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INTRODUCTION

Background

6.1 This chapter of the EIAR provides a description of the existing land, soils, and geology conditions in the application area of the site within the context of the regional setting. It assesses the potential impacts the proposed development will have on the land, soils, geological features, and other geological aspects of the development. Mitigation measures, if required, are proposed.

Proposed Development

6.2 The proposed development is described in detail in Chapter 2: Project Description of this EIAR and only those elements which relate to land, soils, and geology are presented here. The proposed site layout is shown on EIAR Chapter 2, **Figure 2-2**.

6.3 The proposed development includes for drilling, blasting, crushing and screening of rock; and lateral extension to same, with an overall extraction area of c. 6.2 hectares with no vertical deepening below the existing quarry floor.

6.4 Additionally, the application includes for the importation of up to 35,000 tonnes per annum of processed fine aggregate, principally sand for use in readymix concrete production on site.

6.5 The existing aggregate processing regime will be used at the site which includes crushing, washing, and screening plant with associated silt disposal lagoons as well as the continued production of concrete. Site facilities consist of the readymix concrete batching plant including powerhouse prefabricated office, weighbridge, and workshop building with concrete laboratory, bunded fuel tanks, aggregate storage bays and one liquid effluent treatment system unit.

6.6 The restoration of the application site lands will be to a combination of beneficial agricultural and ecological after uses, refer to EIAR Chapter 2, **Figure 2-5**.

Scope of Work

6.7 This EIAR is based on a desk study of the site and surrounding lands using published geological data, a site investigation undertaken comprising boreholes drilled in 2021 and an inspection of the lands.

Project Team

6.8 This chapter of the EIAR was prepared by SLR Consulting Ireland. The project team consists of:

- Clodagh Gillen BSc, MSc
- Nikolina Bozinovic BSc, MSc
- Peter Glanville BA, MSc, PGeo, EurGeol

REGULATORY BACKGROUND

EU Directives

6.9 The following European Union (EU) Directive relate to Land, Soils and Geology at the site in this EIAR:

- Environmental Impact Assessment Directive (2011/92/EU);
- Environmental Impact Assessment Directive (2014/52/EU);
- The management of waste from extractive industries (2006/21/EC); and
- Environmental Liability Directive (2004/35/EC).

6.10 The EU EIA Directive regulates the information impact assessment process and information in this EIAR. The management of waste Directive and the Environmental Liability Directive regulate the activities at the site.

Irish Legislation

6.11 The following legislation relating to Land, Soils and Geology at the site is referred to in this EIAR:

- No. 349 of 1989, European Communities (Environmental Impact Assessment) Regulations, and subsequent amendments (S.I. No. 84 of 1994, S.I. No. 352 of 1998, S.I. No.; 93 of 1999, S.I. No. 450 of 2000 and S.I. No. 538 of 2001);
- S.I. No. 473 of 2011, European Union (Environmental Impact Assessment and Habitats) Regulations 2011;
- S.I. No. 584 of 2011, European Union (Environmental Impact Assessment and Habitats) (No.2) Regulations 2011; and
- The Planning and Development Act, 2000 (as amended).

6.12 The above legislation regulates the information contained in an EIAR and planning at the site.

Planning Policy and Development Control

6.13 The Planning Policy and Development Control relating to Land, Soils and Geology at the site in this EIAR is set out in the:

- Kildare County Development Plan 2023-2029.

6.14 The county development plan sets out conservation objectives in relation to soils, geology, geomorphology and geological heritage in the County.

Guidelines

6.15 This Land, Soils and Geology chapter of the EIAR has been prepared with regard to the following guidelines:

- Environmental Protection Agency (2022) *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.* May 2022. Environmental Protection Agency, Johnstown Castle Estate, Co. Wexford.
- DoEHLG (2010) Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities;

- Environmental Protection Agency (2003) Advice Notes on current practice (in the preparation of Environmental Impact Statements);
- Geological Survey of Ireland, Irish Concrete Federation (2008) Geological Heritage Guidelines for the Extractive Industry;
- Institute of Geologists of Ireland (2002) Geology in Environmental Impact Statements, A Guide;
- Institute of Geologists of Ireland (2013) Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- National Roads Authority (2008) Environmental Impact Assessment of National Road Schemes - A Practical Guide;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- National Roads Authority (2006) A Guide to Landscape Treatments for National Road Schemes in Ireland; and
- Transport Infrastructure Ireland (March 2013). Specification for Road Works Series 600 – Earthworks.
- Good Practice Guide for Handling of Soils (UK Ministry of Agriculture, Fisheries and Food, 2000).

RECEIVING ENVIRONMENT

Study Area

6.16 The study area for this Land, Soils, and Geology chapter of the EIAR comprises three principal geographic areas:

- the existing hard rock quarry;
- the existing sand and gravel pit area; and
- the immediate surrounding area within approximately 2 km of the lands under the control of the applicant (IGI EIS Guidelines, 2013).

6.17 The IGI EIS Guidelines (2013) state that maps should be sourced to allow for the review of the geological and hydrogeological conditions that exist within a minimum of 2 km of the site boundary (from the outer limit of the planning and/or licence area) and presented at a scale of 1:25,000. The baseline maps produced for the EIAR are at a scale of 1:25,000 and include an area up to c. 3.5 km from the lands under the control of the applicant.

6.18 The guidelines also state that the minimum distance of 2 km should be reviewed in the context of the geological / hydrogeological environment as well as the scale of development and increased to reflect the sensitivity of the subsurface. In this respect there are no particularly sensitive groundwater receptors in the vicinity of the site, such as geological heritage, limestone karst features or groundwater dependent ecosystems, and therefore the data from the immediate surrounding area of 2 km and up to 3.5 km as shown on the base mapping is considered sufficient for the purpose of the EIAR with regard to the characteristics of the site surrounds and the nature of the proposed development at the site.

Baseline Study Methodology

6.19 The baseline study undertaken for Land, Soils, and Geology here involves a review of published literature and information and the findings from a walkover survey of the site and the context of the site within the surrounding area.

6.20 The baseline study is a qualitative assessment of the available information based on professional experience.

Sources of Information

6.21 The following sources of information were consulted in the preparation of the receiving environment baseline study for Land, Soils and Geology:

- Geological Survey of Ireland (*www.gsi.ie*);
- Teagasc soil and subsoil mapping for Irish Forestry Soils Project (*www.epa.ie*);
- Irish Soils Information System (*www.teagasc.ie/soils*);
- Irish Geological Heritage Programme (*www.gsi.ie*); and
- Ordnance Survey of Ireland (*www.osi.ie*).

Land Baseline

6.22 Within the EIA EU Directive (2014/52/EU) Land is recognised as a 'natural resource' and the Directive also refers to the importance of the sustainable use of soil and the need to address the unsustainable increase in settlement areas over time ('land take'). Therefore, the issues of land as both a natural resource and land take must be considered in an assessment.

6.23 The introduction section to the EU Directive (2014/52/EU) notes that the:

'final document of the United Nations Conference on Sustainable Development held in Rio de Janeiro on 20-22 June 2012, which recognises the economic and social significance of good land management, including soil, and the need for urgent action to reverse land degradation. Public and private projects should therefore consider and limit their impact on land, particularly as regards land take, and on soil, including as regards organic matter, erosion, compaction and sealing; appropriate land-use plans and policies at national, regional and local level are also relevant in this regard'.

6.24 Land can be considered to be a resource with a beneficial use to society, for example agricultural land-use, extractive industry land-use or urban residential land-use; unnecessary land take may result in the loss of this resource which has the potential to have adverse social and economic consequences for society.

6.25 The extraction of rock at the site is a tied land-use activity as it is dependent on the location and suitability of the limestone materials, which may be considered to be a natural resource.

6.26 The County Development Plan sets out a number of policies and objectives which relate to the land use and resource nature of extractive industries in the County.

6.27 Policy **RD P8** states that it is the policy of the Council to:

- Support and manage the appropriate future development of Kildare's natural aggregate resources in appropriate locations to ensure adequate supplies are available to meet the future needs of the county and the region in line with the principles of sustainable development and environmental management and to require operators to appropriately manage extraction sites when extraction has ceased.

6.28 The objectives in the County Development Plan relating to the extractive industry and land use are set out here.

6.29 Objective **RD O47** states that it is an objective of the Council to:

- Protect and safeguard the county's natural aggregate resources from inappropriate development.

6.30 Objective **RD O48** states that it is an objective of the Council to:

- Manage the finite aggregate resources being mined by the extractive industries in the county to supply the future needs of our region while working to reach our climate change targets.

6.31 Objective **RD O50** states that it is an objective of the Council to:

- Ensure the satisfactory and sensitive re-instatement and/or re-use of disused quarries and extraction facilities, where active extraction use has ceased. Future uses should include amenity, recreation and biodiversity areas shall be informed by an assessment of the specific site/lands and shall be subject to an ecological impact assessment or other environmental assessments as appropriate. Where it is proposed to reclaim, regenerate, or rehabilitate old quarries by filling or re-grading with inert soil or similar material, or to use worked-out quarries as disposal locations for inert materials, the acceptability of the proposal shall be evaluated against the criteria set out in Section 15.9.6 of this Plan. The Council will resist development that would significantly or unnecessarily alter the natural landscape and topography, including land infilling/ reclamation projects or projects involving significant landscape remodelling, unless it can be demonstrated that the development would enhance the landscape and / or not give rise to adverse impacts.

6.32 Objective **RD O51** states that it is an objective of the Council to:

- Require that quarry remediation plans provide for environmental benefit, biodiversity and re-wilding in all instances. The 80% requirement for environmental/biodiversity may be waived at sites closer to urban areas where a significant portion of the site is being provided for sports, recreation, and amenity.

6.33 These policies and objectives in relation to the extractive industry in the county recognise the regional importance of aggregates and that the material is tied or resource based land use.

6.34 In terms of land take, the proposed development will result in a loss of the limestone resource within the proposed extraction area at this location. The remaining soils within the final quarry footprint area will be stripped and stored on site during the extraction of the rock material, before being replaced following extraction as part of the overall site restoration operations; this will result in a land take for scrub land use during the operational extraction life at the site. All the topsoil stripped from within the final quarry footprint area will be stored on site and used in site restoration works.

Soils Baseline

6.35 Soil is defined as the top layer of the earth's crust and is formed by mineral particles, organic matter, water, air and living organisms. Soil is an extremely complex, variable, and living medium and its characteristics are a function of parent subsoil or bedrock materials, climate, relief, and the actions of living organisms over time.

6.36 Soil formation is an extremely slow process and can take thousands of years to evolve; soil can be considered essentially as a non-renewable resource.

6.37 As the interface between the earth, the air, and the water, soil performs many vital functions; it supports food and other biomass production (forestry, biofuels etc.) by providing anchorage for

vegetation and storing water and nutrients long enough for plants to absorb them. Soil also stores, filters, and transforms other substances including carbon and nitrogen, and has a role supporting habitats serving as a platform for human activity.

National Soils

6.38 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).

6.39 This soil project has identified a number of Soil Associations across Ireland, which are each comprised of a range of soil types (or '*Series*'), each of them different in properties, and in environmental and agronomic responses.

6.40 The soil association is classified as the Elton Soil Association (1000c and 1000x) at the majority of the site and the small section of Mylerstown Soil Association (0650a) in the south-east, see **Figure 6-1**, all are characterised as '*fine loamy drift with limestone*'.

6.41 The Elton Soil Association is described as comprising *'Luvisols associated to histic and humic Groundwater Gleys and Calcareous Brown earths, on drift with Limestones'*[1]. The Elton Soil Association is one of the most extensive soil associations found across the limestone lowlands of Ireland and is considered to be naturally moderately draining. The Elton Soil Association is considered to have good agricultural potential being friable deep soils with plentiful, well-developed roots, a high base saturation with good nutrient retention (Creamer *et. al*., 2018). The Elton Soil Association is comprised of a total of 10 separate soil series which include soil series which have developed on limestone glacial drift.

6.42 The Soils of County Kildare (An Foras Taluntais, 1970) notes that the Elton Series soils have a wide use range and are suitable for a wide range of farm and vegetable crops but are mainly used for grassland. The series are first class grassland soils as they are free draining but have a good moisture holding capacity.

6.43 The Mylerstown soil association is mainly located in Kildare, Laois, Galway, Offaly and Tipperary. The association is characterised by high pH and consists of "poorly drained Calcareous or Humic Calcareous Groundwater Gleys with Luvisols on drift with limestones" (Creamer *et. al*., 2018).

6.44 The Soils of County Kildare (An Foras Taluntais, 1970) notes that the Mylerstown soil series has a moderately wide use range, they can grow a wide range of crops, but it is difficult to produce good tilth in unfavourable seasons. Most of the soils are now free draining due to the use of artificial drainage systems and field drains, the portions that are not artificially drained have limited use range. Mylerstown soils are best suited toward grass production.

Application Site Soils

6.45 The Teagasc soil mapping for the Irish Forestry Soils (IFS) mapping project, indicates that the soils in the site area (IFS Code 22) comprise Rendzinas and Lithosols which are shallow well drained soils derived mainly from calcareous parent material, i.e., carboniferous limestone. The soils at the site have formed on the well-drained sand & gravel subsoils.

6.46 The soils mapping also indicates lacustrine type soils (IFS code 56) beneath the forested area to the east of the site. To the south of the site there is an area of Grey Brown Podzolics which are deep well

[1] EPA Report No. 130 (2014), Irish Soil Information System: Synthesis Report Appendix 3 - Soil Association List

drained soils. To the east of the west of the site there are alluvium soils (IFS code 51) associated with the Annagh River.

Subsoils Baseline

Regional Subsoils

6.47 The Quaternary (Subsoil) deposits were deposited during the last 2 million years, and essentially comprise the unconsolidated materials overlying bedrock. The two main types of quaternary subsoils in Ireland are glacial till, deposited at the base of ice sheets, and sand & gravel deposits associated with the melting of the ice sheets which are generally termed glaciofluvial outwash sands and gravels. Other extensive quaternary subsoils in Ireland include peat, river alluvium, and coastal process deposits. Most Quaternary subsoils in Ireland were deposited since the maximum of the last glaciation, the Midlandian, which occurred approximately 17,000 years ago.

6.48 The subsoils across Ireland have been mapped on a national basis by Teagasc as part of the EPA Soil and Subsoil Mapping Project for the Irish Forestry Soils (IFS) project. The subsoil mapping was undertaken using existing Quaternary Geology maps, publications, remote sensing, field mapping and sampling.

6.49 The subsoils at the site have been mapped by Teagasc as gravel deposits and tills derived from limestone material, as well as some deposits of alluvium see **Figure 6-2**. Other subsoils in the vicinity of the site have been mapped as lacustrine sediments.

Application Site Subsoils

6.50 The subsoils have largely been removed from across the site of the existing operations due to the existing extraction and ancillary activities at the site.

6.51 The subsoils in the vicinity of the quarry landholding are primarily characterised by sands and gravels overlaying rock.

Bedrock Geology Baseline

6.52 The GSI 1:100,000 Geology Map Sheet 16 (2018) for Kildare and Wicklow indicates that the majority of the existing site is underlain by Carboniferous Limestone and Shale from the Lucan Formation along the northern side of the site, see **Figure 6-3**, with Carboniferous Limestone and Shale from the Edenderry Oolite Member at central part of the site and a small section of Waulsortian limestones in the south-eastern corner of the site.

6.53 Bedrock is exposed at the existing quarry area and this proposal will involve the further extraction of bedrock from the proposed overall quarry footprint of c. 6.2 hectares.

Site Boreholes

6.54 Within the application site itself, three boreholes were drilled in 2021 for groundwater monitoring and were drilled into the bedrock along the landholding site boundary.

6.55 The borehole locations are shown in **Figure 6-4** and a copy of the logs are included in **Appendix 6-A**. Summary details of the working borehole logs are shown in **Table 6-1** below.

Table 6-1
Summary Borehole Details

Borehole ID	Borehole Depth (m)	Borehole Elevation (mOD)	Rock Head (mOD)	Description
21-CL-01	60	90.6	77.8	Overburden extends to 12.8m below ground level. It consisted of soft to medium pale brown sandy gravelly clay which transitions into clayey silty Sand & Gravel with limestone cobbles and minor clay intervals and finally to firm dark brown clay overlying bedrock. Bedrock consists of the Edenderry Oolite formation. The upper sections consist of moderately strong heavily brecciated and fractured limestones with some calcite veining and argillaceous beds. From roughly 40m depth and onwards the limestone becomes more bedded and less fractured with some dolomitization.
21-CL-02	53.4	83.4544	60.0544	Overburden extends to 23.4m below ground level. The first 7m has pale buff brown clay with limestone cobbles. Medium coarse sands to 10m and very soft, medium dark grey, brown sandy clay with angular gravels and cobbles of argillaceous and pale grey limestone to the bottom of the overburden. The Lucan formation extends from 23.4m to 40.1m overlying the Edenderry oolite formation that extends to base of borehole. The upper section of the Lucan formation is dark weak fine grained argillaceous limestone interbedded with silts, and clays. The base of the formation is Weak and moderately strong buff brown clays with medium grey, fine grained dolomitised limestone. Possible fault zone. The Edenderry formation is moderately strong, pale blue grey, medium grained, massive oolitic LIMESTONE.
21-CL-03	40	67.6	60.7	The overburden extends to 6.9m and consists of Firm, medium brown and grey sandy silty clay with trace gravels of limestone. It is underlain by the Lucan formation that extends to the base of the borehole. The top 4 meters of weathered bedrock formation is highly fractured medium - fine grained moderately strong limestone with cobbles, gravels and shale bands. The formation remains largely moderately strong and medium grained to the base of the borehole with evidence of bioclastic and argillaceous material and interbedded with shales.

Geological Heritage Baseline

6.56 The County Development Plan sets out a number of policies and objectives which relate to the geological heritage in the County.

6.57 Policy **BI P10** states that it is the policy of the Council to:

- Maintain and protect the conservation value of geological sites of national or local importance and seek the sustainable management of the county's geological heritage resource as listed in Table 12.7.

6.58 Objectives of the Council within the Plan include:

- **BI O60** Consult with the Geological Survey of Ireland regarding any development proposals within or likely to have an impact on Sites of Geological Importance set out in Table 12.7.

- **BI O61** Contribute towards the protection from inappropriate development of Geological Natural Heritage Areas that become designated during the lifetime of this Plan.
- **BI O62** Promote, encourage, and support the provision of access to geological and geo-morphological features of interest in cooperation/consultation with landowners (where appropriate/practicable).
- **BI O63** Where appropriate support the restoration of Sites of Geological Importance (identified in Table 12.7).

6.59 The Geological Survey Ireland (GSI) Irish Geological Heritage (IGH) Programme of audited sites was reviewed to establish if any geological heritage issues were present in relation to the proposed development at Clonard.

6.60 The Ballykane Hill geological heritage site, code KE010, is located in the south-eastern corner of the existing site (ITM coordinates 665666, 740362), see **Figure 6-5**. The site demonstrates an *"interesting section of Carboniferous limestones, with Edenderry Oolite Formation infilling fissures within Waulsortian mudbank limestones"*.

6.61 The existing quarry void is at Ballykane Hill which is located in the Ballykane Hill CGS (Ref. No. KE010). The planning application area, proposed quarry void extent and the Ballykane Hill CGS boundary are shown **Figure 6-5**. A copy of the Ballykane Hill CGS report is included in **Appendix 6-B**.

6.62 The GSI IGH programme will be consulted by Kildare County Council once the planning application is submitted. However as part of the consultation process carried out for the previous planning application 22/83 for a similar type of development to that proposed within this planning application, a consultation submission to the GSI on behalf of Kilsaran was made, see **Appendix 6-C**, and the consultation response from the GSI is provided in **Appendix 6-D**.

6.63 The County Geological Site report for Ballykane Hill states that:

'The abandoned quarry is on private property and unsuitable for general promotion without appropriate arrangements agreed with the landowners. However, it is understood that local schools have used it over many years to seek fossils and look at geology in the field.'

6.64 The existing historic quarry exposures which have been used to view the geology at the Ballykane Hill site, and the reason for the CGS designation, are relatively small and located along the south western side of Ballykane Hill.

6.65 Part of the existing quarry exposures are outside of the footprint of the proposed quarry extension and therefore will be preserved as part of the proposed development, see **Figure 6-5**.

6.66 In relation to the information included in the EIAR and consultation with the GSI the following points are noted:

- Part of the existing historic quarry exposures at the geological heritage site are outside of the footprint of the proposed quarry extension and therefore will be preserved as part of the proposed development;
- The GSI consultation response states that:

  'It is desirable to consider retaining representative faces for geological purposes during aftercare and restoration plans instead of straight forward infill to original pre-quarrying topography, and we recognize your intention to do so in your planning application'; and
- The EIAR states that the proposed quarry void extension will provide additional exposures into the geology at the Ballykane Hill CGS showing a greater geological sequence than is otherwise visible in the existing historic quarry exposures. At other Kilsaran sites, they have agreed access

to their sites for the GSI to record and log the geology as and when requested by the GSI and Kilsaran will accommodate the GSI at this site also.

6.67 With respect to Ballykane Hill CGS it is considered that the proposed development is aligned with the County Development Plan policies and objectives. The proposed development will conserve the value of the geological heritage source, i.e., existing historic quarry exposures, and will also extend the scientific knowledge at the site with additional exposures of the geology and geological sequence at the site, i.e., the retention of extended quarry exposures after the restoration of the site.

6.68 There are no other sites of designated County Geological Importance within 2 km of the proposed quarry / pit development, as indicated in the Kildare County Development Plan (2023-2029).

Sensitive Receptors

6.69 In terms of land, soils and geology baseline considered here, the sensitive receptors identified from this baseline are:

- the Ballykane Hill geological heritage site in the corner of the site.

IMPACT ASSESSMENT

Evaluation Methodology

6.70 The evaluation of impacts of the proposed development is based on a methodology similar to that outlined in the '*Guidelines for the Assessment of Geology, Hydrology and Hydrogeology for National Road Schemes*' published by the National Roads Authority (2009) and the '*Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements*' published by the IGI (2013).

Evaluation of Impacts

6.71 This assessment focuses on the potential impact of the proposed development on the land, soils, and geology at the site. It specifically describes the significance and sensitivity of the receiving environment.

6.72 Construction impacts will include stripping of any remaining topsoil/overburden within the final quarry footprint area. Operational impacts will include the removal of rock from the quarry area. It is not expected that there will be any Post-Operation impacts.

6.73 The importance of existing land, soil, and geology attributes identified at the application site is assessed in **Table 6-2**.

Table 6-2
Importance of Attributes in Vicinity of Application-site

Attribute	Status / Occurrence	Significance/Sensitivity/Importance
Land	The land at the site comprises existing pit/quarry lands used for extraction, processing, storage and manufacturing operations, a small section of scrub land at the most southern site area and agricultural land to the northern site area.	The agricultural land at the site has a value in terms of its ability to support agriculture and is considered to be of **High** importance at the local and regional scale only.
Soils	The Elton Soil Association is the most extensive association across the limestone lowlands of Ireland and therefore occurs widely. The Elton Soil Association is moderately draining. It does not have any particular status.	The soils are considered to be of **High** importance at the local and regional scale. Although principally used for grassland, they have a range of uses. As the soils are moderately draining, they can be used for agriculture without the requirement for any drainage improvement works.
	The restored lands at the site (sand and extraction areas) will facilitate agricultural land-use and soils will remain moderately drained following their reinstatement.	Restored soils are considered to be of **High** importance for agriculture at the local and regional scale only as they are widely distributed in the lowlands of Ireland.
Subsoils	The sand & gravel subsoils at the existing site have mostly been removed within the existing site area. The subsoils do not have any designated status.	Sand & gravel subsoils are considered to be of **High** importance at the local and regional scale as an economic resource for the construction industry.
Geology	Bedrock is exposed in the current quarry area. The bedrock does not have any particular status.	In terms of the proposed development, the Bedrock geology is considered to be of **Low** importance at the site.
Geological Heritage	IGH and CGS designated site at Ballykane Hill	Nationally and locally important as reflected in its designation

6.74 The magnitude of these impacts on the land, soils and geology attributes is assessed in **Table 6-3** below.

Table 6-3
Significance of Impacts on Land, Soil and Geology with no Mitigation

Attribute	Impact of Proposal on Land, Soil and Geology	Magnitude of potential impact
Land	Long-term (10 years) loss of small area of agricultural lands covering the bedrock extraction area.	Long-term and negative during lifetime of project.
	Bedrock extraction area will retain representative faces for geological purposes during aftercare and restoration plans.	Negative, regarding a permanent loss of bedrock material volume, but beneficial for the extend of the scientific knowledge with additional exposures of the geology and geological sequence at the site.
Soils	Any remaining soils to be stripped will be stored on-site to be used in the restoration of the overall site	Long-term during lifetime of project with loss of the use of soils across the quarry extraction area during extraction. Impact considered to be negligible as the soils will be restored to agriculture use.
	Soils will be restored across the site where required following the cessation of extraction.	Neutral with restoration of soils to agricultural use with negligible impact.
Subsoils	Permanent loss of sand & gravel subsoils within the existing sand and gravel pit area.	Permanent loss of available resource which is of local and regional importance to the construction industry.
Geology	Permanent loss of bedrock to a depth of c. 75.1m AOD within the quarry extraction area.	Permanent loss of available resource which is of local and regional importance to the construction industry.
Geological Heritage	Existing exposures in Ballykane Hill along the south west edge of the hill will be maintained outside of the footprint of the proposed quarry extension.	Positive impact as the existing exposures will be maintained and additionally, more extensive exposures will be provided into the geology at the site.

Indirect Impacts

6.75 There will be no indirect impacts on land, soils, or geology as a result of the proposed development at the site.

Unplanned Events (i.e., Accidents)

6.76 Unplanned events within the application-site, such as accidents, have the potential to impact on the land, soils and geology adjoining the site.

6.77 Ground instability, particularly the long-term stability of pit/quarry faces, has the potential to impact on adjoining lands. Operations at the site will adhere to the Health and Safety Authority Safe Quarry Guidelines in relation to the Safety Health and Welfare at Work (Quarries) Regulations 2008 and this will limit the potential for unplanned events such as instability of pit/quarry faces or instability in adjacent lands. With the implementation of the Quarry Regulations 2008, it is considered unlikely that instability of pit faces would result in an impact on the land, soils, and geology at the site.

Human Health

6.78 From a land, soils and geology perspective, any potential impacts on human health from the excavation and processing of the extracted rock at the site would not be via the land-use, soils and

geology pathways but via other pathways such as air and water, which are addressed in the relevant Chapters of this EIAR.

Cumulative Impacts

6.79 There are a number of disused, proposed and current sand and gravel pits in the local area including the proposed Kilsaran Concrete Brackagh pit, an adjacent pit to the west of the site at Kilrainy, and several pits further removed c. 2-3km to the southeast of the site in the townlands of Balrinnet, Kilglass and Ballinderry.

6.80 Most of the pits within the general vicinity of the site are currently not operational at the time this EIAR was prepared.

6.81 It is not considered that there are cumulative impacts in terms of the Land, Soil and Geology between this application and existing and/or dormant quarry/pit operations in the surrounding area.

'Do-nothing Scenario'

6.82 In a 'do-nothing scenario', the development at the existing sand and gravel pit and ancillary manufacturing facilities, currently permitted would continue to operate within the extant planning permission until January 2024 and thereafter be restored in a similar fashion to what is proposed in this planning application, i.e., a mix of agricultural use and beneficial habitat area. The hard rock quarry would remain inactive with rock previously permitted for extraction under P. Ref. 99/2042 remaining in-situ and the quarry void being restored in line with what was proposed previously.

6.83 Following closure there would be a loss of both the valuable proven aggregate reserves effectively sterilising these valuable aggregates. There would be a loss of the valuable concrete supply to the region.

MITIGATION MEASURES

6.84 Mitigation measures are outlined here for the construction and operational stages of the proposed development. The construction stage is relatively short lived (approximately six months) and is proposed to be carried out in tandem with the operational stage. The operational stage is the extraction of rock material from the quarry and subsequent aggregate processing, importation of a fine aggregate (principally sand) and concrete manufacturing over the lifetime of the project.

Construction Stage

6.85 Soils will be managed on-site in line with best practice national guidelines (National Roads Authority, 2006) and Specification for Road Works Series 600 – Earthworks (Transport Infrastructure Ireland, March 2013).

6.86 A specific Soil Management Plan will be developed for the site.

6.87 During the construction stage any topsoil required to be stripped will be stockpiled on-site ready for use in the site restoration. The soils will be stripped and stored in accordance with best practice guidance including MAFF (2000) *Good Practice for Handling Soils (Sheet 1 and Sheet 2)*.

6.88 The soil handling method can affect the quality of the restoration through severe soil deformation (compression and smearing); this is primarily caused through trafficking, the effects of which increases with increasing soil wetness.

6.89 Good practice measures will be implemented at the site to preserve the structure and integrity of the soils and limit the effects of erosion on the stored soil during excavation and storage.

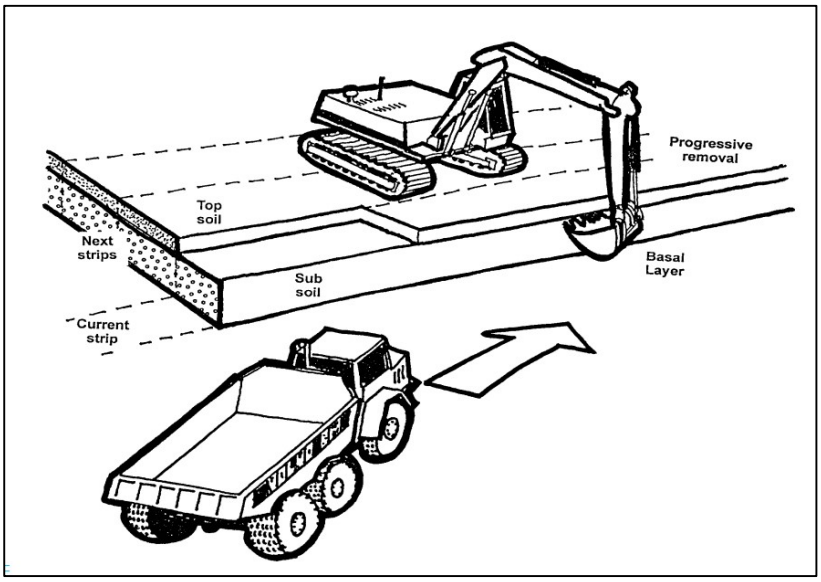
6.90 The key operational points to ensure avoidance of severe soil deformation and to minimise compaction using excavators and dump trucks are as follows:

- the dump trucks must only operate on the 'basal'/non-soil layer, and their wheels must not, on any circumstances, run on to the soil layer(s);
- the excavator should only operate on the topsoil layer;
- the adoption of a bed/strip system avoids the need for the trucks to travel on the soil layers; and
- the machines are to only work when ground conditions enable their maximum operating efficiency.

6.91 For soil stripping with excavators and dump trucks:

- the area to be stripped is to be protected from in-flow of water, ponding etc. Wet sites should be drained in advance;
- if significant rainfall occurs during operations, the stripping must be suspended;
- all machines must be always in a safe and efficient working condition. The machines are to only work when ground conditions enable their maximum operating efficiency. The operation is to be suspended before traction becomes a problem and haul routes fail;
- the operation should follow a detailed stripping plan showing soil units to be stripped, haul routes and the phasing of vehicle movements;
- the soil layer should be stripped to its natural thickness without incorporating material from the lower subsoil layers;
- the haul routes and soil storage areas must be defined, and should be stripped first;
- the excavator is only to work on the topsoil layer; the dump trucks are only to travel on the basal/formation layer; and
- stripping is to be undertaken by the excavator standing on the surface of the topsoil and digging the topsoil to its maximum depth and loading into dump trucks. The dump trucks draw alongside the exposed soil profile, standing and travelling only on the basal layer (see **Diagram 1** below).

Diagram 1
Removal of Topsoil: Stripping Using Excavator and Dump Truck (MAFF 2000)

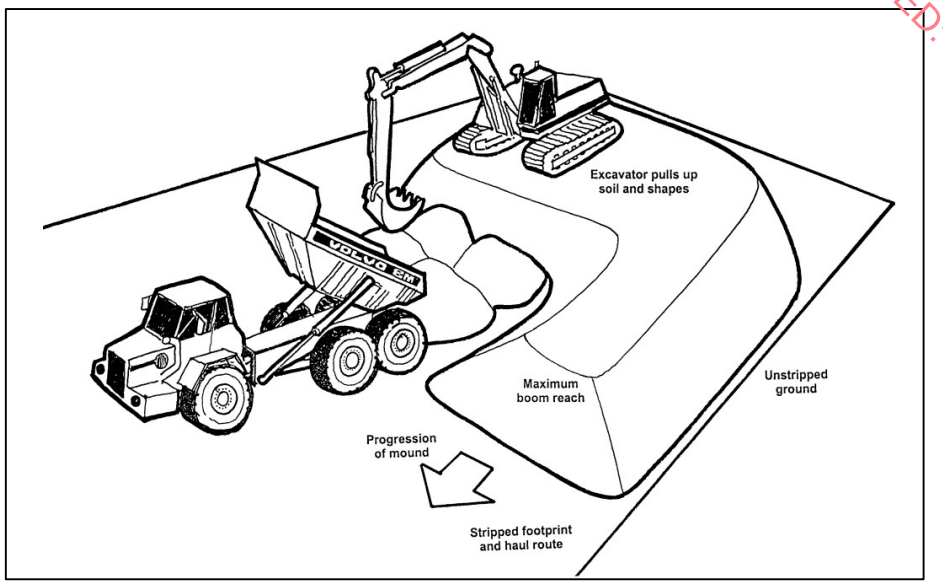


6.92 In order to avoid compaction single-tier mounds are preferred to multi-tier mounds for soil storage as it avoids the need for trafficking on the soil being stored.

6.93 For the building of soil storage mounds with excavators and dump trucks:

- the mounds should be sited on dry ground, not in hollows and should not disrupt local surface drainage. Where necessary, mounds should be protected from run-off/ponding by a cut-off ditch. Where the storage mound is in a hollow due to the removal of surface soils, measures should be undertaken to ensure that water is not able to pond within the storage area;
- the dump trucks must only travel within the haul route and operational areas. The trucks should enter the storage area, reverse and back-tip the soil load starting at the furthest point of the mound from the point of access. The excavator pulls up the soil into a mound of the required dimensions. The excavator operates by standing on the mound (see **Diagram 2** below). The excavator bucket can be used to shape and firm the sides as the mound is progressively formed to promote the shedding of rain; particularly at the end of each day, but also on the onset of rain during the day. This should include any exposed incomplete surfaces;
- the process is repeated with the tipping of soil against the forming mound, and without wheels traversing onto previously tipped material;
- work should stop in wet conditions with measures undertaken to prevent ponding at the base of the mound and on the basal layer. At the start of each day ensure there is no ponding on the basal layers and operating areas; and
- topsoil storage mounds should not exceed 2 m in height.

Diagram 2
Soil Storage Mound Construction Using Excavator and Dump Truck (MAFF 2000)



6.94 Stockpiles of soil will be re-vegetated where they are in place for a sufficient length of time to justify such a measure. The re-handling of soil material will be minimised as much as possible to preserve the integrity of the topsoil material. This is also an economically prudent practice.

Operation Stage

6.95 During the operation stage the bedrock materials will be excavated and processed at the site.

6.96 Mitigation measures outlined above for the Construction Stage will continue to be implemented throughout the Operation Stage.

6.97 Operations at the site will adhere to the Health and Safety Authority Safe Quarry Guidelines in relation to the Safety Health and Welfare at Work (Quarries) Regulations 2008 and this will limit the potential for unplanned events such as instability of pit faces or instability in adjacent lands.

6.98 No other specific mitigation measures are required at the site in terms of land, soil and geology at this stage.

6.99 Kilsaran will facilitate access to the quarry by GSI staff in order to inspect the geology at the Ballykane Hill geological heritage site.

RESIDUAL IMPACT ASSESSMENT

Construction and Operation Stages

6.100 Examination of the identified potential impacts on the receiving environment show that provided appropriate mitigation measures are put in place, there are no significant residual impacts with respect to land, soils, or geology during the Construction and Operation Stages.

MONITORING

6.101 The proposed overall quarry void extraction will provide additional exposures into the geology at the Ballykane Hill CGS showing a greater geological sequence than is otherwise visible in the existing historic quarry exposures. At other Kilsaran sites, they have agreed access to their sites for the GSI to record and log the geology as and when requested by the GSI and Kilsaran will accommodate the GSI at this site also.

6.102 Following the restoration of the site initial monitoring will be required over a period of two years to ensure that the restored soil and land-use is successful and that the remaining quarry faces are stable.

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Institute of Geologists of Ireland (2013) 'Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements'.

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MAFF (2000) GOOD PRACTICE GUIDE FOR HANDLING SOILS Sheet 1: Soil Stripping with Excavators and Dump Trucks

MAFF (2000) GOOD PRACTICE GUIDE FOR HANDLING SOILS Sheet 2: Building Soil Storage Mounds with Excavators and Dump Trucks

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Transport Infrastructure Ireland (March 2013). Specification for Road Works Series 600 -Earthworks

FIGURES

Figure 6-1
National Soils Association Map

Figure 6-2
National Subsoils Map

Figure 6-3
Geology Map

Figure 6-4
Trial Pit and Borehole Locations

Figure 6-5
Geological Heritage Sites

NOTES

Extract from Ordnance Survey Discovery Series Map No. 49

Extract from Soil Data © Teasasc

LEGEND

- APPLICANTS LAND INTEREST BOUNDARY (c. 51.6 ha)
- SITE APPLICATION AREA c.51.6 ha
  TOTAL APPLICATION AREA c.51.7 ha
  (Site & Road Works)
- MYLERSTOWN
- PEAT
- RIVER
- ELTON
- URBAN

N

0 800m 2000

Metres 1:25,000

Kilsaran
ideas taking shape

SLR CONSULTING IRELAND
7 DUNDRUM BUSINESS PARK
WINDY ARBOUR
DUBLIN 14
T: +353-1-2964667
F: +353-1-2964676
www.slrconsulting.com

KILSARAN CONCRETE UNLIMITED COMPANY

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

QUARRY DEVELOPMENT AT KILRATHMURRY & KILRAINY TOWNLANDS, CO. KILDARE

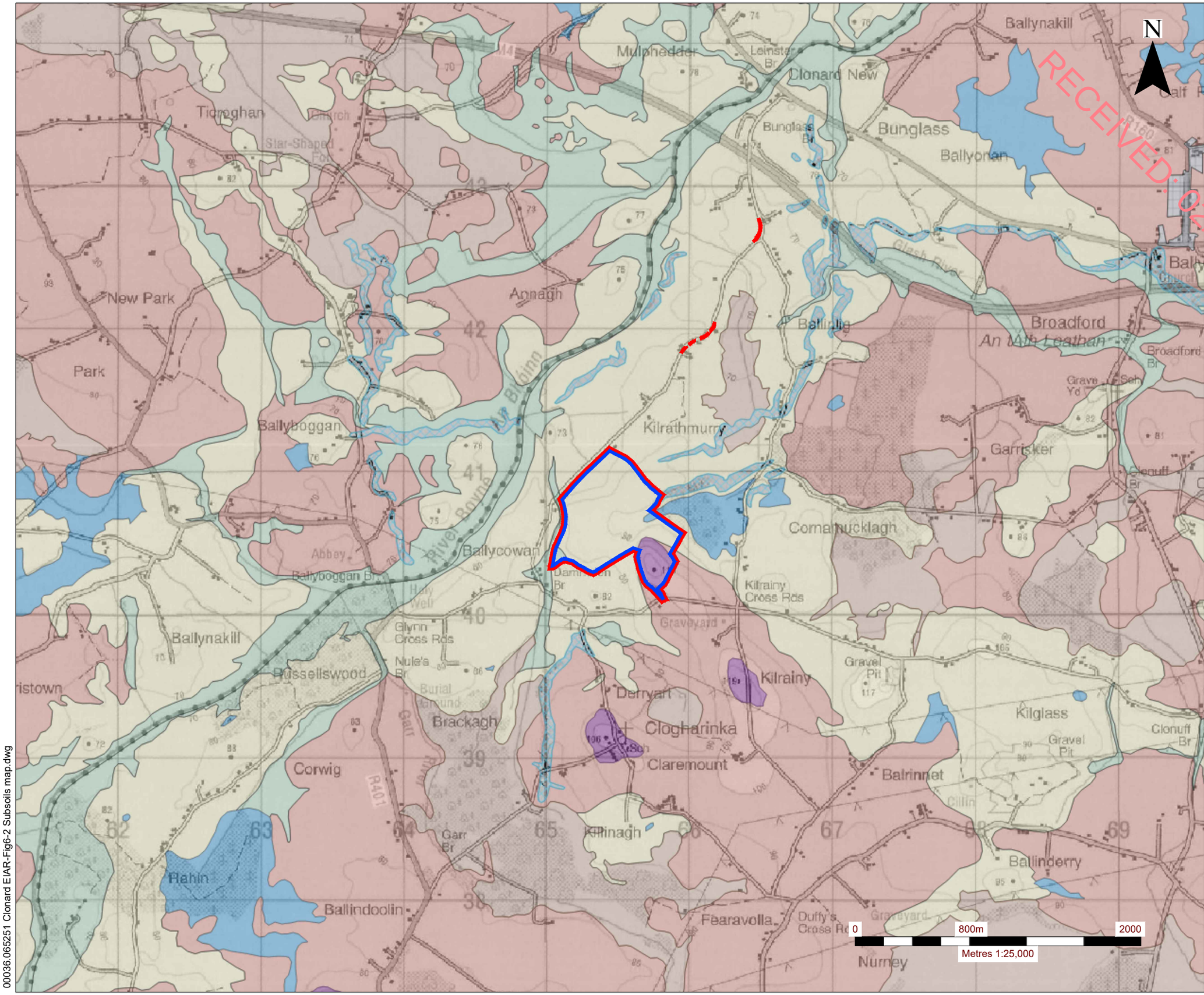
SOILS MAP

FIGURE 6-1

Scale: 1:25,000 @ A3

Date: SEPTEMBER 2023

00036.065251 Clonard EIAR -Fig6-1 Soils map.dwg



NOTES

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Extract from Ordnance Survey Discovery Series Map No. 49
Extract from Subsoils Data Mapping © Teagasc

LEGEND

- APPLICANTS LAND INTEREST BOUNDARY (c. 51.6 ha.)
- SITE APPLICATION AREA c.51.6 ha TOTAL APPLICATION AREA c.51.7 ha (Site & Road Works)
- LIMESTONE TILL
- GRAVELS
- ROCK
- ALLUVIUM
- CUT OVER RAISED BOG
- ESKERS

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SLR CONSULTING IRELAND
7 DUNDRUM BUSINESS PARK
WINDY ARBOUR
DUBLIN 14
T: +353-1-2964667
F: +353-1-2964676
www.slrconsulting.com

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QUARRY DEVELOPMENT AT
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TOWNLANDS, CO. KILDARE

SUBSOILS MAP

FIGURE 6-2

Scale	Date
1:25000 @ A3	SEPTEMBER 2023

00036.065251 Clonard EIAR-Fig6-2 Subsoils map.dwg

NOTES

Extract from Ordnance Survey Discovery Series Map No. 49

Extract from Bedrock Data Mapping © GSI

LEGEND

APPLICANTS LAND INTEREST BOUNDARY (c. 51.6 ha.)

SITE APPLICATION AREA c.51.6 ha
TOTAL APPLICATION AREA c.51.7 ha (Site & Road Works)

FAULTS

BEDROCK GEOLOGY (Source: GSI)

LUCAN FORMATION

BALLYSTEEN FORMATION

EDENDERRY OOLITE MEMBER

VOLCANICS (IN CARBONIFEROUS)

WAULSORTIAN LIMESTONES

N

0 800m 2000

Metres 1:25,000

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7 DUNDRUM BUSINESS PARK
WINDY ARBOUR
DUBLIN 14
T: +353-1-2964667
F: +353-1-2964676
www.slrconsulting.com

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BEDROCK MAP

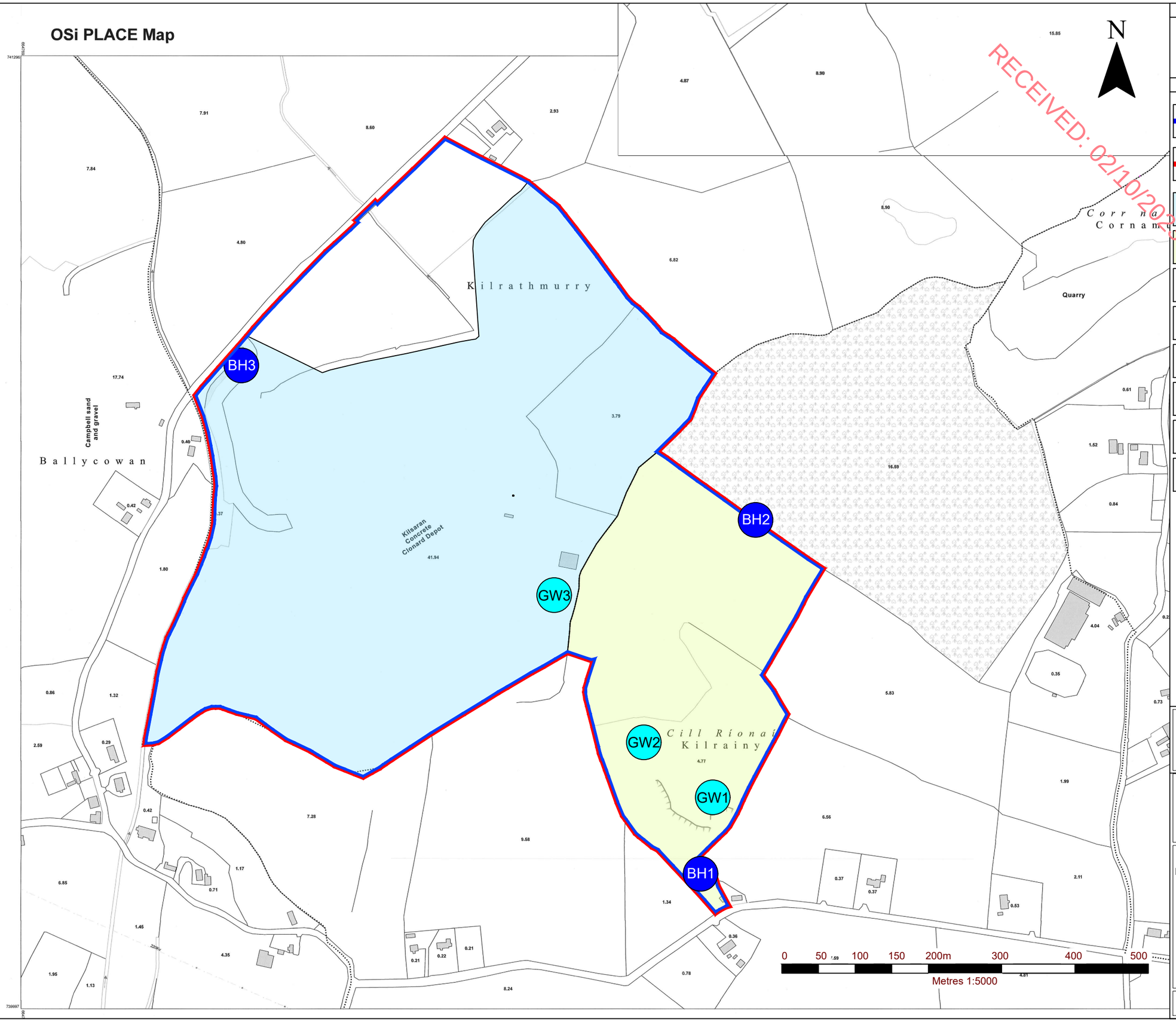
FIGURE 6-3

Scale 1:25,000 @ A3

Date SEPTEMBER 2023

00036.065251 Clonard EIAR-Fig6-3 Bedrock map.dwg

OSi PLACE Map



N

NOTES

Extract from Ordnance Survey 1:5000 Sheets 3119 & 3051

LEGEND

- APPLICANTS LAND INTEREST BOUNDARY (c. 51.6 ha)
- SITE APPLICATION AREA c.51.6 ha
  TOTAL APPLICATION AREA c.51.7 ha
  (Site & Road Works)
- EXISTING PERMITTED SAND & GRAVE SITE AREA
  P.Ref. **03/2754**
- PREVIOUSLY PERMITTED QUARRY AREA P.Ref. **99/2042** (P.Ref. **16/1246**)
- BH1 — 21-CL-01
- BH2 — 21-CL-02
- BH3 — 21-CL-03
- GW1 — W1
- GW2 — W2
- GW3 — W3

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SLR CONSULTING IRELAND
7 DUNDRUM BUSINESS PARK
WINDY ARBOUR
DUBLIN 14
T: +353-1-2964667
F: +353-1-2964676
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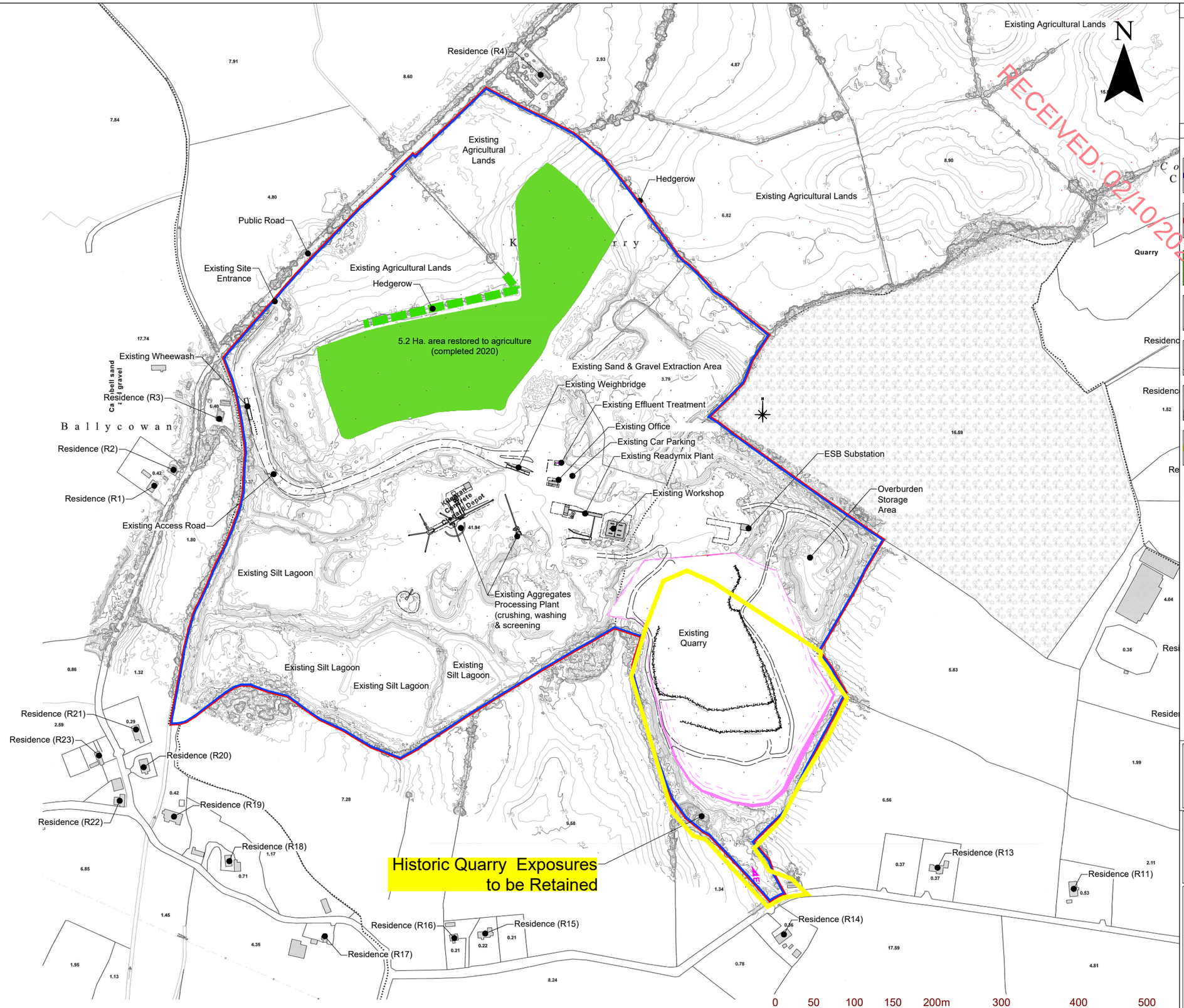
QUARRY DEVELOPMENT AT
KILRATHMURRY & KILRAINY
TOWNLANDS, CO. KILDARE

SITE BOREHOLE LOCATIONS

FIGURE 6-4

Scale	Date
1:5,000 @ A3	SEPTEMBER 2023

00036.065251 Clonard EIAR-Fig6-4 Borehole map.dwg



RECEIVED: 02/10/2023

NOTES

Extract from Ordnance Survey 1:5000 Sheets 3119 & 3051

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LEGEND

- APPLICANTS LAND INTEREST BOUNDARY (c. 51.6 ha)
- SITE APPLICATION AREA c.51.6 ha TOTAL APPLICATION AREA c.51.7 ha (Site & Road Works)
- AREA RESTORED TO AGRICULTURAL LANDS IN 2020 (c.5.2 HECTARES)
- CONTOURS
- BUILDINGS / STRUCTURES
- CROSS SECTION LOCATIONS
- BALLYKANE HILL COUNTY GEOLOGICAL SITE, Ref. No. KE010

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SLR CONSULTING IRELAND
7 DUNDRUM BUSINESS PARK
WINDY ARBOUR
DUBLIN 14
T: +353-1-2964667
F: +353-1-2964676
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QUARRY DEVELOPMENT AT KILRATHMURRY & KILRAINY TOWNLANDS, CO. KILDARE

COUNTY GEOLOGY SITE MAP

FIGURE 6-5

Scale 1:5,000 @ A3

Date SEPTEMBER 2023

00036.065251 Clonard EIAR-Fig6-5 CGH Site.dwg

APPENDICES

Appendix 6-A
Borehole Logs

Appendix 6-B
Ballykane Hill County Geological Site

Appendix 6-C
Ballykane Hill County Geological Site Consultation Submission to the GSI

Appendix 6-D
Ballykane Hill County Geological Site Consultation Response from the GSI

Appendix 6-A
Borehole Logs

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 2 of 5	
Easting		Start date	27/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	49.60 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
													At 11.1m Base of partial weathering.	
					11.10						11.10		OOLITE Massive oolitic limestone	
						100	86	88	11.					
					15.25								At 15.15 -15.25 Strong clay filled stylolites. At 15.15 - 20m FRACTURED	
											(10.40)			
													Fracture with minor clay seams at 20deg. / 45deg. / 80deg. to core axis at intervals of 10-40cm.	
						100	100	81	8.6					

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH1

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 3 of 5	
Easting		Start date	27/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	49.60 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
			21.6	21.7	21.50						21.50		OOLITE Very homogeneous. At 22.8m Bedding at 70deg. to core axis within generally massive oolite. At 25.05 - 25.2m Shale band (sub-horizontal) At 26.5m Narrow calcite veinlets.	
						94	90	95	4.0		(9.20)			

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH1

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 4 of 5	
Easting		Start date	27/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	49.60 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
					30.70						30.70			
													OOLITE More brittle and more strongly fractured. Strong component of vertical fracturing. Fractures at sub-horizontal / 30 / 20 / 0 deg. to core axis with narrow iron oxide clay seams <0.5cm.	
						95	69	79	3.7		(8.45)			
			38.5	38.7										
					39.15						39.15			
													OOLITE Very homogeneous competent unit.	

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH1

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 5 of 5	
Easting		Start date	27/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	49.60 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
													At 40.25m weak vugs developed along dissolved vein in stylolite.	
													At 40.85m Minor vugs.	
													At 42.5 - 43.2m Minor vertical fractures with sub-horizontal partings.	
						100	96	86	3.7		(8.30)			
													At 43.85m Minor vuggy cavities.	
													At 45m Clay filled parting at 40deg. to core axis.	
													At 45.7 - 46.6m Minor vugs along dissolved vertical vein (after calcite).	
					47.45						47.45			
			48.2	48.3									WAULSORTIAN REEF Conformable erosional, sharp (at 20 - 40deg. to CA) contact, with angular clasts of reef in basal oolite. Competent. Nine major partings. At 47.8 - 48.25m 15 stylolite seams <2mm.	
						100	98	80	4.2		(2.15)			
													At 48.9 - 49.3m 15 stylolite seams <2mm.	
											49.60			

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH1

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 1 of 4	
Easting		Start date	26/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	39.80 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
											(1.50)		OVERBURDEN	
			1.50	3.80	1.50						1.50		EDENDERRY OOLITE Medium-pale grey competent, recrystallised oolitic limestone, calcareous medium coarse grained - non-dolomitic. At 1.5 - 3.4m Moderate weathering and fracturing along joints, causing pale discolouration of rock. Highly broken at surface only.	
						60	7	27						
					3.40								At 3.5 - 4.0m Weakly developed vuggy cavities, where sub-vertical calcite veins weathered out.	
											(10.55)		At 6.8m bedding in oolite at 65 deg. to core axis. Otherwise very massive shoal.	
						98	94	83	5.6				Homogeneous OOLITE	
			9.05	11.1									At 9.4 - 9.45m shale parting, minor movement. At 9.75m Anhedral rip-up clasts with weak orientation 45deg. to core axis	

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH2

John Barnett and Associates
Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete
Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 2 of 4	
Easting		Start date	26/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	39.80 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
													At 10.0 - 12.05 White narrow calcite veins at 5 - 10 cm frequency at 45deg. to core axis in otherwise homogeneous oolite - very even grain size.	
					12.05						12.05			
						100	100	94	7.7		(0.65)		WAULSORTIAN REEF Altered and recrystallised in footwall of fault. Complex contact with tiny fault repeats of the overlying oolite. At 12.05 Fault marks contact between the Waulsortian and the overlying oolite - strong veins associated.	
					12.70						12.70			
													WAULSORTIAN REEF Blue grey recrystallised Waulsortian Reef. Competent massive limestone with weakly developed partings along clay seams and stylolites. Weakly mottled, patchy calcareous recrystallisation locally.	
			15.5	20.0									At 15.15m Clay (iron oxide) in stylolite up to 3cm thick.	
													At 16.7 - 16.8m Vuggy cavities after calcite vein. At 17.0 - 18.0m Sub-horizontal stylolites +/- 70 deg. to core axis, weakly developed.	
													At 18.0 - 20.0m Minor calcite veins <1cm and weakly developed stylolites with clay seams through very competent Reef interval. Bedding at 70deg. to core axis.	
						100	96	92	2.3		(12.43)			

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH2

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 3 of 4	
Easting		Start date	26/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	39.80 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
													At 21m Shaley partings.	
													At 23.0m Calcite veinlets (<0.5m) at sub-vertical to 45deg. to core axis.	
													At 23-25m Coarse crinoidal debris in massive reef limestones.	
					25.15						25.13			
			25.7	25.8		100	77	96	8.6		(1.42)		REEF	
					26.55						26.55			
					26.70	100	90	0	6.7		(0.15) 26.70		FAULT	
						100	100	100	3.1		(0.65)			
					27.35						27.35		ENCRINITIC REEF Very competent, pale grey, coarse grained massive unit At 27.58 - 28.8m Clay filled, weak stylolites at 5 - 10cm intervals.	

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH2

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 4 of 4	
Easting		Start date	26/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	39.80 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
			31.8	32.7		100	84	70	3.8		(6.05)			
					33.40						33.40			
						100	84	63	12.		(0.40)		FAULT calcite + / - red iron oxide clays within shale-rich bands. Clasts of very fine grained dark grey Reef.	
					33.80						33.80			
						100	100	97	2.2		(0.90)		REEF	
					34.70						34.70			
						100	100	100	2.2		(0.45)		Insitu REEF BRECCIA very strong dips at 20deg. CA.	
					35.15						35.15			
						100	100	80	9.3		(0.75)		Mixed calcareous SHALE	
					35.90						35.90			
													BRYOZOAN REEF Strongly developed fabric in massive reef related to dips (10 - 15 deg.to CA) to 38m, with bryozoa fronds, but shaley partings are sub-horizontal.	
						100	90	85	3.1		(3.90)			
													Below 38.5m Strongly banded, crinoidal and bryozoa-rich reef. Very competent between partings at 0.5m spacings.	
											39.80			

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH2

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 1 of 5	
Easting		Start date	26/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	45.10 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
											(1.50)		OVERBURDEN Red clays with pebbles.	
					1.50						1.50			
						90	92	64	7.3				WAULSORTIAN REEF	
			2.80	5.80							(2.75)			
					3.00								At 1.56 - 3.5m Partings with thin clay films. At 1.6 - 3.2m Stockwork.	
													At 4.05 - 4.25m Shale partings in Reef sub-horizontal.	
											4.25		REEF Blue grey - medium grey Reef Limestone. Competent generally but strong vertical veining reduces SCR. Minor clay filled partings along 10cm spaced weak stylolites. At 4.8m Bedding steepens to 50deg. to core axis with clay partings along bedding parallel stylolites weakly developed).	
						100	47	91	5.6				At 4.4 to 7.58m Minor clay filled partings at 10cm spacing	
											(4.25)		At 7.6 - 8.2m Strong vertical veining.	
					8.50						8.50			
													ARGILLACEOUS REEF Gradual transition to darker grey, more argillaceous Reef. Strongly developed fenestellid bryozoan fossils orientated at 65deg. to core axis - weak dip.	
						100	88	86	2.3		(3.00)			

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH3

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 2 of 5	
Easting		Start date	26/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	45.10 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
													At 10.5m Bryozoan fronds define bedding at 70deg. to core axis (relatively flat). Minor crinoids / brachs.	
					11.50						11.50			
													WAULSORTIAN REEF Blue grey massive Waulsortian Reef. Crinoidal debris throughout. Bedding at 20deg. to core axis. Competent unit with notable iron rich partings.	
						100	93	89	2.2		(3.20)		At 11.9 - 14.55m iron rich clay partings at 45deg. to core axis - subhorizontal.	
					14.70						14.70			
													BRYOZOAN REEF Coral (Syringopora) and brachiopod shells at top of unit. Strongly developed fenestellid bryozoan fronds.	
													Becomes more competent below 16.2m to 17.3m where subvertical fracture disrupts unit. At 15.65 - 16.2m Intense shale partings, subhorizontal with minor brown carbonate clay.	
													At 17.3 - 17.9m Fracture. Intense calcite veining just below fault. Complex calcite vein / clay filled fracture.	
			17.9	18.5		100	82	83	3.4		(7.10)			
													At 19.3m Brown earthy (carbonate) clay in joint. At 19.5 - 19.7m Carbonate rich shale.	

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH3

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 3 of 5	
Easting		Start date	26/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	45.10 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
													At 21.05 - 20.8 Partings, weak stylolites only.	
					21.80						21.80			
			23.0	33.0		100	95	95	2.4		(2.10)		ENCRINITIC REEF Moderate fault-vein-fracture, complex system. Well bedded, crinoidal Reef Limestones (ossicles >1cm) Bedding 15-20deg. (70-75deg. to core axis) below the vein complex. At 21.8 - 22.6m Sulphide rims on veins. At 21.9 - 22.2m Friable.	
					23.90						23.90			
						100	0	0			(0.70)		FAULT	
					24.60						24.60			
													BRYOZOAN REEF Blue grey mottled Reef with well developed bryozoan fronds, define bedding at 75deg. to core axis. Minor and major partings throughout at 15-20cm intervals, sub-horizontal. Weak brecciation / mottling within Reef.	
													At 28.1 - 28.38m Sub-horizontal bounding fractures with internal brecciation and iron oxide clay seams. At 28.6 - 28.8m Intense zone of sub-horizontal partings - weak clay fill. Minor brecciation in Reef. At 29.45 - 29.5m Partings and weak brecciation of limestone with clay fill. At 29.9 - 30.05m Partings and weak brecciation of limestone with clay fill.	

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH3

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 4 of 5	
Easting		Start date	26/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	45.10 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
						99	83	50	5.3		(13.30)		At 32.3-32.8m Intense sub-horizontal partings, with vertical veining / fractures.	
													At 33.0m some core loss in strong subhorizontal partings and clay seams.	
													At 30.85 - 37.4m Partings and minor fractures. Results in poor RQD from 30 - 34m and 35 - 37.9m, but competent between partings.	
													At 34.1 - 34.85m Weak brecciation within Reef with angular clasts of fine grained dark muddy limestone.	
													At 34.85 to 36.8m Intense sub-horizontal partings locally.	
													At 36.2m Clay filled joint cross cuts sub-horizontal partings.	
					37.90						37.90			
													FAULT ZONE Major fault with brecciation of host Waulsortian.	
													At 39.0 - 42.4m Clay filled gouge in fault.	
													At 39.0 - 40.0m Red oxidised clays with fragments of Reef and underlying dark grey facies.	

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH3

John Barnett and Associates

Geotechnical, Environmental and Minerals Consultants

Client : Kilsaran Concrete

Site Location : Ballykane Hill, Co. Kildare

Job Number	JBA 2278	Sheet 5 of 5	
Easting		Start date	26/08/1999
Northing		End date	
Ground level	mOD	Scale	1:50
Final depth	45.10 m	Logged by	DL

Progress			Sample		Core Data					Strata				Piezometers
Date	Hole	Casing	Depths From	Depths To	Core Run	TCR	SCR	RQD	F	Legend	Depth (m) (Thickness)	Level (mOD)	Strata Descriptions	
						58	5	5			(4.50)		At 40.0 - 41.5m Brown red clay fill / gouge in fault zone (90% matrix). Minor pebbles Reef and off Reef facies.	
					42.40						42.40		At 41.5 - 42.4m Broken and faulted dark grey fine grained (chaotic zone) limestone - weakly developed greenish brown clays.	
			43.7	43.8		96	72	65	5.6		(2.70)		Dark grey, fine grained, chaotic clastic non-calcareous matrix? debris flow / mudflow - part of the Waulsortian complex or CALP? Large clasts <8cm in fine grained matrix - weakly calcareous, with pyrite laminae and rims. Clasts with fine grained laminated pyrite (early) within dark grey matrix with fine disseminated pyrite. At 42.5 - 44.5m Fine calcite 'eyes' <0.5cm from strong vertical fractures.	
											45.10			

Diameters(mm)		
Depth(m)	Hole	Casing

General Remarks

Rotary Core Hole No.

BH3

Borehole Log

Project: Clonard Ballykane Hill	Location: 665694.3E, 740180.2N, 90.6m AOD Elev ITM	Borehole No.: 21-CL-01 Type: Rotary Core
Date: 25/03/21 – 31/03/21	Described by: Ciara Bannon	Sheet No.: 1 *of* 1

Description		
Depth (m)	Stratigraphy	Detail
0 – 2.3m	Overburden	Recovered as soft to medium pale brown sandy gravelly CLAY.
2.3 – 5.3	Overburden	Recovered as boulders and cobbles of pale grey limestone.
5.3 – 9.8	Overburden	Recovered as clayey silty SAND and gravel with cobbles and minor clay intervals.
9.8 – 11.5	Overburden	Recovered as sub rounded to sub angular COBBLES of medium to dark grey limestone.
11.5 – 12.8	Overburden	Recovered as firm, dark brown CLAY.
12.8 – 25.2	Edenderry Oolite Formation	Weathered top of bedrock. Recovered as highly fractured gravels and cobbles of pale grey and medium dark grey LIMESTONE infilled with dark brown clay and minor pale buff cream clay.
25.2 – 38.3	Edenderry Oolite Formation	Moderately strong, pale grey to whiteish, fine grained LIMESTONE. Heavily brecciated and fractured. Infilled with multiple overprints of calcite veining. Trace intervals of darker limestone. Some argillaceous beds in uppermost 30cm. Minor brown iron staining and partial dolomitization related to vein infill.
38.3 – 39	Edenderry Oolite Formation	Moderately strong, medium pale grey, fine grained LIMESTONE breccia. Angular medium grey limestone clasts in paler grey breccia matrix. Moderately fractured.
39 – 42.8	Edenderry Oolite Formation	Moderately strong, pale grey to whiteish, fine grained LIMESTONE. Heavily brecciated and fractured. Infilled with multiple overprints of calcite veining. Trace intervals of darker limestone. Some argillaceous beds in uppermost 30cm. Minor brown iron staining and partial dolomitization related to vein infill.
42.8 - 60	Edenderry Oolite Formation	Moderately strong, pale grey, fine to medium grained LIMESTONE. Minor calcite veining. Becoming more bedded and less brecciated with depth. Negligible argillaceous wisps. Patchy veines blues and bioclasts throughout. Slightly dolomitised in parts.
Remarks: Standpipe installed to 60m. 0 – 10m: Plain, 10 – 60m: Slotted with sock. Backfilled with pea gravel and bentonite seal at 9.6 – 10m. Raised cover installed and cemented in place.		

Borehole Log

Project: Clonard Ballykane Hill	Location: 665759.8E, 740638.5N, 83.4544 Elev ITM	Borehole No.: 21-CL-02 Type: Rotary Core
Date: 31/03/21 – 13/04/21	Described by: Ciara Bannon	Sheet No.: 1 *of* 1

Description		
Depth	Stratigraphy	Detail
0 – 6.9m	Overburden	Recovered as highly fractured and broken pale grey limestone cobbles in pale buff brown clay. Overburden mound.
6.9 – 9.9m	Overburden	Unconsolidated medium coarse silty SAND (of limestone) with minor gravels.
9.9 – 23.4m	Overburden	Very soft, medium dark grey brown sandy CLAY with angular gravels and cobbles of argillaceous and pale grey limestone.
23.4 – 27m	Lucan Formation	Weak, dark brown black, fine grained argillaceous LIMESTONE and thin interbedded weak siltstones.
27 – 34.5m	Lucan Formation	Weak, dark blackish grey, fine grained, argillaceous LIMESTONE and interbedded weak mudstones (recovered as clay).
34.5 – 37.5m	Lucan Formation	Moderately strong to weak, medium grey, fine grained LIMESTONE with minor interbedded buff brown clays and thin red brown siltstones.
37.5 – 40.1m	Lucan Formation	Weak and moderately strong buff brown clays with medium grey, fine grained dolomitised limestone. Possible fault zone.
40.1 – 53.4m	Edenderry Oolite Formation	Moderately strong, pale blue grey, medium grained, massive oolitic LIMESTONE. Sugary, crystalline texture throughout.
Remarks: Standpipe installed to 53.4m. 0 – 25m: plain, 25 – 53.4m: slotted with sock. Backfilled with pea gravel and bentonite seal at 24.6 – 25m. Bentonite seal at top and raised cover installed and cemented in place.		

Borehole Log

Project: Clonard Ballykane Hill	Location: 665071.1E, 740881.6N, 67.6m AOD Elev ITM	Borehole No.: 21-CL-03 Type: Rotary Core
Date: 14/04/21 – 26/04/21	Described by: Ciara Bannon	Sheet No.: 1 *of* 1

Description		
Depth (m)	Stratigraphy	Detail
0 – 6.9	Overburden	Firm, medium brown and grey sandy silty CLAY with trace gravels of limestone.
6.9 – 10.15	Lucan Formation	Recovered as highly fractured, moderately strong, medium grey LIMESTONE with cobbles and gravels. Weathered top of bedrock.
10.15 – 13.4	Lucan Formation	Moderately strong, medium to pale blue grey, fine to medium grained bedded LIMESTONE. Minor thin (<10cm) shale bands.
13.4 – 17.5	Lucan Formation	Moderately strong, pale blue grey fine to medium grained bioclastic LIMESTONE interbedded with common dark grey to black fine grained argillaceous limestone, grading to shales (up to 20cm).
17.5 - 21	Lucan Formation	Moderately strong, pale grey, fine to medium grained LIMESTONE interbedded with minor <10cm shales. Partially brecciated, with interbedded shales.
21 – 23.1	Lucan Formation	Moderately strong, medium grey, medium grained, slightly argillaceous bioclastic LIMESTONE with minor thin (~2cm) shales interbeds and minor calcite veining.
23.1 – 27.9	Lucan Formation	Moderately strong, pale blue grey, medium grained bioclastic LIMESTONE with common (up to 70cm wide) medium to dark grey, fine grained argillaceous limestone (grading to thin shales in minor areas).
27.9 – 40	Lucan Formation	Moderately strong, medium dark grey, fine grained argillaceous LIMESTONE interbedded with numerous pale blue grey, medium grained bioclastic limestone. Fairly uniform.
Remarks: Standpipe installed to 40m. 0 – 13m: plain, 13 - 40m: slotted. Cover in sock. Backfilled with pea gravel and sealed with bentonite at 13m. Raised cover installed and cemented in place.		

Borehole Log

Project: Clonard Killrathmurray North	Location: 665609.7E, 741126.2N, 76.6m AOD Elev ITM	Borehole No.: 21-CL-04 Type: Rotary Core
Date: 27/04/21 – 28/04/21	Described by: Ciara Bannon	Sheet No.: 1 *of* 1

Description		
Depth (m)	Stratigraphy	Detail
0 – 1.5	Overburden	Soft, mid brown, sandy gravelly CLAY.
1.5 – 6.9	Sand and Gravel	Unconsolidated, brown grey silty SAND. Sand particles mainly of sub rounded, medium grey bioclastic limestones and dolomite.
6.9 – 11.2	Sand and Gravel	Unconsolidated, mid grey silty SAND. Particles mainly of sub rounded, medium grey bioclastic limestones and dolomite.
11.2 – 11.6	Sand and Gravel	Unconsolidated, mid grey sandy GRAVEL. Gravels and minor cobbles of sub rounded pale to dark limestone and minor dolomite.
11.6 – 12.9	Sand and Gravel	Unconsolidated, mid grey sandy GRAVEL (clast size increasing with depth). Gravels and minor cobbles of sub rounded pale to dark limestone and minor dolomite.
12.9 – 16.4	Sand and Gravel	Unconsolidated, mid grey sandy GRAVEL with minor boulders. Gravels and minor cobbles of sub rounded pale to dark limestone and minor dolomite.
16.4 – 17.1	Bedrock – Lucan Fm.	Recovered as stiff, dark grey clasts of highly weathered LIMESTONE.

Remarks: Standpipe installed to 17.1m. 0 – 2m: plain, 2 – 16m: slotted with sock, 16 – 17.1m: plain with bentonite seal. Backfilled borehole with pea gravel, raised cover installed and cemented in place.

Resting water level at 5.5m.

Borehole Log

Project: Clonard Kilrathmurray North	Location: 665920.7E, 740945.4N, 81.14m AOD Elev ITM	Borehole No.: 21-CL-05 Type: Rotary Core
Date: 28/04/21 – 29/04/21	Described by: Ciara Bannon	Sheet No.: 1 *of* 1

Description		
Depth (m)	Stratigraphy	Detail
0 -1.7	Overburden	Soft, mid brown, sandy gravelly CLAY.
1.7 – 2.6	Overburden	Soft, mid brown silty CLAY.
2.6 – 5.4	Sand and Gravel	Unconsolidated, mid brown grey, sandy GRAVEL. Particles mainly of sub rounded, medium grey bioclastic limestones, medium to dark grey limestones and buff dolomite.
5.4 – 6.9	Sand and Gravel	Unconsolidated, mid grey, fine sandy GRAVEL. Particles mainly of sub rounded, medium grey bioclastic limestones, medium to dark grey limestones and buff dolomite.
6.9 – 9.9	Sand and Gravel	Unconsolidated, mid grey, sandy GRAVEL with minor interbedded clay.
9.9 – 11.4	Sand and Gravel	Unconsolidated, mid grey, sandy GRAVEL with minor boulders and interbedded clay.
11.4 – 20.1	Sand and Gravel	Unconsolidated, mid grey, sandy GRAVEL with minor boulders. Particles mainly of sub rounded, medium grey bioclastic limestones, medium to dark grey limestones and buff dolomite.
20.1 – 21.9	Bedrock – Lucan Fm	Recovered as clast of weathered, dark grey, fine grained LIMESTONE.
Remarks: Standpipe installed to 21.9m. 0 – 3m: plain, 3 – 19m: slotted with sock, 19 – 21.9m: bentonite seal. Backfilled with pea gravel. Standpipe pulled up to 15m while casing being pulled. Failed to get standpipe back to 19m after multiple attempts.		

Borehole Log

Project: Clonard Kilrathmurray North	Location: 665911.3E, 741404.6N, 77.494 m AOD Elev ITM	Borehole No.: 21-CL-06 Type: Rotary Core
Date: 30/04/21 – 04/05/2021	Described by: Ciara Bannon	Sheet No.: 1 *of* 1

Description		
Depth (m)	Stratigraphy	Detail
0 – 2.4	Overburden	Soft, mid brown, sandy gravelly CLAY.
2.4 – 3.9	Overburden	Soft, mid brown, sandy gravelly CLAY with minor boulders.
3.9 – 7.2	Overburden	Soft, mid brown, fine sandy gravelly CLAY.
7.2 – 9.9	Sand and Gravel	Unconsolidated mid grey sandy GRAVEL. Particles mainly of sub rounded, medium grey bioclastic limestones, medium to dark grey limestones and buff dolomite.
9.9 – 12.9	Sand and Gravel	Unconsolidated, mid grey, sandy GRAVEL with minor to trace clay. Particles mainly of sub rounded, medium grey bioclastic limestones, medium to dark grey limestones and buff dolomite.
12.9 – 18.9	Sand and Gravel	Unconsolidated, mid grey sandy GRAVEL. Poor recovery, with fine sands washing away. Particles mainly of sub rounded, medium grey bioclastic limestones, medium to dark grey limestones and buff dolomite.
18.9 – 20.4	Bedrock – Lucan Fm.	Recovered as stiff, dark grey clasts of highly weathered LIMESTONE.
Remarks: Standpipe installed to 20.4m. 0 – 7.2m: plain, 7.2 – 19m: slotted with sock, 19 – 20.1: plain and sealed with bentonite seal. Backfilled with pea gravel and raised cover cemented in place.		

Appendix 6-B
Ballykane Hill County Geological Site

KILDARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Ballykane Hill**		
Other names used for site			
TOWNLAND(S)	Kilrainy		
NEAREST TOWN	Edenderry		
SIX INCH MAP NUMBER	3		
NATIONAL GRID REFERENCE	265714 240191 = N657 401		
1:50,000 O.S. SHEET NUMBER	49	**1/2 inch Sheet No.**	16

Outline Site Description
A disused quarry on Ballykane Hill

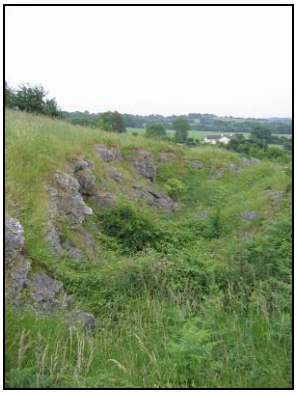
Geological System/Age and Primary Rock Type
Carboniferous limestones, with Edenderry Oolite Formation infilling fissures within Waulsortian mudbank limestones.

Main Geological or Geomorphological Interest
The quarry demonstrates an interesting section of Carboniferous limestones, with Edenderry Oolite Formation infilling fissures within Waulsortian mudbank limestones. However it is poorly exposed and the old quarry must never have been extensive. Fossiliferous exposure is relatively common, with crinoidal limestone. Turner (1948) recorded a coral and 8 brachiopod species from this quarry. Wyse Jackson (2001) has recorded many additional species of different types.

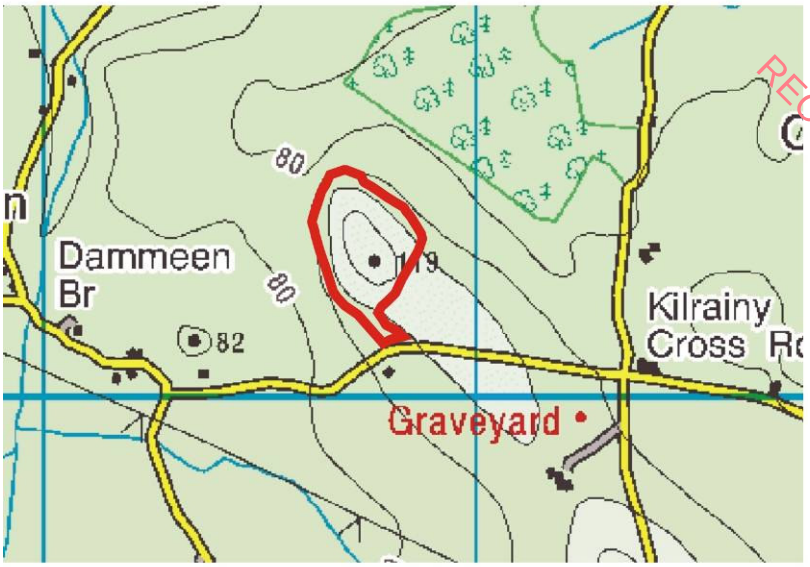
Site Importance
The site merits inclusion as a County Geological Site for the unusual Carboniferous limestone relationships and the relative rarity of such sites in Kildare, as well as a rich fossil fauna.

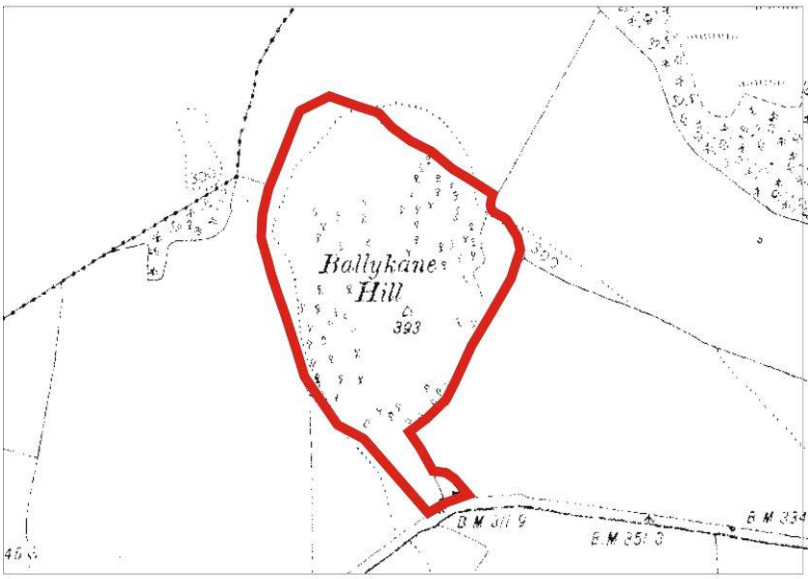
Management/promotion issues
The abandoned quarry is on private property and unsuitable for general promotion without appropriate arrangements agreed with the landowners. However, it is understood that local schools have used it over many years to seek fossils and look at geology in the field. There are no major cliffs or drops, so it is relatively safe. The adjacent Kilsaran quarry to the west is now approaching very close and may eventually consume the older quarry.

Below: a panorama view of the quarry entrance area.
Bottom: some crinoidal limestone.
Right: One of the overgrown upper quarry exposures



Ballykane Hill





Appendix 6-C

Ballykane Hill County Geological Site Consultation Submission to the GSI

By email
gsiplanning@gsi.ie

14th December 2021

Clare Glanville,
Geological Survey Ireland,
Beggars Bush
Haddington Road
Dublin, D04 K7X4

Our Ref: 501.00036.00101.L.GSI Ballykane Hill
Your Ref: **Ballykane Hill CGS Ref. No. KE010**

Dear Clare,

RE: CONSULTATION SUBMISSION FOR BALLYKANE HILL COUNTY GEOLOGICAL SITE INCLUDED UNDER IGH THEMES 7 & 8

We are currently preparing a Planning Application and EIAR for the Kilsaran site at Kilrainy & Kilrathmurry townlands, Co. Kildare. The application is for the extension and deepening of the existing quarry void and a lateral extension to the existing sand and gravel extraction area at the site.

The proposed quarry void extension and deepening is at Ballykane Hill which is located in the Ballykane Hill CGS (Ref. No. KE010). The planning application area, proposed quarry void extent and the Ballykane Hill CGS boundary are shown on the attached site plan (Figure 6-X). Attached is a copy of the Ballykane Hill CGS report for your reference.

The GSI IGH programme will be consulted by Kildare Co. Council once the PA is submitted. However, this consultation submission is being undertaken prior to the submission of the Planning Application, on behalf of Kilsaran.

The current county development plan for Kildare (2017-2023) lists the site at Ballykane Hill as a Site of Geological Importance. Policy NH16 of the development plan states that the Council will maintain the conservation value and seek the sustainable management of the counties geological heritage sites.

The County Geological Site report for Ballykane Hill states that:

'The abandoned quarry is on private property and unsuitable for general promotion without appropriate arrangements agreed with the landowners. However, it is understood that local schools have used it over many years to seek fossils and look at geology in the field.'

The existing historic quarry exposures which have been used to view the geology at the Ballykane Hill site, and the reason for the CGS designation, are relatively small and located along the south western side of Ballykane Hill.

Part of the existing quarry exposures are outside of the footprint of the proposed quarry extension and therefore will be preserved as part of the proposed development, see attached Figure 6-X.

The proposed quarry void extension will provide additional exposures into the geology at the Ballykane Hill CGS, potentially showing a greater geological sequence than is otherwise visible in the existing historic quarry exposures.

At other pits and quarries, Kilsaran have agreed access to their sites for the GSI to record and log the geology as and when requested by the GSI. Kilsaran are happy to accommodate a similar arrangement at Clonard to access and record the geology within the quarry void.

While the Ballykane Hill CGS is on private property Kilsaran will continue to take appropriate measures to protect the quarry faces from public access.

If you have any comments in relation to the implications of the proposed application on Ballykane Hill CGS please do not hesitate to contact us.

Yours sincerely
SLR Consulting Ireland

Shane McDermott.

Shane McDermott

Cc Mr. Fergus Gallagher (Kilsaran)
Enc Ballykane Hill CGS Report and Proposed Site Layout Plan (Figure 6-X).

Appendix 6-D

Ballykane Hill County Geological Site Consultation Response from the GSI

An Roinn Comhshaoil,
Aeráide agus Cumarsáide
Department of the Environment,
Climate and Communications

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Shane McDermott
SLR Consulting Ireland
7 Dundrum Business Park
Windy Arbour
D14 N2Y7

11 January 2022

Re: Planned extension to the existing quarry at Ballykane Hill, Kilrainny and Kilrathmurry townlands, Co Kildare

Your Ref: 501.00036.00101.L.GSI Ballykane Hill
Our Ref: 21/470

Dear Shane,

Geological Survey Ireland is the national earth science agency and is a division of the Department of the Environment, Climate and Communications. We provide independent geological information and advice and gather various data for that purpose. Please see our website for data availability. We recommend using these various data sets, when conducting the EIAR, SEA, planning and scoping processes. Use of our data or maps should be attributed correctly to 'Geological Survey Ireland'.

With reference to your email received on the 14 December 2021, concerning the planned extension to existing quarry at Ballykane Hill, Kilrainny and Kilrathmurry townlands, Co Kildare, Geological Survey Ireland would encourage use of and reference to our datasets. Please find attached a list of our publicly available datasets that may be useful to the environmental assessment and planning process. We recommend that you review this list and refer to any datasets you consider relevant to your assessment. The remainder of this letter and following sections provide more detail on some of these datasets.

Geoheritage

We note the inclusion of and reference to the County Geological Site [Bally Kane Hill] in the planning application documents and drawing 'Figure 6-X'. Below is some further information that may be useful in relation to the CGS and our approach to managing CGSs that are also existing quarries.

Geological Survey Ireland is in partnership with the National Parks and Wildlife Service (NPWS, Department of Housing, Local Government and Heritage), to identify and select important geological and geomorphological sites throughout the country for designation as geological NHAs (Natural Heritage Areas). This is addressed by the Geoheritage Programme of Geological Survey Ireland, under 16 different geological themes, in which the minimum number of scientifically significant sites that best represent the theme are rigorously selected by a panel of theme experts.

County Geological Sites (CGSs), as adopted under the National Heritage Plan, include additional sites that may also be of national importance, but which were not selected as the very best examples for NHA designation. All geological heritage sites identified by Geological Survey Ireland are categorised as CGS pending any further NHA designation by NPWS. CGSs are now routinely included in County Development Plans and in the GIS of planning departments, to ensure the recognition and appropriate protection of geological heritage within the planning system. CGSs can be viewed online under the Geological Heritage tab on the online Map Viewer.

The audit for Co. Kildare was carried out in 2005. The full report details can be found at The Geological Heritage of Kildare. **Our records show that the proposed sand and gravel extension of the quarry is adjacent to the Ballykane Hill County Geological Site.**

> **Ballykane Hill**, Co. Kildare (GR 265730, 240338), under IGH themes: IGH 8 Lower Carboniferous, IGH7 Quaternary. The quarry demonstrates an interesting section of Carboniferous limestones, with Edenderry Oolite Formation infilling fissures within Waulsortian mudbank limestones. Link to Site Report: KE010.

As a working quarry, the listing as a County Geological Site has no implications for the normal operation of the quarry, subject to standard permissions and conditions under planning and environmental legislation. It is desirable to consider retaining representative faces for geological purposes during aftercare and restoration plans instead of straight forward infill to original pre-quarrying topography, and we recognize your intention to do so in your planning application. We would encourage you to work with the local authority to explore the potential opportunities to highlight these significant geological exposers post quarrying, and we would be happy to provide some geological context or content for any such promotion, be it physical signage or online detail. The heritage officer in Kildare Co Co would be a good contact if required.

In addition, and in relation to the proposed quarry extension which looks as if it is designed to exploit the gravels in the adjacent esker system, Geological Survey Ireland would request that the operator might assist our geological heritage goals with the following (and ideally this would be written into the restoration / closure plan) and be included as a condition of planning as deemed appropriate by the planning authority:

1. Allowing access to quarry faces by appropriate scientists (upon request and with due regards to Health and Safety requirements) during quarrying to check for interesting new stratigraphies / relationships as they might become exposed and to establish if the quarry / sand and gravel site is worthy of recognition post extraction and through aftercare/restoration planning.

2. If deemed appropriate in (1) above, leaving a representative section of the quarry face at the end of the quarry life or inclusion of information panels to promote the geology to the public or develop tourism or educational resources if appropriate depending on the future use of the site. Natural exposures are few, or deeply weathered, this measure would permit on-going improvement of geological knowledge of the subsurface.

The Geoheritage Programme tries to promote a partnership between geological heritage and active quarrying, with such measures as those outlined in the 'Geological Heritage Guidelines for the Extractive Industry', which can be downloaded here. This document, written in association with Irish Concrete Federation, acts as a comprehensive guide in the sustainable extraction of natural resources while preserving the geological heritage of Ireland.

Groundwater

Geological Survey Ireland's Groundwater and Geothermal Unit, provides advice, data and maps relating to groundwater distribution, quality and use, which is especially relevant for safe and secure drinking water supplies and healthy ecosystems.

Proposed developments need to consider any potential impact on specific groundwater abstractions and on groundwater resources in general. We recommend using the groundwater maps on our Map viewer. which should include: wells; drinking water source protection areas; the national map suite - aquifer, groundwater vulnerability, groundwater recharge and subsoil permeability maps. For areas underlain by limestone, please refer to the karst specific data layers (karst features, tracer test database; turlough water levels (gwlevel.ie). Background information is also provided in the Groundwater Body Descriptions. Please read all disclaimers carefully when using Geological Survey Ireland data.

The Groundwater Data Viewer indicates two aquifers classed as a 'Locally important gravel aquifer' and a 'Locally Important Aquifer - Bedrock which is Generally Moderately Productive' underlie the proposed sand and gravel extension of the quarry. The Groundwater Vulnerability map indicates the area covered is classed as 'High' Vulnerability.

GWClimate is a groundwater monitoring and modelling project that aims to investigate the impact of climate change on groundwater in Ireland. This is a follow on from a previous project (GWFlood) and the data may be useful in relation to Flood Risk Assessment (FRA) and management plans. Maps and data are available on the Map viewer.

The Groundwater Protection Response overview and link to the main report is here: https://www.gsi.ie/en-ie/programmes-and-projects/groundwater-and-geothermal-unit/projects/protecting-drinking-water/what-is-drinking-water-protection/county-groundwater-protection-schemes/Pages/default.aspx.

Geohazards

Geohazards can cause widespread damage to landscapes, wildlife, human property and human life. In Ireland, landslides, flooding and coastal erosion are the most prevalent of these hazards. We recommend that geohazards be taken into consideration, especially when developing areas where these risks are prevalent, and we encourage the use of our data when doing so.

Geological Survey Ireland has information available on landslides in Ireland via the National Landslide Database and Landslide Susceptibility Map both of which are available for viewing on our dedicated Map Viewer. Associated guidance documentation relating to the National Landslide Susceptibility Map is also available.

Geological Survey Ireland also engaged in a national project on Groundwater Flooding. The data from this project may be useful in relation to Flood Risk Assessment (FRA) and management plans, and is described in more detail under 'Groundwater' above.

Geochemistry of soils, surface waters and sediments

Geological Survey Ireland provides baseline geochemistry data for Ireland as part of the Tellus programme. Baseline geochemistry data can be used to assess the chemical status of soil and water at a regional scale and to support the assessment of existing or potential impacts of human activity on environmental chemical quality. Tellus is a national-scale mapping programme which provides multi-element data for shallow soil, stream sediment and stream water in Ireland. At present, mapping consists of the border, western and midland regions. Data is available at https://www.gsi.ie/en-ie/data-and-maps/Pages/Geochemistry.aspx. This page also hosts Geochemical Mapping of Agricultural and Grazing Land Soil of Europe (GEMAS) and lithogeochemistry (rock geochemistry) from southeast Ireland datasets. Geological Survey Ireland and partners are undertaking applied geochemistry projects to provide data for agriculture (Terra Soil), waste soil characterisation (Geochemically Appropriate Levels for Soil Recovery Facilities) and mineral exploration (Mineral Prospectivity Mapping).

Geophysical data

Geological Survey Ireland produces high-resolution geophysical data (Magnetic field, electrical conductivity, natural gamma-ray radiation) of soils & rocks as part of the Tellus programme. These data currently cover approximately 75% of the country and provide supporting geological information on a regional scale useful for assessing environmental impact and risk. The Tellus programme provides expertise to the Environmental Protection Agency (EPA) for the determination of radon risk. The data is used in mineral exploration or is useful in aiding site investigation works for large scale projects.

Guidelines

The following guidelines may also be of assistance:

- Institute of Geologists of Ireland, 2013. Guidelines for the Preparation of the Soils, Geology and Hydrogeology Chapters of Geology in Environmental Impact Statements.
- Department of Environment, Heritage and Local Government, 2004. Quarries and Ancillary Activities, Guidelines for Planning Authorities.
- Environmental Protection Agency, 2006. Environmental Management in the Extractive Industry: Non-Scheduled Minerals.
- Geological Survey of Ireland - Irish Concrete Federation, 2008. Geological Heritage Guidelines for the Extractive Industry.

Other Comments

Should development go ahead, all other factors considered, Geological Survey Ireland would much appreciate a copy of reports detailing any site investigations carried out. Should any significant bedrock cuttings and/or sand and gravel exposures be created, we would ask that they will be designed to remain visible as cuttings/exposures rather than covered with soil and vegetated, in accordance with safety guidelines and engineering constraints. In areas where natural exposures are few, or deeply weathered, this measure would permit on-going improvement of geological knowledge of the subsurface and could be included as additional sites of the geoheritage dataset, if appropriate.

Alternatively, we ask that a digital photographic record of significant new excavations could be provided. Potential visits from Geological Survey Ireland to personally document exposures could also be arranged.

The data would be added to Geological Survey Ireland's national database of site investigation boreholes, implemented to provide a better service to the civil engineering sector. Data can be sent to the Geological Mapping Unit, at mailto:GeologicalMappingInfo@gsi.ie, 01-678 2795.

I hope that these comments are of assistance, and if we can be of any further help, please do not hesitate to contact me Clare Glanville, or my colleague Trish Smullen at GSIPlanning@gsi.ie.

Yours sincerely,

Clare Glanville
Senior Geologist
Geological Survey Ireland

Enc: Table - Geological Survey Ireland's Publicly Available Datasets Relevant to Planning, EIA and SEA processes.