.00	0.5478	9.9834	5.60				27.95	0.03	27.98
08.04.2004 10:36:23	400	16.67	24000.00	1440000.00	0.5479	9.998	5.60				27.95	0.03	27.98
08.04.2004 14:36:23	404	16.83	24240.00	1454400.00	0.5477	9.9688	5.59				27.96	0.03	27.99
08.04.2004 18:36:23	408	17.00	24480.00	1468800.00	0.5457	10.0127	5.57				27.98	0.03	28.01
08.04.2004 22:36:23	412	17.17	24720.00	1483200.00	0.5454	9.9834	5.57				27.98	0.04	28.02
09.04.2004 02:36:23	416	17.33	24960.00	1497600.00	0.5432	9.998	5.55				28.00	0.04	28.04
09.04.2004 06:36:23	420	17.50	25200.00	1512000.00	0.5454	9.9834	5.57				27.98	0.04	28.02
09.04.2004 10:36:23	424	17.67	25440.00	1526400.00	0.5454	9.9834	5.57				27.98	0.04	28.02
09.04.2004 14:36:23	428	17.83	25680.00	1540800.00	0.5407	9.9834	5.52				28.03	0.04	28.07
09.04.2004 18:36:23	432	18.00	25920.00	1555200.00	0.5406	9.9688	5.52				28.03	0.05	28.07
09.04.2004 22:36:23	436	18.17	26160.00	1569600.00	0.5431	9.9834	5.55				28.00	0.05	28.05
10.04.2004 02:36:23	440	18.33	26400.00	1584000.00	0.5406	9.9688	5.52				28.03	0.05	28.08
10.04.2004 06:36:23	444	18.50	26640.00	1598400.00	0.5379	9.9999	5.49				28.06	0.05	28.11
10.04.2004 10:36:23	448	18.67	26880.00	1612800.00	0.5406	9.9688	5.52				28.03	0.05	28.08
10.04.2004 14:36:23	452	18.83	27120.00	1627200.00	0.5381	9.9536	5.50				28.05	0.06	28.11
10.04.2004 18:36:23	456	19.00	27360.00	1641600.00	0.5382	9.9688	5.50				28.05	0.06	28.11
10.04.2004 22:36:23	460	19.17	27600.00	1656000.00	0.5406	9.9688	5.52				28.03	0.06	28.09
11.04.2004 02:36:23	464	19.33	27840.00	1670400.00	0.5379	9.9999	5.49				28.06	0.06	28.12
11.04.2004 06:36:23	468	19.50	28080.00	1684800.00	0.5357	9.9536	5.47				28.08	0.06	28.14
11.04.2004 10:36:23	472	19.67	28320.00	1699200.00	0.5385	9.998	5.50				28.05	0.07	28.12
11.04.2004 14:36:23	476	19.83	28560.00	1713600.00	0.5359	9.9688	5.47				28.08	0.07	28.14
11.04.2004 18:36:23	480	20.00	28800.00	1728000.00	0.5357	9.9536	5.47				28.08	0.07	28.15

Date and Time	Elapsed		Elapsed Days	Elapsed		Elapsed Seconds	Logger reading bar	Logger Temp °C	Total Pressure Head	Manual	Water level m	Drift	Water Level Corrected for drift
	Hours	Minutes		Mins	Seconds								
11.04.2004 22:36:23	484	20:17		29040.00		1742400.00	0.5356	9.9399	5.47		28.08	0.07	28.15
12.04.2004 02:36:23	488	20:33		29280.00		1756800.00	0.5359	9.9688	5.47		28.08	0.07	28.15
12.04.2004 06:36:23	492	20:50		29520.00		1771200.00	0.5356	9.9399	5.47		28.08	0.07	28.15
12.04.2004 10:36:23	496	20:67		29760.00		1785600.00	0.536	9.9834	5.47		28.08	0.08	28.15
12.04.2004 12:00:00	497.5	20:73		29850.00		1791000.00				28.54			
12.04.2004 14:36:23	500	20:83		30000.00		1800000.00	0.5359	9.9688	5.47		28.08	0.08	28.15
12.04.2004 18:36:23	504	21:00		30240.00		1814400.00	0.536	9.9834	5.47		28.08	0.08	28.16
12.04.2004 22:36:23	508	21:17		30480.00		1828800.00	0.5334	9.9536	5.45		28.10	0.08	28.18
13.04.2004 02:36:23	512	21:33		30720.00		1843200.00	0.5334	9.9536	5.45		28.10	0.08	28.19
13.04.2004 06:36:23	516	21:50		30960.00		1857600.00	0.531	9.9536	5.42		28.13	0.09	28.21
13.04.2004 10:36:23	520	21:67		31200.00		1872000.00	0.5288	9.9688	5.40		28.15	0.09	28.24
13.04.2004 14:36:23	524	21:83		31440.00		1886400.00	0.5264	9.9688	5.38		28.17	0.09	28.26
13.04.2004 18:36:23	528	22:00		31680.00		1900800.00	0.5239	9.9536	5.35		28.20	0.09	28.29
13.04.2004 22:36:23	532	22:17		31920.00		1915200.00	0.5217	9.9688	5.33		28.22	0.09	28.32
14.04.2004 02:36:23	536	22:33		32160.00		1929600.00	0.5195	9.9834	5.31		28.24	0.10	28.34
14.04.2004 06:36:23	540	22:50		32400.00		1944000.00	0.5145	9.9536	5.26		28.29	0.10	28.39
14.04.2004 10:36:23	544	22:67		32640.00		1958400.00	0.5146	9.9688	5.26		28.29	0.10	28.39
14.04.2004 14:36:23	548	22:83		32880.00		1972800.00	0.5098	9.9536	5.21		28.34	0.10	28.44
14.04.2004 18:36:23	552	23:00		33120.00		1987200.00	0.5076	9.9688	5.18		28.37	0.10	28.47
14.04.2004 22:36:23	556	23:17		33360.00		2001600.00	0.5099	9.9688	5.21		28.34	0.11	28.45
15.04.2004 02:36:23	560	23:33		33600.00		2016000.00	0.5077	9.9834	5.19		28.36	0.11	28.47
15.04.2004 06:36:23	564	23:50		33840.00		2030400.00	0.5077	9.9834	5.19		28.36	0.11	28.47
15.04.2004 10:36:23	568	23:67		34080.00		2044800.00	0.5101	9.9834	5.21		28.34	0.11	28.45
15.04.2004 14:36:23	572	23:83		34320.00		2059200.00	0.5076	9.9688	5.18		28.37	0.11	28.48
15.04.2004 18:36:23	576	24:00		34560.00		2073600.00	0.5074	9.9536	5.18		28.37	0.11	28.48
15.04.2004 22:36:23	580	24:17		34800.00		2088000.00	0.5051	9.9536	5.16		28.39	0.12	28.51
16.04.2004 02:36:23	584	24:33		35040.00		2102400.00	0.5074	9.9536	5.18		28.37	0.12	28.49
16.04.2004 06:36:23	588	24:50		35280.00		2116800.00	0.5052	9.9688	5.16		28.39	0.12	28.51
16.04.2004 10:36:23	592	24:67		35520.00		2131200.00	0.5031	9.998	5.14		28.41	0.12	28.53
16.04.2004 14:36:23	596	24:83		35760.00		2145600.00	0.5008	9.998	5.12		28.43	0.12	28.56
16.04.2004 18:36:23	600	25:00		36000.00		2160000.00	0.4981	9.9688	5.09		28.46	0.13	28.59
16.04.2004 22:36:23	604	25:17		36240.00		2174400.00	0.498	9.9536	5.09		28.46	0.13	28.59
17.04.2004 02:36:23	608	25:33		36480.00		2188800.00	0.4933	9.9536	5.04		28.51	0.13	28.64
17.04.2004 06:36:23	612	25:50		36720.00		2203200.00	0.4866	9.998	4.97		28.58	0.13	28.71

Date and Time	Elapsed		Elapsed		Elapsed		Logger reading bar	Logger Temp °C	Total Pressure Head	Manual	Water level m bd	Drift Correction	Water Level Corrected <i>for drift</i>
	Hours	Days	Mins	Seconds	Seconds	Seconds							
17.04.2004 10:36:23	616	25.67	36960.00	2217600.00	0.4816	9.9688	4.92	0.13	28.63		28.77		
17.04.2004 14:36:23	620	25.83	37200.00	2232000.00	0.4769	9.9688	4.87	0.14	28.68		28.82		
17.04.2004 18:36:23	624	26.00	37440.00	2246400.00	0.4745	9.9688	4.85	0.14	28.70		28.84		
17.04.2004 22:36:23	628	26.17	37680.00	2260800.00	0.4748	9.998	4.85	0.14	28.70		28.84		
18.04.2004 02:36:23	632	26.33	37920.00	2275200.00	0.472	9.9536	4.82	0.14	28.73		28.87		
18.04.2004 06:36:23	636	26.50	38160.00	2289600.00	0.47	9.9834	4.80	0.14	28.75		28.89		
18.04.2004 10:36:23	640	26.67	38400.00	2304000.00	0.47	9.9834	4.80	0.15	28.75		28.90		
18.04.2004 14:36:23	644	26.83	38640.00	2318400.00	0.4723	9.9834	4.82	0.15	28.73		28.87		
18.04.2004 18:36:23	648	27.00	38880.00	2332800.00	0.472	9.9536	4.82	0.15	28.73		28.88		
18.04.2004 22:36:23	652	27.17	39120.00	2347200.00	0.4723	9.9834	4.82	0.15	28.73		28.88		
19.04.2004 02:36:23	656	27.33	39360.00	2361600.00	0.4723	9.9834	4.82	0.15	28.73		28.88		
19.04.2004 06:36:23	660	27.50	39600.00	2376000.00	0.4678	9.998	4.78	0.16	28.77		28.93		
19.04.2004 10:36:23	664	27.67	39840.00	2390400.00	0.4676	9.9834	4.78	0.16	28.77		28.93		
19.04.2004 14:36:23	668	27.83	40080.00	2404800.00	0.4652	9.9834	4.75	0.16	28.80		28.96		
19.04.2004 18:36:23	672	28.00	40320.00	2419200.00	0.4747	9.9834	4.85	0.16	28.70		28.86		
19.04.2004 22:36:23	676	28.17	40560.00	2433600.00	0.477	9.9834	4.87	0.16	28.68		28.84		
20.04.2004 02:36:23	680	28.33	40800.00	2448000.00	0.4748	9.998	4.85	0.16	28.70		28.87		
20.04.2004 06:36:23	684	28.50	41040.00	2462400.00	0.4725	9.998	4.83	0.17	28.72		28.89		
20.04.2004 10:36:23	688	28.67	41280.00	2476800.00	0.4723	9.9834	4.82	0.17	28.73		28.89		
20.04.2004 14:36:23	692	28.83	41520.00	2491200.00	0.4678	9.998	4.78	0.17	28.77		28.94		
20.04.2004 18:36:23	696	29.00	41760.00	2505600.00	0.4629	9.9834	4.73	0.17	28.82		28.99		
20.04.2004 22:36:23	700	29.17	42000.00	2520000.00	0.4605	9.9834	4.70	0.17	28.85		29.02		
21.04.2004 02:36:23	704	29.33	42240.00	2534400.00	0.4629	9.9834	4.73	0.18	28.82		29.00		
21.04.2004 06:36:23	708	29.50	42480.00	2548800.00	0.4605	9.9834	4.70	0.18	28.85		29.02		
21.04.2004 10:36:23	712	29.67	42720.00	2563200.00	0.4604	9.9688	4.70	0.18	28.85		29.03		
21.04.2004 14:36:23	716	29.83	42960.00	2577600.00	0.4629	9.9834	4.73	0.18	28.82		29.00		
21.04.2004 18:36:23	720	30.00	43200.00	2592000.00	0.4629	9.9834	4.73	0.18	28.82		29.01		
21.04.2004 22:36:23	724	30.17	43440.00	2606400.00	0.4676	9.9834	4.78	0.19	28.77		28.96		
22.04.2004 02:36:23	728	30.33	43680.00	2620800.00	0.4676	9.9834	4.78	0.19	28.77		28.96		
22.04.2004 06:36:23	732	30.50	43920.00	2635200.00	0.4675	9.9688	4.77	0.19	28.78		28.96		
22.04.2004 10:36:23	736	30.67	44160.00	2649600.00	0.4697	9.9536	4.80	0.19	28.75		28.94		
22.04.2004 14:36:23	740	30.83	44400.00	2664000.00	0.4698	9.9688	4.80	0.19	28.75		28.95		
22.04.2004 18:36:23	744	31.00	44640.00	2678400.00	0.4675	9.9688	4.77	0.20	28.78		28.97		
22.04.2004 22:36:23	748	31.17	44880.00	2692800.00	0.4678	9.998	4.78	0.20	28.77		28.97		

Date and Time	Elapsed		Elapsed		Logger reading bar	Logger Temp °C	Total Pressure Head	Manual	Water level m		Drift Correction	Water Level Corrected for drift
	Hours	Days	Mins	Seconds					bd			
23.04.2004 02:36:23	752	31.33	45120.00	2707200.00	0.4673	9.9536	4.77		28.78	0.20	28.98	
23.04.2004 06:36:23	756	31.50	45360.00	2721600.00	0.4654	9.998	4.75		28.80	0.20	29.00	
23.04.2004 10:36:23	760	31.67	45600.00	2736000.00	0.47	9.9834	4.80		28.75	0.20	28.95	
23.04.2004 14:36:23	764	31.83	45840.00	2750400.00	0.4747	9.9834	4.85		28.70	0.21	28.91	
23.04.2004 18:36:23	768	32.00	46080.00	2764800.00	0.4888	9.9834	4.99		28.56	0.21	28.76	
23.04.2004 22:36:23	772	32.17	46320.00	2779200.00	0.5053	9.9834	5.16		28.39	0.21	28.60	
24.04.2004 02:36:23	776	32.33	46560.00	2793600.00	0.5219	9.9834	5.33		28.22	0.21	28.43	
24.04.2004 06:36:23	780	32.50	46800.00	2808000.00	0.5409	9.998	5.52		28.03	0.21	28.24	
24.04.2004 10:36:23	784	32.67	47040.00	2822400.00	0.5618	9.9688	5.74		27.81	0.21	28.03	
24.04.2004 14:36:23	788	32.83	47280.00	2836800.00	0.5714	9.9834	5.84		27.71	0.22	27.93	
24.04.2004 18:36:23	792	33.00	47520.00	2851200.00	0.5737	9.9834	5.86		27.69	0.22	27.91	
24.04.2004 22:36:23	796	33.17	47760.00	2865600.00	0.5808	9.9834	5.93		27.62	0.22	27.84	
25.04.2004 02:36:23	800	33.33	48000.00	2880000.00	0.5833	9.998	5.96		27.59	0.22	27.81	
25.04.2004 06:36:23	804	33.50	48240.00	2894400.00	0.5855	9.9834	5.98		27.57	0.22	27.79	
25.04.2004 10:36:23	808	33.67	48480.00	2908800.00	0.5857	9.998	5.98		27.57	0.23	27.79	
25.04.2004 14:36:23	812	33.83	48720.00	2923200.00	0.5903	9.9834	6.03		27.52	0.23	27.75	
25.04.2004 18:36:23	816	34.00	48960.00	2937600.00	0.5903	9.9834	6.03		27.52	0.23	27.75	
25.04.2004 22:36:23	820	34.17	49200.00	2952000.00	0.5926	9.9834	6.05		27.50	0.23	27.73	
26.04.2004 02:36:23	824	34.33	49440.00	2966400.00	0.5903	9.9834	6.03		27.52	0.23	27.75	
26.04.2004 06:36:23	828	34.50	49680.00	2980800.00	0.5926	9.9834	6.05		27.50	0.24	27.73	
26.04.2004 10:36:23	832	34.67	49920.00	2995200.00	0.5925	9.9688	6.05		27.50	0.24	27.74	
26.04.2004 14:36:23	836	34.83	50160.00	3009600.00	0.5928	9.998	6.05		27.50	0.24	27.73	
26.04.2004 18:36:23	840	35.00	50400.00	3024000.00	0.595	9.9834	6.08		27.47	0.24	27.71	
26.04.2004 22:36:23	844	35.17	50640.00	3038400.00	0.5975	9.998	6.10		27.45	0.24	27.69	
27.04.2004 02:36:23	848	35.33	50880.00	3052800.00	0.5997	9.9834	6.13		27.42	0.25	27.67	
27.04.2004 06:36:23	852	35.50	51120.00	3067200.00	0.5997	9.9834	6.13		27.42	0.25	27.67	
27.04.2004 10:36:23	856	35.67	51360.00	3081600.00	0.6021	9.9834	6.15		27.40	0.25	27.65	
27.04.2004 14:36:23	860	35.83	51600.00	3096000.00	0.5998	9.998	6.13		27.42	0.25	27.67	
27.04.2004 18:36:23	864	36.00	51840.00	3110400.00	0.5997	9.9834	6.13		27.42	0.25	27.68	
27.04.2004 22:36:23	868	36.17	52080.00	3124800.00	0.6021	9.9834	6.15		27.40	0.25	27.66	
28.04.2004 02:36:23	872	36.33	52320.00	3139200.00	0.6022	9.998	6.15		27.40	0.26	27.66	
28.04.2004 06:36:23	876	36.50	52560.00	3153600.00	0.6018	9.9536	6.15		27.40	0.26	27.66	
28.04.2004 10:36:23	880	36.67	52800.00	3168000.00	0.6019	9.9688	6.15		27.40	0.26	27.66	
28.04.2004 14:36:23	884	36.83	53040.00	3182400.00	0.6021	9.9834	6.15		27.40	0.26	27.66	

Date and Time	Elapsed		Elapsed		Elapsed		Logger reading bar	Logger Temp °C	Total Pressure Head	Manual	Water level m bd	Drift Correction	Water Level Corrected <i>for drift</i>
	Hours	Days	Mins	Seconds	bar	Temp °C							
28.04.2004 18:36:23	888	37.00	53280.00	3196800.00	0.6021	9.9834	6.15				27.40	0.26	27.66
28.04.2004 22:36:23	892	37.17	53520.00	3211200.00	0.6018	9.9536	6.15				27.40	0.27	27.67
29.04.2004 02:36:23	896	37.33	53760.00	3225600.00	0.5995	9.9688	6.12				27.43	0.27	27.70
29.04.2004 06:36:23	900	37.50	54000.00	3240000.00	0.5993	9.9399	6.12				27.43	0.27	27.70
29.04.2004 10:36:23	904	37.67	54240.00	3254400.00	0.597	9.9536	6.10				27.45	0.27	27.72
29.04.2004 14:36:23	908	37.83	54480.00	3268800.00	0.5944	9.9243	6.07				27.48	0.27	27.75
29.04.2004 18:36:23	912	38.00	54720.00	3283200.00	0.5901	9.9688	6.03				27.52	0.28	27.80
29.04.2004 22:36:23	916	38.17	54960.00	3297600.00	0.5904	9.998	6.03				27.52	0.28	27.80
30.04.2004 02:36:23	920	38.33	55200.00	3312000.00	0.5854	9.9688	5.98				27.57	0.28	27.85
30.04.2004 06:36:23	924	38.50	55440.00	3326400.00	0.5855	9.9834	5.98				27.57	0.28	27.85
30.04.2004 10:36:23	928	38.67	55680.00	3340800.00	0.5853	9.9536	5.98				27.57	0.28	27.86
30.04.2004 14:36:23	932	38.83	55920.00	3355200.00	0.5876	9.9536	6.00				27.55	0.29	27.83
30.04.2004 18:36:23	936	39.00	56160.00	3369600.00	0.5876	9.9536	6.00				27.55	0.29	27.84
30.04.2004 22:36:23	940	39.17	56400.00	3384000.00	0.59	9.9536	6.03				27.52	0.29	27.81
01.05.2004 02:36:23	944	39.33	56640.00	3398400.00	0.5878	9.9688	6.00				27.55	0.29	27.84
01.05.2004 06:36:23	948	39.50	56880.00	3412800.00	0.5878	9.9688	6.00				27.55	0.29	27.84
01.05.2004 10:36:23	952	39.67	57120.00	3427200.00	0.5901	9.9688	6.03				27.52	0.30	27.82
01.05.2004 14:36:23	956	39.83	57360.00	3441600.00	0.5878	9.9688	6.00				27.55	0.30	27.84
01.05.2004 18:36:23	960	40.00	57600.00	3456000.00	0.5878	9.9688	6.00				27.55	0.30	27.85
01.05.2004 22:36:23	964	40.17	57840.00	3470400.00	0.59	9.9536	6.03				27.52	0.30	27.82
02.05.2004 02:36:23	968	40.33	58080.00	3484800.00	0.5876	9.9536	6.00				27.55	0.30	27.85
02.05.2004 06:36:23	972	40.50	58320.00	3499200.00	0.5878	9.9688	6.00				27.55	0.30	27.85
02.05.2004 10:36:23	976	40.67	58560.00	3513600.00	0.5876	9.9536	6.00				27.55	0.31	27.85
02.05.2004 14:36:23	980	40.83	58800.00	3528000.00	0.588	9.998	6.01				27.54	0.31	27.85
02.05.2004 18:36:23	984	41.00	59040.00	3542400.00	0.5879	9.9834	6.00				27.55	0.31	27.86
02.05.2004 22:36:23	988	41.17	59280.00	3556800.00	0.5878	9.9688	6.00				27.55	0.31	27.86
03.05.2004 02:36:23	992	41.33	59520.00	3571200.00	0.5855	9.9834	5.98				27.57	0.31	27.88
03.05.2004 06:36:23	996	41.50	59760.00	3585600.00	0.5853	9.9536	5.98				27.57	0.32	27.89
03.05.2004 10:36:23	1000	41.67	60000.00	3600000.00	0.5857	9.998	5.98				27.57	0.32	27.89
03.05.2004 14:36:23	1004	41.83	60240.00	3614400.00	0.5805	9.9536	5.93				27.62	0.32	27.94
03.05.2004 18:36:23	1008	42.00	60480.00	3628800.00	0.5785	9.9834	5.91				27.64	0.32	27.96
03.05.2004 22:36:23	1012	42.17	60720.00	3643200.00	0.569	9.9834	5.81				27.74	0.32	28.06
04.05.2004 02:36:23	1016	42.33	60960.00	3657600.00	0.5618	9.9688	5.74				27.81	0.33	28.14
04.05.2004 06:36:23	1020	42.50	61200.00	3672000.00	0.5571	9.9688	5.69				27.86	0.33	28.19

Date and Time	Elapsed		Elapsed	Mins	Seconds	Logger reading bar	Logger Temp °C	Total Pressure Head	Manual	Water level m bd	Drift Correction	Water Level Corrected for Drift
	Hours	Days										
04.05.2004 10:36:23	1024	42.67	61440.00		3686400.00	0.5527	9.998	5.65		27.90	0.33	28.23
04.05.2004 14:36:23	1028	42.83	61680.00		3700800.00	0.5525	9.9834	5.64		27.91	0.33	28.24
04.05.2004 18:36:23	1032	43.00	61920.00		3715200.00	0.5569	9.9536	5.69		27.86	0.33	28.20
04.05.2004 22:36:23	1036	43.17	62160.00		3729600.00	0.5596	9.9834	5.72		27.83	0.34	28.17
05.05.2004 02:36:23	1040	43.33	62400.00		3744000.00	0.5571	9.9688	5.69		27.86	0.34	28.20
05.05.2004 06:36:23	1044	43.50	62640.00		3758400.00	0.5549	9.9834	5.67		27.88	0.34	28.22
05.05.2004 10:36:23	1048	43.67	62880.00		3772800.00	0.5549	9.9834	5.67		27.88	0.34	28.22
05.05.2004 14:36:23	1052	43.83	63120.00		3787200.00	0.5572	9.9834	5.69		27.86	0.34	28.20
05.05.2004 18:36:23	1056	44.00	63360.00		3801600.00	0.5592	9.9399	5.71		27.84	0.34	28.18
05.05.2004 22:36:23	1060	44.17	63600.00		3816000.00	0.5618	9.9688	5.74		27.81	0.35	28.16
06.05.2004 02:36:23	1064	44.33	63840.00		3830400.00	0.5599	10.0127	5.72		27.83	0.35	28.18
06.05.2004 06:36:23	1068	44.50	64080.00		3844800.00	0.5618	9.9688	5.74		27.81	0.35	28.16
06.05.2004 10:36:23	1072	44.67	64320.00		3859200.00	0.5615	9.9399	5.74		27.81	0.35	28.17
06.05.2004 14:36:23	1076	44.83	64560.00		3873600.00	0.5618	9.9688	5.74		27.81	0.35	28.17
06.05.2004 18:36:23	1080	45.00	64800.00		3888000.00	0.5618	9.9688	5.74		27.81	0.36	28.17
06.05.2004 22:36:23	1084	45.17	65040.00		3902400.00	0.5642	9.9688	5.76		27.79	0.36	28.15
07.05.2004 02:36:23	1088	45.33	65280.00		3916800.00	0.5642	9.9688	5.76		27.79	0.36	28.15
07.05.2004 06:36:23	1092	45.50	65520.00		3931200.00	0.5643	9.9834	5.76		27.79	0.36	28.15
07.05.2004 10:36:23	1096	45.67	65760.00		3945600.00	0.5665	9.9688	5.79		27.76	0.36	28.13
07.05.2004 14:36:23	1100	45.83	66000.00		3960000.00	0.5665	9.9688	5.79		27.76	0.37	28.13
07.05.2004 18:36:23	1104	46.00	66240.00		3974400.00	0.5667	9.9834	5.79		27.76	0.37	28.13
07.05.2004 22:36:23	1108	46.17	66480.00		3988800.00	0.567	10.0127	5.79		27.76	0.37	28.13
08.05.2004 02:36:23	1112	46.33	66720.00		4003200.00	0.5643	9.9834	5.76		27.79	0.37	28.16
08.05.2004 06:36:23	1116	46.50	66960.00		4017600.00	0.562	9.9834	5.74		27.81	0.37	28.18
08.05.2004 10:36:23	1120	46.67	67200.00		4032000.00	0.5618	9.9688	5.74		27.81	0.38	28.19
08.05.2004 14:36:23	1124	46.83	67440.00		4046400.00	0.5593	9.9536	5.71		27.84	0.38	28.21
08.05.2004 18:36:23	1128	47.00	67680.00		4060800.00	0.5596	9.9834	5.72		27.83	0.38	28.21
08.05.2004 22:36:23	1132	47.17	67920.00		4075200.00	0.5572	9.9834	5.69		27.86	0.38	28.24
09.05.2004 02:36:23	1136	47.33	68160.00		4089600.00	0.5574	9.998	5.69		27.86	0.38	28.24
09.05.2004 06:36:23	1140	47.50	68400.00		4104000.00	0.5574	9.998	5.69		27.86	0.39	28.24
09.05.2004 10:36:23	1144	47.67	68640.00		4118400.00	0.555	9.998	5.67		27.88	0.39	28.27
09.05.2004 14:36:23	1148	47.83	68880.00		4132800.00	0.5571	9.9688	5.69		27.86	0.39	28.25
09.05.2004 18:36:23	1152	48.00	69120.00		4147200.00	0.5547	9.9688	5.67		27.88	0.39	28.28
09.05.2004 22:36:23	1156	48.17	69360.00		4161600.00	0.5572	9.9834	5.69		27.86	0.39	28.25

Date and Time	Elapsed		Elapsed		Elapsed		Logger reading bar	Logger Temp °C	Total Pressure Head	Manual	Water level m bd	Drift Correction	Water Level Corrected <i>last drift</i>
	Hours	Days	Mins	Seconds									
10.05.2004 02:36:23	1160	48.33	69600.00	4176000.00			0.5574	9.998	5.69		27.86	0.39	28.25
10.05.2004 06:36:23	1164	48.50	69840.00	4190400.00			0.5569	9.9536	5.69		27.86	0.40	28.26
10.05.2004 10:36:23	1168	48.67	70080.00	4204800.00			0.5549	9.9834	5.67		27.88	0.40	28.28
10.05.2004 14:36:23	1172	48.83	70320.00	4219200.00			0.5524	9.9688	5.64		27.91	0.40	28.31
10.05.2004 18:36:23	1176	49.00	70560.00	4233600.00			0.5525	9.9834	5.64		27.91	0.40	28.31
10.05.2004 22:36:23	1180	49.17	70800.00	4248000.00			0.5524	9.9688	5.64		27.91	0.40	28.31
11.05.2004 02:36:23	1184	49.33	71040.00	4262400.00			0.5522	9.9536	5.64		27.91	0.41	28.32
11.05.2004 06:36:23	1188	49.50	71280.00	4276800.00			0.55	9.9688	5.62		27.93	0.41	28.34
11.05.2004 10:36:23	1192	49.67	71520.00	4291200.00			0.5503	9.998	5.62		27.93	0.41	28.34
11.05.2004 10:36:23										28.34			

O'Neill Ground Water Engineering

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Project No: 060201

Project Name: Proposed Quarry Cam, Co. Roscommon

Ground Water Readings

Borehole	Datum	Easting	Northing	Ground lvl	Casing lvl	Stick-up	19th February 2004			19th March 2004			22nd March 2004			5th April 2004			12th April 2004			11th May 2004				
							Time	level b.c	level O.D	Time	level b.c	level O.D	Time	level b.c	level O.D	Time	level b.c	level O.D	Time	level b.c	level O.D	Time	level b.c	level O.D	Time	level b.c
BH1	top casing	190455	244044	84.20	84.37	0.17	NR	13.00	71.37	NR	13.42	70.95		13:37	13.24	71.13	NR	13.35	71.02	NR	13.35	71.02	13:48	13.66	70.71	
BH3	top casing	190099	244700	101.58	101.75	0.17	NR	40.20	61.55	NR	41.6	60.15	41:02	41.08	60.67	11:12	41.70	61.03	42.90	58.85	NR	42.90	58.85	13:32	45.01	56.74
BH5	top casing	190606	244222	95.99	96.16	0.17	NR	34.40	61.76	NR	35.81	60.35				14:05	35.99	60.17	37.25	58.91	NR	37.25	58.91	13:53	39.51	56.65
BH6	top casing	190211	244403	99.48	99.66	0.18	NR	24.50	75.16	NR	24.86	74.80	14:08	23.73	75.93	11:31	24.57	75.09	24.80	74.86	NR	24.80	74.86	13:39	25.09	74.57
BH8	top casing	189939	244576	91.00	91.20	0.20	NR	29.40	61.80	NR	31.24	59.96	14:41	30.88	60.82	11:56	31.12	60.08	32.37	58.83	NR	32.37	58.83	14:24	34.55	56.65
BH9	top casing	189933	244961	96.48	96.74	0.26	NR	19.90	76.84	NR	23.87	72.87	13:45	20.90	75.84	14:42	20.68	76.06	22.72	74.02	NR	22.72	74.02	14:45	24.89	71.85
BH10	top casing	190273	244912	96.71	96.84	0.13	NR	34.70	62.14	NR	36.82	60.02	13:52	36.80	60.04	10:59	36.47	60.37	37.51	59.33	NR	37.51	59.33	10:39	39.60	57.24
BH11	top casing	189894	245238	87.35	87.48	0.13	NR	NR	NR	NR	20.52	66.96	13:57	18.86	68.62	14:49	19.00	68.48	20.48	67.00	NR	20.48	67.00	14:51	22.54	64.94
BH11	top casing	190056	244348			NR							BH filled with sludge			11:48	29.63		NR	NR	NR	NR	14:11	33.20		
BH11	top casing	190427	245328			NR							15:28	27.74		15:05	28.04		NR	28.54	NR	28.54	15:03	28.34		
PW2A	top casing																						10:34	40.16		

Notes:

Weather 19th March 2004 fine locally heavy showers

Weather 22nd March 2004 fine locally heavy showers

Weather 11th May 2004 cool and overcast

Logger installed BH MW2 15:30 22/03/04

Logger installed BH MW1 15:00 05/04/04

Logger out MW1 14:07 11/05/04

Logger out MW2 15:01 11/05/04

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Appendix One : Pumping Test Data (Monitoring Wells)

Proposed Quarry, Cam, Co. Roscommon

Contract Number: 060201/3

Compiled by : CDL 06/07/04

Date of Test: 28/06/04

BH1

Time and Date	Elapsed Time (seconds)	Elapsed Time (minutes)	Water Level below Datum (metres)	Drawdown (metres)	Reduced Level (m .O.D)	
23/06/2004 10:33			13.675		70.695	
28/06/2004 10:41			14.650		69.720	
28/06/2004 12:32	0	0	14.650	0.000	69.720	Pump on
29/06/2004 18:25	107580	1793	14.670	-0.020	69.700	
30/06/2004 13:09	175020	2917	13.920	0.730	70.450	
30/06/2004 19:56	199440	3324	14.625	0.025	69.745	
01/07/2004 10:45	252780	4213	14.540	0.110	69.830	
02/07/2004 13:17	348300	5805	14.660	-0.010	69.710	Pump off

Ground Level = 84.20

Stick-up = 0.17

Datum Level = 84.37

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Appendix One : Pumping Test Data (Monitoring Wells)

Proposed Quarry, Cam, Co. Roscommon

Contract Number: 060201/3

Compiled by : CDL 05/07/04

Date of Test: 28/06/04

BH3

Time and Date	Elapsed Time (seconds)	Elapsed Time (minutes)	Water Level below Datum (metres)	Drawdown (metres)	Reduced Level (m .O.D)	
23/06/2004 09:51			47.030		54.720	
28/06/2004 09:51			47.020		54.730	
28/06/2004 12:32	0	0	47.020	0.000	54.730	Pump on
28/06/2004 16:37	14700	245	47.040	-0.020	54.710	
29/06/2004 10:21	78540	1309	47.020	0.000	54.730	
29/06/2004 13:07	88500	1475	47.020	0.000	54.730	
29/06/2004 18:05	106380	1773	47.050	-0.030	54.700	
30/06/2004 12:50	173880	2898	47.055	-0.035	54.695	
30/06/2004 19:35	198180	3303	47.050	-0.030	54.700	
01/07/2004 10:10	250680	4178	47.040	-0.020	54.710	
02/07/2004 09:50	335880	5598	47.060	-0.040	54.690	Pump off

Ground Level = 101.58

Stick-up = 0.14

Datum Level = 101.75

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Appendix One : Pumping Test Data (Monitoring Wells)

Proposed Quarry, Cam, Co. Roscommon

Contract Number: 060201/3

Compiled by : CDL 06/07/04

Date of Test: 28/06/04

BH5

Time and Date	Elapsed Time (seconds)	Elapsed Time (minutes)	Water Level below Datum (metres)	Drawdown (metres)	Reduced Level (m .O.D)	
23/06/2004 10:44			42.020		54.140	
28/06/2004 11:15			42.130		54.030	
28/06/2004 12:32	0	0	42.130	0.000	54.030	Pump on
29/06/2004 18:43	108660	1811	42.020	0.110	54.140	
30/06/2004 13:15	175380	2923	42.215	-0.085	53.945	
30/06/2004 20:02	199800	3330	42.210	-0.080	53.950	
01/07/2004 11:15	254580	4243	42.235	-0.105	53.925	
02/07/2004 13:12	348000	5800	42.270	-0.140	53.890	Pump off

Ground Level = 95.99

Stick-up = 0.17

Datum Level = 96.16

O'Neill Ground Water Engineering

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Appendix One : Pumping Test Data (Monitoring Wells)

Proposed Quarry, Cam, Co. Roscommon

Contract Number: 060201/3

Compiled by : CDL 05/07/04

Date of Test: 28/06/04

BH6

Time and Date	Elapsed Time (seconds)	Elapsed Time (minutes)	Water Level below Datum (metres)	Drawdown (metres)	Reduced Level (m .O.D)	
23/06/2004 09:58			28.910		70.750	
28/06/2004 10:02			29.890		69.770	
28/06/2004 12:32	0	0	29.890	0.000	69.770	Pump on
28/06/2004 16:05	12780	213	29.900	-0.010	69.760	
29/06/2004 13:17	89100	1485	30.030	-0.140	69.630	
29/06/2004 18:13	106860	1781	30.025	-0.135	69.635	
30/06/2004 12:58	174360	2906	30.130	-0.240	69.530	
30/06/2004 19:43	198660	3311	30.160	-0.270	69.500	
01/07/2004 10:20	251280	4188	30.300	-0.410	69.360	
02/07/2004 09:59	336420	5607	30.350	-0.460	69.310	Pump off

Ground Level = 99.48

Stick-up = 0.18

Datum Level = 99.66

O'Neill Ground Water Engineering

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Appendix One : Pumping Test Data (Monitoring Wells)

Proposed Quarry, Cam, Co. Roscommon

Contract Number: 060201/3

Compiled by : CDL 06/07/04

Date of Test: 28/06/04

BH8

Time and Date	Elapsed Time (seconds)	Elapsed Time (minutes)	Water Level below Datum (metres)	Drawdown (metres)	Reduced Level (m .O.D)	
23/06/2004 10:16			35.560		55.640	
28/06/2004 10:17			36.650		54.550	
28/06/2004 12:32	0	0	36.650	0.000	54.550	Pump on
28/06/2004 16:19	13620	227	36.640	0.010	54.560	
29/06/2004 13:53	91260	1521	36.675	-0.025	54.525	
29/06/2004 18:25	107580	1793	36.655	-0.005	54.545	
30/06/2004 13:47	177300	2955	36.705	-0.055	54.495	
30/06/2004 20:34	201720	3362	36.695	-0.045	54.505	
01/07/2004 11:38	255960	4266	36.730	-0.080	54.470	
02/07/2004 10:11	337140	5619	36.745	-0.095	54.455	Pump off

Ground Level = 91.00

Stick-up = 0.20

Datum Level = 91.20

O'Neill Ground Water Engineering

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Appendix One : Pumping Test Data (Monitoring Wells)

Proposed Quarry, Cam, Co. Roscommon

Contract Number: 060201/3

Compiled by : CDL 05/07/04

Date of Test: 28/06/04

BH9

Time and Date	Elapsed Time (seconds)	Elapsed Time (minutes)	Water Level below Datum (metres)	Drawdown (metres)	Reduced Level (m .O.D)	
23/06/2004 09:09			28.655		68.085	
28/06/2004 09:16			29.260		67.480	
28/06/2004 12:32	0	0	29.260	0.000	67.480	Pump on
28/06/2004 17:51	19140	319	29.240	0.020	67.500	
29/06/2004 09:23	75060	1251	29.295	-0.035	67.445	
29/06/2004 15:39	97620	1627	29.255	0.005	67.485	
29/06/2004 17:28	104160	1736	29.260	0.000	67.480	
30/06/2004 14:10	178680	2978	29.290	-0.030	67.450	
30/06/2004 20:48	202560	3376	29.285	-0.025	67.455	
01/07/2004 11:59	257220	4287	29.345	-0.085	67.395	
02/07/2004 12:40	346080	5768	29.380	-0.120	67.360	Pump off

Ground Level = 96.48

Stick-up = 0.26

Datum Level = 96.74

O'Neill Ground Water Engineering

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Appendix One : Pumping Test Data (Monitoring Wells)

Proposed Quarry, Cam, Co. Roscommon

Contract Number: 060201/3

Compiled by : CDL 05/07/04

Date of Test: 28/06/04

BH10

Time and Date	Elapsed Time (seconds)	Elapsed Time (minutes)	Water Level below Datum (metres)	Drawdown (metres)	Reduced Level (m .O.D)
23/06/2004 09:21			41.940		54.900
23/06/2004 12:36			41.940		54.900
23/06/2004 12:55			41.970		54.870
23/06/2004 14:23			42.050		54.790
28/06/2004 09:26			41.990		54.850
28/06/2004 12:18			42.020		54.820
28/06/2004 12:32	0	0	42.020	0.000	54.820
28/06/2004 13:50	4680	78	42.100	-0.080	54.740
28/06/2004 13:55	4980	83	42.110	-0.090	54.730
28/06/2004 14:00	5280	88	42.115	-0.095	54.725
28/06/2004 14:05	5580	93	42.120	-0.100	54.720
28/06/2004 14:10	5880	98	42.120	-0.100	54.720
28/06/2004 14:22	6600	110	42.130	-0.110	54.710
28/06/2004 14:27	6900	115	42.130	-0.110	54.710
28/06/2004 14:57	8700	145	42.150	-0.130	54.690
28/06/2004 15:02	9000	150	42.150	-0.130	54.690
28/06/2004 15:13	9660	161	42.170	-0.150	54.670
28/06/2004 15:22	10200	170	42.170	-0.150	54.670
28/06/2004 15:27	10500	175	42.170	-0.150	54.670
28/06/2004 15:32	10800	180	42.180	-0.160	54.660
28/06/2004 17:03	16260	271	42.235	-0.215	54.605
28/06/2004 17:34	18120	302	42.250	-0.230	54.590
28/06/2004 18:39	22020	367	42.280	-0.260	54.560
28/06/2004 23:55	40980	683	42.405	-0.385	54.435
29/06/2004 06:12	63600	1060	42.490	-0.470	54.350
29/06/2004 09:28	75360	1256	42.505	-0.485	54.335
29/06/2004 10:07	77700	1295	42.510	-0.490	54.330
29/06/2004 10:39	79620	1327	42.515	-0.495	54.325
29/06/2004 10:55	80580	1343	42.515	-0.495	54.325
29/06/2004 10:56	80640	1344	42.520	-0.500	54.320
29/06/2004 10:57	80700	1345	42.520	-0.500	54.320
29/06/2004 10:58	80760	1346	42.520	-0.500	54.320
29/06/2004 10:59	80820	1347	42.520	-0.500	54.320
29/06/2004 11:00	80880	1348	42.520	-0.500	54.320
29/06/2004 11:01	80940	1349	42.530	-0.510	54.310
29/06/2004 11:02	81000	1350	42.530	-0.510	54.310
29/06/2004 11:03	81060	1351	42.535	-0.515	54.305
29/06/2004 11:04	81120	1352	42.535	-0.515	54.305
29/06/2004 11:05	81180	1353	42.535	-0.515	54.305
29/06/2004 11:06	81240	1354	42.535	-0.515	54.305
29/06/2004 11:07	81300	1355	42.535	-0.515	54.305
29/06/2004 11:08	81360	1356	42.535	-0.515	54.305
29/06/2004 11:09	81420	1357	42.535	-0.515	54.305
29/06/2004 11:14	81720	1362	42.535	-0.515	54.305
29/06/2004 11:19	82020	1367	42.535	-0.515	54.305
29/06/2004 11:24	82320	1372	42.535	-0.515	54.305

Pump on

2nd Pump

Time and Date	Elapsed Time (seconds)	Elapsed Time (minutes)	Water Level below Datum (metres)	Drawdown (metres)	Reduced Level (m .O.D)
29/06/2004 11:29	82620	1377	42.540	-0.520	54.300
29/06/2004 11:38	83160	1386	42.545	-0.525	54.295
29/06/2004 12:00	84480	1408	42.560	-0.540	54.280
29/06/2004 12:11	85140	1419	42.565	-0.545	54.275
29/06/2004 12:22	85800	1430	42.570	-0.550	54.270
29/06/2004 12:32	86400	1440	42.570	-0.550	54.270
29/06/2004 12:57	87900	1465	42.585	-0.565	54.255
29/06/2004 13:58	91560	1526	42.615	-0.595	54.225
29/06/2004 16:03	99060	1651	42.650	-0.630	54.190
29/06/2004 16:33	100860	1681	42.660	-0.640	54.180
29/06/2004 17:03	102660	1711	42.675	-0.655	54.165
29/06/2004 18:59	109620	1827	42.705	-0.685	54.135
29/06/2004 21:44	119520	1992	42.785	-0.765	54.055
30/06/2004 00:48	130560	2176	42.835	-0.815	54.005
30/06/2004 03:59	142020	2367	42.875	-0.855	53.965
30/06/2004 07:38	155160	2586	42.915	-0.895	53.925
30/06/2004 10:30	165480	2758	42.910	-0.890	53.930
30/06/2004 12:24	172320	2872	42.775	-0.755	54.065
30/06/2004 14:01	178140	2969	42.735	-0.715	54.105
30/06/2004 14:36	180240	3004	42.720	-0.700	54.120
30/06/2004 19:19	197220	3287	42.640	-0.620	54.200
30/06/2004 21:35	205380	3423	42.615	-0.595	54.225
01/07/2004 04:11	229140	3819	42.565	-0.545	54.275
01/07/2004 09:41	248940	4149	42.540	-0.520	54.300
01/07/2004 12:17	258300	4305	42.525	-0.505	54.315
01/07/2004 12:31	259140	4319	42.530	-0.510	54.310
01/07/2004 12:33	259260	4321	42.520	-0.500	54.320
01/07/2004 12:35	259380	4323	42.515	-0.495	54.325
01/07/2004 12:37	259500	4325	42.500	-0.480	54.340
01/07/2004 12:39	259620	4327	42.490	-0.470	54.350
01/07/2004 12:41	259740	4329	42.485	-0.465	54.355
01/07/2004 12:50	260280	4338	42.480	-0.460	54.360
01/07/2004 13:00	260880	4348	42.475	-0.455	54.365
01/07/2004 13:15	261780	4363	42.455	-0.435	54.385
01/07/2004 13:30	262680	4378	42.440	-0.420	54.400
01/07/2004 16:48	274560	4576	42.340	-0.320	54.500
02/07/2004 09:43	335460	5591	42.125	-0.105	54.715

Ground Level = 96.71
Stick-up = 0.13
Datum Level = 96.84

O'Neill Ground Water Engineering

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Appendix One : Pumping Test Data (Monitoring Wells)

Proposed Quarry, Cam, Co. Roscommon

Contract Number: 060201/3

Compiled by : CDL 05/07/04

Date of Test: 28/06/04

BH11

Time and Date	Elapsed Time (seconds)	Elapsed Time (minutes)	Water Level below Datum (metres)	Drawdown (metres)	Reduced Level (m .O.D)	
23/06/2004 09:05			25.740		61.740	
28/06/2004 08:49			26.170		61.310	
28/06/2004 12:32	0	0	26.170	0.000	61.310	Pump on
28/06/2004 17:57	19500	325	26.150	0.020	61.330	
29/06/2004 09:19	74820	1247	26.245	-0.075	61.235	
29/06/2004 15:29	97020	1617	26.235	-0.065	61.245	
29/06/2004 17:35	104580	1743	26.235	-0.065	61.245	
30/06/2004 14:20	179280	2988	26.330	-0.160	61.150	
30/06/2004 20:55	202980	3383	26.280	-0.110	61.200	
01/07/2004 12:05	257580	4293	26.395	-0.225	61.085	
02/07/2004 12:44	346320	5772	26.460	-0.290	61.020	Pump off

Ground Level = 87.35
Stick-up = 0.13
Datum Level = 87.48

O'Neill Ground Water Engineering

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Appendix One : Pumping Test Data (Monitoring Wells)

Proposed Quarry, Cam, Co. Roscommon

Contract Number: 060201/3

Compiled by : CDL 06/07/04

Date of Test: 28/06/04 (Start 2)

MW1

Time and Date	Elapsed Time (seconds)	Elapsed Time (minutes)	Water Level below Datum (metres)	Drawdown (metres)	Reduced Level (m .O.D)	
23/06/2004 10:09			35.215		53.935	
28/06/2004 10:08			35.360		53.790	
28/06/2004 12:32	0	0	35.360	0.000	53.790	Pump on
28/06/2004 16:10	13080	218	35.380	-0.020	53.770	
29/06/2004 13:26	89640	1494	35.385	-0.025	53.765	
29/06/2004 18:18	107160	1786	35.335	0.025	53.815	
30/06/2004 13:40	176880	2948	35.410	-0.050	53.740	
30/06/2004 20:23	201060	3351	35.410	-0.050	53.740	
01/07/2004 11:32	255600	4260	35.440	-0.080	53.710	
02/07/2004 10:04	336720	5612	35.450	-0.090	53.700	Pump off

Ground Level = 88.40

Stick-up = 0.75

Datum Level = 89.15

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Appendix One : Pumping Test Data (Monitoring Wells)

Proposed Quarry, Cam, Co. Roscommon

Contract Number: 060201/3

Compiled by : CDL 05/07/04

Date of Test: 28/06/04

MW2

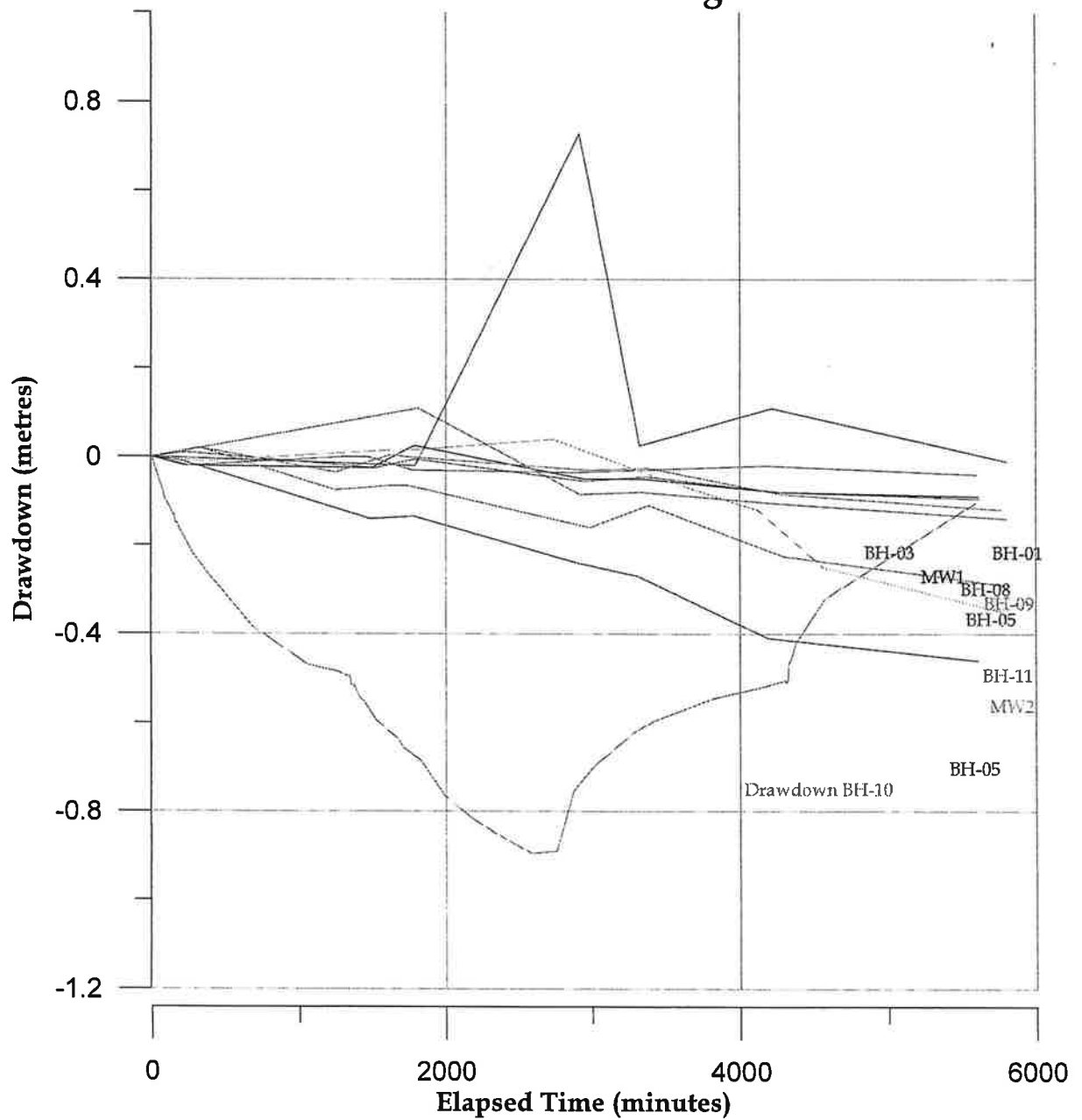
Time and Date	Elapsed Time (seconds)	Elapsed Time (minutes)	Water Level below Datum (metres)	Drawdown (metres)	Reduced Level (m .O.D)	
23/06/2004 08:38			27.980		63.070	
28/06/2004 08:20			28.030		63.020	
28/06/2004 12:32	0	0	28.030	0.000	63.020	Pump on
28/06/2004 18:11	20340	339	28.040	-0.010	63.010	
29/06/2004 15:39	97620	1627	28.015	0.015	63.035	
29/06/2004 17:48	105360	1756	28.015	0.015	63.035	
30/06/2004 10:08	164160	2736	27.990	0.040	63.060	
30/06/2004 22:23	208260	3471	28.080	-0.050	62.970	
01/07/2004 09:10	247080	4118	28.150	-0.120	62.900	
01/07/2004 16:35	273780	4563	28.280	-0.250	62.770	Pump off
02/07/2004 12:51	346740	5779	28.380	-0.350	62.670	

Ground Level = 90.28

Stick-up = 0.77

Datum Level = 91.05

Drawdown in all Monitoring Wells



January	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
February	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
March	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
April	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
May	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
June	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
July	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
August	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
September	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
October	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
November	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
December	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

[illegible]

Category	2016-2024	2015-2024	2014-2024	2013-2024	2012-2024	2011-2024	2010-2024	2009-2024	2008-2024	2007-2024	2006-2024	2005-2024	2004-2024	2003-2024	2002-2024	2001-2024	2000-2024	1999-2024	1998-2024	1997-2024	1996-2024	1995-2024	1994-2024	1993-2024	1992-2024	1991-2024	1990-2024	1989-2024	1988-2024	1987-2024	1986-2024	1985-2024	1984-2024	1983-2024	1982-2024	1981-2024	1980-2024	1979-2024	1978-2024	1977-2024	1976-2024	1975-2024	1974-2024	1973-2024	1972-2024	1971-2024	1970-2024	1969-2024	1968-2024	1967-2024	1966-2024	1965-2024	1964-2024	1963-2024	1962-2024	1961-2024	1960-2024	1959-2024	1958-2024	1957-2024	1956-2024	1955-2024	1954-2024	1953-2024	1952-2024	1951-2024	1950-2024	1949-2024	1948-2024	1947-2024	1946-2024	1945-2024	1944-2024	1943-2024	1942-2024	1941-2024	1940-2024	1939-2024	1938-2024	1937-2024	1936-2024	1935-2024	1934-2024	1933-2024	1932-2024	1931-2024	1930-2024	1929-2024	1928-2024	1927-2024	1926-2024	1925-2024	1924-2024	1923-2024	1922-2024	1921-2024	1920-2024	1919-2024	1918-2024	1917-2024	1916-2024	1915-2024	1914-2024	1913-2024	1912-2024	1911-2024	1910-2024	1909-2024	1908-2024	1907-2024	1906-2024	1905-2024	1904-2024	1903-2024	1902-2024	1901-2024	1900-2024	1899-2024	1898-2024	1897-2024	1896-2024	1895-2024	1894-2024	1893-2024	1892-2024	1891-2024	1890-2024	1889-2024	1888-2024	1887-2024	1886-2024	1885-2024	1884-2024	1883-2024	1882-2024	1881-2024	1880-2024	1879-2024	1878-2024	1877-2024	1876-2024	1875-2024	1874-2024	1873-2024	1872-2024	1871-2024	1870-2024	1869-2024	1868-2024	1867-2024	1866-2024	1865-2024	1864-2024	1863-2024	1862-2024	1861-2024	1860-2024	1859-2024	1858-2024	1857-2024	1856-2024	1855-2024	1854-2024	1853-2024	1852-2024	1851-2024	1850-2024	1849-2024	1848-2024	1847-2024	1846-2024	1845-2024	1844-2024	1843-2024	1842-2024	1841-2024	1840-2024	1839-2024	1838-2024	1837-2024	1836-2024	1835-2024	1834-2024	1833-2024	1832-2024	1831-2024	1830-2024	1829-2024	1828-2024	1827-2024	1826-2024	1825-2024	1824-2024	1823-2024	1822-2024	1821-2024	1820-2024	1819-2024	1818-2024	1817-2024	1816-2024	1815-2024	1814-2024	1813-2024	1812-2024	1811-2024	1810-2024	1809-2024	1808-2024	1807-2024	1806-2024	1805-2024	1804-2024	1803-2024	1802-2024	1801-2024	1800-2024	1799-2024	1798-2024	1797-2024	1796-2024	1795-2024	1794-2024	1793-2024	1792-2024	1791-2024	1790-2024	1789-2024	1788-2024	1787-2024	1786-2024	1785-2024	1784-2024	1783-2024	1782-2024	1781-2024	1780-2024	1779-2024	1778-2024	1777-2024	1776-2024	1775-2024	1774-2024	1773-2024	1772-2024	1771-2024	1770-2024	1769-2024	1768-2024	1767-2024	1766-2024	1765-2024	1764-2024	1763-2024	1762-2024	1761-2024	1760-2024	1759-2024	1758-2024	1757-2024	1756-2024	1755-2024	1754-2024	1753-2024	1752-2024	1751-2024	1750-2024	1749-2024	1748-2024	1747-2024	1746-2024	1745-2024	1744-2024	1743-2024	1742-2024	1741-2024	1740-2024	1739-2024	1738-2024	1737-2024	1736-2024	1735-2024	1734-2024	1733-2024	1732-2024	1731-2024	1730-2024	1729-2024	1728-2024	1727-2024	1726-2024	1725-2024</
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[illegible]

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July	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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September	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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November	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
December	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

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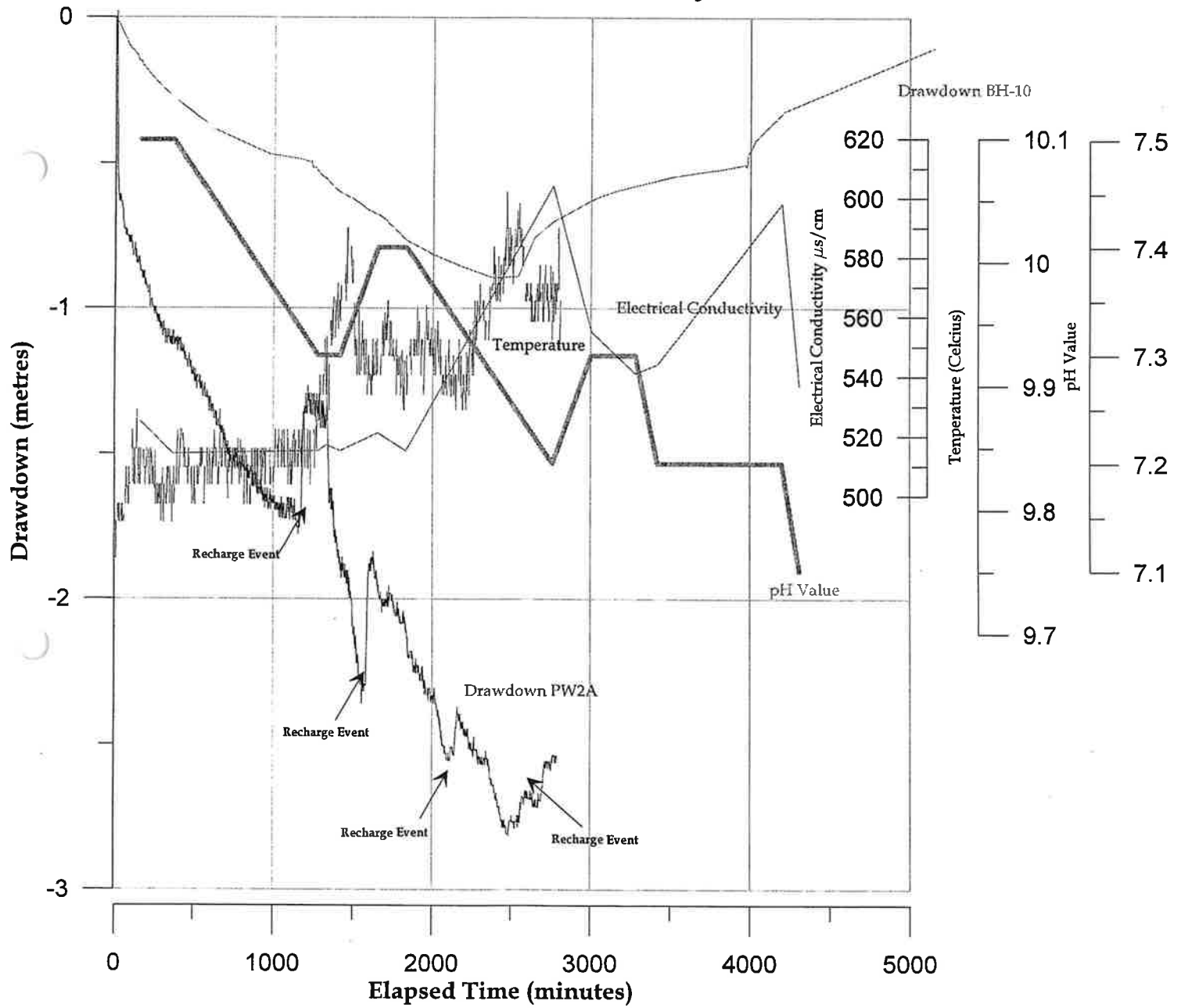
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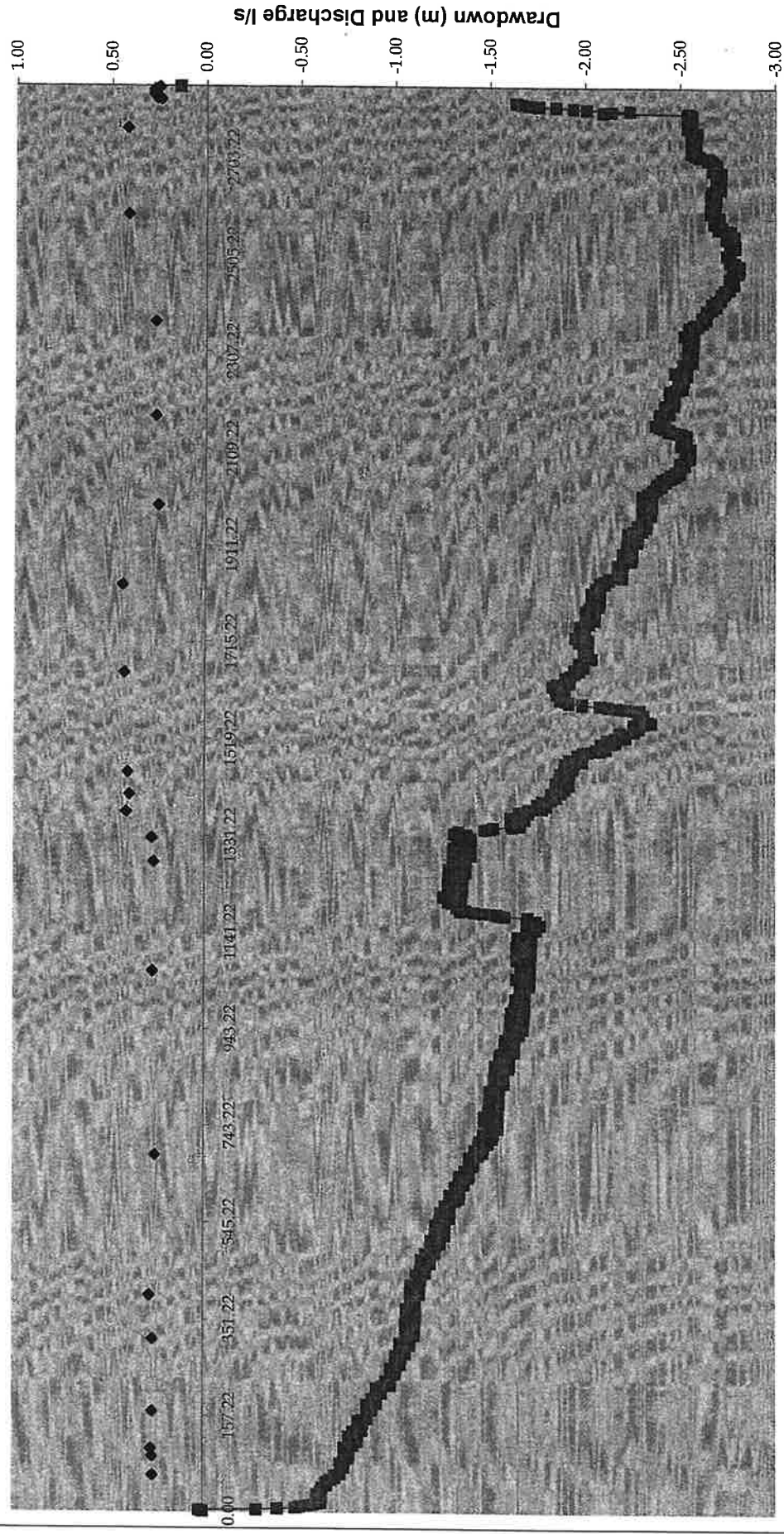
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[illegible]

Drawdown in Production Well PW2A and Monitoring Well BH10 and Changes Water Chemistry

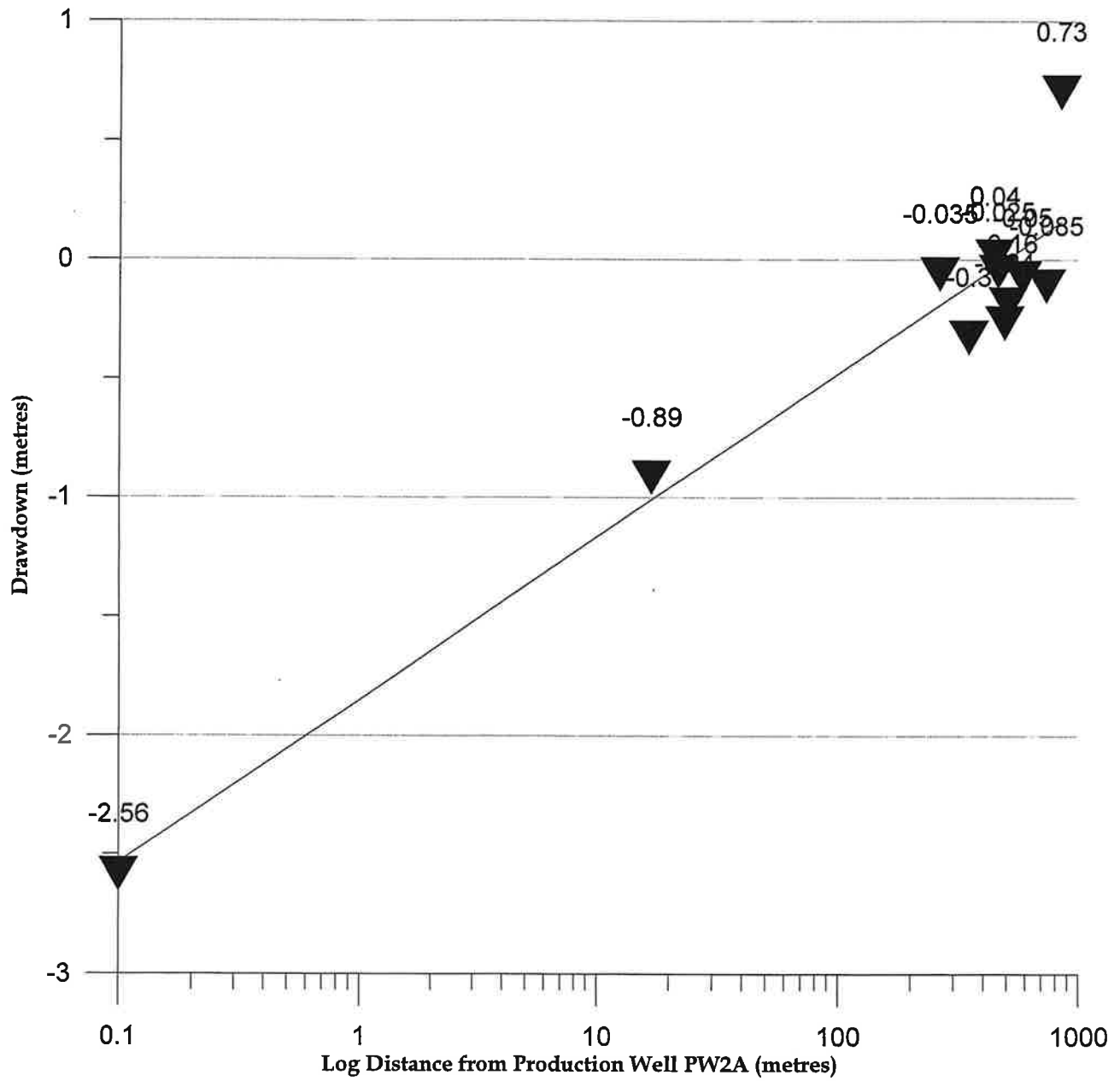


Drawdown and Discharge in Production Well PW2A



Elapsed Time in Minutes

Distance/Drawdown Plot



APPENDIX 3.4.2

GSI KARST DATABASE

5km Karst Search for Cam. Co. Roscommon (E191420-N245180)											
FNUM	FTYPE	FNAME	EASTING	NORTHING	TOWNLAND	COUNTY	GRID	ACCURACY	STRAT	LITH	
1723NEK003	Turfough	LOUGH CROAN	18743	24963	TURROCK	Roscommon	to within	50 m	SHU	Limestone, clean (>=90% CaCO3), bedded	
1723NEK004	Turfough	CUILEENIRWAN LOUGH	18880	24852	CUILEENIRWAN	Roscommon	to within	50 m	SHU	Limestone, clean (>=90% CaCO3), bedded	
1723NEK005	Turfough	FEACLE LOUGH	19079	24339	FEACLE	Roscommon	to within	50 m	SHU	Limestone, clean (>=90% CaCO3), bedded	
1723NEK006	Turfough	CORKIP	19204	24347	CORNAGEENA/POLLALAH	Roscommon	to within	50 m	SHU	Limestone, clean (>=90% CaCO3), bedded	
1723NEK007	Spring	N/A	19582	24518	MULLAGH	Roscommon	to within	20 m	Stratigraphy, VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK001	Swallow Hole	N/A	19443	24972	SRAHAUNS	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK008	Spring		18958	24052	ROCKLAND	Roscommon			VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK009	Spring		18948	24083	ROCKLAND	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK010	Swallow Hole		18921	24111	ROCKLAND	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK011	Spring		18959	24126	TOBERMACLOUGHLIN	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK012	Turfough		19042	24139	ONAGH	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK017	Swallow Hole		19160	24037	KILKENNY	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK013	Enclosed Depression		19050	24108	ONAGH	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK014	Enclosed Depression		18122	24062	SHEEAN	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK016	Swallow Hole		19123	24072	SHEEAN	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK018	Swallow Hole		19184	24036	KILKENNY	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK019	Superficial Solution Features		19184	24036	KILKENNY	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK020	Dry Valley		19006	24138	KILKENNY	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK021	Enclosed Depression		19077	24017	ONAGH	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK022	Swallow Hole		19078	24025	ONAGH	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK023	Enclosed Depression		19078	24025	ONAGH	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK005	Enclosed Depression		19198	23939	CARROEDUFF	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK006	Swallow Hole		19224	23993	CORRAREE	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK007	Swallow Hole		19224	23986	CORRAREE	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK008	Swallow Hole		19225	23984	CORRAREE	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK009	Enclosed Depression		19225	23984	CORRAREE	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK010	Swallow Hole		19221	23986	CORRAREE	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK011	Enclosed Depression		19221	23986	CORRAREE	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK012	Dry Valley		19236	23918	CARROWDUFF	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK014	Spring		18953	23932	BELLANEENY	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK015	Enclosed Depression		18973	23929	BELLANEENY	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK016	Enclosed Depression		18108	24050	SHEEAN	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK007	Spring		19582	24518	MULLAGH	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK035	Enclosed Depression		19273	23937	CARROWDUFF AND GARBALLY	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK034	Enclosed Depression		19061	23966	ONAGH	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK033	Enclosed Depression		19073	23966	ONAGH	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK032	Enclosed Depression		19145	23929	TURLAGHMORE	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK031	Enclosed Depression		19161	23943	CARROWDUFF AND GARBALLY	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK030	Enclosed Depression		19188	23934	CARROWDUFF AND GARBALLY	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK025	Enclosed Depression		19096	24002	ONAGH	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK028	Enclosed Depression		19134	24014	ONAGH	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK028	Enclosed Depression		19256	24062	CASTLESAMPSON	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK027	Enclosed Depression		19220	24087	CASTLESAMPSON	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK032	Enclosed Depression		18258	24080	ONAGH	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK029	Enclosed Depression		19229	24049	CASTLESAMPSON	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK030	Enclosed Depression		19270	24023	CASTLESAMPSON	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK031	Enclosed Depression		19273	24023	CASTLESAMPSON	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK024	Swallow Hole		18282	24053	CASTLESAMPSON	Roscommon	to within	20 m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK033	Spring		18847	24094	CILLIN	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK034	Spring		18849	24119	CILLIN	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723NEK035	Spring		18842	24149	CILLIN	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK046	Spring		18976	23919	DUNDONNELL	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	
1723SEK047	Dry Valley		18964	23920	DUNDONNELL	Roscommon	to within	10m	VIS	Limestone, clean (>=90% CaCO3), bedded	

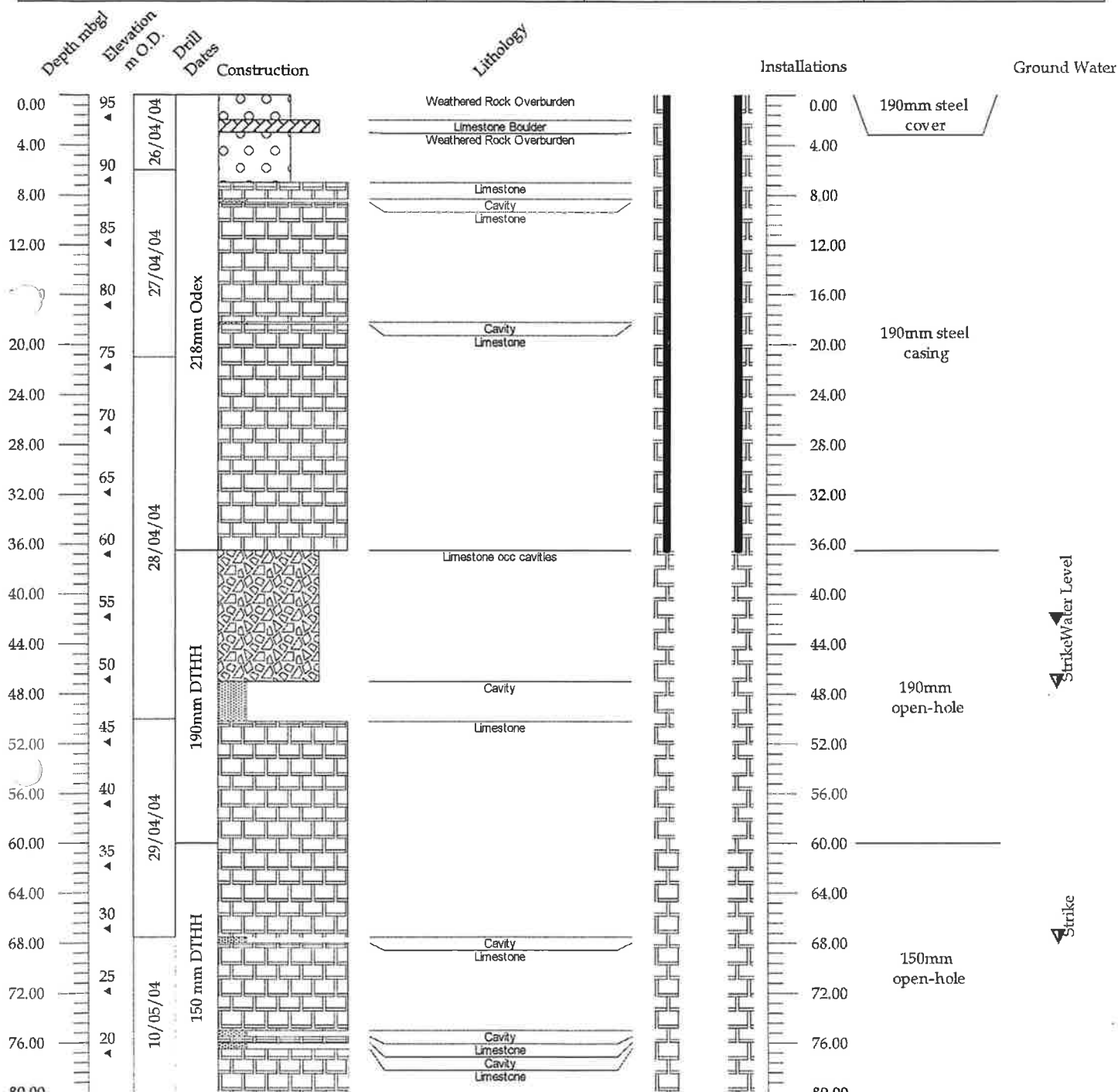
APPENDIX 3.4.3

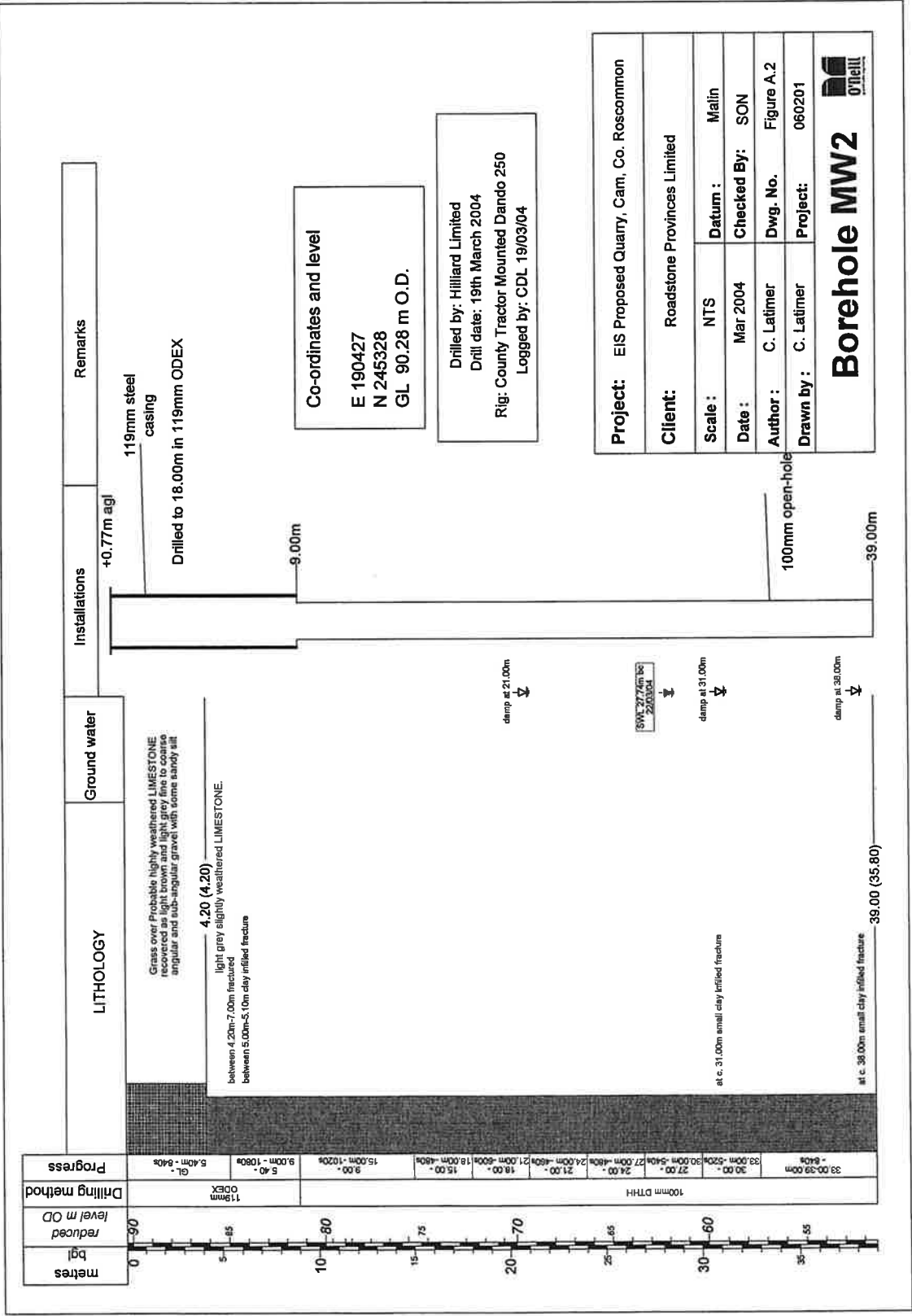
BOREHOLE RECORDS

Engineering Borehole Record

PW2A

Client: Roadstone Provinces Limited	Ground Level: 96.84m O.D.	Drilled by: Hilliard Limited	Logged by: n/a
Project No: 060201/3	NGR: E 190281 N 244897	Rig: Tractor Dando 250	Compiled by: C. D. Latimer
Location: Roscommon		Drill Dates: 26/04/04 - 10/05/04	Checked by: S O'Neill





APPENDIX 3.4.4

HYDROCHEMICAL AND ABSTRACTION DATA FROM THE KILLEGLAN PUBLIC WATER SUPPLY (ROSCOMMON COUNTY COUNCIL)

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Certificate of Analysis

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Date Printed : 26-Feb-04
Time Printed : 17:22:59

Environmental Laboratory
Engineering Department
Roscommon County Council
Court House
Roscommon

Lab ID Code :

Analysis Number : 24222

Protocol : 1 G.W.S. Drinking Water - Sources

Source : REG12 South Roscommon

Sampled : 145 K McKeon

Date : 4-Feb-04

Received : 145 Date Received : 4-Feb-04

Comments on Sampling :

SOP Code	Standard Operating Procedure	Result	Analyst Reference
030	pH	7.160	145
040	Conductivity us/cm at 25C	465.000	145
047	Colour mg/l Pt-Co	40.000	145
048	Turbidity NTU	.821	145
055	Flouride mg/l F	.094	180
081	Nitrate mg/l NO3-N	2.653	1344
082	Total Oxidised Nitrogen mg/l N	2.655	1344
086	Nitrite mg/l NO2-N	.002	1344
090	Phosphate (ortho) mgP/l	.004	1344
100	Ammonia (as N) mg/l	.007	1344
200	Total Coliforms per 100ml	326.000	145
205	Faecal Coliforms per 100ml	40.000	145

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Comments on Analysis :

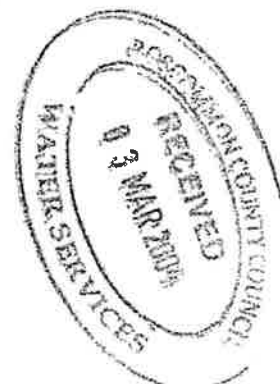
Verified : Marie Fallon

Date Verified : 26-Feb-04

Approved : John O'Gorman

Date Approved : 26-Feb-04

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Certificate of Analysis

Date Printed : 31-Dec-03

Time Printed : 15:47:22

Environmental Laboratory
Engineering Department
Roscommon County Council
Court House
Roscommon

Lab ID Code :

Analysis Number : 23738

Protocol : 1 G.W.S. Drinking Water - Sources

Source : REG12 South Roscommon

Sampled : 145 K McKeon

Received : 145 Date Received : 1-Dec-03

Date : 1-Dec-03

Comments on Sampling :

SOP Code	Standard Operating Procedure	Result	Analyst	Reference
030	pH	7.250	145	
040	Conductivity us/cm at 25C	392.000	145	
047	Colour mg/l Pt-Co	96.000	145	
048	Turbidity NTU	2.190	145	
055	Flouride mg/l F	.120	180	
081	Nitrate mg/l NO3-N	1.414	1344	
082	Total Oxidised Nitrogen mg/l N	1.414	1344	
086	Nitrite mg/l NO2-N	.001	1344	
090	Phosphate (ortho) mgP/l	.007	1344	
100	Ammonia (as N) mg/l	.012	1344	
150	Aluminium ug/l Al	72.000		
155	Iron ug/l Fe	199.000		
160	Manganese ug/l Mn	3.000		
200	Total Coliforms per 100ml	2419.000	145	
205	Faecal Coliforms per 100ml	461.000	145	



Comments on Analysis :

Verified : John O'Gorman

Date Verified : 31-Dec-03

Approved : John O'Gorman

Date Approved : 31-Dec-03

=====

Certificate of Analysis

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Date Printed : 17-Nov-03 Environmental Laboratory
 Time Printed : 14:55:11 Engineering Department
 Roscommon County Council
 Court House
 Roscommon

Lab ID Code : =====

Analysis Number : 23261
 Protocol : 1 G.W.S. Drinking Water - Sources
 Source : REG12 South Roscommon
 Sampled : 145 K McKeon Date : 8-Oct-03
 Received : 145 Date Received : 8-Oct-03
 Comments on Sampling :

SOP Code	Standard Operating Procedure	Result	Analyst Reference
030	pH	7.060	145
040	Conductivity us/cm at 25C	709.000	145
047	Colour mg/l Pt-Co	4.000	145
048	Turbidity NTU	.282	145
055	Flouride mg/l F	.128	180
081	Nitrate mg/l NO3-N	3.352	1344
082	Total Oxidised Nitrogen mg/l N	3.357	1344
086	Nitrite mg/l NO2-N	.005	1344
090	Phosphate (ortho) mgP/l	.006	1344
100	Ammonia (as N) mg/l	.008	1344
150	Aluminium ug/l Al	8.000	
155	Iron ug/l Fe	127.000	
160	Manganese ug/l Mn	49.000	
200	Total Coliforms per 100ml	18.000	145
205	Faecal Coliforms per 100ml	6.000	145

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Comments on Analysis :

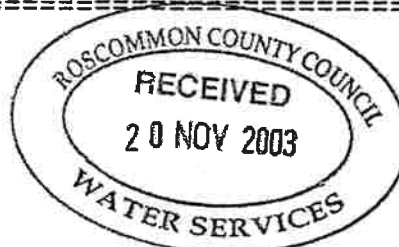
Verified : Marie Fallon

Date Verified : 17-Nov-03

Approved : John O'Gorman

Date Approved : 17-Nov-03

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===== Certificate of Analysis =====

Date Printed : 29-Sep-03
Time Printed : 16:25:43

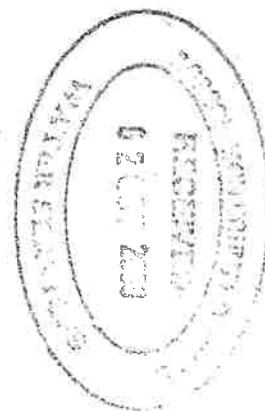
Environmental Laboratory
Engineering Department
Roscommon County Council
Court House
Roscommon

Lab ID Code :

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Analysis Number : 22729
Protocol : 1 G.W.S. Drinking Water - Sources
Source : REG12 South Roscommon
Sampled : 145 K McKeon
Received : 145 Date Received : 6-Aug-03 Date : 6-Aug-03
Comments on Sampling :

SOP Code	Standard Operating Procedure	Result	Analyst	Reference
030	pH	7.220	145	
040	Conductivity us/cm at 25C	690.000	145	
047	Colour mg/l Pt-Co	5.000	145	
048	Turbidity NTU	.255	145	
055	Flouride mg/l F	.125	180	
081	Nitrate mg/l NO3-N	2.749	1344	
082	Total Oxidised Nitrogen mg/l N	2.749	1344	
086	Nitrite mg/l NO2-N	.009	1344	
090	Phosphate (ortho) mgP/l	.005	1344	
100	Ammonia (as N) mg/l	.005	1344	
150	Aluminium ug/l Al	6.000		
155	Iron ug/l Fe	6.000		
160	Manganese ug/l Mn	2.000		
200	Total Coliforms per 100ml	25.000	145	
205	Faecal Coliforms per 100ml	17.000	145	



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Comments on Analysis :

Verified : Marie Fallon

Date Verified : 29-Sep-03

Approved : John O'Gorman

Date Approved : 29-Sep-03

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Certificate of Analysis

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Date Printed : 23-Jul-03
Time Printed : 10:22:45

Environmental Laboratory
Engineering Department
Roscommon County Council
Court House
Roscommon

Lab ID Code :

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Analysis Number : 21934
Protocol : 1 G.W.S. Drinking Water - Sources
Source : REG12 South Roscommon
Sampled : 145 K McKeon Date : 21-May-03
Received : 145 Date Received : 21-May-03
Comments on Sampling :

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SOP Code	Standard Operating Procedure	Result	Analyst Reference
030	pH	7.150	195
040	Conductivity us/cm at 25C	539.000	195
047	Colour mg/l Pt-Co	78.000	195
048	Turbidity NTU	2.190	195
081	Nitrate mg/l NO3-N	3.182	1344
082	Total Oxidised Nitrogen mg/l N	3.183	1344
086	Nitrite mg/l NO2-N	.000	1344
090	Phosphate (ortho) mgP/l	.006	1344
100	Ammonia (as N) mg/l	.002	1344
150	Aluminium ug/l Al	9.000	
155	Iron ug/l Fe	39.000	
160	Manganese ug/l Mn	4.000	
200	Total Coliforms per 100ml	18.000	195
205	Faecal Coliforms per 100ml	8.000	195

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Comments on Analysis :

Verified : Marie Fallon

Date Verified : 14-Jul-03

Approved : John O'Gorman

Date Approved : 23-Jul-03



Certificate of Analysis

Date Printed : 26-Mar-03
Time Printed : 11:50:22

Environmental Laboratory
Engineering Department
Roscommon County Council
Court House
Roscommon

Lab ID Code :

Analysis Number : 20872
Protocol : 1 G.W.S. Drinking Water - Sources
Source : REG12 South Roscommon
Sampled : 145 K McKeon
Received : 145 Date Received : 12-Feb-03 Date : 12-Feb-03
Comments on Sampling :

SOP Code	Standard Operating Procedure	Result	Analyst	Reference
030	pH	7.380	195	
040	Conductivity us/cm at 25C	597.000	195	
047	Colour mg/l Pt-Co	18.000	195	
048	Turbidity NTU	.250	195	
081	Nitrate mg/l NO3-N	3.299	190	
082	Total Oxidised Nitrogen mg/l N	3.299	190	
086	Nitrite mg/l NO2-N	.000	190	
090	Phosphate (ortho) mgP/l	.004	190	
100	Ammonia (as N) mg/l	.016	190	
150	Aluminium ug/l Al	11.000		
155	Iron ug/l Fe	40.000		
160	Manganese ug/l Mn	9.000		
200	Total Coliforms per 100ml	4.000	195	
205	Faecal Coliforms per 100ml	0.000	195	

Comments on Analysis :

Verified : Marie Fallon

Date Verified : 25-Mar-03

Approved : John O'Gorman

Date Approved : 26-Mar-03



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Certificate of Analysis

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Date Printed : 20-Dec-02
Time Printed : 14:55:25

Environmental Laboratory
Engineering Department
Roscommon County Council
Court House
Roscommon

Lab ID Code :

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Analysis Number : 20059
Protocol : 1 G.W.S. Drinking Water - Sources
Source : REG12 South Roscommon
Sampled : 145 K McKeon
Received : 145 Date Received : 3-Dec-02 Date : 3-Dec-02
Comments on Sampling :

SOP Code	Standard Operating Procedure	Result	Analyst Reference
030	pH	7.180	145
040	Conductivity us/cm at 25C	583.000	145
047	Colour mg/l Pt-Co	22.000	145
048	Turbidity NTU	.542	145
081	Nitrate mg/l NO3-N	3.194	190
082	Total Oxidised Nitrogen mg/l N	3.194	190
086	Nitrite mg/l NO2-N	.000	190
090	Phosphate (ortho) mgP/l	.005	190
100	Ammonia (as N) mg/l	.005	190
150	Aluminium ug/l Al	13.000	
155	Iron ug/l Fe	68.000	
160	Manganese ug/l Mn	11.000	
200	Total Coliforms per 100ml	74.000	145
205	Faecal Coliforms per 100ml	29.000	145

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Comments on Analysis :

Verified : John O'Gorman

Date Verified : 20-Dec-02

Approved : John O'Gorman

Date Approved : 20-Dec-02



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Certificate of Analysis

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Date Printed : 30-Oct-02 Environmental Laboratory
Time Printed : 10:22:44 Engineering Department
 Roscommon County Council
 Court House
Lab ID Code : Roscommon

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Analysis Number : 19373
Protocol : 1 G.W.S. Drinking Water - Sources
Source : REG12 South Roscommon
Sampled : 145 K McKeon Date : 14-Oct-02
Received : 190 Date Received : 14-Oct-02
Comments on Sampling :

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SOP Code	Standard Operating Procedure	Result	Analyst	Reference
030	pH	7.140	205	
040	Conductivity us/cm at 25C	661.000	205	
047	Colour mg/l Pt-Co	52.000	205	
048	Turbidity NTU	.458	205	
150	Aluminium ug/l Al	6.000		
155	Iron ug/l Fe	52.000		
160	Manganese ug/l Mn	6.000		
200	Total Coliforms per 100ml	74.000	205	
205	Faecal Coliforms per 100ml	34.000	205	

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Comments on Analysis :

Verified : John O'Gorman Date Verified : 30-Oct-02
Approved : John O'Gorman Date Approved : 30-Oct-02

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Certificate of Analysis

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Date Printed : 9-Aug-02
Time Printed : 15:09:49

Environmental Laboratory
Engineering Department
Roscommon County Council
Court House
Roscommon

Lab ID Code :

Analysis Number : 17769

Protocol : 1 G.W.S. Drinking Water - Sources

Source : REG12 South Roscommon

Sampled : 145 K McKeon

Date : 1-Jul-02

Received : 190 Date Received : 1-Jul-02

Comments on Sampling :

SOP Code	Standard Operating Procedure	Result	Analyst	Reference
030	pH	7.160	190	
040	Conductivity us/cm at 25C	637.000	190	
047	Colour mg/l Pt-Co	5.000	190	
048	Turbidity NTU	.157	190	
080	Nitrate (NO3) mg/l	17.643	195	
085	Nitrites mg/l NO2	.003	195	
090	Phosphate (ortho) mgP/l	.006	195	
105	Ammonium mg/l NH4	.007	195	
150	Aluminium ug/l Al	6.000		
155	Iron ug/l Fe	16.000		
160	Manganese ug/l Mn	2.000✓		
200	Total Coliforms per 100ml	43.000	190	✓
205	Faecal Coliforms per 100ml	4.000	190	

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Comments on Analysis :

Verified : John O'Gorman

Date Verified : 9-Aug-02

Approved : John O'Gorman

Date Approved : 9-Aug-02

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Certificate of Analysis

Date Printed : 9-Aug-02
Time Printed : 10:31:18

Environmental Laboratory
Engineering Department
Roscommon County Council
Court House
Roscommon

Lab ID Code :

Analysis Number : 18245

Protocol : 1

Source : REG12

Sampled : 145

Received : 205

Comments on Sampling :

G.W.S. Drinking Water - Sources

South Roscommon

K McKeon

Date Received : 30-Jul-02

Date : 30-Jul-02

SOP Code	Standard Operating Procedure	Result	Analyst	Reference
030	pH	7.060	205	
040	Conductivity us/cm at 25C	608.000	205	
047	Colour mg/l Pt-Co	21.000	205	
048	Turbidity NTU	.231	205	
080	Nitrate (NO3) mg/l	21.620	195	
082	Total Oxidised Nitrogen mg/l N	4.881	195	
085	Nitrites mg/l NO2	.008	195	
090	Phosphate (ortho) mgP/l	.006	195	
105	Ammonium mg/l NH4	.010	195	
200	Total Coliforms per 100ml	0.000	205	✓
205	Faecal Coliforms per 100ml	0.000	205	

Comments on Analysis :

Verified : John O'Gorman

Date Verified : 9-Aug-02

Approved : John O'Gorman

Date Approved : 9-Aug-02



===== Certificate of Analysis =====

Date Printed : 10-Sep-02
Time Printed : 10:44:32

Environmental Laboratory
Engineering Department
Roscommon County Council
Court House
Roscommon

Lab ID Code :
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Analysis Number : 18404
Protocol : 1 G.W.S. Drinking Water - Sources
Source : REG12 South Roscommon
Sampled : 145 K McKeon
Received : 205 Date Received : 12-Aug-02 Date : 12-Aug-02
Comments on Sampling :

SOP Code	Standard Operating Procedure	Result	Analyst	Reference
030	pH	7.120	205	
040	Conductivity us/cm at 25C	551.000	205	
047	Colour mg/l Pt-Co	16.000	205	
048	Turbidity NTU	.512	205	
081	Nitrate mg/l NO3-N	3.890	195	
082	Total Oxidised Nitrogen mg/l N	3.890	195	
086	Nitrite mg/l NO2-N	.002	195	
090	Phosphate (ortho) mgP/l	.007	195	
100	Ammonia (as N) mg/l	.010	195	
150	Aluminium ug/l Al	16.000		
155	Iron ug/l Fe	48.000		
160	Manganese ug/l Mn	4.000		
200	Total Coliforms per 100ml	201.000	205	
205	Faecal Coliforms per 100ml	94.000	205	

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Comments on Analysis :

Verified : John O'Gorman

Date Verified : 10-Sep-02

Approved : John O'Gorman

Date Approved : 10-Sep-02

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                          Certificate of Analysis
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Date Printed :    4-Jun-02          Environmental Laboratory
Time Printed :   12:39:18          Engineering Department
                                      Roscommon County Council
                                      Court House
Lab ID Code :                      Roscommon
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Analysis Number : 16655
Protocol : 1 G.W.S. Drinking Water - Sources
Source : REG12 South Roscommon
Sampled : 145 K McKeon
Received : 190 Date Received : 16-Apr-02
Comments on Sampling :

SOP Code	Standard Operating Procedure	Result	Analyst	Reference
030	pH	7.110	190	
040	Conductivity us/cm at 25C	604.000	190	
047	Colour mg/l Pt-Co	12.000	190	
048	Turbidity NTU	.126	190	
080	Nitrate (NO3) mg/l	18.140	195	
085	Nitrites mg/l NO2	.134	195	
090	Phosphate (ortho) mgP/l	.004	195	
105	Ammonium mg/l NH4	.007	195	
150	Aluminium ug/l Al	8.000		
155	Iron ug/l Fe	17.000		
160	Manganese ug/l Mn	6.000		
200	Total Coliforms per 100ml	4.000	190	
205	Faecal Coliforms per 100ml	0.000	190	

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Comments on Analysis :
Verified : John O'Gorman                      Date Verified : 4-Jun-02
Approved : John O'Gorman                      Date Approved : 4-Jun-02
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Date Verified : 4-Jun-02

Date Approved : 4-Jun-02

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Certificate of Analysis

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Date Printed : 26-Mar-02
Time Printed : 14:51:13

Environmental Laboratory
Engineering Department
Roscommon County Council
Court House
Roscommon

Lab ID Code :

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Analysis Number : 16006
Protocol : 1 G.W.S. Drinking Water - Sources
Source : REG12 South Roscommon
Sampled : 145 K McKeon Date : 20-Feb-02
Received : 190 Date Received : 20-Feb-02
Comments on Sampling : SRRWSS

SOP Code	Standard Operating Procedure	Result	Analyst Reference
010	Temperature (deg C)	8.600	145
030	pH	7.110	190
040	Conductivity us/cm at 25C	578.000	190
047	Colour mg/l Pt-Co	21.000	190
048	Turbidity NTU	.234	190 ✓
080	Nitrate (NO3) mg/l	19.873	195
085	Nitrites mg/l NO2	.010	195
090	Phosphate (ortho) mgP/l	.002	195
105	Ammonium mg/l NH4	.007	195
200	Total Coliforms per 100ml	13.000	190 ✓
205	Faecal Coliforms per 100ml	8.000	190 ✓

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Comments on Analysis :

Verified : John O'Gorman

Date Verified : 26-Mar-02

Approved : John O'Gorman

Date Approved : 26-Mar-02

=====



O'Neill Ground Water Engineering

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email: info@groundwatereng.ie



Appendix 3.4.4

EIS - Water Section, Proposed Quarry at Cam, Co. Roscommon

Contract Number: 060201

Killeglan Public Water Supply [REDACTED] Figures (Supplied by Roscommon Co. Co.)

Killeglan Springs abstraction figures in cubic meters per month

Jan-00	Feb-00	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Sep-00	Oct-00	Nov-00	Dec-00
204,102	188,332	203,133	262,100	221,313	219,912	241,996	234,690	221,664	227,615	212,888	219,850
Jan-01	Feb-01	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01	Nov-01	Dec-01
223,975	205,013	240,531	273,776		234,756	250,948	243,834		223,708	225,668	
Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Sep-02	Oct-02	Nov-02	Dec-02
246,555	207,953	237,946	244,124	242,232	228,284		248,062	242,283			228,957
Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03
	220,655	242,414	236,932	241,310	232,277	248,139		249,245	257,007	248,482	240,495
Jan-04	Feb-04	Mar-04	Apr-04	May-04	Jun-04						
224,184	235,448	240,752	229,642	239,457	238,006						

APPENDIX 3.4.5

50 AND 100 YEAR RETURN PERIOD STORM EVENT CALCULATION FOR PROPOSED DEVELOPMENT

O'Neill Ground Water Engineering

7, South Main Street, Naas, Co. Kildare.
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email: info@groundwatereng.ie



Appendix 3.4.5

EIS - Water Section, Proposed Quarry at Cam, Co. Roscommon

Contract Number: 060201

1, 50 and 100 yr return period storm event calculation for
hardstanding in Quarry Management Area

100 Year Storm Return Event

i 2-day R5	ii r	iii Storm Duration	iv rD	v Dr5	vi Growth Factor	Dr100	DR100	Area	Flow	Flow
mm		hours		mm (i) x (iv)		mm (v) x (vi)	m	m ²	m ³ /duration	m ³ /s
53	0.33	0.5	0.25	13.25	1.97	26.10	0.026	22584	589	0.327499
53	0.33	1	0.33	17.49	1.96	34.19	0.034	22584	772	0.214504
53	0.33	2	0.46	24.38	1.91	46.57	0.047	22584	1052	0.146061
53	0.33	6	0.57	30.21	1.85	55.89	0.056	22584	1262	0.058435
53	0.33	12	0.7	37.10	1.79	66.41	0.066	22584	1500	0.034717
53	0.33	24	0.87	46.11	1.74	80.23	0.080	22584	1812	0.020972

50 Year Storm Return Event

i 2-day R5	ii r	iii Storm Duration	iv rD	v Dr5	vi Growth Factor	Dr50	DR50	Area	Flow	Flow
mm		hours		mm (i) x (iv)		mm (v) x (vi)	m	m ²	m ³ /duration	m ³ /s
53	0.33	0.5	0.25	13.25	1.69	22.39	0.022	22584	506	0.280951
53	0.33	1	0.33	17.49	1.68	29.38	0.029	22584	664	0.184331
53	0.33	2	0.46	24.38	1.64	39.98	0.040	22584	903	0.125414
53	0.33	6	0.57	30.21	1.61	48.64	0.049	22584	1098	0.050854
53	0.33	12	0.7	37.10	1.575	58.43	0.058	22584	1320	0.030547
53	0.33	24	0.87	46.11	1.54	71.01	0.071	22584	1604	0.018561

1 Year Storm Return Event

i 2-day R5	ii r	iii Storm Duration	iv rD	v Dr5	vi Growth Factor	Dr1	DR1	Area	Flow	Flow
mm		hours		mm (i) x (iv)		mm (v) x (vi)	m	m ²	m ³ /duration	m ³ /s
53	0.33	0.5	0.25	13.25	0.69	9.08	0.009	22584	205	0.113877
53	0.33	1	0.33	17.49	0.70	12.16	0.012	22584	275	0.076256
53	0.33	2	0.46	24.38	0.71	17.31	0.017	22584	391	0.054295
53	0.33	6	0.57	30.21	0.72	21.75	0.022	22584	491	0.022742
53	0.33	12	0.7	37.10	0.79	29.31	0.029	22584	662	0.015322
53	0.33	24	0.87	46.11	0.80	36.89	0.037	22584	833	0.009642

O'Neill Ground Water Engineering

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email: info@groundwatereng.ie



Appendix 3.4.5

EIS - Water Section, Proposed Quarry at Cam, Co. Roscommon

Contract Number: 060201

1, 50 and 100 yr return period storm event calculation for proposed quarry footprint

100 Year Storm Return Event

i 2-day R5	ii r	iii Storm Duration	iv rD	v Dr5	vi Growth Factor	Dr100	DR100	Area	Flow	Flow
mm		hours		mm (i) x (iv)		mm (v) x (vi)	m	m ²	m ³ /duration	m ³ /s
53	0.33	0.5	0.25	13.25	1.97	26.10	0.026	237000	6186	3.436829
53	0.33	1	0.33	17.49	1.96	34.19	0.034	237000	8104	2.251036
53	0.33	2	0.46	24.38	1.91	46.57	0.047	237000	11036	1.532791
53	0.33	6	0.57	30.21	1.85	55.89	0.056	237000	13246	0.613221
53	0.33	12	0.7	37.10	1.79	66.41	0.066	237000	15739	0.364327
53	0.33	24	0.87	46.11	1.74	80.23	0.080	237000	19015	0.220079

50 Year Storm Return Event

i 2-day R5	ii r	iii Storm Duration	iv rD	v Dr5	vi Growth Factor	Dr50	DR50	Area	Flow	Flow
mm		hours		mm (i) x (iv)		mm (v) x (vi)	m	m ²	m ³ /duration	m ³ /s
53	0.33	0.5	0.25	13.25	1.69	22.39	0.022	237000	5307	2.948346
53	0.33	1	0.33	17.49	1.68	29.38	0.029	237000	6964	1.934394
53	0.33	2	0.46	24.38	1.64	39.98	0.040	237000	9476	1.316114
53	0.33	6	0.57	30.21	1.61	48.64	0.049	237000	11527	0.533668
53	0.33	12	0.7	37.10	1.575	58.43	0.058	237000	13849	0.320567
53	0.33	24	0.87	46.11	1.54	71.01	0.071	237000	16829	0.194783

1 Year Storm Return Event

i 2-day R5	ii r	iii Storm Duration	iv rD	v Dr5	vi Growth Factor	Dr1	DR1	Area	Flow	Flow
mm		hours		mm (i) x (iv)		mm (v) x (vi)	m	m ²	m ³ /duration	m ³ /s
53	0.33	0.5	0.25	13.25	0.69	9.08	0.009	237000	2151	1.19504
53	0.33	1	0.33	17.49	0.70	12.16	0.012	237000	2881	0.80024
53	0.33	2	0.46	24.38	0.71	17.31	0.017	237000	4102	0.569781
53	0.33	6	0.57	30.21	0.72	21.75	0.022	237000	5155	0.238659
53	0.33	12	0.7	37.10	0.79	29.31	0.029	237000	6946	0.160792
53	0.33	24	0.87	46.11	0.80	36.89	0.037	237000	8742	0.101186

O'Neill Ground Water Engineering

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email: info@groundwatereng.ie



Appendix 3.4.5

EIS - Water Section, Proposed Quarry at Cam, Co. Roscommon

Contract Number: 060201

1, 50 and 100 yr return period storm event calculation for
Ballyglass River Catchment above proposed discharge point

i 2-day R5	ii r	iii Storm Duration	iv rD	v Dr5	vi Growth Factor	Dr100	DR100	Area	Flow	Flow
mm		hours		mm (i) x (iv)		mm (v) x (vi)	m	m ²	m ³ /duration	m ³ /s
53	0.33	0.5	0.25	13.25	1.97	26.10	0.026	7970000	208037	115.5761
53	0.33	1	0.33	17.49	1.96	34.19	0.034	7970000	272518	75.69939
53	0.33	2	0.46	24.38	1.91	46.57	0.047	7970000	371129	51.54575
53	0.33	6	0.57	30.21	1.85	55.89	0.056	7970000	445431	20.62182
53	0.33	12	0.7	37.10	1.79	66.41	0.066	7970000	529280	12.25185
53	0.33	24	0.87	46.11	1.74	80.23	0.080	7970000	639444	7.400975

50 Year Storm Return Event

i 2-day R5	ii r	iii Storm Duration	iv rD	v Dr5	vi Growth Factor	Dr50	DR50	Area	Flow	Flow
mm		hours		mm (i) x (iv)		mm (v) x (vi)	m	m ²	m ³ /duration	m ³ /s
53	0.33	0.5	0.25	13.25	1.69	22.39	0.022	7970000	178468	99.14901
53	0.33	1	0.33	17.49	1.68	29.38	0.029	7970000	234184	65.05114
53	0.33	2	0.46	24.38	1.64	39.98	0.040	7970000	318666	44.25918
53	0.33	6	0.57	30.21	1.61	48.64	0.049	7970000	387646	17.94656
53	0.33	12	0.7	37.10	1.575	58.43	0.058	7970000	465707	10.78026
53	0.33	24	0.87	46.11	1.54	71.01	0.071	7970000	565945	6.550288

1 Year Storm Return Event

i 2-day R5	ii r	iii Storm Duration	iv rD	v Dr5	vi Growth Factor	Dr1	DR1	Area	Flow	Flow
mm		hours		mm (i) x (iv)		mm (v) x (vi)	m	m ²	m ³ /duration	m ³ /s
53	0.33	0.5	0.25	13.25	0.69	9.08	0.009	7970000	72338	40.18762
53	0.33	1	0.33	17.49	0.70	12.16	0.012	7970000	96880	26.91104
53	0.33	2	0.46	24.38	0.71	17.31	0.017	7970000	137959	19.16099
53	0.33	6	0.57	30.21	0.72	21.75	0.022	7970000	173357	8.02579
53	0.33	12	0.7	37.10	0.79	29.31	0.029	7970000	233593	5.407239
53	0.33	24	0.87	46.11	0.80	36.89	0.037	7970000	293997	3.402747

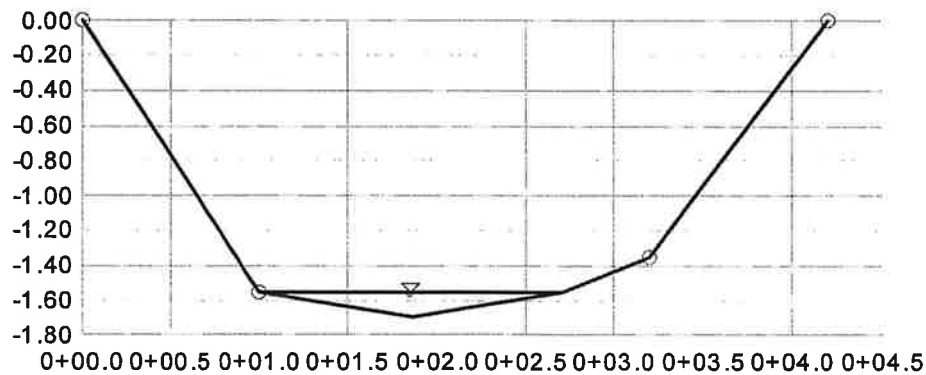
APPENDIX 3.4.6

BANK FULL CAPACITY OF THE BALLYGLASS RIVER

Ballyglass River Location 2 –1st September 2004 Flow Cross Section for Irregular Channel

Project Description	
Worksheet	Irregular Channel - 3
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.050	
Slope	0.001230	m/m
Water Surface Elevation	-1.55	m
Elevation Range	-1.70 to 0.00	
Discharge	0.0157	m ³ /s

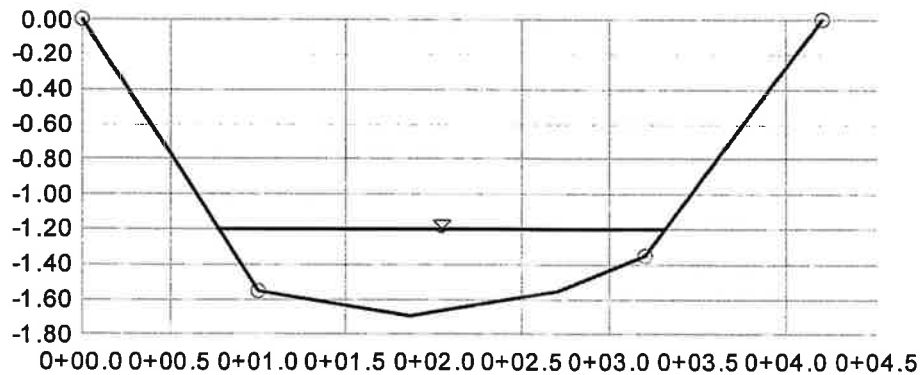


v:1
H:1
NTS

Ballyglass River Location 2 – Mean Flood Flow Cross Section for Irregular Channel

Project Description	
Worksheet	Irregular Channel - 3
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.049	
Slope	0.001230	m/m
Water Surface Elevation	-1.20	m
Elevation Range	-1.70 to 0.00	
Discharge	0.2951	m ³ /s

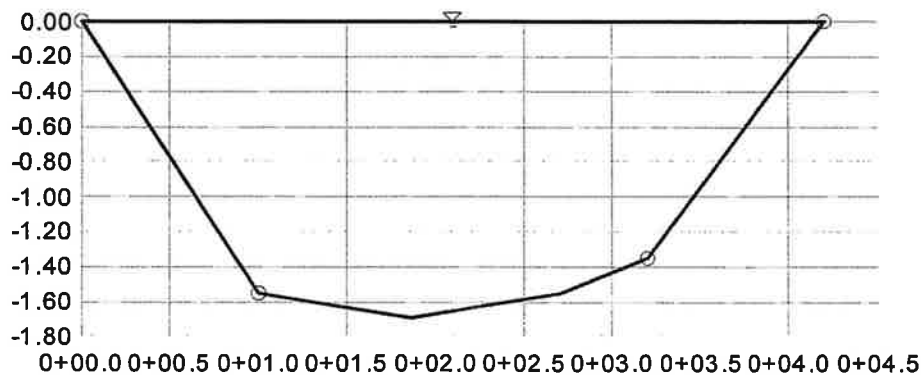


v:1
H:1
NTS

Ballyglass River Location 2 – Bank Full Capacity Cross Section for Irregular Channel

Project Description	
Worksheet	Irregular Channel - 3
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.047	
Slope	0.001230	m/m
Water Surface Elevation	0.00	m
Elevation Range	-1.70 to 0.00	
Discharge	3.3143	m ³ /s

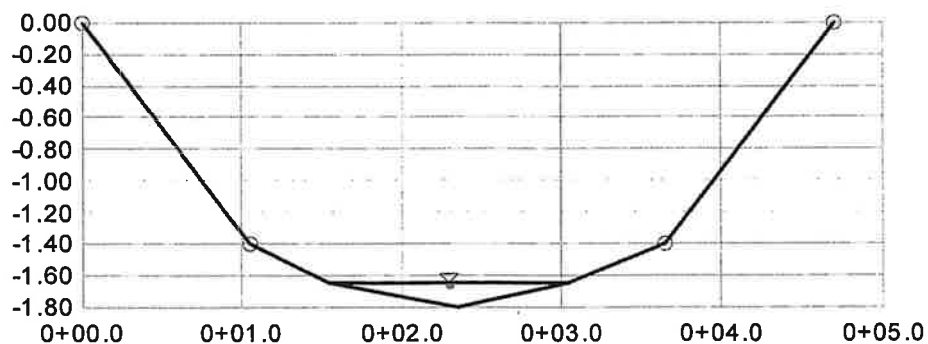


V:1
H:1
NTS

Ballyglass River Location 1 -1st September 2004 Flow Cross Section for Irregular Channel

Project Description	
Worksheet	Irregular Channel - 1
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.050	
Slope	0.001230	m/m
Water Surface Elevation	-1.65	m
Elevation Range	-1.80 to 0.00	
Discharge	0.0139	m ³ /s

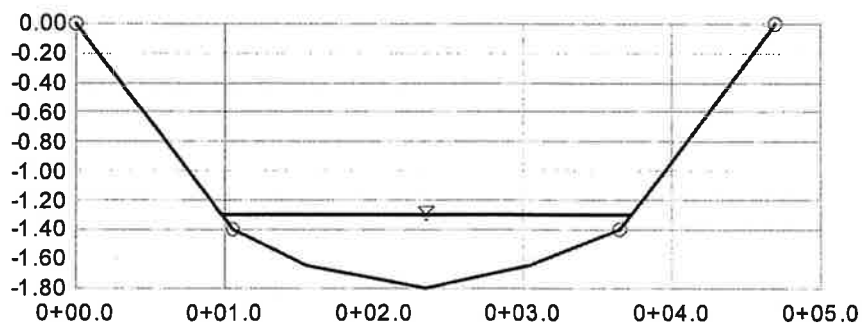


V:1
H:1
NTS

Ballyglass River Location 1 – Mean Flood Flow Cross Section for Irregular Channel

Project Description	
Worksheet	Irregular Channel - 1
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data	
Mannings Coefficient	0.050
Slope	0.001230 m/m
Water Surface Elevation	-1.30 m
Elevation Range	-1.80 to 0.00
Discharge	0.2820 m ³ /s

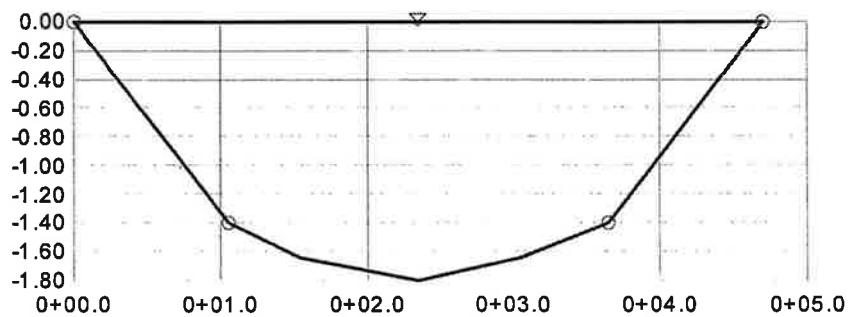


V:1
H:1
NTS

Ballyglass River Location 1 – Bank Full Capacity Cross Section for Irregular Channel

Project Description	
Worksheet	Irregular Channel - 1
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.047	
Slope	0.001230	m/m
Water Surface Elevation	0.00	m
Elevation Range	-1.80 to 0.00	
Discharge	4.0263	m ³ /s



V:1
H:1
NTS

APPENDIX 3.4.7

QUARRY WATER TREATMENT SYSTEM DESIGN

Settlement Lagoon

Water will be pumped from the quarry sump to the settlement lagoon. The average daily discharges from the quarry will be 2.6Ml/day. OGE have over-designed the system such that precipitation falling on the quarry footprint from a 1 year return period storm event as well as ground water inputs could be treated within a 24 hour period.

The settlement lagoon is made up of two stages: a primary settlement lagoon and a secondary settlement/water storage lagoon. The total volume of the combined lagoon is 2,700m³. The design of the lagoon is such that a fluid velocity of less than 1.2×10^{-4} m/s is achieved (see Design of Settlement Lagoon for calculation).

The lagoon will be divided into two compartments (*Figure No. App 3.4.1/1*). The total lagoon dimensions are 15m x 60m x 3m with a central dividing spill-over wall, forming two lagoons of 15m x 30m x 3m each.

Two moveable spill-overs will project from the bank across the first stage of the lagoon dividing it into 3 sections of 15m x 10m x 3m each. Increasingly clear supernatant will overflow the spill-overs along the direction of water flow in this lagoon. The reduction in sediment load at each successive spill-over will increase the efficiency of the sediment settling process. The division of the settlement lagoon into a number of sub-sections and two stages will facilitate the dredging/pumping of each section to remove settled sediment without greatly increasing turbidity within the other compartments. The spill-over will be height-adjustable within the range of the lagoon freeboard to ensure that the depth of water overspilling does not become excessive, which would result in the transfer of water of relatively higher turbidity to downstream section.

The second stage of the overall lagoon design will have dimensions 15m x 30m x 3m. It will receive water flow from the final compartment of the first lagoon over a dividing wall. The secondary compartment will act as a surface water store and allow further time for the sedimentation of any remaining fine sediment. The secondary settlement compartment will discharge via a pipe controlled by an adjustable valve into a klargestor oil interceptor

Assuming complete mixing, then the retention time is a function of the flow rate into the settlement lagoon. The volume of the lagoon is 2700m³. The maximum estimated inflow into the lagoon is

10,000m³/day. This gives a retention time in excess of six hours. Under mean flow conditions the retention time will be 24 hours, i.e, the capacity of the system is approximately 4 times the average system through-put.

Klargester Interceptor

A Klargester interceptor shall be installed downstream from the settlement lagoon on the discharge pipe to filter off any possible mineral oils and diesel range hydrocarbons. Details are shown in *Figure No. App. 3.4.1/2..* The Klargester shall be of the type *NS 120 Full Retention Class 1* that accepts a nominal flow of 120litres/s (432m³/hr). Inflow and outflow to and from the oil interceptor will be via the water discharge pipe.

Discharge Pipe

It is proposed that water from the quarry will be pumped via a pipeline to discharge to the Ballyglass River some 1300 metres to the west of the site. The estimated fall between the north-western corner of the site and the Ballyglass River is approximately 20 metres. The fall on the pipeline is therefore approximately 0.016. Assuming the worst case scenario discharge rate of 10,000m³/day (120l/s) and an unpressurised welded uPVC pipeline, then the minimum pipe diameter required is 255mm. A discharge gauge and sample tap will be placed on the discharge pipe within the quarry so that accurate records of discharge rates and water quality can be recorded. The discharge point at the Ballyglass River will be in a constructed concrete surround for maintenance purposes. A steel flap will cover the end of the discharge pipe.

Project Description	
Worksheet	Pressure Pipe - 1
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pipe Diameter
Input Data	
Pressure at 1	0.00 kPa
Pressure at 2	0.00 kPa
Elevation at 1	84.00 m
Elevation at 2	64.00 m
Length	1,250.00 m
C Coefficient	150.0
Discharge	0.1200 m ³ /s

Results	
Diameter	253 mm
Headloss	20.00 m
Energy Grade at 1	84.29 m
Energy Grade at 2	64.29 m
Hydraulic Grade at 1	84.00 m
Hydraulic Grade at 2	64.00 m
Flow Area	0.1 m ²
Wetted Perimeter	0.79 m
Velocity	2.40 m/s
Velocity Head	0.29 m
Friction Slope	0.0160 m/m

DESIGN OF SETTLEMENT LAGOON

Calculation of settling velocity for particles (Stokes Law)

Settlement is possible when the impelling force of a particle is equal to the drag force.

The Impelling force is calculated thus = $F_I = (\gamma_s - \gamma_w) \text{ Vol}$

Where:

$$\gamma_s = \rho_s g \text{ and } \gamma_w = \rho_w g$$

ρ_s = density of the particle, which is assumed as 2.65 g/cm³ (the density of Calcite, then primary mineral in limestone is 2.71, and assuming a relatively low porosity, then a figure of 2.65 is a good average density of a limestone rock fragment)

ρ_w = density of fluid, which is assumed as water at 1.00 g/cm³

g = acceleration due to gravity = 9.81 m/s²

Vol = Volume of particles (assumed spherical) = $\frac{4}{3} \pi r^3$ or $\pi d^3/6$

The Drag force is calculated thus = $F_d = C_d A_s \rho_s (V_s^2/2)$

C_d = Drag Co-efficient = $24v/V_s d \approx 0.4$ for spheres

v = Kinematic Viscosity = μ/ρ

A_s = Sectional area of a sphere = πr^2 or $\pi d^2/4$



V_s = Settling velocity 'Stokes'

By equating the impelling force and the drag force (such that particles will start to settle when these forces are equal) then

$$F_I = F_d = (\gamma_s - \gamma_w) Vol = C_d A_s \rho_s (V_s^2/2)$$

The above equation can be solved for V_s (the settling velocity of a spherical particle of density 2.65) thus:

$$(\gamma_s - \gamma_w) Vol = C_d A_s \rho_w \left(\frac{V_s^2}{2} \right)$$

$$(\rho_s g - \rho_w g) \frac{\pi d^3}{6} = \left(\frac{24 \nu}{V_s d} \right) \left(\frac{\pi d^2}{4} \right) \rho_w \left(\frac{V_s^2}{2} \right)$$

$$g (\rho_s - \rho_w) \frac{\pi d^3}{6} = \left(\frac{24 \nu}{V_s d} \right) \left(\frac{\pi d^2}{4} \right) \rho_w \left(\frac{V_s^2}{2} \right)$$

$$\frac{g \pi d^3}{6} (\rho_s - \rho_w) = \frac{24 \nu \pi d^2 \rho_w V_s^2}{8 V_s d}$$

$$V_s = \frac{g \pi d^3 (\rho_s - \rho_w)}{18 \nu}$$

$$\frac{g \pi d^3}{6} (\rho_s - \rho_w) = \nu \pi d \rho_w V_s$$

$$V_s = \frac{g \pi d^3 (\rho_s - \rho_w)}{18 \nu \pi d \rho_w}$$

$$V_s = \frac{g (\rho_s - \rho_w) d^2}{18 \nu \rho_w}$$

$$\nu = \frac{\mu_w}{\rho_w}$$

$$V_s = \frac{g (\rho_s - \rho_w) d^2}{18 \mu_w}$$

Then to calculate the settlement velocity of particles we may use the following equation:

$$V_s = g/18\mu_w \cdot (\rho_s - \rho_w) d^2$$

As previously established

g = Acceleration due to gravity is 9.81 m/s^2

ρ_s = density of the particle = 2.65 g/cm^3 or $2.65 \times 10^3 \text{ kg/m}^3$

ρ_w = density of fluid = 1.00 g/cm^3 or $1 \times 10^3 \text{ kg/m}^3$

μ_w = dynamic viscosity of water = $1.002 \times 10^{-3} \text{ kg/ms}$ @ 20°C (or 1.519×10^{-3} @ 5°C and 0.797×10^{-3} @ 30°C)

d = particle diameter in m

Then V_s (@ 20°C for 2.65 density particle) = $897,451 d^2$ in m/s

Stokes Law applies for particles where the Reynolds Number is less than 1, in all the below cases Stokes Law is applicable, since the Reynolds Number is less than 1.

Reynolds Number = $V_s d$

particle size (m)	particle size (mm)	at 20C for 2.65 density particle		
		$V_s \text{ m/s}$	$V_s \text{ mm/s}$	Re
1.00E-06	0.001	8.97E-07	8.97E-04	8.97E-07
2.00E-06	0.002	3.59E-06	3.59E-03	7.18E-06
1.00E-05	0.01	8.97E-05	8.97E-02	8.97E-04
2.00E-05	0.02	3.59E-04	3.59E-01	7.18E-03
4.00E-05	0.04	1.44E-03	1.44E+00	5.74E-02
6.00E-05	0.06	3.23E-03	3.23E+00	1.94E-01
7.00E-05	0.07	4.40E-03	4.40E+00	3.08E-01

The settling velocity of particles of 0.001 and 0.002 diameter (assumed spherical) in water can be calculated for variable particle densities and water temperature using the above equation:

Particle Density	Water Temp C	Vs mm/s 0.01 particle	Vs m/s 0.01 particle	Vs mm/s 0.02 particle	Vs m/s 0.02 particle
2	5	3.59E-02	3.59E-05	1.44E-01	1.44E-04
2.3	5	4.66E-02	4.66E-05	1.87E-01	1.87E-04
2.65	5	5.92E-02	5.92E-05	2.37E-01	2.37E-04
2	20	5.44E-02	5.44E-05	2.18E-01	2.18E-04
2.3	20	7.07E-02	7.07E-05	2.83E-01	2.83E-04
2.65	20	8.97E-02	8.97E-05	3.59E-01	3.59E-04
2	30	6.84E-02	6.84E-05	2.74E-01	2.74E-04
2.3	30	8.89E-02	8.89E-05	3.56E-01	3.56E-04
2.65	30	1.13E-01	1.13E-04	4.51E-01	4.51E-04

In the worst case scenario to ensure all particles 0.02 mm are settled under cold conditions the best settlement velocity will be that which allows 0.02mm particles to settlement of low density (2×10^{-3} kg/m³) in a water temperature of 5°C is 1.44×10^{-4} m/s. This represents a surface overflow rate of 12.4 m³/day/m².

Calculation of Settlement Lagoon Area and Volume

The settlement lagoon for the proposed quarry site is designed for the maximum (worse case) storage capacity of 10ML/day. This figure is derived by the following:

Volume of water in storage:	16.5m ³ /d
Discharge required to lower water table to 40m O.D.	620m ³ /d
Additional 100% contingency on ground water inflows	636.5m ³ /d
Run-off from a 24 hour 1 year return period storm event on quarry footprint	8,700m ³ /d
Total	9,973m³/d

The above figures assume that run-off from potentially contributing areas to the quarry footprint will be prevented from entering the excavation and not require treatment. This design also assumes that run-off from more intensive storms will be allowed to pool in the base of the quarry prior to treatment. The effluent treatment system is designed to treat a maximum discharge of 10ML/day

With a calculated surface overflow rate (SOR) of 12.4 m³/day/m² then the area of the settlement lagoon (A) will be as follow:

$$A = 10,000/12.4 = 806 \text{ m}^2$$

If the length of the lagoon (L) $\geq$ 2W (width), then the following table is calculated



W	L	Area - 1 stage	Area - 2 stages	Area - 3 stages
5	10	50	100	150
7.5	15	112.5	225	337.5
10	20	200	400	600
11	22	242	484	726
12	24	288	576	864
12.5	25	312.5	625	937.5
14	28	392	784	1176
15	30	450	900	1350
17.5	35	612.5	1225	1837.5
20	40	800	1600	2400

As the area required to treat the discharge water is 806m² all the shaded options are acceptable.

The chosen lagoon is a two stage design with a total surface area of 900m² split into two compartments each measuring 15 metres by 30 metres.

The surface overflow rate (SOR) will therefore be $10,000\text{m}^3\text{d}^{-1} / 900\text{ m}^2 = 11.11\text{ m}^3/\text{day}/\text{m}^2$ this is equal to a velocity of $1.29 \times 10^{-4}\text{ m/s}$

In order to have a minimum retention time of 6 hours then

$$\text{Height} = \text{SOR} \times 6/24 = 11.11/4 = 2.775\text{ m}$$

A 3 metre depth is chosen

Therefore each stage of settlement lagoon will have the follow dimensions:

Width = 15 metres

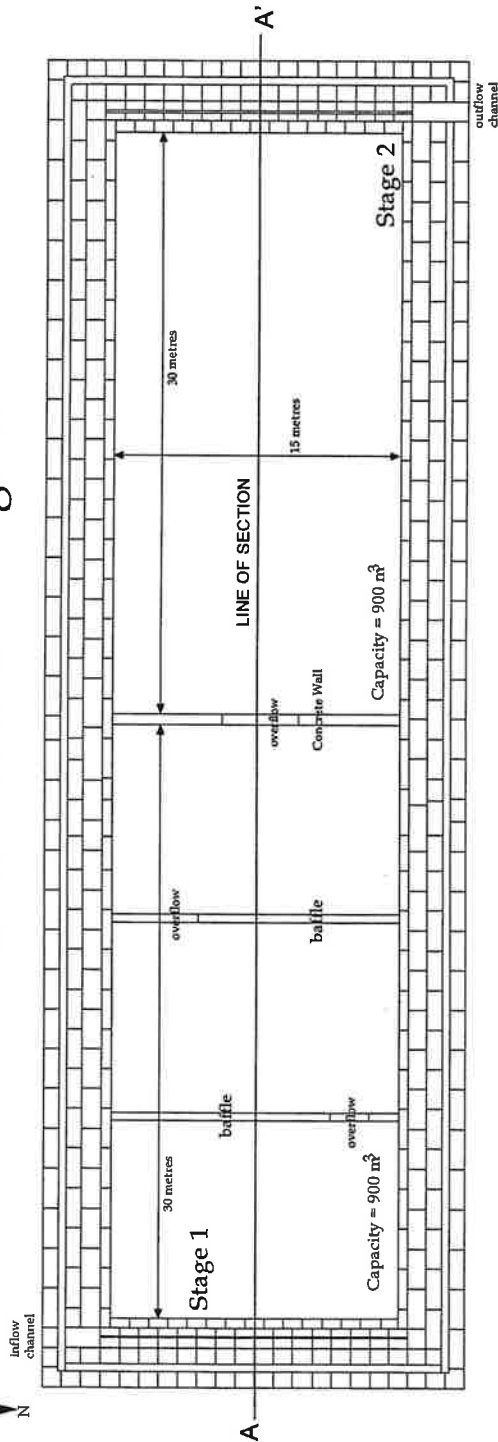
Length = 30 metres

Depth = 3 metres

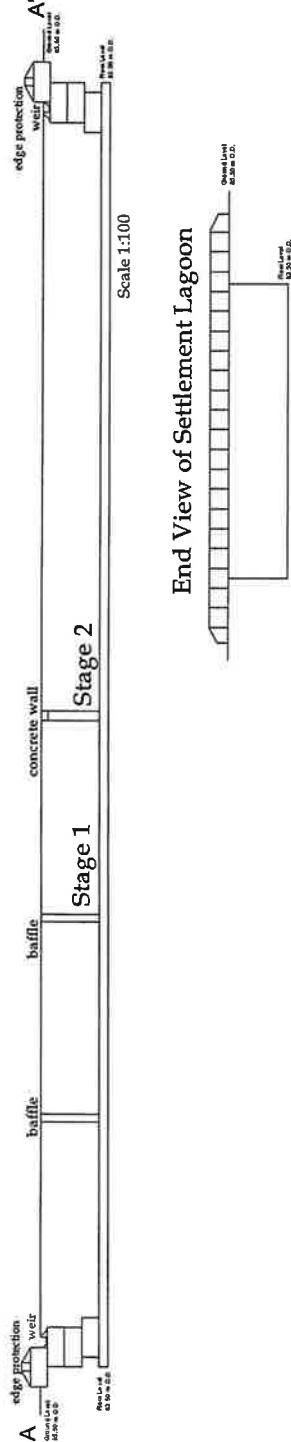
Total Volume of each stage = 1,350 m³, volume of both stages = 2,700 m³.

Since the estimated likely average discharge rate from the quarry is 2.600m³/day the residence time of treatment water in the settlement lagoon system under normal operations is approximately 24 hours.

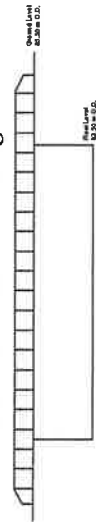
Plan of Settlement Lagoon



Section through Settlement Lagoon

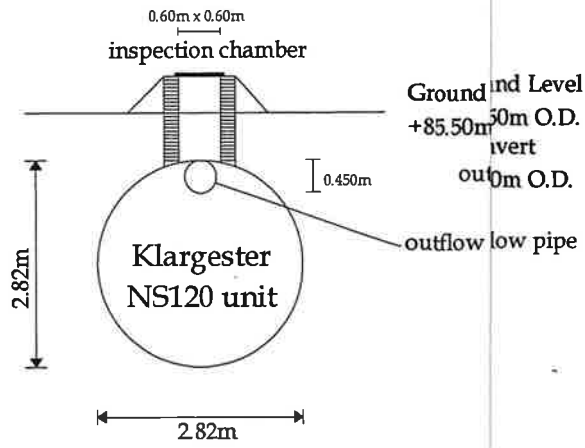


End View of Settlement Lagoon



Client :		Roadstone Provinces Limited	
Project :		EIS - Water Section for the Proposed Quarry at Curry/Cloonacaltry, Nr Brideswell, Co. Roscommon	
Date :	August 2004	Checked By :	SON
Author :	SON	Dwg. No. :	D 20
Drawn By :	C. Latimer	Reference :	060201/3
Title		Design of Settlement Lagoon	
REF: 3.4.1/1		7, South Main Street, Naas, Co. Kildare. P+353-4586668; F+353-45-881705; M+353-87-2300833 email : sonell@groundwatereng.ie	

North View (looking South)



invert
+84.40m O.D.

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Additional
060201/3

33



REF: 3.4.2

APPENDIX 3.4.8

SITE ASSESSMENT FOR WASTE WATER TREATMENT SYSTEM

SITE CHARACTERISATION FORM FOR AN ON-SITE WASTEWATER TREATMENT SYSTEM

From E.P.A. Wastewater Treatment Manual, *Treatment Systems for Single Houses* (2000).

1.0 GENERAL DETAILS (from planning application)

Planning Application Ref. No:	To be advised
Name and Address of Applicant	Roadstone Provinces Limited, Two Mile Ditch, Tuam Road, Galway
Site Location and Townland:	Proposed Quarry at Curry/Cloonacaltry, Nr Brideswell, Co. Roscommon
Telephone No.	091 770700
Fax No.	091 752199
E-mail	N/A
Maximum No. of Residents	N/A (Office with canteen: 45 persons per day usage)
No. of Double Bedrooms	N/A
No. of Single Bedrooms	N/A
Proposed capacity Of Septic Tank (litres) (if applicable)	5150 litres. Based upon 45 person average usage of quarry office with canteen (70 litres per person per day), EPA, 1999 (Table 3).
Number of Chambers	2

Proposed Water Supply:

Mains ☐ Group Water Scheme ☐ Private well/borehole ☒ Group well/borehole ☐

2.0 DESK STUDY

Soil Type	SANDY loam (Grey Brown Podzolic Teagasc Classification)
Bedrock Type	Undifferentiated Visean Limestone
Subsoil Type	GRAVELS, COBBLES and BOULDERS with sandy silt matrix
Aquifer Type	Rf – a regional important aquifer - fissure flow dominant
Vulnerability Class	High (H) based upon > 5 metres of sub-soil, but sub-soil of high permeability
Groundwater Protection Response	R1 Acceptable subject to normal good practice

Presence of Significant sites (archaeological, natural and historical):

None present

Zoning in County Development Plan	n/a rural area
Past Experience in the Area	All other houses, farms and commercial premises in the area served by septic tanks.

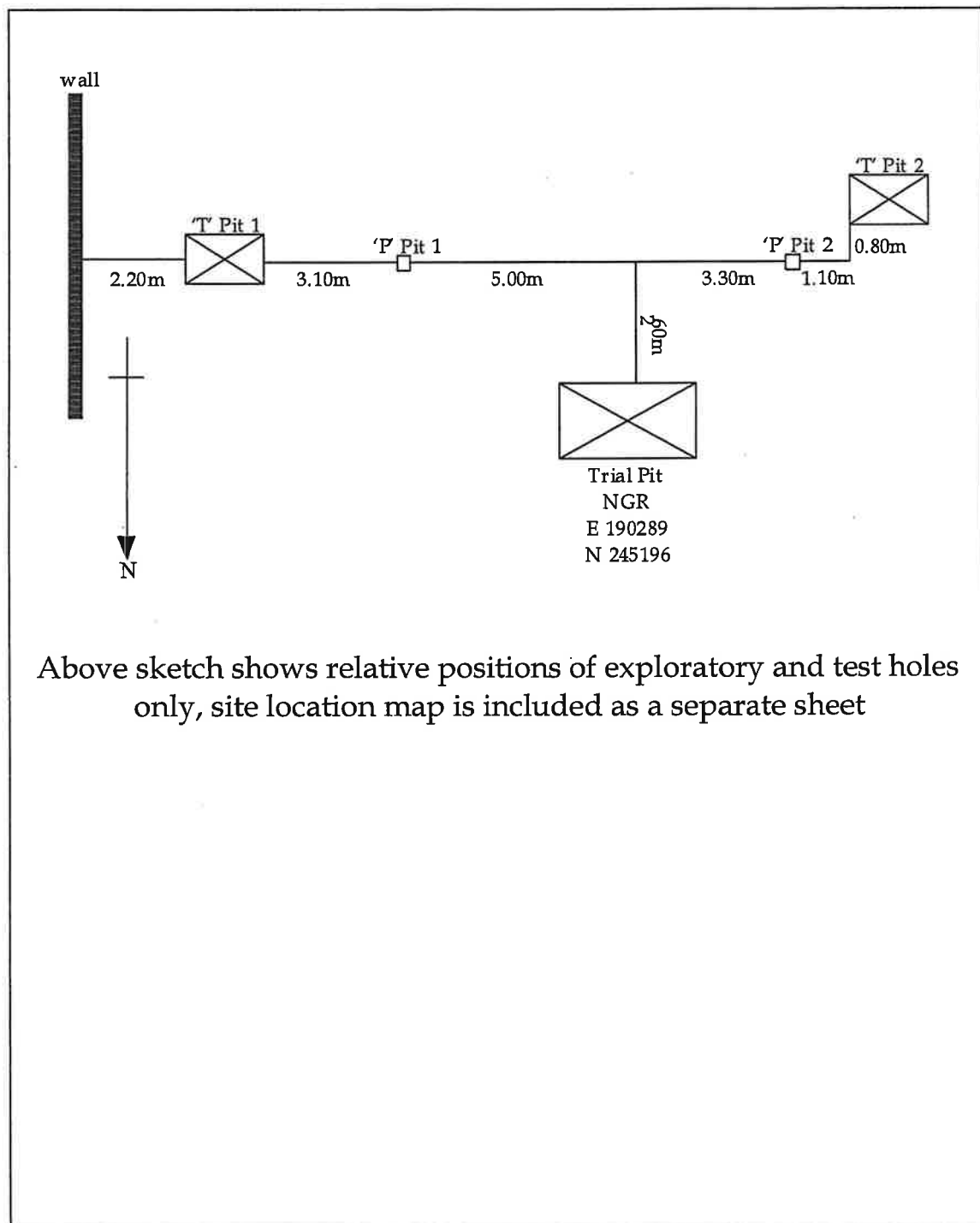
Comments:

(Integrate the information above in order to comment on the potential suitability of the site, potential targets at risk, and/or any potential site restrictions).

The site is suitable for the proposed development, given the aquifer classifications and low vulnerability.

Sketch of site showing measurement to Trial Hole location and Percolation Test Hole locations, wells and direction of groundwater flow, proposed house (incl. distances from boundaries) adjacent houses, watercourses, significant sites and other features. North point should always be included.

(a copy of the site layout drawing should be used if available)



Above sketch shows relative positions of exploratory and test holes only, site location map is included as a separate sheet

3.0 ON-SITE ASSESSMENT

3.1 VISUAL ASSESSMENT

Topography:	The land is gently undulating at approximately 90m O.D. There are number of small hills in the area and some circular depression probably related to karstification
Landscape:	The site is in mid elevation position close to the base of a small rise. The land will be levelled during the construction phase
Geology:	The bedrock is a partially karstified limestone, no outcrops are known on the study site, rockhead generally varies from 2.00 to >15.00 metres. There are a number of circular depressions nearby probably related to karstification

Slope	
Steep (>1:5)	n/a
Shallow (1:5 - 1:20)	Close to a small rise, but land to be levelled during construction phase
Relatively Flat (<1:20)	n/a

Surface Features

Outcrops	No outcrops in area, GSI reports outcrop 700 metres to north-east.
Houses	The nearest dwellings are located approximately 500 metres to the north-west.
Ditches*	There are no drainage ditches on the site, most of the surface soaks to ground.
Wells*	The nearest recorded serviceable well is located in one of the dwellings to the north-west, NGR E 189816 N 242770
Springs	None on the study site, the ground water level is >20metres below ground level at the test location
Karst Features	The site is within a karstified area. The bedrock below the test area is relatively weakly karstified (based upon geophysical evidence), although three circular depression (probably karst features) are located 115metres, 140 metres and 200 metres from the test area. To the west of the test area the bedrock is more fractures and karstified (based upon geophysical evidence)
Roads	The R363 is located 140 metres to the north of the test area
Watercourse*	There are no water courses on the site
Lakes/Surface Water Ponding/Beaches/Shellfish Areas/Wetlands	There are no open water bodies on the site
Site Boundaries	The northern boundary of the application site is approximately 130 metres, eastern boundary 165 metres, part of the southern boundary 450 metres and the western boundary 540 metres from the test area
Existing Land Use	Rough low density pasture

* Note Water Level

Local Drainage:	No drainages ditches, most surface water soaks to ground
Type of Vegetation:	Rough pasture and bracken in generally boulder strewn landscape
Ground Condition:	Relatively dry, thick ground vegetation and slightly clayey topsoil retains some moisture

Comments:

(Integrate the information above in order to comment on the potential suitability of the site, potential targets at risk, the suitability of the site to treat the wastewater and the location of the proposed system within the site).

There is little apparent risk to wells or surface watercourses if the effluent treatment system is correctly constructed.

3.2.1 Trial Hole No. 1

Hole should be approximately 1m x 0.75m in plan and a minimum of 2.1m deep.

Depth of Trial Hole (m)	2.2m
Date and time of excavation	31 August, 2004 (11:00)
Date and time of Examination	31 August 2004 (11:00)
Depth from ground surface to bedrock (m)	Bedrock not encountered (>2.20m)
Depth from ground surface to water table (m)	No ground water or seepages encountered, subsoil is dry
Soil type	Sandy loam
Subsoil type	Gravel, Cobbles and Boulders in sandy silt matrix (c. 40-50%)

Additional soil/Subsoil Information

	Texture	Structure	Bulk Density	Colour*	Preferential Flow paths
0.1m	Sandy loam	Crumb	Medium	Light Brown	Roots and rootlets
0.2m					
0.3m					
0.4m					
0.5m					
0.6m	Gravel, Cobbles and Boulders with matrix (c. 40%-50%) of sandy silt. Locally with pockets of silty gravel. Boulders can exceed 1 metre diameter (Glacial Till of Limestone Origin)	Blocky (fissured, friable locally with open structure)	Medium	Light grey	Permeable throughout
0.7m					
0.8m					
0.9m					
1.0m					
1.1m					
1.2m					
1.3m					
1.4m					
1.5m					
1.6m					
1.7m					
1.8m					
1.9m					
2.0m					
2.1m					
2.2m					
EOH @ 2.2 0m					

Other Information (e.g. depth of water ingress)

None

- All signs of mottling should be recorded

3.3 Percolation Test (1)

Type of Test

T-Test ☐

P-Test ☒

Percolation Test Hole	1	2
Depth from ground surface to top of hole (mm) (A):	0	0
Depth from ground surface to base of hole (mm) (B):	400	400
Depth of hole (mm) (B-A):	400	400
Dimensions of hole [length x breadth (mm)]:	300 x 300	300 x 300

Each hole must be pre-soaked twice before the test is carried out (from 10:00am to 5:00pm and from 5:00pm to next morning)

Percolation Test Hole	1	2
Date of Test	1 September 2004	1 September 2004
Date pre-soaked started:	31 August 2004	31 August 2004
Time filled to 400mm:	09:24:00	09:33:00
Time water level at 300mm:	11:18:00	11:43:00

Percolation Test Hole No.	1			2			
	Fill No.	Start Time (at 300mm)	Finish Time (at 200mm)	Δt (min)	Start Time (at 300mm)	Finish Time (at 200mm)	Δt (min)
1	11:18:00	16:37:00	319	11:48:00	14:12:00	144	
2				14:15:00	16:56:00	161	
3				17:02:00	19:37:00 (est.)	155	
Average			n/a	Average			153.33

Average $\Delta t/4 = [\text{Hole No. 1}] > 60 (t_1)$

Average $\Delta t/4 = [\text{Hole No. 2}] 38.33 (t_2)$

P value = $(t_1 + t_2)/2 = n/a$ (min/25mm)

Result of Test: P = FAILED

Comments:

None

Type of TestT-Test ☒P-Test ☐

Percolation Test Hole	1	2
Depth from ground surface to top of hole (mm) (A):	600	600
Depth from ground surface to base of hole (mm) (B):	1000	1000
Depth of hole (mm) (B-A):	400	400
Dimensions of hole [length x breadth (mm)]:	300 x 300	300 x 300

Each hole must be pre-soaked twice before the test is carried out (from 10:00am to 5:00pm and from 5:00pm to next morning)

Percolation Test Hole	1	2
Date of Test	1 September 2004	1 September 2004
Date pre-soaked started:	31 August 2004	31 August 2004
Time filled to 400mm:	09:20:00	09:11:00
Time water level at 300mm:	09:51:00	09:17:00

Percolation Test Hole No.	1			2			
Fill No.	Start Time (at 300mm)	Finish Time (at 200mm)	Δt (min)	Start Time (at 300mm)	Finish Time (at 200mm)	Δt (min)	
1	09:51:00	10:41:00	50	09:17:00	09:35:00	18	
2	10:46:00	11:47:00	61	09:42:00	10:06:00	24	
3	11:49:00	12:56:00	67	10:09:00	10:36:00	27	
Average			59.33	Average			23

Average $\Delta t/4$ = [Hole No. 1] 14.83 (t_1)Average $\Delta t/4$ = [Hole No. 2] 5.75 (t_2)T value = $(t_1 + t_2)/2$ = 10.3 (min/25mm)

Result of Test: T = PASSED

Comments:

None

4.0 CONCLUSIONS

(Integrate the information from the desk study and on-site assessment (i.e. visual assessment, trial hole and percolation tests) above and conclude the type of system that is appropriate. This information is also used to choose the optimum final disposal route of the treated wastewater).

Suitable for *(delete as appropriate):*

- a. Septic tank and soil percolation system
- b. ~~Septic tank and intermittent soil filter system and polishing filter unit; or septic tank and constructed wetlands and polishing unit.~~
- c. ~~Biofilter C SAM Package Treatment Plant, intermittent soil filter and *in situ* soil polishing unit~~

And **SUITABLE** for discharge to ~~surface water/~~ **ground water** *(delete as appropriate)*

5.0 RECOMMENDATION

- d. Propose to install septic tank and intermittent soil filter system and polishing filter unit and discharge to ~~surface water/~~ **groundwater** *(delete as appropriate)*

Signed:



Address: O'Neill Ground Water Engineering, 7 South Main Street, Naas, Co. Kildare

Qualifications: MSc Hydrogeology

Date of Report: 2nd September 2004

Phone: 045-895668 **Fax:** 045-881705 **E-mail:** info@groundwatereng.ie

6.0 VERIFICATION *(By Local Authority)*

Site Visit ☐ Date: _____

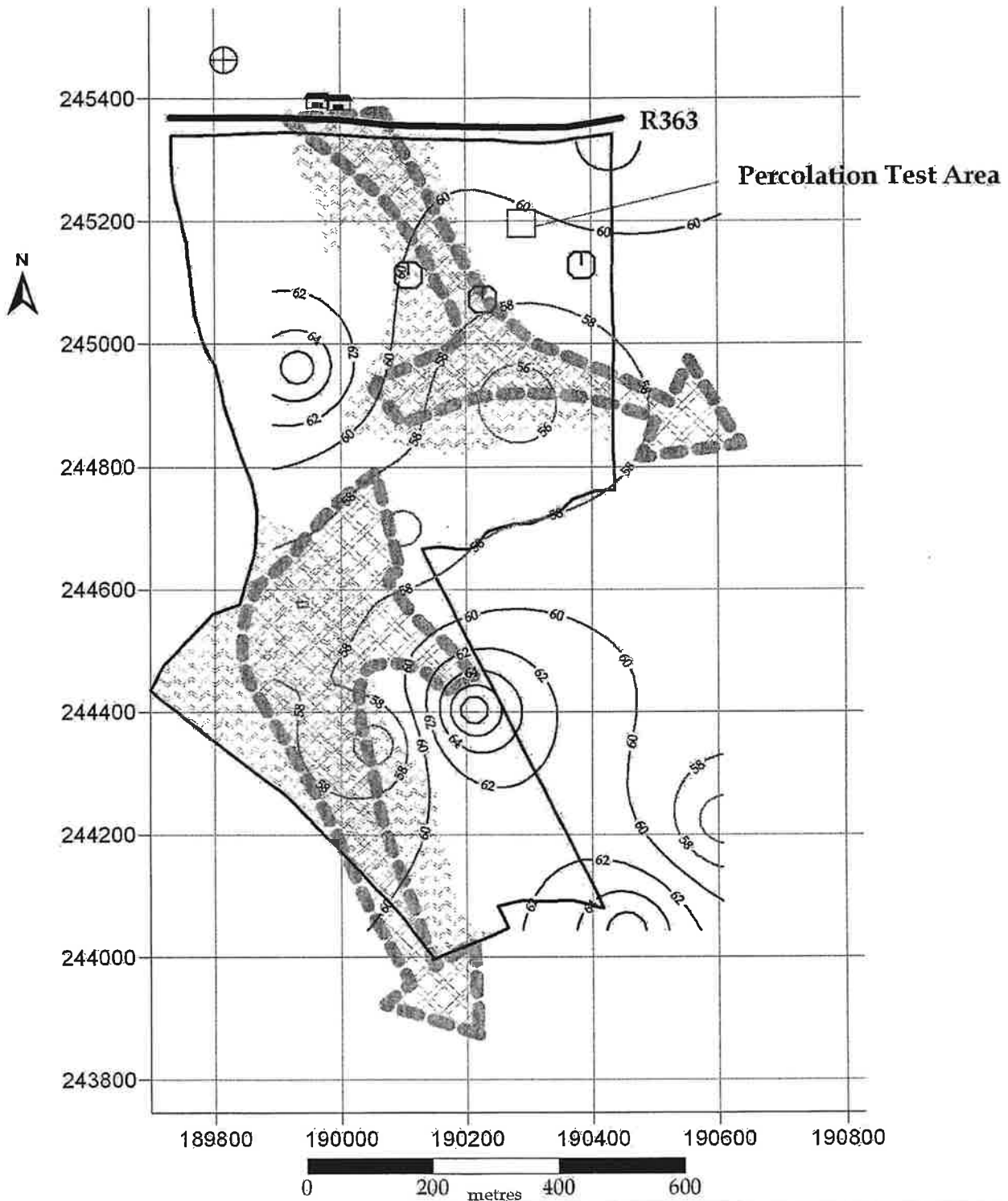
Inspection of Trial Hole ☐ Date: _____

Inspection of Percolation Test Holes ☐ Date: _____

Comments:

Signed: _____

Date: _____



key:



Application Boundary



Areas of Karstified Bedrock



Nearest Dwellings



Enclosed Depressions



Generalised Directions
of Ground Water Flow



Ground Water Contours
(m O.D.) June 2004

Well



7, South Main Street,
Naas, Co. Kildare, Ireland.
P+353-45-895688; F+353-45-881705; M+353-87-2300933;
info@groundwatereng.ie

Client: **Roadstone Provinces Limited**

Project: **Water Section of Environmental
Impact Statement for Proposed
Quarry at Curry/Cloonacaltry,
Co. Roscommon**

Title: **EPA Site Assessment - Percolation Test
Location and other Relevant Features**

Scale	NTS	Datum	n/a
Date	Sept 2004	Checked	S. O'Neill
Author	C. Latimer	Figure No.	Appen 3.4.8
Drawn By	C. Latimer	Ref	060201/3

Appendix 7-K Rating of Existing Environment Significance / Sensitivity

Rating of Existing Environment Significance / Sensitivity (IGI, 2013 Guidelines)

Importance	Criteria	Typical Example
High	Attribute has a high quality or value on an international scale	Groundwater/ Surface Water supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – e.g. NHA status. Regionally important potable water source supplying >2,500 homes Inner source protection area for regionally important water source. Drinking water supply from river. Amenity use of waterbody
	Attribute has a high quality or value on a local scale	Regionally Important Aquifer. Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer Potable water source supplying >50 homes. Outer source protection area for locally important water source. No specific recreational use of waterbody
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer. Potable water source supplying <50 homes. No water supply from surface water, no abstraction designation for watercourse No amenity value of waterbody
Negligible	Attribute has negligible quality or value on a local site scale	No groundwater supply from a bedrock aquifer in vicinity of site. Surface water not used for any specific purpose.

Appendix 7-L Descriptions of Effects (EPA, 2022)

Descriptions of Effects (EPA, 2022)

Impact Characteristic	Term	Description
Quality of Effects	Positive Effects	A change which improves the quality of the environment
	Neutral Effects	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
	Negative / Adverse Effects	A change which reduces the quality of the environment
Describing the Significance of Effects	Imperceptible	An effect capable of measurement but without significant consequences
	Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
	Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound Effects	An effect which obliterates sensitive characteristics
Describing the Extent and Context of Effects	Extent	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect
	Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)
Describing the Probability of Effects	Likely Effects	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
	Unlikely Effects	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)
Describing the Duration and Frequency of Effects	Momentary Effects	Effects lasting from seconds to minutes
	Brief Effects	Effects lasting less than a day
	Temporary Effects	Effects lasting less than a year
	Short-term Effects	Effects lasting one to seven years
	Medium-term Effects	Effects lasting seven to fifteen years
	Long-term Effects	Effects lasting fifteen to sixty years
	Permanent Effects	Effects lasting over sixty years

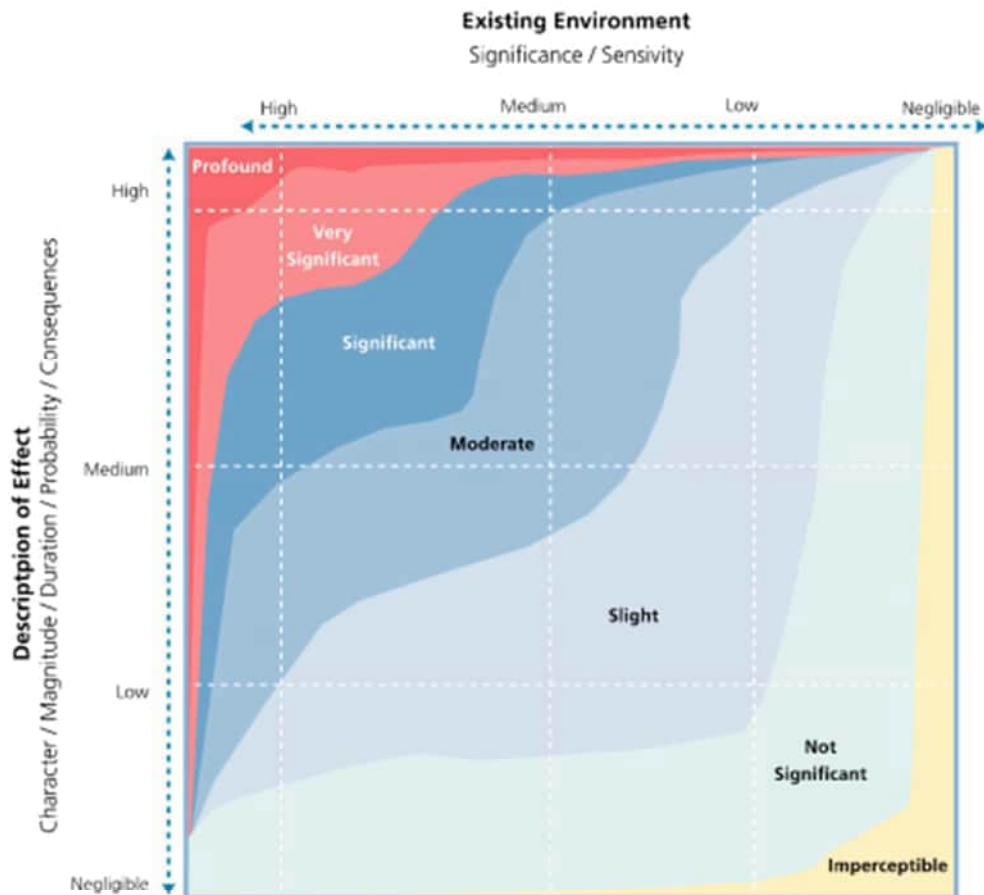
Water (Hydrology & Hydrogeology) 7

Impact Characteristic	Term	Description
	Reversible Effects	Effects that can be undone, for example through remediation or restoration
	Frequency of Effects	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually.
Describing the Types of Effects	Indirect / Secondary Effects	Likely, significant effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative Effects	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
	Do-Nothing Effects	The environment as it would be in the future should the subject project not be carried out.
	Worst Case Effects	The effects arising from a project in the case where mitigation measures substantially fail.
	Indeterminable Effects	When the full consequences of a change in the environment cannot be described.
	Irreversible Effects	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
	Residual Effects	The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic Effects	Where the resultant effect is of greater significance than the sum of its constituents, (e.g. combination of SO _x and NO _x to produce smog).

Appendix 7-M Classification of the Significance of Impacts

Determining Significance

Figure 3.4 shows how comparing the character of the predicted effect to the sensitivity of the receiving environment can determine the significance of the effect.



There are seven generalised degrees of effect significance that are commonly used in EIA. Imperceptible, Not Significant, Slight, Moderate, Significant, Very Significant and Profound. Generalised definitions of each of these are provided in Table 3.4. When more specific definitions exist within a specialised factor or topic, e.g. biodiversity, these should be used in preference to these generalised definitions. (ref. Advice Notes⁶⁸.)

(Source: Figure 3.4 Environmental Protection Agency (May 2022), 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports').

D.4.1 GSI Groundwater Vulnerability Rating (Table 7-4 from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand / gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/Gravel aquifers only)	(< 30 m radius)
Extreme (E)	0-3.0m	0-3.0m	0-3.0m	0-3.0m	-
High (H)	>3.0m	3.0-10.0m	3.0-5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0-10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A
Notes: (i) N/A= not applicable (ii) Precise permeability value cannot be given at present. (iii) Release point of contaminants is assumed to be 1-2m below ground surface.					

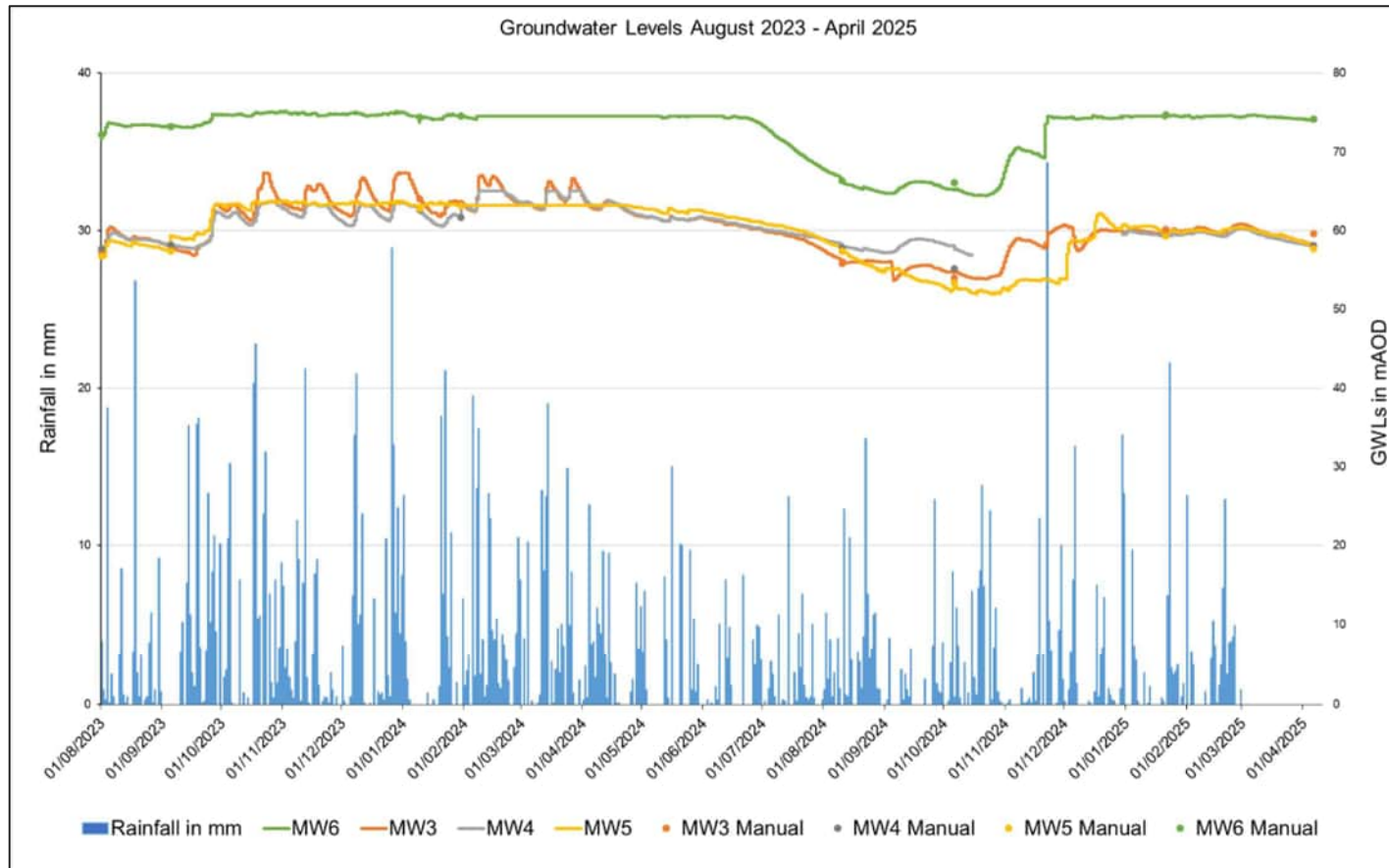
D.4.2 Summary of groundwater level logger data (August 2023 – April 2025)

		MW3	MW4	MW5	MW6
Strata			Limestone	Limestone	Limestone
mAOD	Minimum	53.59	56.85	51.90	64.42
	Average	60.59	60.94	60.09	72.51
	Maximum	67.34	65	63.85	75.20
m	Range	13.76	8.15	11.95	10.78

D.4.3 Summary of manual groundwater levels (August 2023 – April 2025)

	Units	MW3	MW4	MW5	MW6
Min	m AOD	53.97	55.17	53.36	66.06
Max	m AOD	64.01	62.63	63.14	74.73
Range	m	10.04	7.46	9.78	8.67

D.4.4 Groundwater levels at on-site boreholes and on-site rainfall (chart 7-1 from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))



D.4.5 Groundwater quality 05/08/2023 (extracted from Table 7-16 from from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Inorganics								
Ammoniacal Nitrogen as N (low level)	0.065 - 0.175		0.15	mg/l	0.288	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₃	0.07891 - 0.21245		0.1821	mg/l	0.35	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₄	0.083525 - 1.651225			mg/l	0.37	<0.3	<0.3	<0.3
Chloride	187.5	250	30	mg/l	24.9	63.4	7.8	13.1
Conductivity	0.8 - 1.875	2.5	1	mS/cm	0.581	0.626	0.349	0.414
Cyanide, Free (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Cyanide, Total (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Fluoride		0.8	1	mg/l	<0.5	<0.5	<0.5	<0.5
Nitrate as NO ₃	37.5	50	25	mg/l	6.61	3.9	1.88	12.4
Nitrite as NO ₂	0.375	0.5	0.1	Mg/l	<0.25	<0.05	<0.05	<0.05
pH		6.5-9.5	6.5-9.5	pH Units	7.68	7.76	7.96	8
Phosphate (Ortho as PO ₄)			0.03	mg/l	<0.05	<0.05	<0.05	<0.05
Sulphate	187.5	250	200	mg/l	6.3	5.4	18.8	<2
Sulphide				mg/l	0.0681	0.0378	0.0328	0.0138
Alkalinity, Total as CaCO ₃				mg/l	303	280	260	204
Total Oxidised Nitrogen as N				mg/l	-	-	-	-

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Metals Filtered (Dissolved)								
Aluminium (diss.filt)	150	200	200	µg/l	<10	<10	<10	11.1
Arsenic (diss.filt)	7.5	10	10	µg/l	<0.5	<0.5	<0.5	<0.5
Barium (diss.filt)			100	µg/l	8.08	7.78	3.92	3.92
Boron (diss.filt)	750,000	1000		µg/l	<10	<10	<10	<10
Cadmium (diss.filt)	3.75*	5	5	µg/l	<0.08	<0.08	<0.08	<0.08
Calcium (Dis.Filt)			200	mg/l	96.7	95.7	71.9	87.2
Chromium (diss.filt)	37.5	50	30	µg/l	1.74	<1	<1	<1
Copper (diss.filt)	1500	2000	30	µg/l	1.38	0.692	<0.3	1.62
Iron (Dis.Filt)		200	200	mg/l	<0.019	<0.019	<0.019	<0.019
Lead (diss.filt)	7.5	10	10	µg/l	<0.2	<0.2	<0.2	<0.2
Mercury (diss.filt)	0.75	1	1	µg/l	<0.01	<0.01	<0.01	<0.01
Nickel (diss.filt)	15	20	20	µg/l	5.23	1.51	1.55	0.725
Phosphorus (diss.filt)				µg/l	<10	<10	<10	<10
Potassium (Dis.Filt)			5	mg/l	0.762	0.669	0.213	0.996
Selenium (diss.filt)		10		µg/l	1.9	<1	<1	<1
Sodium (Dis.Filt)				mg/l	7.83	29.3	4.06	6.33
Vanadium (diss.filt)				µg/l	2.74	<1	<1	<1
Zinc (diss.filt)	75		100	µg/l	5.09	9.13	3.73	22.5

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Metals Unfiltered (Total)								
Aluminium (tot.unfilt)				µg/l	-	-	-	-
Magnesium (tot.unfilt)				mg/l	14.5	14	3.81	2.39
Manganese (tot.unfilt)				µg/l	2190	1160	290	14.5
TPH Criteria Working Group (TPH CWG)								
Aliphatics >C10-C12				µg/l	<10	<10	<10	<10
Aliphatics >C12-C16 (aq)				µg/l	<10	<10	<10	<10
Aliphatics >C16-C21 (aq)				µg/l	<10	<10	<10	<10
Aliphatics >C21-C35 (aq)				µg/l	213	<10	<10	<10
Aliphatics >C5-C6				µg/l	<10	<10	<10	<10
Aliphatics >C6-C8				µg/l	<10	<10	<10	<10
Aliphatics >C8-C10				µg/l	<10	<10	<10	<10
Aromatics >EC10-EC12				µg/l	<10	<10	<10	<10
Aromatics >EC12-EC16 (aq)				µg/l	<10	<10	<10	<10
Aromatics >EC16-EC21 (aq)				µg/l	<10	<10	<10	<10
Aromatics >EC21-EC35 (aq)				µg/l	12	<10	<10	<10
Aromatics >EC5-EC7				µg/l	<10	<10	<10	<10
Aromatics >EC7-EC8				µg/l	<10	<10	<10	<10
Aromatics >EC8-EC10				µg/l	<10	<10	<10	<10
GRO >C5-C12				µg/l	<50	<50	<50	<50

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Total Aliphatics & Aromatics >C5-35 (aq)	7.5			µg/l	225	<10	<10	<10
Total Aliphatics >C12-C35 (aq)				µg/l	213	<10	<10	<10
Total Aromatics >EC12-EC35 (aq)				µg/l	12	<10	<10	<10
EPH CWG (Speciated)								
Aliphatics >C16-C35 Aqueous				µg/l	213	<10	<10	<10
Polyaromatic Hydrocarbons (PAHs)								
Acenaphthene (aq)				µg/l	<0.005	<0.005	<0.005	<0.005
Acenaphthylene (aq)				µg/l	<0.005	<0.005	<0.005	<0.005
Anthracene (aq)			10000	µg/l	<0.0052 5	<0.005	<0.005	<0.005
Benzo(a)anthracene (aq)				µg/l	0.00824	<0.005	<0.005	<0.005
Benzo(a)pyrene (aq)	0.0075	0.01	0.01	µg/l	0.0192	<0.002	<0.002	<0.002
Benzo(b)fluoranthene (aq)			0.5	µg/l	0.0223	<0.005	<0.005	<0.005
Benzo(g,h,i)perylene (aq)			0.05	µg/l	<0.005	<0.005	<0.005	<0.005
Benzo(k)fluoranthene (aq)			0.05	µg/l	<0.005	<0.005	<0.005	<0.005
Chrysene (aq)				µg/l	0.0195	<0.005	<0.005	<0.005
Dibenzo(a,h)anthracene (aq)				µg/l	<0.005	<0.005	<0.005	<0.005
Fluoranthene (aq)			1	µg/l	0.0697	<0.005	<0.005	<0.005
Fluorene (aq)				µg/l	0.0074	<0.005	<0.005	<0.005
Indeno(1,2,3-cd)pyrene (aq)			0.05	µg/l	0.00711	<0.005	<0.005	<0.005

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Naphthalene (aq)			1	µg/l	<0.01	<0.01	<0.01	<0.01
PAH, Total Detected USEPA 16 (aq)		0.075	0.1	µg/l	0.272	<0.082	<0.082	<0.082
Phenanthrene (aq)				µg/l	0.0617	<0.005	<0.005	<0.005
Pyrene (aq)				µg/l	0.0519	<0.005	<0.005	<0.005
Microbiological								
Escherichia coli		0	0	CFU/100 ml	2	>100	0	0
Coliform bacteria		0	0	CFU/100 ml	31	>100	0	2
Highlighted values; exceedances assessment criteria; SI No 366 of 2016 (GW Regs), SI No 122 of 2014 (EC Drinking Water Regs), EPA IGVs (in that order)								

D.4.6 Groundwater quality 11/01/2024 (extracted from Table 7-17 from from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Inorganics								
Ammoniacal Nitrogen as N (low level)	0.065-0.175		0.15	mg/l	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₃	0.07891-0.21245		0.1821	mg/l	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₄	0.083525-1.651225			mg/l	<0.3	<0.3	<0.3	<0.3
Chloride	187.5	250	30	mg/l	16.6	66.8	7.2	10.5
Conductivity	0.8 - 1.875	2.5	1	mS/cm	0.582	0.657	0.281	0.407
Cyanide, Free (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Cyanide, Total (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Fluoride		0.8	1	mg/l	<0.5	<0.5	<0.5	<0.5
Nitrate as NO ₃	37.5	50	25	mg/l	11.8	2.4	2.94	17
Nitrite as NO ₂	0.375	0.5	0.1	Mg/l	<0.25	<0.5	<0.5	<0.5
pH		6.5-9.5	6.5-9.5	pH Units	7.68	7.74	7.88	7.87
Phosphate (Ortho as PO ₄)			0.03	mg/l	<0.05	<0.05	<0.05	<0.05
Sulphate	187.5	250	200	mg/l	4	4.6	21.2	7.3
Sulphide				mg/l	<0.01	<0.01	<0.01	<0.01
Alkalinity, Total as CaCO ₃				mg/l	366	270	143	202
Total Oxidised Nitrogen as N				mg/l	2.66	0.542	0.665	3.85

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Metals Filtered (Dissolved)								
Aluminium (diss.filt)	150	200	200	µg/l	<10	<10	<10	<10
Arsenic (diss.filt)	7.5	10	10	µg/l	0.524	0.577	<0.5	<0.5
Barium (diss.filt)			100	µg/l	16.1	11	3.12	4.41
Boron (diss.filt)	750,000	1000		µg/l	10.5	15.2	<10	10.2
Cadmium (diss.filt)	3.75	5	5	µg/l	0.167	<0.08	<0.08	<0.08
Calcium (Dis.Filt)			200	mg/l	121	98.6	55.5	82.9
Chromium (diss.filt)	37.5	50	30	µg/l	<1	<1	<1	<1
Copper (diss.filt)	1500	2000	30	µg/l	1.99	1.25	1.82	1.37
Iron (Dis.Filt)		200	200	mg/l	<0.019	<0.019	<0.019	<0.019
Lead (diss.filt)	7.5	10	10	µg/l	0.543	0.521	0.334	<0.2
Mercury (diss.filt)	0.75	1	1	µg/l	<0.01	<0.01	<0.01	<0.01
Nickel (diss.filt)	15	20	20	µg/l	4.38	0.801	0.565	<0.4
Phosphorus (diss.filt)				µg/l	<10	<10	11.3	<10
Potassium (Dis.Filt)			5	mg/l	1.91	0.726	0.227	0.835
Selenium (diss.filt)		10		µg/l	2.71	<1	<1	<1
Sodium (Dis.Filt)				mg/l	8.96	32.3	5.03	6.69
Vanadium (diss.filt)				µg/l	5.62	<1	<1	<1
Zinc (diss.filt)	75		100	µg/l	Null	Null	Null	Null

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Metals Unfiltered (Total)								
Aluminium (tot.unfilt)				µg/l	36200	241	9590	46.9
Magnesium (Tot. Unfilt.)				mg/l	13.2	14.2	3.42	2.23
Manganese (tot.unfilt)				µg/l	1340	50.9	416	<1
TPH Criteria Working Group (TPH CWG)								
Aliphatics >C10-C12				µg/l	<10	<10	<10	<10
Aliphatics >C12-C16 (aq)				µg/l	<50	<10	<50	<10
Aliphatics >C16-C21 (aq)				µg/l	<50	<10	<50	<10
Aliphatics >C21-C35 (aq)				µg/l	<50	<10	<50	<10
Aliphatics >C5-C6				µg/l	<10	<10	<10	<10
Aliphatics >C6-C8				µg/l	<10	<10	<10	<10
Aliphatics >C8-C10				µg/l	<10	<10	<10	<10
Aromatics >EC10-EC12				µg/l	<10	<10	<10	<10
Aromatics >EC12-EC16 (aq)				µg/l	<50	<10	<50	<10
Aromatics >EC16-EC21 (aq)				µg/l	<50	<10	<50	<10
Aromatics >EC21-EC35 (aq)				µg/l	<50	12	<50	<10
Aromatics >EC5-EC7				µg/l	<10	<10	<10	<10
Aromatics >EC7-EC8				µg/l	<10	<10	<10	<10
Aromatics >EC8-EC10				µg/l	<10	<10	<10	<10
GRO >C5-C12				µg/l	<50	<50	<50	<50

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Total Aliphatics & Aromatics >C5-35 (aq)	7.5			µg/l	<10	34	<50	<10
Total Aliphatics >C12-C35 (aq)				µg/l	<50	<10	<50	<10
Microbiological								
Escherichia coli		0	0	CFU/100ml	10	46	3	0
Coliform bacteria		0	0	CFU/100ml	3	49	17	11
Highlighted values; exceedances assessment criteria; SI No 366 of 2016 (GW Regs), SI No 122 of 2014 (EC Drinking Water Regs), EPA IGVs (in that order)								

D.4.7 Groundwater quality 08/10/2024 (extracted from Table 7-18 from from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Inorganics								
Ammoniacal Nitrogen as N (low level)	0.065-0.175		0.15	mg/l	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₃	0.07891-0.21245		0.1821	mg/l	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₄	0.083525-1.651225			mg/l	<0.3	<0.3	<0.3	<0.3
Chloride	187.5	250	30	mg/l	17.4	63.7	6.8	10.3
Conductivity	0.8 - 1.875	2.5	1	mS/cm	0.579	0.653	0.293	0.421
Cyanide, Free (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Cyanide, Total (low level)	37.5	50	10	µg/l	<0.05	<0.05	<0.05	<0.05
Fluoride		0.8	1	mg/l	<0.5	<0.5	<0.5	<0.5
Nitrate as NO ₃	37.5	50	25	mg/l	10.8	0.33	2.61	12.4
Nitrite as NO ₂	0.375	0.5	0.1	mg/l	<0.25	0.269	0.062	<0.05
pH		6.5-9.5	6.5-9.5	pH Units	7.54	7.84	7.96	7.76
Phosphate (Ortho as PO ₄)			0.03	mg/l	<0.05	<0.05	<0.05	<0.05
Sulphate	187.5	250	200	mg/l	5.2	6.5	14.2	5.7
Sulphide				mg/l	<0.01	<0.01	<0.01	<0.01
Alkalinity, Total as CaCO ₃				mg/l	312	272	203	534
Total Oxidised Nitrogen as N				mg/l	2.44	0.156	0.607	2.81

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Filtered (Dissolved) Metals								
Aluminium (diss.filt)	150	200	200	µg/l	<10	<10	13.6	<10
Arsenic (diss.filt)	7.5	10	10	µg/l	<0.5	<0.5	<0.5	<0.5
Barium (diss.filt)			100	µg/l	11	9.57	3.4	4.94
Boron (diss.filt)	750,000	1000		µg/l	<10	<10	<10	<10
Cadmium (diss.filt)	3.75	5	5	µg/l	<0.08	<0.08	<0.08	<0.08
Calcium (Dis.Filt)			200	mg/l	115	96	60.3	88.4
Chromium (diss.filt)	37.5	50	30	µg/l	<1	<1	<1	1
Copper (diss.filt)	1500	2000	30	µg/l	0.33	0.589	0.708	0.915
Iron (Dis.Filt)		200	200	mg/l	<0.019	<0.019	0.0227	0.0203
Lead (diss.filt)	7.5	10	10	µg/l	<0.2	<0.2	0.267	1.83
Mercury (diss.filt)	0.75	1	1	µg/l	<0.01	<0.01	<0.01	<0.01
Nickel (diss.filt)	15	20	20	µg/l	2.04	1.29	1	0.851
Phosphorus (diss.filt)				µg/l	<10	13	21.4	<10
Potassium (Dis.Filt)			5	mg/l	1.34	0.716	0.45	0.907
Selenium (diss.filt)		10		µg/l	1.16	<1	<1	<1
Sodium (Dis.Filt)				mg/l	8.4	28.2	4.31	6
Vanadium (diss.filt)				µg/l	2.08	<1	<1	<1
Zinc (diss.filt)	75		100	µg/l	-	-	-	-

Parameter	SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (DW Regs)	EPA IGVs	Units	MW3	MW4	MW5	MW6
Unfiltered (Total) Metals								
Aluminium (tot.unfilt)				µg/l	-	-	-	-
Magnesium (Tot. Unfilt.)			50	mg/l	16.3	12.7	4.84	10.7
Manganese (tot.unfilt)		50	50	µg/l	2190	177	697	692
Microbiological								
Escherichia coli		0	0	CFU/100ml	11	11	15	248
Coliform bacteria		0	0	CFU/100ml	1	4	8	0
Highlighted values: exceedances assessment criteria; SI No 366 of 2016 (GW Regs), SI No 122 of 2014 (EC Drinking Water Regs), EPA IGVs (in that order) Bold values: Exceeds laboratory limit of detection for organics where no assessment criteria exists								

D.4.8 Surface water quality results screened (extracted from Table 7-22 from EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology))

Parameter	EQS Inland Surface Waters (MACs)	Units	SW1	SW2	SW1	SW2	SW1	SW2	SW1	SW2	SW3	SW1	SW2	Sump
			05/08/2023		01/01/2024		08/10/2024		17/07/2025			16/09/2025		
Inorganics														
Suspended solids		mg/l	189	8.6	<2	<2	263	8.35	220	<2	4.7	3.65	2.45	7.75
BOD	High status ≤1.3 (mean) or ≤2.2 (95%ile) Good status ≤1.5 (mean) or ≤2.6 (95%ile)"	mg/l	2.36	<1	<1	<1	2.04	<1	-	-	-	<1	<1	<1
COD		mg/l	108	50.2	18	11.7	105	30.4				56.5	60.8	<7
pH	Soft water (<100mg/l CaCO ₃): 4.5-9.0. Hard water (>100mg/l CaCO ₃): 6.0-9.0	pH Units	7.75	8.23	7.92	7.94	8.01	8.12	7.47	7.84	8.1	7.72	7.84	8.11
Phosphate (Ortho as PO ₄)		mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	0.057	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Alkalinity, as CaCO ₃	Soft water (<100mg/l CaCO ₃): 4.5-9.0. Hard water (>100mg/l CaCO ₃): 6.0-9.0	mg/l	244	209	242	248	242	234	157	153	248	166	165	112

Parameter	EQS Inland Surface Waters (MACs)	Units	SW1	SW2	SW1	SW2	SW1	SW2	SW1	SW2	SW3	SW1	SW2	Sump
Total Oxidised Nitrogen as N		mg/l	-	-	0.46	0.553	0.59	0.768	0.156	0.139	0.283	0.237	0.265	9.02
Filtered (Dissolved) Metals														
Aluminium		µg/l	<10	<10	<10	<10	281	24.3	33.4	<10	<10	13.6	<10	<10
Arsenic	25	µg/l	0.791	0.841	<0.5	<0.5	0.523	0.766	0.941	0.879	1.04	0.733	0.651	<0.5
Barium		µg/l	10.2	9.56	7.8	7.77	11.4	10.8	10.9	8.59	27	9.7	8.7	7.75
Boron		µg/l	<10	<10	<10	13.4	18.6	14.2	10.8	14.4	18.1	<10	<10	24.2
Cadmium	0.45 - 1.5	µg/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Calcium		µg/l	87.9	88.6	94	93.4	92.3	91.5	62.3	62.3	93.7	68.8	70.3	80.8
Chromium	32	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	5	µg/l	0.403	0.416	0.312	<0.3	1.51	1.01	0.548	0.761	1.02	0.364	0.467	0.375
Iron		µg/l	0.507	0.457	0.0606	0.0549	0.313	0.185	0.901	0.686	0.0852	0.367	0.29	<0.019
Lead	7.2	µg/l	<0.2	<0.2	<0.2	<0.2	<0.2	0.389	0.423	<0.2	0.237	<0.2	<0.2	<0.2
Mercury	0.07	µg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	20	µg/l	1.54	1.27	0.617	0.744	1.58	1.1	8.67	7.33	1.21	4.7	4.06	8.58
Phosphorus	High status ≤ 10 (mean). Good status ≤ 25(mean)	µg/l	12.2	10.1	<10	<10	31.2	22.1	<10	<10	<10	<10	<10	<10
Potassium		µg/l	1.37	1.38	2.08	2.03	3.52	3.3	1.83	1.83	1.8	1.58	1.64	0.823
Selenium		µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.54
Sodium		µg/l	8.09	8.31	6.57	6.57	10.3	10.5	7.39	7.24	9.49	8.52	8.78	10.8

Parameter	EQS Inland Surface Waters (MACs)	Units	SW1	SW2	SW1	SW2	SW1	SW2	SW1	SW2	SW3	SW1	SW2	Sump
Vanadium		µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc		µg/l	2.72	2.74	-	-	-	-	6.41	5	4.87	3.47	2.46	2.81
Unfiltered (Total) Metals														
Aluminium		µg/l	151	24.8	<10	10.1	281	24.3	33.4	<10	<10	13.6	<10	<10
Magnesium		mg/l	2.52	2.54	3.24	3.21	3.07	3.05	1.9	1.89	5.41	1.83	1.87	10.7
Manganese (		µg/l	218	192	14.5	13.5	736	56.6	267	99.2	21.7	57.5	25.4	<3
Hydrocarbons														
Mineral oil >C10 C40 (aq)		µg/l	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Exceedances in bold														

D.4.9 Significance of Impacts extracted from Table 7-15 from the EIAR (updated) Chapter 7 – Water (Hydrology & Hydrogeology)

No.	Potential Impacts	Impact Rating (No Mitigation)	Significance of Impact (No Mitigation)
Construction and Operational Stage – Direct – Surface Water			
1	Potential impact of suspended solids in surface water runoff to the Ballyglass River	Medium - Low. Potential to affect surface water quality in the Ballyglass River through run-off from the site	Moderate - Slight
2	The accidental leaking or spillage of fuel and/or other petroleum-based products could impact on surface water runoff to the Ballyglass River.	Medium. Potential to affect surface water quality in the Ballyglass River through contaminated runoff. Any leakage / spillage would be accidental only and of limited volume.	Moderate
Construction and Operational Stage – Direct - Groundwater			
3	Elevated suspended solids could impact on groundwater in the regionally important karstified bedrock aquifer.	Medium - Low. Potential to affect groundwater quality in bedrock underlying facility through vertical migration of sediment in run-off.	Moderate - Slight
4	The accidental leaking or spillage of fuel and/or other petroleum-based products could also impact on groundwater in the regionally important karstified bedrock aquifer.	Medium. Potential to affect groundwater quality in underlying karstified bedrock aquifer through vertical migration of fuels etc. Any leakage / spillage would be accidental only and of limited volume.	Moderate
Construction and Operational Stage – Indirect – Surface Water			
5	Elevated suspended solids could indirectly impact on local water courses and turloughs.	Low. Potential to affect surface water quality (suspended solids) in local water courses and turloughs, through groundwater baseflow to the watercourse. Groundwater may not be in hydraulic continuity with watercourses. Since Feacle Lough and Corkip Lough are fed by groundwater predominantly from the epikarst the proposed development is considered unlikely to significantly impact on these.	Slight
6	The accidental leaking or spillage of fuel and/or other petroleum-based	Medium - Low. Potential to affect surface water quality (fuels etc) in local water courses and turloughs, through groundwater baseflow to the watercourse.	Moderate - Slight

No.	Potential Impacts	Impact Rating (No Mitigation)	Significance of Impact (No Mitigation)
	products or concrete could also indirectly impact on local water courses and turloughs.	Groundwater may not be in hydraulic continuity with watercourses. Since Feacle Lough and Corkip Lough are fed by groundwater predominantly from the epikarst the proposed development is considered unlikely to significantly impact on these.	
7	The accidental leaking or spillage of concrete could also indirectly impact on local water courses and turloughs.	Low. Potential to affect surface water quality (concrete) in local water courses and turloughs, through groundwater baseflow to the watercourse. Groundwater may not be in hydraulic continuity with watercourses. Since Feacle Lough and Corkip Lough are fed by groundwater predominantly from the epikarst the proposed development is considered unlikely to significantly impact on these.	Slight
Construction and Operational Stage – Indirect – Groundwater			
8	Elevated suspended solids could indirectly impact on groundwater in the regionally important karstified bedrock aquifer and indirectly impact on PWS and local water supplies.	Low Potential to affect the Killeglan PWS and local supply wells through lateral migration in the bedrock aquifer. The majority of the residences in the study area have access to mains water supply. The Cam area is within the Uisce Éireann Killeglan water supply zone.	Slight
9	The accidental leaking or spillage of fuel and/or other petroleum-based products could also indirectly impact on PWS and local water supplies.	Medium – Low Potential to affect the Killeglan PWS and local supply wells through lateral migration in the bedrock aquifer. The majority of the residences in the study area have access to mains water supply. The Cam area is within the Uisce Éireann Killeglan water supply zone.	Moderate - Slight
10	The accidental leaking or spillage of concrete could indirectly impact on PWS and local water supplies.	Low. Potential to affect the Killeglan PWS and local supply wells through lateral migration in the bedrock aquifer. The majority of the residences in the study area have access to mains water supply. The Cam area is within the Uisce Éireann Killeglan water supply zone.	Slight
Construction and Operational Stage – Indirect – Protected Areas			
14	Any indirect impact on the local rivers and streams could impact the designated surface water bodies downstream, i.e. River Suck Callows SPA and NHA and River Shannon Callows SAC/pNHA / Middle	Low. Any reduction in quality in local water bodies (suspended solids / fuel / concrete leakages) could migrate downstream and impact on designated areas. The protected areas are located at distance; the Suck River Callows is located c. 4.6km from the site.	Slight

No.	Potential Impacts	Impact Rating (No Mitigation)	Significance of Impact (No Mitigation)
	Shannon Callows SPA at distance from the site.		

D.5 EIAR Water Chapter 7 Addendum



EIAR Addendum – Chapter 7 Water

Cam Quarry, Brideswell, Co. Roscommon – Continuance of Use (Planning Ref. PD/25/60577)

Roadstone Ltd

Cam, Brideswell, Co Roscommon.

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SLR Project No.: 501.065512.00001

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14 September 2026

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
Final	14 September 2026	MS/SMcD/IMR/TP	TP	TP

Basis of Report

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Table of Contents

Basis of Report	i
1.0 Introduction	3
2.0 Groundwater Levels Update	4
2.1 Groundwater Level Information Update	4
2.2 Conclusion	10
3.0 Proposed Quarry Floor Level	11
3.1 Existing Quarry Floor Level	11
3.2 Proposed Quarry Floor Level.....	11
3.3 Quarry Dewatering (Worst Case Precautionary Assessment).....	11
3.3.1 Hydraulic Conductivity	11
3.3.2 Estimated Zone of Influence / Potential Long Term Groundwater Level Drawdown....	12
3.3.3 Potential Impact on Groundwater Body / Bedrock Aquifer	12
4.0 Quarry Water Management Infrastructure	13
4.1 Existing Quarry.....	13
4.2 Proposed Quarry Water Management	13
4.3 Water Management Infrastructure Design	14
4.3.1 Rainfall	14
4.3.2 Runoff areas and coefficients	14
4.3.3 Collection - Lagoon 1	15
4.3.4 Settlement Treatment & Attenuation – Lagoon 2	15
4.3.5 Hydrocarbon Interceptor.....	16
4.3.6 Settlement Treatment.....	16
4.3.7 Infiltration Area	17
4.3.8 Section 4 discharge Licence.....	18
5.0 Water Environment Monitoring Programme.....	19

Figures

- EIAR Figure 7-1** Borehole Locations
- EIAR Figure 7.7 Rev A** Source Protection Areas (showing the proposed quarry footprint and the non-development area to south)

Drawings (ACP-1, ACP-2, ACP-3, ACP-5 and ACP-5 provided as separate drawings)

Appendix A

Water Management Infrastructure Design (Causeway Flow Models)



1.0 Introduction

Roadstone Limited (hereafter referred to as “Roadstone”) has submitted a planning application to Roscommon Co. Council (P. Ref. PD/25/60577) for the continued use of the existing quarry development permitted by P. Ref. 04/147 and ABP Ref. PL20.215417.

This EIAR Addendum Chapter 7 Water provides supporting information to the 1st Party appeal by Roadstone Ltd. against the decision of Roscommon Co. Council to refuse permission for the proposed development. Refusal Reason No. 1 states:

The Planning Authority in consultation with Roscommon County Councils Environment Department is not satisfied based on submissions received that it has been satisfactorily evidenced that dewatering will not be required to facilitate the proposed development and that satisfactory proposals for and assessment of dewatering arrangements have been provided. It is considered therefore that based on the information submitted in the Environmental Impact Assessment Report (as updated) and as identified in the Environmental Impact Assessment carried out by the Planning Authority, a sufficient level of information and assessment has not been provided in relation to impacts on Water and Biodiversity (with particular attention to Habitats and Birds Directives).

Having regard to the foregoing, it is therefore concluded that there is insufficient information and insufficient mitigation measures provided for the competent authority to make an EIA determination that there is an acceptably low likelihood of environmental effects of a magnitude which would give rise to a significant effect on sensitive environmental receptors as a result of the proposed development proceeding. Therefore, if permitted, the proposed development would be contrary to the provisions of policy objectives ED 6.17 and ED 6.18 set out in the Roscommon County Development Plan 2022-2028 and would be contrary to the proper planning and sustainable development of the area.

Section 2 of this Addendum provides an update and further assessment of groundwater levels on the site. Section 3 describes the proposed quarry floor / extraction level and on a precautionary basis assesses dewatering requirements. The proposed water management system for the quarry, including engineering design basis and drawings is set out in Section 4. A risk assessment is provided in Section 5 and the proposed water environment monitoring programme is detailed in Section 6.



2.0 Groundwater Levels Update

2.1 Groundwater Level Information Update

The revised EIAR Chapter 7 submitted as part of the Further Information response to the Planning Authority provided a summary of groundwater logger data from the 4 no. on-site monitoring boreholes MW3, MW4, MW5 and MW6 for the period August 2023 – April 2025 in Table 7-7, and Table 7-8 provided a summary of manual groundwater levels over the same period. For ease of reference these Tables are reproduced below in **Tables 1 & 2**. Refer to Figure 7-1 RevA enclosed for monitoring boreholes locations. (Note: the other boreholes shown on Figure 7-1 are decommissioned and not accessible for monitoring)

Table 3 below, provides a summary of additional monitoring carried out at the site from April to September 2025, providing complete monitoring over an extended 2-year period. **Table 4** provides a summary of the manual groundwater levels at the site from August 2026.

Please note Tables 3 & 4 show new data that did not form part of the original application assessment.

Table 1: Summary of groundwater level logger data (August 2023 – April 2025)

Reproduction of EIAR Table 7-7 (from Further Information submission)

		MW3	MW4	MW5	MW6
Strata			Limestone	Limestone	Limestone
mAOD	Minimum	53.59	56.85	51.90	64.42
	Average	60.59	60.94	60.09	72.51
	Maximum	67.34	65	63.85	75.20
m	Range	13.76	8.15	11.95	10.78

Table 2: Summary of manual groundwater levels (August 2023 – April 2025)

Reproduction of EIAR Table 7-8 (from Further Information submission)

		MW3	MW4	MW5	MW6
Strata			Limestone	Limestone	Limestone
mAOD	Minimum	53.97	55.17	53.36	66.06
	Average	58.99	58.9	58.25	70.40
	Maximum	64.01	62.63	63.14	74.73
m	Range	10.04	7.46	9.78	8.67

Table 3: Summary of groundwater level logger data (April 2025 – September 2025)

		MW3	MW4	MW5	MW6
Strata			Limestone	Limestone	Limestone
mAOD	Minimum	49.65	57.64	52.75	64.90
	Average	51.54	60.60	54.99	69.76
	Maximum	59.22	62.35	58.11	74.27
m	Range	9.56	4.71	5.36	9.37



Table 4: Summary of manual groundwater levels (28th August 2026)

	MW3	MW4	MW5	MW6
Strata		Limestone	Limestone	Limestone
mAOD	54.98	55.27	53.81	61.90

Both the Applicant's on-site observations and the findings of the on-site groundwater monitoring programme indicate that water accumulation within the quarry is seasonal in nature and varies throughout the year in response to prevailing weather conditions. During the late autumn, winter and spring months, water run-off is typically present within the low-lying area (sump / infiltration area) of the quarry, whereas conditions can be substantially drier during the summer and early autumn months.

Consequently, groundwater levels and the presence of water in the sump / infiltration area are not static and fluctuate seasonally, reflecting natural hydrological / hydrogeological conditions.

This seasonal water accumulation variation within the sump / infiltration area is illustrated in **Plate 1** and

Plate 2 below, which show the presence of water in April 2025 and an absence of water in August 2026 within the quarry sump / infiltration area. **Plates 3, 4** and **5** show the dry condition of the overall quarry extraction area in August 2026.

The collection of surface water runoff within the sump / infiltration area allows extraction activities to continue in dry working conditions throughout quarry extraction area. The active extraction areas are currently located at elevations ranging from approximately 70 mOD to 85mOD. Roadstone has operated the quarry for the past 20-years without the requirement for any dewatering.



Plate 1: April 2025 – Southwest Corner (Lowest Point c. 62-63mOD) of Quarry – Sump / Infiltration Area showing surface water run-off accumulation



Plate 2: August 2026 - Southwest Corner (Lowest Point) of Quarry – Sump / Infiltration Area showing no water (dry)



Plate 3: August 2026 - Southwest Corner (Lowest Point c. 62–63mOD) of Quarry – Sump / Infiltration Area showing No Water Present (dry)



Plate 4: August 2026 – View from Southwest Corner of Quarry – above Sump / Infiltration Area looking East



Plate 5: August 2026 – View from Southwest Corner of Quarry - above Sump / Infiltration Area looking North



The seasonal variation is further demonstrated by the fluctuation of groundwater levels for the monitoring boreholes shown in **Tables 1 - 4** above. Over the period August 2023 to April 2025 the fluctuation range was 13.76m in MW3, 8.15m in MW4, 11.95m in MW5 and 10.78m in MW6 where data loggers are installed. Subsequent data downloaded for the period April 2025 to September 2025 shows similar seasonal fluctuation range was 9.56m in MW3, 4.71m in MW4, 5.36m in MW5 and 9.37m in MW6.

Error! Reference source not found.-4 below show the logger data for the on-site borehole ground water levels and on-site rainfall for the years August 2023 to September 2025 (c. 2 year period). The proposed quarry floor level of 65mOD is shown in the charts for reference.

Please note Chart 4 shows new data that did not form part of the original application assessment.

Chart 1: 2023 (August – December) Groundwater levels at on-site boreholes and on-site rainfall

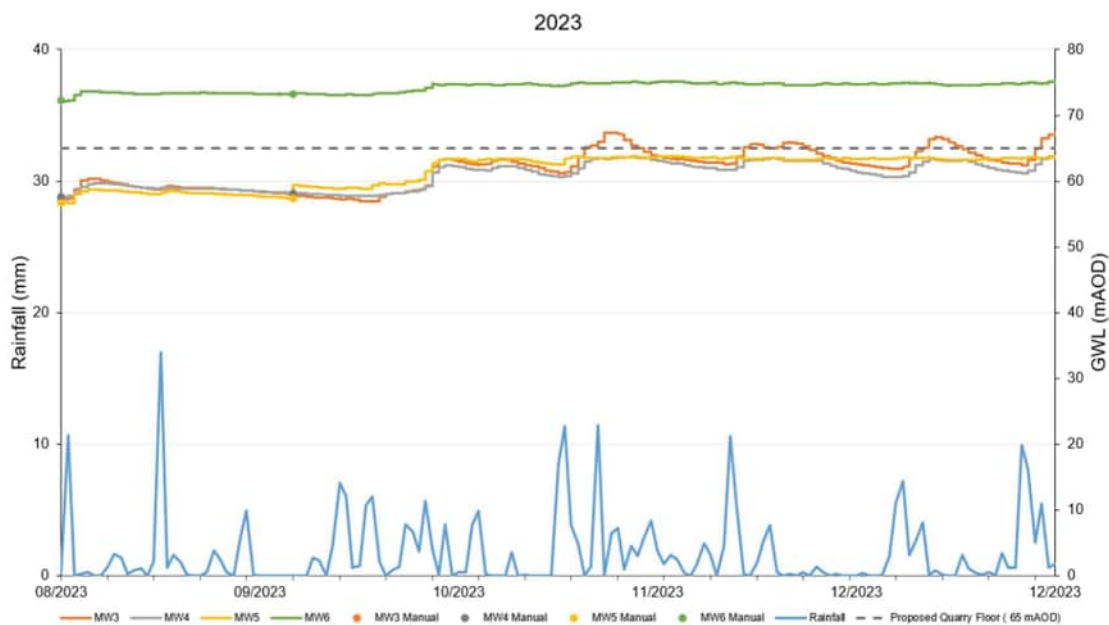


Chart 2: 2024 (January – December) Groundwater levels at on-site monitoring boreholes and on-site rainfall

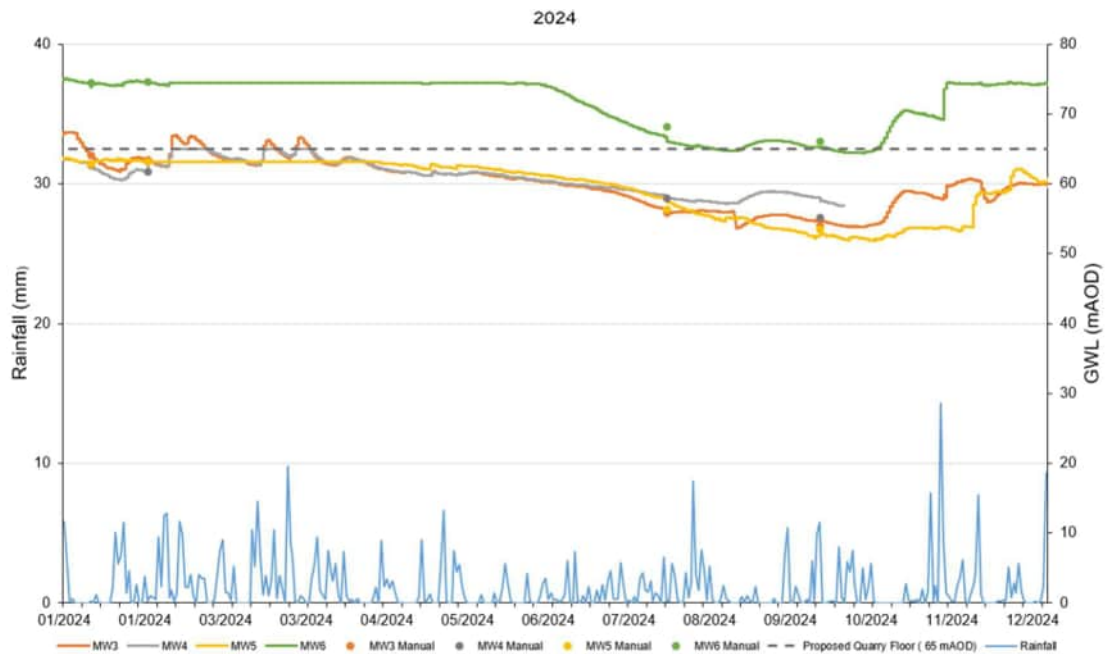


Chart 3: 2025 (January – April) Groundwater levels at on-site monitoring boreholes and on-site rainfall

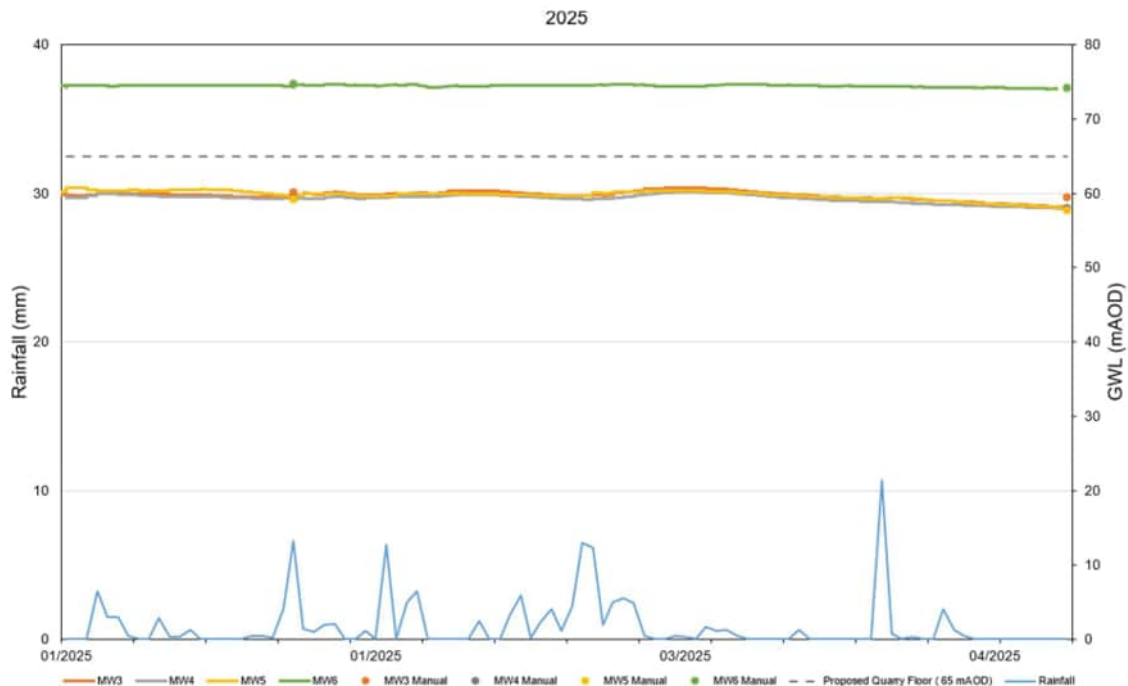
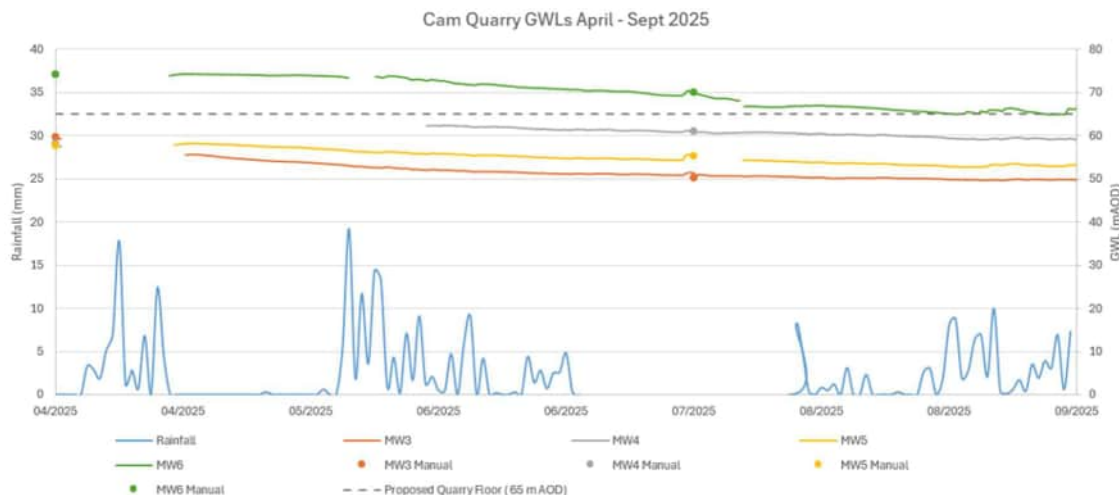


Chart 4: 2025 (April – September) Groundwater levels at on-site monitoring boreholes and on-site rainfall



2.2 Conclusion

The recorded groundwater levels (up to 75mOD) in monitoring borehole MW6 located at the northern boundary of the overall site are an outlier showing water levels c. 10 metres above the other three monitoring boreholes MW3, MW4 and MW5. It should be noted that no groundwater inflows have been observed in the vicinity of the current quarry floor level at 70mOD in the north of the extraction area closest to monitoring borehole MW6, some 5 metres below the recorded groundwater level of 75mOD.

The long term groundwater levels recorded in monitoring boreholes MW3, MW4 and MW5 over a two year monitoring period (August 2023 to September 2025) are below 65 mOD, except for some short periods at borehole MW3 (located over c. 468 metres south of the quarry extraction area) where the levels rise 1 -2 metres in response to rainfall. The average groundwater level in these monitoring boreholes is below c. 61mOD. There is a seasonal fluctuation in groundwater levels of up to c. 13 metres, with the lowest groundwater level of c. 50mOD being recorded.

On this basis, the proposed quarry floor level of 65mOD will not require dewatering operations within the quarry extraction area.



3.0 Proposed Quarry Floor Level

3.1 Existing Quarry Floor Level

The existing floor level ranges from c. 62 to 65 mOD in the sump / infiltration area; c. 70 mOD in the northern extraction area and c. 85 mOD in the southern extraction area, refer to **Drawings ACP-1** Existing Site Layout (August 2026) and **ACP-3** Existing & Proposed Cross Sections.

Roadstone have not observed any groundwater inflows within the existing quarry extraction area and there are no dewatering operations. Surface water run-off is captured in the existing sump / infiltration area and infiltrates naturally to ground.

3.2 Proposed Quarry Floor Level

Based on the assessment of groundwater levels in **Section 2.0** above the proposed quarry floor level has been raised from its original level of 40 mOD to 65 mOD to eliminate the need for dewatering operations.

The proposed quarry floor level and water management infrastructure (refer to **Section 4.0** below) are shown on **Drawings ACP-2** Proposed Site Layout and **ACP-3** Existing & Proposed Cross Sections.

3.3 Quarry Dewatering (Worst Case Precautionary Assessment)

The proposed quarry floor level of 65 mOD has been assessed to eliminate the need for quarry dewatering, refer to **Section 2.2** above.

However, to address the concerns raised by Roscommon Co. Council and on a worst case precautionary basis, the potential impact of dewatering assuming long term groundwater levels at 67.5 mOD and 75.5 mOD, and using the proposed quarry floor level of 65 mOD has been assessed.

3.3.1 Hydraulic Conductivity

In hard rock aquifers the hydraulic conductivity is controlled by the rock mass structure. The quarry is located within aquifer classified as Regionally Important Karstified (Rkc) Aquifer – Bedrock refer to EIAR Figure 7-4.

Estimates of bulk hydraulic conductivity for Rkc aquifers have been published in the Irish Aquifer Properties – A Reference Manual and Guide (EPA, GSI – March 2015), refer to extract from **Table 5** provided below:

Table 5: A Reference Manual and Guide (EPA, GSI – March 2015)

Aquifer Category	Bulk Hydraulic Conductivity
Rkc	0.53 m/day (6.1×10^{-6} m/sec)

A hydraulic conductivity of 6.1×10^{-6} m/sec, as a reasonable representation of the bulk rock mass hydraulic conductivity has used for the assessment.



3.3.2 Estimated Zone of Influence / Potential Long Term Groundwater Level Drawdown

The zone of influence of the potential dewatering operations has been estimated using the Sichardt equation:

$$R = 3000 \times h \times \sqrt{k}$$

Where:

- R = limit of zero drawdown from the extraction area boundary (m)
- h = groundwater drawdown (m)
- k = hydraulic conductivity or permeability (m/sec)

On a precautionary basis, assuming long term groundwater level (GWL) drawdowns, h, of 2.5m (from 67.5 to 65.0 mOD) and 10.5 m (from 75.5 to 65.0 mOD); and the bulk hydraulic conductivity value of 6.1×10^{-6} m/sec referenced above; the zone of influence of any potential quarry dewatering to the proposed floor level of 65 mOD has been estimated as follows:

Table 6: Estimated Zone of Influence (Extraction to 65 mOD) – GWL Drawdown h = 2.5m & 10.5m

Rock Mass Bulk Hydraulic Conductivity	Estimated Zone of Influence (GWL Drawdown h = 2.5 m) : From Extraction Boundary to Zero Drawdown (m)	Estimated Zone of Influence (GWL Drawdown h = 10.5 m) : From Extraction Boundary to Zero Drawdown (m)
6.1×10^{-6} m/sec	18.5 m from extraction boundary	77.8m from extraction boundary

On this precautionary basis, the zone of influence for any potential dewatering associated with extraction to 65 mOD is estimated to range from c. **19 to 78** metres from the quarry extraction boundary, refer to **EIAR Figure7-7 Rev A** enclosed. The extent of these estimated Zones of Influence associated with the potential drawdown are very small, effectively contained within the overall site boundary. Based on experience of groundwater inflows at other limestone quarries, and the proposed extraction area, the volume of groundwater inflow at these potentially shallow groundwater drawdown levels could be up to c. 200 m³ per day. This potential volume is small compared to the overall surface water runoff volumes accommodated in the water management design below, and is covered by the conservative design parameters (20% climate change allowance; 10% addition to surface run-off areas etc.).

3.3.3 Potential Impact on Groundwater Body / Bedrock Aquifer

The area within the potential zone of influence, Zol for R = c. **80 m** worst case from the quarry extraction area boundary, for extraction to a level 65mOD, is c. 0.31km² including the quarry area. This is shown on **EIAR Figure 7.7 Rev A** Source Protection Areas enclosed.

In context of the Suck groundwater body (c. 1,099 km²), the potential Zol area equates to less than 0.03% of the overall groundwater body. The potential impact on the groundwater body (bedrock aquifer) is insignificant.

The potential zone of influence would not impact on any private water supply; public water supplies (including the source protection area for the Killeglan PWS Tobermore Spring, refer to **Figure 7-7 Rev A**); or any European site.



4.0 Quarry Water Management Infrastructure

4.1 Existing Quarry

As stated in **Section 2.0** there is no groundwater inflow into the existing quarry and there is no dewatering required for the ongoing quarry operations. Surface water run-off drains by gravity and is captured in the existing sump / infiltration area where infiltrates naturally to ground, refer to **Drawing ACP-1** Existing Site Layout and **ACP-3** Cross Sections. Water quality sampling and testing has been carried out in the existing sump / infiltration area in September 2025, refer to **EIA Chapter 7 Water**. The recorded suspended solids level in the sump / infiltration area water sample tested was very low - 7.75 mg / litre.

4.2 Proposed Quarry Water Management

It is proposed to implement the following quarry water management as part of the current planning application (refer to **Drawings ACP-2** Proposed Site Layout and **ACP-3** Cross Sections):

1. Construction of a Barrier Berm

A barrier berm will be constructed at the base of the access ramp leading to the lowest extraction bench, adjacent to the groundwater discharge area in the south-western corner of the quarry.

The purpose of the berm is to prevent surface water runoff potentially containing suspended solids from entering the sump / infiltration area directly.

Similarly, a 20 m-wide block of in situ rock will be retained along the northern boundary of the sump / infiltration area to provide an additional barrier against surface water runoff entering the area during quarry extraction at the proposed final level of 65 m AOD.

These design measures will create a dedicated enclosure around the groundwater discharge area, effectively separating it from the operational quarry. As a result, only treated, clean water will be permitted to enter the sump / infiltration area.

2. Collection of Runoff in Lagoon 1

Surface water runoff generated within the active extraction area will be directed to Lagoon 1, which will function as the primary collection and containment pond. Lagoon 1 will be lined, refer to sections below and **Drawing ACP-5 / ACP-6** for detailed design.

The lagoon will allow the initial settlement of coarse suspended solids and provide temporary storage of runoff generated within the quarry workings before being pumped to Lagoon 2 for treatment.

3. Transfer to Lagoon 2 for Secondary Treatment

Water collected within Lagoon 1 will be pumped via pipeline to Lagoon 2, located at surface level. Two pumps will be employed at Lagoon 1, one acting as the duty pump and one as a stand-by. The pumps, along with the associated generator and bunded fuel storage tank will be housed on a sealed concrete pad with bunded kerb to direct any rainfall over the pad to the lined Lagoon 1.

Lagoon 2 will be lined, and function as a secondary settlement lagoon and will provide additional retention time to facilitate the removal of sediment prior to reuse or discharge, refer to sections below and **Drawings ACP-5 / ACP-6** for detailed design.



4. Water Reuse within Quarry Operations

Lagoon 2 will serve as the principal water storage reservoir for the quarry. Stored water will be reused within site operations for the following purposes:

a. Wheelwash Supply

Water stored within Lagoon 2 will be used to supply the existing wheelwash facility. This will minimise the requirement to use water from the mains supply for wheelwash operations.

b. Dust Suppression

Stored water will provide a reliable year-round source of water for dust suppression activities throughout the quarry. This will minimise the requirement to use water from the mains supply during periods of dry weather when water is not naturally available within the quarry void.

5. Controlled Discharge of Treated Water

A water level monitoring system and automated control valve will be installed within **Lagoon 2**. When water levels exceed a predefined operational threshold, surplus water will be discharged under controlled conditions (using a hydrobrake) via a gravity-fed pipeline to the existing Sump / Infiltration Area in the south-western corner of the quarry.

Prior to discharge, the water will pass through a Class 1 hydrocarbon interceptor to ensure the removal of any residual hydrocarbons.

This system **will ensure that only clean, treated water is discharged to ground** in the sump / infiltration area and will provide an additional robust level of environmental protection for the underlying groundwater and any related pathways to European sites.

The proposed water management infrastructure is well established and proven practice / technology implemented by Roadstone at other locations.

Whilst it is demonstrated that the quarry has residual storage capacity with respect to storm events, should it be deemed necessary by the Competent Authority and as an additional layer of precaution, a condition on any grant of permission could be applied that pumping will stop into the discharge point during red and amber rain weather event warnings.

4.3 Water Management Infrastructure Design

4.3.1 Rainfall

The design is based on rainfall data obtained from the Met Eireann information online calculator, from this the design rainfall data used is:-

- M5-60 = 15.2
- M5 2 day = 56.2
- Ratio R = 0.270

The design has been tested for a 1 in 1, 30 and 100 year storm events with 20% allowance for climate change included for the 1:100 year event.

4.3.2 Runoff areas and coefficients

The total areas input into the design are:-

- 11.424ha for the quarry base
- 0.427ha into Lagoon 2



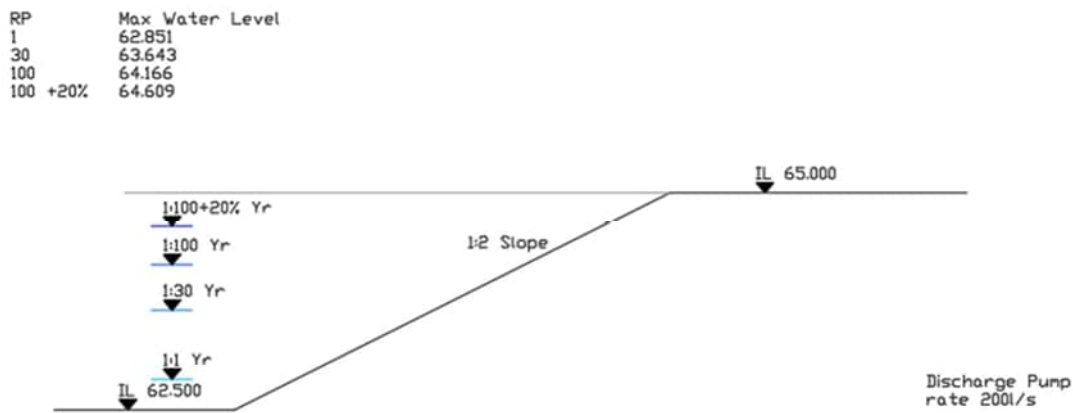
- 1.456ha into the infiltration area

On a precautionary basis an additional 10% has been added to all areas.

The runoff coefficients (Cv) used for the design are 0.75 and 0.84 for summer and winter storms respectively.

4.3.3 Collection - Lagoon 1

Lagoon 1 has been modelled as a 2.5m deep lagoon with 1:2 side slopes, the base area is 1,660m² and the top of bank area is 2,400m², refer to planning / design **Drawings ACP-5** and **ACP-6**. The lagoon footprint is 60m by 40m. The discharge from the lagoon is via pumps set at 200l/s. The lagoon has a freeboard of c. 0.4 metre during a 1:100 +climate change (CC) storm event.

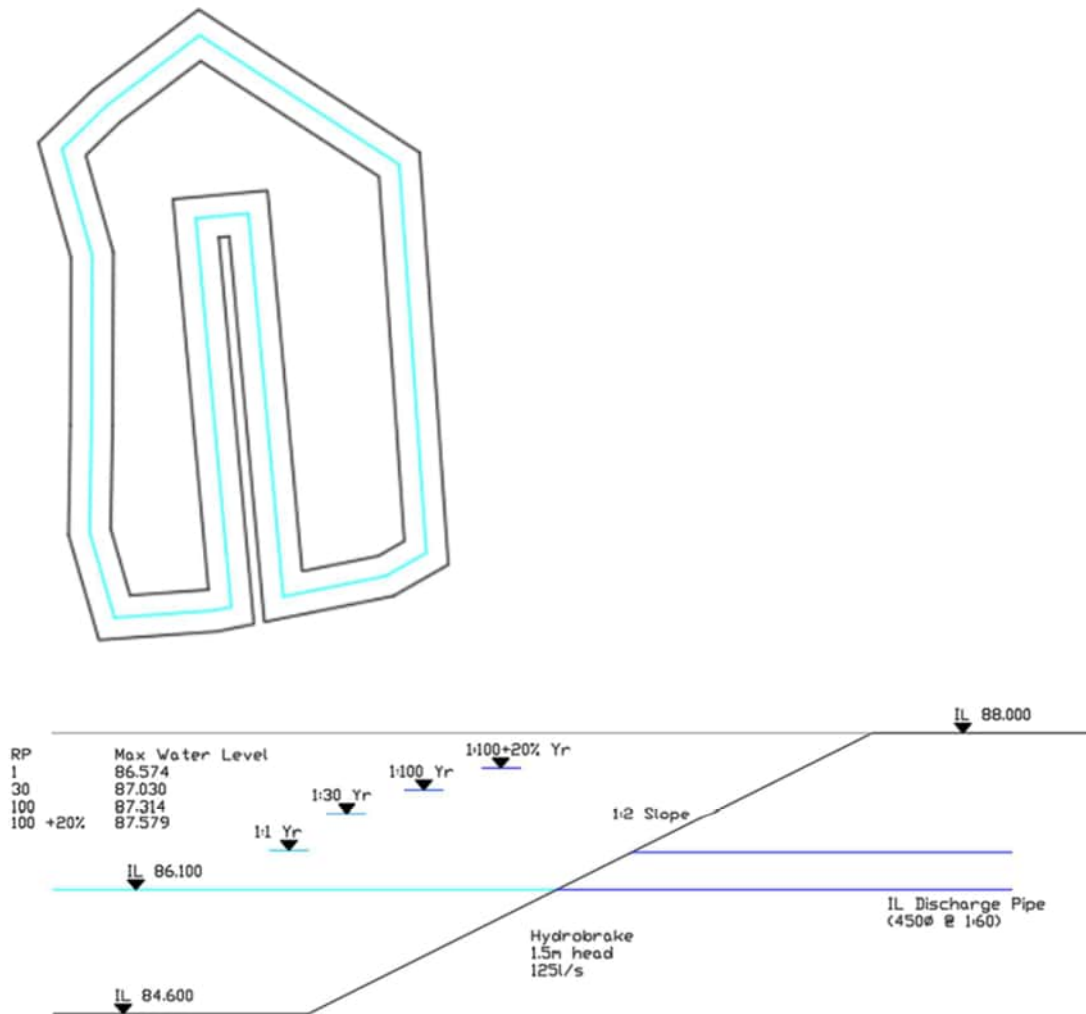


4.3.4 Settlement Treatment & Attenuation – Lagoon 2

Lagoon 2 has been modelled as a 3.4m deep lagoon with 1:2 side slopes, the base area is 2885m² and the top of bank area is 3930m², refer to planning /design **Drawings ACP-5** and **ACP-6**. The discharge from the lagoon is via a hydrobrake set for 125l/s at 1.5m head.

It is proposed to provide a further 1.5m depth below the outlet to allow for water storage for use on the site.





4.3.5 Hydrocarbon Interceptor

The discharge from the site will be via a 450mm diameter pipe to a Class 1 full retention hydrocarbon separator sized for a flow rate of 125l/s (SPEL Ref: P125 1CSC, Diameter 2.7m, Length 8.58m or similar). The discharge from the separator will flow by gravity to the existing infiltration area in the southwest corner of the site.

4.3.6 Settlement Treatment

The collection lagoon (Lagoon1) has a base area of c. 1,660m² and the settlement lagoon (Lagoon 2) has a base area of c.2,885 m² giving a total surface area of 4,545 m².

The required lagoon surface area to settle out silt size particles (diameter 0.01 mm) based on a discharge of 125 litres / second is 812 m², based on National Coal Board Guidance. On this basis the proposed settlement lagoon (Lagoon 2) has more than sufficient treatment capacity to remove / settle out silt size particles prior to being piped via Class 1 hydrocarbon separator to the infiltration area for discharge to ground.



4.3.7 Infiltration Area

The Causeway Flow models show that the infiltration area at the site has sufficient storage to deal with a 1:100 year storm event with 20% allowance for climate change followed 24 hrs later by a 1:30 year storm event (refer to **Appendix A**).

The existing sump / infiltration area covers an area of 6,000 square metres and has a volume of c. 16,000 cubic metres. A smaller sump / infiltration area and volume of c. 4,900 m² and 14,700 m³ has been modelled on a conservative basis.

4.3.7.1 Sump / Infiltration Area - Storage Requirement: Overall Water Balance

A simple water balance model has been constructed using rainfall and evaporation data from a nearby meteorological station (Mt Dillion) and site specific data (quarry extraction area, rock mass bulk hydraulic conductivity / permeability and quarry sump / infiltration area geometry).

The model uses average annual rainfall and evaporation data to assess the likely variation in water storage required in the quarry sump / infiltration area. The requirements for storm events are set out in Section 4.3.6.2 below.

The following input data are used:

- Quarry Area : 129,000 (m²) (the proposed maximum quarry extent);
- Monthly rainfall / runoff coefficient : 0.55 (dim);
- Average Annual Rainfall (1981 – 2010) : 1,047 mm/yr;
- Average Annual Evaporation (2023 – 2026) : 703.6 mm/yr;
- Bulk hydraulic conductivity / infiltration rate: 6.1×10^{-6} m/sec

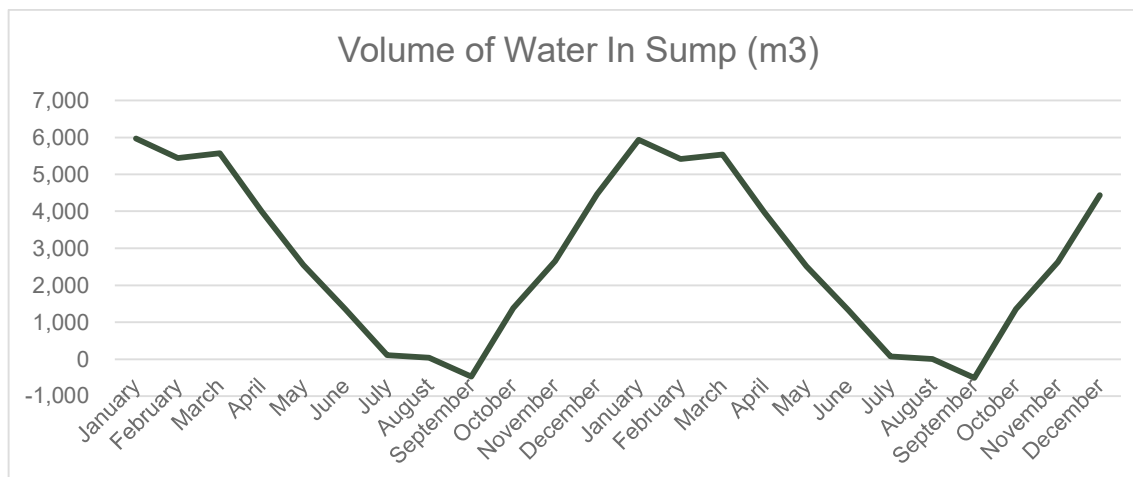
The model has been run monthly for a period of 2 years. Steady state conditions are reached within this period.

The model shows the average annual volume of water derived from incident rainfall onto the quarry and to be managed in the quarry water management infrastructure area is of the order of 74,000m³. The same volume of water is discharged over the course of one year via infiltration to groundwater (71,000m³) or lost to evaporation from the sump (3,000m³). Given the small area of the sump / infiltration area compared to the extent of the bedrock aquifer unit beneath the site the loss to evaporation is insignificant and will have no effect on local or regional groundwater levels, yield or flow direction.

The modelling shows that in the winter months excess runoff is generated and water needs to be stored in the sump / infiltration area. The water level falls in the sump / infiltration area during the drier summer months before the volume of water storage then increases again. This is consistent with observations in the existing quarry. In the winter months approximately 6,000m³ of water storage is required to contain excess winter rainfall. This is well within the sump / infiltration area volume of c. 16,000 m³. **Diagram 1** shows the annual water storage requirements.



Diagram 1 – Water Balance Output : Water Storage Required in Quarry Sump / Infiltration Area



As the water balance model has been constructed using a monthly timestep and using average rainfall and evaporation values there will be variation from the model results presented from year-to-year. For example, in a particularly wet year slightly more water storage will be required, and conversely, in a drier than average year less water storage will be required.

The water balance model does however confirm that the compared to the extent of the quarry and the depth of the proposed quarry floor at 65 mOD that there is ample space / volume within the sump / infiltration area to manage water within the quarry.

4.3.7.2 Sump / Infiltration Area Storage Requirement - Storm Events

The infiltration area capacity has been checked for the various storm events, using an infiltration rate of 6.1×10^{-6} m/sec (rock mass bulk hydraulic conductivity, refer to Section 3.3.1 above). The estimate water depth and infiltration volume are summarised in **Table 7** below:

Table 7: Sump / Infiltration area Storage Requirements – Storm Events

Return Period (1:x)	Infiltration Area Water Depth (m)	Infiltration Volume (m3)	Infiltration rate (l/s)
1	0.520	2,549	20.5
30	1.404	6,882	21.5
100	1.873	9,180	22.0
100+20%	2.402	11,772	22.7

The existing sump / infiltration area (c. 16,000 m3) has sufficient capacity to accommodate these storm volumes.

4.3.8 Section 4 discharge Licence

Roadstone Ltd. are in the process of submitting a Section 4 discharge licence application to Roscommon County Council based on the water management infrastructure design described above.



5.0 Water Environment Monitoring Programme

As outlined in the Mitigation and Monitoring Measures (EIA Chapter 16), the following water monitoring programme is proposed for the site as outlined in **Table 8**. However, the previously proposed surface water monitoring at the discharge point to the Ballyglass River will be replaced by monitoring of treated water at the discharge point to the on-site quarry sump / infiltration area, following collection at Lagoon 1, treatment through Lagoon 2 and passing through the Class 1 hydrocarbon interceptor.

Table 8: Indicative Schedule of Environmental Monitoring for Water

Activity (Responsibility)	Q1			Q2			Q3			Q4		
	J	F	M	A	M	J	J	A	S	O	N	D
Continual Groundwater Level in 4 boreholes MW3, MW4, MW5, MW6 with loggers (Contracted Consultant)	logger	logger	logger	logger	logger	logger	logger	logger	logger	logger	logger	Logger
Quarterly Groundwater Quality in 4 boreholes MW3, MW4, MW5, MW6 (Contracted Consultant)												
Monthly Treated Water Discharged to Infiltration Area at location between hydrocarbon interceptor and water entering the infiltration area in the SW corner of quarry – location of discharge to ground (Contracted Consultant) Note – only when treated water is being discharged to the infiltration area												



Figures

EIA Figure 7-1

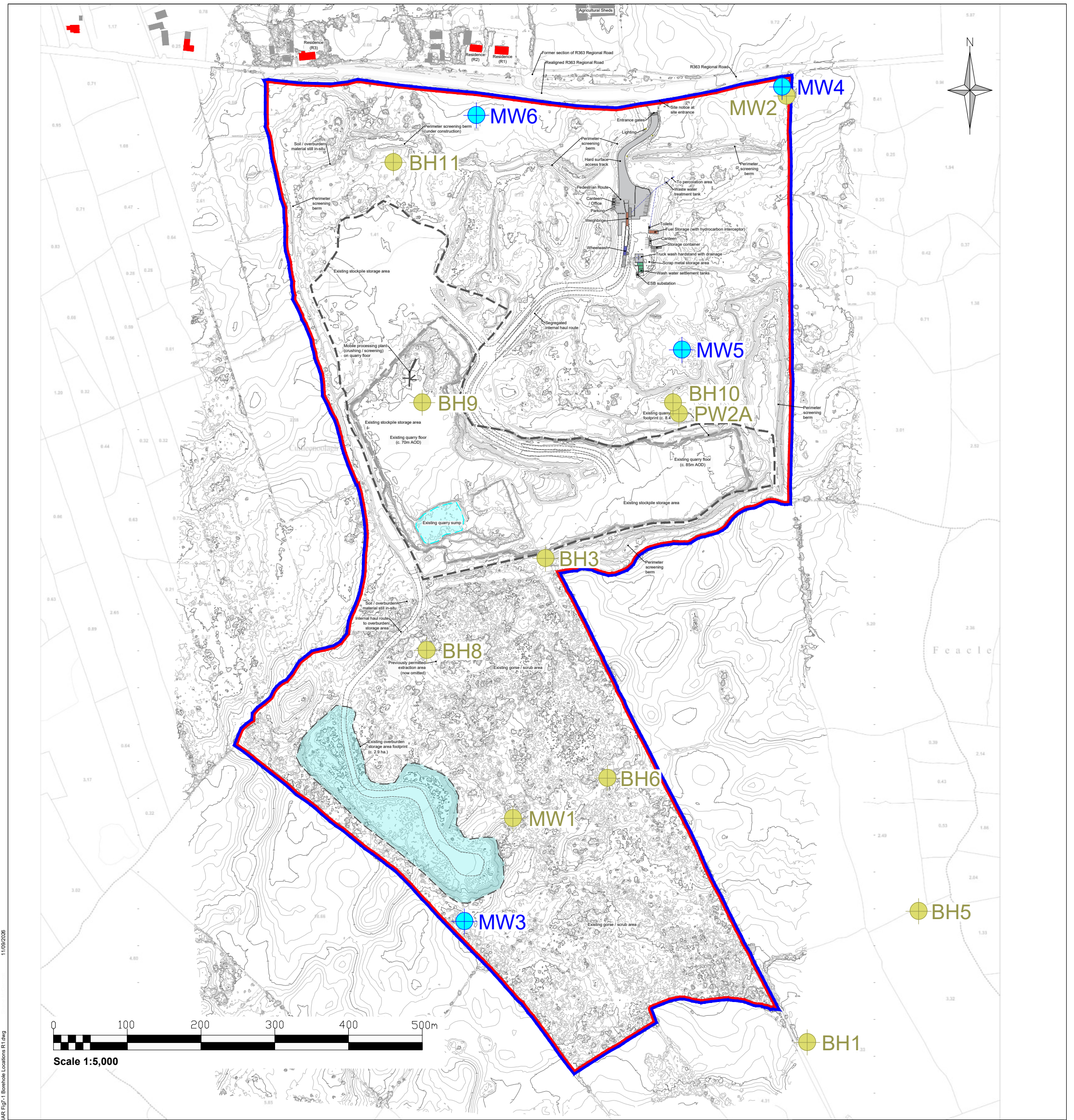
Borehole Locations

EIA Figure 7.7 Rev A

Source Protection Areas

(showing the proposed quarry footprint and the non-development area to south)





11/09/2028

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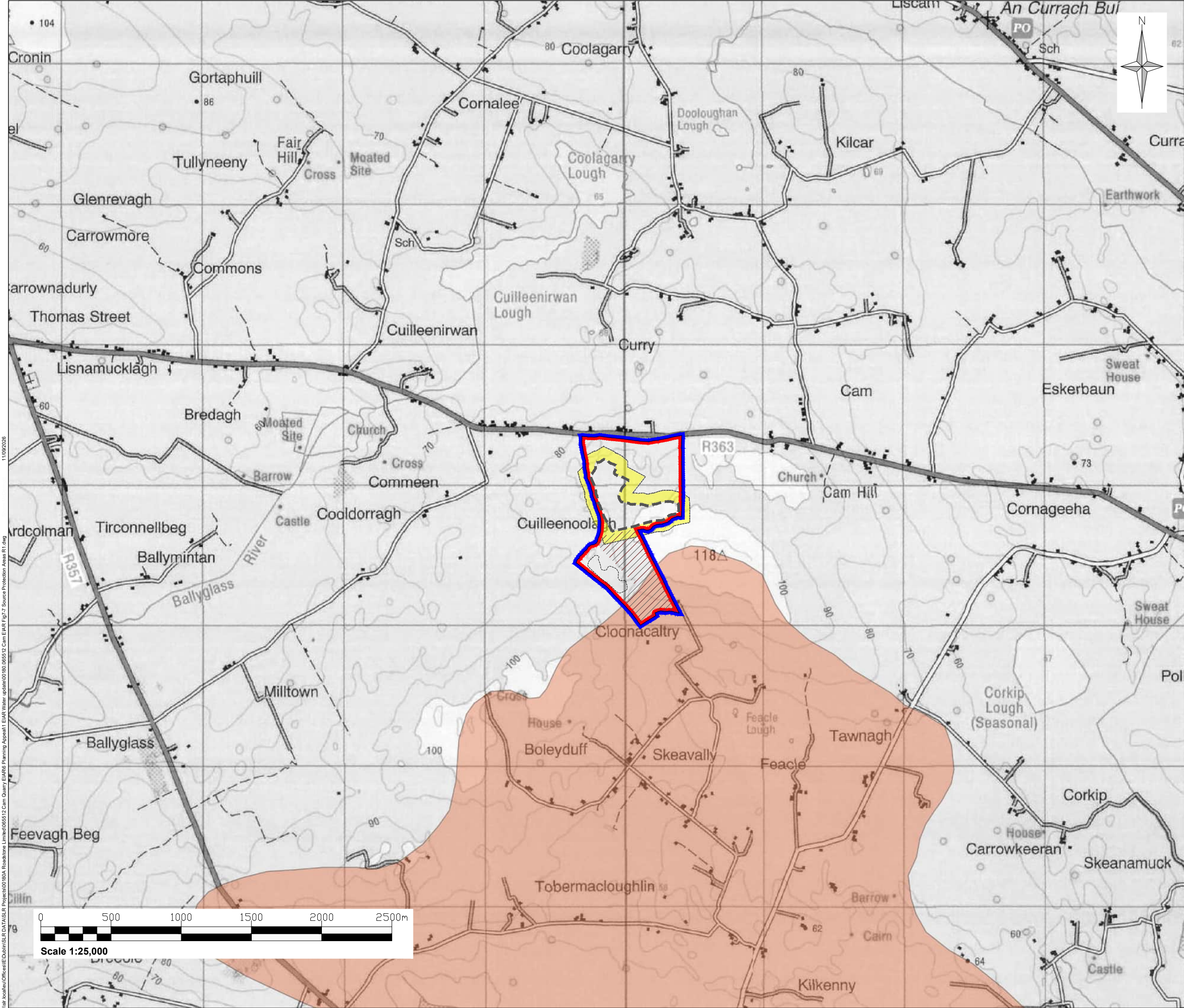
Notes:

1. Based on 6 inch scale Tailte Eireann Discovery raster mapiing RN047, RN048, RN050, RN051

Legend:

- Landholding (c. 66.3 hectares)
- Planning Application Area (c. 66.3 hectares)
- Existing Extraction Area (c. 8.4 hectares)
- Proposed Extraction Area (c. 12.9 hectares)
- Area part of Planning Permission 04/1479 & ABP PL20.215417 (c. 1.7 hectares) over which the public road was realigned
- Area of existing overburden storage (c. 2.9 hectares)
- Residence Locations
- Concrete hard surface areas
- Ancillary Site Facilities
- Contours (1m interval)
- 2023 Boreholes - Current Groundwater Monitoring Well Locations Locations
- 2003-2004 Boreholes - Decommissioned

Rev	Amendments	Date	By	Chk	Auth
www.slrconsulting.com					
Client Roadstone Limited					
Project Continued Use of Existing Cam Quarry at Curry & Cloonacaltry townlands, Co. Roscommon					
Figure Title Onsite Borehole Locations Map					
Scale 1:5,000		@ A3		SLR Project No. 501.065512.00001	
Designed mcob	Drawn mcob	Checked pg	Authorised pg		
Date 04/26	Date 04/26	Date 04/26	Date 04/26		
Figure Number Figure 7-1					Rev. 0



Notes:

1. Based on 6 inch scale Tailte Eireann Discovery raster maping RN047, RN048, RN050, RN051

Legend:

Landholding (c. 66.3 hectares)

Planning Application Area (c. 66.3 hectares)

Proposed Final Extraction Footprint (c. 12.9 hectares)

Non-Development Area

Zone of Influence extending c. 80m from Extraction Area:
GWL Drawdown 75m - 65m AOD (Precautionary Assessment)
- refer to EIAR Addendum Chapter 7 (September 2026)

Public Water Supply Source
Protection Area
Killeglan PWS Tobermore Spring

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11/09/2026

Appendices



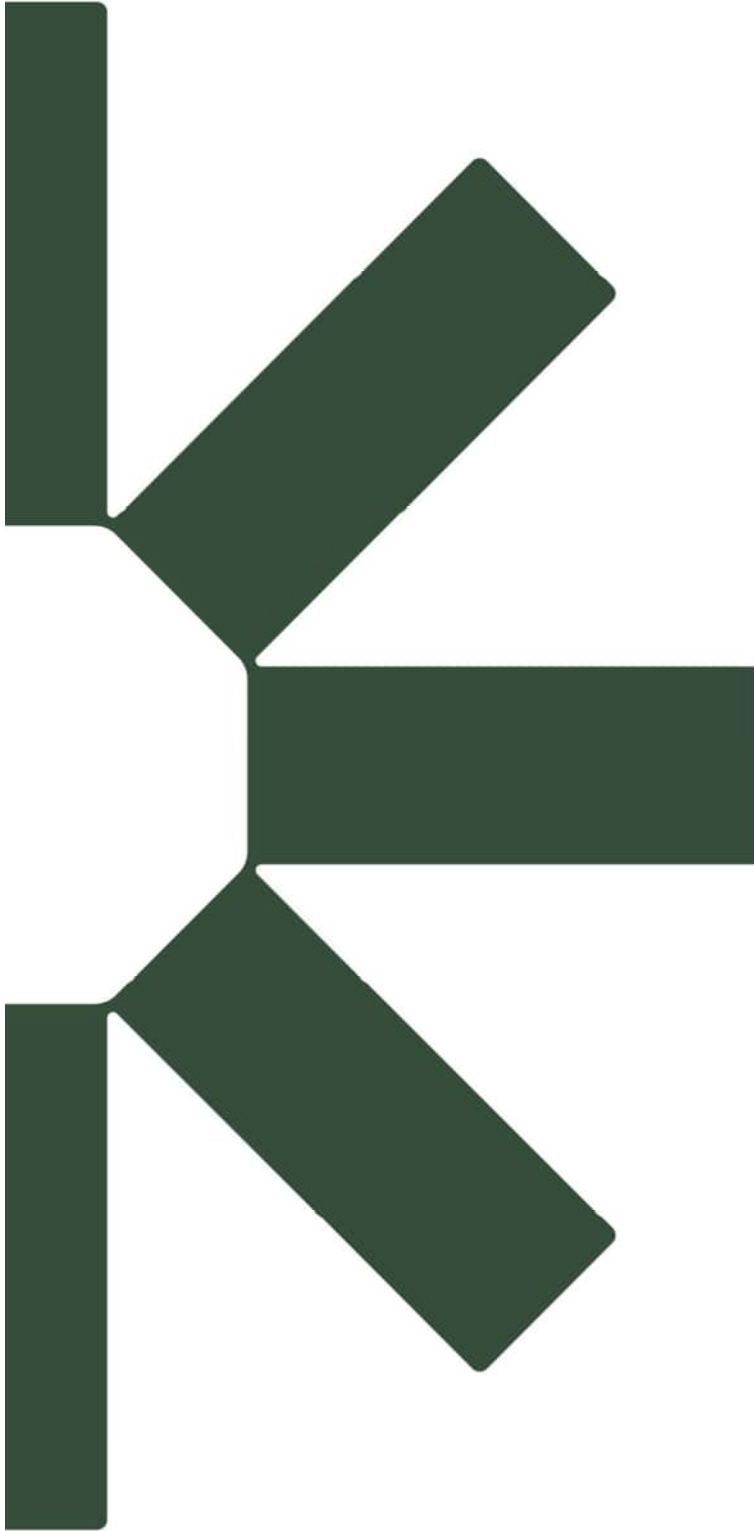
Appendix A

Water Management Infrastructure Design

Causeway Flow Models







Making Sustainability Happen