CHAPTER 7

LAND, SOILS AND GEOLOGY

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QUARRY CONSULTING

Table of Contents

CHAPTER 7: Land, Soils and Geology

Introduction

7.1 This 'Land, Soils and Geology' (LSG) chapter of the Environmental Impact Assessment Report (EIAR) has been prepared for a continuation of existing operations including site quarrying, concrete manufacturing activities and associated storage and yards within the previously authorised area, all within an application area of 16.3ha site at Cartron, Belclare, Co. Galway. A new yard area is proposed, to the east of the quarry void, as part of this application.

7.2 Details of the site layout shown on the Application's Drawing Series as EIAR Figure 1.3 and the associated Cross Sections shown as Figure 3.2. The development proposes to continue to excavate bedrock from the central void. There is no subsoil cover in the site area proposed for continuation of extraction.

7.3 The elevation permitted for the existing quarry floor is 33 mOD, which is in the central part of the site. The proposed development includes continuation of extraction of materials previously permitted almost 20 years ago but still remaining in the ground. The proposal to continue quarrying bedrock includes drilling, blasting, crushing, processing, and stockpiling of materials within a total site area of c. 16 hectares (ha) to the previously permitted depth of 33m OD.

7.4 In all of the four walls of the exposed void and its exposed limestone, which has been excavated two benches into the subsurface in the centre of the site and one bench in the southerly portion of site, there is no evidence of groundwater or conduits. The walls are dry through the bedrock profile. There is no evidence of groundwater on the floor of the void. There is an accumulation of rainfall in the centre of the site.

7.5 The site holds an active Waste Facility Permit (WFP-G-21-0007-02, granted 29/09/2022), which allows for the importation of permitted and controlled material for the purpose of progressive infilling and restoration of the bedrock void. This restoration strategy supports national and EU policy objectives for the circular economy, whereby recovered materials such as soil and stone are used beneficially to restore previously worked land.

7.6 In addition to material accepted under the waste permit, the restoration plan may also include the use of material classified as by-product under Article 27 of the European Communities (Waste Directive) Regulations 2011 (as amended), subject to appropriate notifications and validation by the EPA. This dual approach—combining permitted waste and notified by-product—facilitates sustainable land rehabilitation, minimises the need for disposal to landfill, and aligns with resource efficiency principles set out in the National Waste Action Plan for a Circular Economy.

7.7 Broken rock is hauled from the floor to existing mobile plant within the quarry for processing. Further details for Site and the Proposed Development were provided in Chapters 1 and 3.

7.8 This chapter of the EIAR presents the baseline land, soils and geological environment and then assesses potential impacts, assigns mitigation measures and then reassesses the potential residual impacts. Potential cumulative impacts are also addressed.

7.9 As stated throughout this EIAR, the assessments have been completed in accordance with the EU EIA Directive 2011/92/EU, as amended by EIA Directive 2014/52/EU and the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018, in order to inform the consideration of the Application and provide the planning authority with the environmental information that must be considered when determining the Application.

This LSG Impact Assessment has applied the most recent guidance from the EPA (2022) in the presentation of information in an EIAR and application of Impact Assessment.

7.10 The overall site subject of this application is within the administrative boundary of Galway County Council (GCC) and the EIAR is being provided to GCC as part of a planning application seeking planning permission.

7.11 Details for the applicant, Mortimer Quarries Ltd., the application site, contributors to this EIAR and other pertinent details were previously presented in Chapter 1 and Chapter 3 of this chapter.

7.12 This Lands, Soils & Geology (LSG) assessment and chapter of the EIAR has been completed by Dr. Pamela Bartley (Hydro-G), who was also the field assessor and author of the Water Chapter of this EIAR for the quarry. The potential risk of groundwater interception in the areas of land surrounding the application site led to a strong Water Chapter focus for the Environmental Impact Assessment for the proposal. Twelve Cross-Sections were prepared in order to demonstrate that Mortimer's quarry sits above the groundwater flow system. Readers are referred to the Water Chapter. This LSG Chapter focusses on the information for the lands, soils and geological environment.

7.13 During previous planning authority determinations for the site, permission was granted to a floor elevation of 33m OD.

Study Methodology

7.14 The objectives of this assessment, as per the EIA Directive (2014/52/EU) and EPA Guidance (2022), include as follows:

(i) Use publicly available resources and historical site-specific literature to characterise the baseline land, soils and geological conditions for the site.

(ii) Update this information using additional site investigation work (*e.g.,* drilling) and analysis.

(iii) Assess the potential impact of the proposed development on the LSG environment.

(iv) Specify appropriate mitigation measures for any identified potential impacts, as deemed necessary. The proposed development works, impacts and mitigation measures will then be reassessed, and residual impacts defined.

Statement of Expertise

7.15 The evaluation of the Lands, Soils and Geological environment and the Assessment of Effects and Potential Impacts, with Mitigation Measures and Remedial Impacts, was completed by Dr. Pamela Bartley (Hydro-G) who is considered a karst groundwater specialist with quarry, Section 4 Discharge Licencing and Public Water Supply expertise. She holds a degree in Civil Engineering, an M.Sc in Environmental Engineering with Geotechnical competency and a Ph.D in hydrogeology that had a strong focus on how soils and subsoils affect groundwater responses. Pamela Bartley's Statement of Expertise is presented as **Appendix 8.1.**

7.16 This Lands, Soils & Geology Chapter and the Water Chapter were created by the same person.

7.17 In the assessment of the geology particular to the Mortimer Quarries site, Dr. Bartley consulted directly with the GSI and their Karst specialist Dr. Caoimhe Hickey.

7.18 Hydro-G holds the required Professional Indemnity Insurances, Employers and Public Liability Insurances.

Legislative Instruments & Planning Guidance

7.19 This Lands, Soils and Geology assessment was prepared with consideration of European legislation, Irish Regulations and Guidance, listed as follows:

(i) Mines and Quarries Act (S.I. No. 7 of 1965).

(ii) S.I. 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).

(iii) The Planning and Development Acts, 2000, as amended.

(iv) The Planning and Development (Amendment) Act 2010, S.I. 600 of 2001 Planning and Development Regulations and subsequent amendments, including S.I. No. 364 of 2005 and S.I. No. 685 of 2006.

(v) EIA Directive (2014/52/EU) of the European Parliament and of the Council of 16 April 2014, amending Directive 2011/92/EU, on the assessment of the effects of certain public and private projects on the environment.

(vi) S.I. No. 473 of 2011, European Union (Environmental Impact Assessment and Habitats) Regulations 2011 and S.I. No. 584 of 2011, European Union (Environmental Impact Assessment and Habitats) (No. 2) Regulations 2011.

(vii) Geology in Environmental Impact Statements. Institute of Geologists of Ireland (2002) & Guidelines for the Preparation of Soils, Geology & Hydrogeology Chapters of Environmental Impact Statements. Institute of Geologists of Ireland (2013).

(viii) Quarries and Ancillary Activities: Guidelines for Planning Authorities. Department of Environment, Heritage and Local Government (2004) & Environmental Management Guidelines for the Extractive Industry (Non-Scheduled Minerals). Environmental Protection Agency (2006).

(ix) Reclamation Planning in Hard Rock Quarries. Department of Civil & Structural Engineering, University of Sheffield and Edge Consultants, Mineral Industry Research Organisation (2004) & A Quarry Design Handbook. GWP Consultants and David Jarvis Associates Limited, UK (2014).

(x) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Transport Infrastructure Ireland (undated, c. 2009). https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

(xi) Environmental Impact Assessment of Projects. Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU, as amended by 2014/52/EU. European Union (2017).

(xii) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment. Department of Housing, Planning and Local Government (2018).

(xiii) Guidelines on the Information to be contained in Environmental Impact Assessment Reports. Environmental Protection Agency (2022).

(xiv) Galway County Development Plan 2022-2028.

Statutory Consultations

7.20 Quarry Consulting managed the development proposal.

7.21 With respect to National Agency responses to consultation communication, the response from the GSI is of importance to the LSG assessment. The Geological Survey of Ireland (GSI) responded on the 26th August 2024 and they referenced important considerations and resources available to the applicant. A full copy of the GSI's Response to Scoping is presented as **Appendix 7-1**. Hydro-G hereby confirms that all data, maps and report GSI resources listed in the scoping response have been included in the assessment. The GSI outlined that An Audit for County Geological Sites (CGSs) has been completed for Galway (Meehan et al, 2019) and that there are Geological Heritage sites in proximity to the quarry. Readers are referred to the Geoheritage section of this Chapter for more detail and the Impact Assessment considered.

Impact Assessment Methodology (EPA, 2022)

7.22 In addition to adhering to "Guidelines on the Information to be contained in Environmental Impact Statement Reports" (EPA, 2022), the Lands, Soils and Geology assessment was completed in accordance with "Geology in Environmental Impact Statements, a Guide" (IGI, 2002), and "Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements" (IGI, 2013). In addition, "Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes" (NRA, 2009) is referenced where the methodology for assessment of impact is appropriate.

7.23 The procedure for determination of potential impacts on the receiving land, soil and geological environment is to identify potential receptors within the site boundary and surrounding environment and use the information gathered during the desk study and field work to assess the degree to which these receptors will be impacted upon.

7.24 Criteria for assessing importance of site attributes and their magnitude of importance were taken from the NRA Guidelines (NRA, 2009) (as included in 'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements' (IGI, 2013)).

7.25 The rating of potential environmental impacts on the land, soils and geology environment is based on the quality, significance, duration and type of impact characteristic identified. Consideration is given to both the importance of an attribute and the magnitude of the potential environmental impacts of the proposed activities on that cited attribute.

Assessment of Magnitude and Significance of Impact on Land, Soils and Geology

7.26 An impact rating has been developed for each of the phases of the proposed development based on the Institute for Geologists Ireland Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI, 2013).

7.27 In line with the IGI Guidance the receiving environment (Geological Features) was first identified.

7.28 The NRA rating criteria Tables of Appendix C of the IGI Guidance are presented as **Appendix 7-2** to this assessment: the importance of the geological features Impact Table is followed by the Impact Table for estimation of the magnitude of the impact. This determines the significance of the impact prior to application of mitigation measures as set out in Table 7-3. Refer to Appendix 7-2 accompanying this assessment.

7.29 The assessments completed in this Section of the EIAR considered phases as follows:

(i) Construction Phase.

(ii) Operational Phase.

(iii) Landscaping, Restoration, Decommissioning & Aftercare.

Existing Environment

7.30 Desktop mapping and published information were employed to describe the land, soils, underlying quaternary and bedrock geology, areas of geological heritage, areas of economic interest with respect to geological resources and potential for soil contamination.

7.31 Desk study site information resources employed include, as follows:

- EPA mapping for land and geology https://gis.epa.ie/EPAMaps/.
- GSI On-line Groundwater database. Teagasc Soil, GSI Subsoils, Bedrock Classifications and Geoheritage Reporting https://dcenr.maps.arcgis.com/apps/MapSeries/.
- GSI (2003, 2005) Bedrock Geology Sheets 11, 14 & 15, 1:100,000 Map Series. Geological Survey of Ireland.
- Ordnance Survey of Ireland, 1:50,000 Discovery Map Series.
- Pracht. M, & Somerville. I.D., 2015. A revised Mississippian lithostratigraphy of County Galway (western Ireland) with an analysis of carbonate lithofacies, biostratigraphy, depositional environments and paleogeographic reconstructions utilising new borehole data. Journal of Palaeogeography: 4(1): 1-26. DOI: 10.3724/SP.J.1261.2015.00065.
- Google Earth Pro Historic Photography series.
- EIA portal (https://housinggovie.maps.arcgis.com/).
- Galway County Council and An Bord Pleanála files for the site.
- Previous EIARs created for applications for the site. Previous Permissions associated with the site are listed in the introductory chapter of this EIAR.

Site Location & Topography

7.32 As described in more detail in Chapter 3 of this EIAR, the site is located within the townland of Cartron, Belclare, Co. Galway.

7.33 The application site and regional topography are presented as **Figure 7-1**.

7.34 The coordinates central to the overall quarry site are ITM 536903 E, 748293 N.

7.35 The natural land surface elevation of the entire quarry lands before excavations took place there was c. 95m OD in the west and c. 67m OD in the east, approximately. The quarry is excavating land on the slope from Knockmaa Hill, which peaks at c. 160m OD, at a distance of c. 1km to the east of the Site's offices at their entrance.

7.36 The land is elevated at Knockmaa but then the land flattens out to a plain of surrounding lands of c.25m OD and very gently falls towards Lough Corrib, which is c.9km to the south west at its closest to the site. The shores of Lough Corrib are c.5m OD.

7.37 The site is located c. 7.5km to the southeast of Tuam, 1km southwest of the village of Belclare, c.10km east of Headford, c.23km to the northeast of Galway city and c.6km west of the M17 Motorway that connects Tuam to the southern parts of County Galway.

7.38 The site can be accessed from roads that connect to the R333 or the N83. From the roads there is an access road that connects to the eastern site boundary.

7.39 The N83 indirectly connects the site to the M17.

7.40 The application site area is c.16.3 ha. The application site is an inverted L Shape and another inactive quarry site, McTigue, adjoins.

7.41 The actively quarried area is in the central part of the site and the deepest part of the bedrock excavation on quarry floor has an elevation of 33m OD. It is proposed to bring the remaining in situ bedrock, previously permitted area of the site, down to the same, previously permitted elevation of 33m OD.

7.42 The parent permission for the site (06/2275) was granted with Conditions in 2007, appealed to An Bord Pleanála (PL.07.222783) and approved in May 2008. The parent permission is for a quarry floor level of 33m OD. No deepening beyond the permitted level is proposed as part of this application.

7.43 In addition to the parent permission, there are multiple sanctions of ancillary developments including the removal and replacement of an existing office and staff facilities building and the provision of a staff and visitors carpark to serve the existing quarry (17512) – refer to Planning Statement.

7.44 Since the parent permission, the quarry has obtained permission to build and operate an asphalt plant, a concrete batching plant (PL 20419), Concrete Block Making and Storage Facility, and all Associated Ancillary Site Services, sheds, covers on aggregates, an ESB substation, wheel washes, weighbridges and all associated infrastructure ancillary to the main activity that is the extraction of limestone.

7.45 The existing quarry operations comprise extraction of limestone using drilling, blasting techniques, processing (crushing, screening and stockpiling) of the fragmented rock to produce aggregates for the construction and agricultural markets.

7.46 The quarry operates a closed loop system utilising rainwater and their own well water to supress dust, wash down equipment and vehicles and manufacture product. More details are presented in the Water Chapter of this EIAR.

Land Use

7.47 According to the Galway County Development Plan (CDP) 2022 – 2028, the site lies within a rural area, approximately c 7.5km south-west of Tuam town centre, which is identified as a Key Town and within the Strategic Development Corridor. The application site is not subject to any specific Land Use designations in the CDP.

7.48 Corine 2018 maps the site as a Quarry (Code 131) and the majority of the surrounding landscape is mapped as Agricultural Pasture (231), with the exception of Knockmaa – mapped as Forest and semi-natural areas (Codes 311 and 313 for Broad Leaved and Mixed Forests respectively).

7.49 There are no Prime Special Amenity or Secondary Special Amenity areas designated at the site but Knockmaa is adjacent and to the west.

7.50 Density of one-off houses is low in the immediate vicinity of the site. A number of one-off houses are present on the local road east of the site.

7.51 A recent history of activities on, and in the vicinity of, the application area was gained from aerial photography and historical mapping and is summarised in Table 7-1.

Table 7-1 Historical Land-Use at the Site and its Surroundings

Ordinance Survey Map Reference (Dates)	On Site	Immediate Surroundings
OS 6" colour (1837-1842)	Nothing at the site of the quarry or its adjacent quarry site.	Caislaun Feecul In Ruins to the west, on the eastern flank of Knockmaa
OS 6" Cassini (1845) & OS 25" Historic (1888-1913)	The site is mapped as uncultivated land.	As above. Castel Feecul Wood now mapped to the north of Caislaun Feecul. Tobermina is a marked spring to the north and it is a townland name in current mapping (2025).
Geohive MapGenie – 1995	Black and white aerial imagery enables view of rock outcrops on Knockmaa and similar bedrock exposure at Mortimer's Belclare Quarry site. Multiple residences exist on all roads north, south, east, west.	
Geohive MapGenie – 1996	Colour aerial imagery enables view of Mortimer's Belclare Quarry site established more in the north than south of eastern part of the application site but some subsoil stripping has occurred in the southern half of Mortimers. Lots of one off houses in the wider area.	
Geohive MapGenie – 2001	Mortimer's Belclare Quarry site well established in northern and southern halves of site. The site has been stripped of all subsoil and soil cover. All areas are Dry. Mc Tigue site, immediately north and to the northwest of Mortimer's is a quarry.	
Google Earth PRO Aerial Imagery 2010	The excavation in the centre holds rainfall and the southern half of the site is stripped only but not excavated significantly in depth.	
Geohive MapGenie – 2013	No significant changes at either quarry site or in the overall area. Dry quarry floors.	
Google Earth PRO Aerial Imagery 2018	As above. No significant changes. Rainfall ponding on the lowest elevations of both Knockmaa Quarries.	
Google Earth PRO Aerial Imagery 2019	No significant changes at the Mortimer site. Mc Tigue establishes a deep cut benching on the north west of the Mortimer site .	
Google Earth PRO Aerial Imagery 2021 - 2022	Infill (for restoration purposes) evident in the deepest part of the Mortimer Belclare Quarry site, which is close to the offices. Waste Permit Number WFP-G-21-0007-02. Seasonal rainfall ponding central in the site.	As previously described for the wider area – Ribbon development of single houses and no changes of significance in the wider area.
Land Direct	The site is divided in subsections.	Land Direct (2025) shows a pipeline from Tobermina to the R333, north of Knockmaa.

Soils

7.52 Teagasc soil classification, as accessed on the GSI Groundwater Viewer, shows that rather than soils at the site, it is mapped as Bedrock at surface-Calcareous (Figure 7-2).

Subsoils (Quaternary Deposits)

7.53 Quaternary deposits are mapped by the GSI as Karstified bedrock outcrop or subcrop (Karst) and Till derived from limestones (TLs) (**Figure 7-3**). It is a free-draining sandy till and is generally thin where present. Mapping shows bedrock is exposed at surface within the application site and in small pockets in the surrounding area.

7.54 Quaternary geology has been intensively mapped in the wider area but it is irrelevant to the quarry assessment because the quarry is mapped as bedrock.

Bedrock

7.55 The site is mapped as underlain by a bedrock that is mapped and named as the Knockmaa Formation, which is primarily composed of pale grey skeletal limestone (**Figure 7-4**). The underlying bedrock geology is mapped by the GSI as a Visean Limestone of Palaeozoic, Carboniferous, Mississippian Geological age.

7.56 Knockmaa Formation limestone is described as a thick-bedded, pale grey, clean limestone similar to that in the Corrallenistrum Formation, which underlies it (GSI, 2024; Long *et al.*, 2005). The Knockmaa formation is exposed in extensive pavement areas southeast of Oughterard and east of the lake it locally forms high ground, as at Knockmaa. The base of this formation is coincident with the incoming of ceroid *Lithostrotium.* The upper part of the formation has been eroded off in the Sheet 11 area, but the thickness of the Burren Formation, its equivalent further south, is c. 400m.

7.57 The Knockmaa Formation is mapped by the GSI as a 94km2 area of Thick Bedded, Pure Clean bedrock.

7.58 The underlying Corrallenistrum Formation is described as a Grey bioclastic calcarenites with chert in the basal part but also containing thin layers of chert nodules and dolomitic beds higher up. Macrofauna is mainly braciopods and corals. The formation is at least 177.25m thick in this area, based on geological logs from (Pracht & Somerville, 2015), with estimates from the Burren area itself suggesting the Formation is 390m thick (GSI, 2024). The Corrallenistrum is exposed to the immediate north of the quarry's western boundary.

7.59 There is no desk top mapping demonstrating karst features within the limestone bedrock of the site itself. Wider area karst is discussed in the Water Chapter.

GSI Mapped Aggregate Potential

7.60 The GSI 'Aggregate Potential' mapping database, available on their Public Mapping viewer, reports that the site has 'High Potential' for Crushed Rock Aggregate in County Galway, Rank 10, Score 81. The overburden score is reported as Type: NOT SAND AND GRAVEL, NO Aggregate Potential.

Geohazard Mapping

7.61 No Landslides are mapped at or near the site.

7.62 The site is not mapped as having any landslide susceptibility.

Geological Heritage Areas

7.63 As requested in the GSI's Response to Scoping (Appendix 8.4), County Geoheritage Sites (CGS) associated with the site and wider environment should be considered in all assessments. As stated in the GSI's response to scoping (dated 26 August 2024) stated that Knockmaa [GY082] and Knockmaa Quarries [GY083] are associated with the application site. In addition, Hydro-G offers that Lough Corrib [GY093] & Pollnahallia are relevant.

7.64 The GSI Geological Heritage Site map viewer presents mapping and information for Geoheritage sites with overview details as follows:

- "**Knockmaa**, Co. Galway (GR 134737, 247715), under IGH themes: IGH1 Karst, IGH3 Carboniferous to Pliocene Palaeontology, IGH7 Quaternary, IGH12 Mesozoic and Cenozoic. A large area of landscape between Headford and Tuam with thin glacial deposits which have only slightly modified a pre-Pleistocene karst landscape, developed on Carboniferous limestones, which contains late Pliocene sediments. The site is of international importance and is recommended to NPWS for Geological NHA status. Site Report: GY082."
- "**Pollnahallia,** Co. Galway and within Knockmaa (GR 133735, 246895), under IGH themes, IGH7, IGH12. Described as a deep, abandoned sand pit, on the southern footslopes of the hills west of Knockmaa Hill and providing an unprecedented view into an era of Ireland's past. The pit is set within an area of thick-bedded, pure Lower Carboniferous limestones of the Knockmaa Formation, but the sand within the feature which has been quarried out, was Pliocene in age (2.5-5.3 million years ago), from within the Cenozoic. Site Report: GY116."

7.65 Hydro-G notes that although it is mapped as part of the Knockmaa site, Pollnahallia is located on a much lower elevation of **29m OD and 3km** to the south west of Mortimers.

- "**Knockmaa Quarries**, Co. Galway (GR 136933, 248357), under IGH themes: IGH1 Karst, IGH8 Lower Carboniferous, IGH12 Mesozoic and Cenozoic. This site includes two large working quarries, side-by-side, on the southeastern slopes of Knockmaa Hill, about 7 km southwest of Tuam. These quarries provide a good representative site displaying the Carboniferous limestone bedrock geology of mid-Galway, with additional features of pre-glacial and karstic interest. Site Report: GY083."
- "**Lough Corrib**, Co. Galway (118000, 244185), under IGH themes: 14, 2 and 7. It is described as "A large lake situated between County Galway's western acidic uplands and the limestone lowlands and is of international conservation importance, for its lakeshore karst assemblages". CGS, recommended for Geological NH. Lough Corrib is of international conservation importance, for its lakeshore karst assemblages.

7.66 Each of these sites are mapped for their contribution to geological understanding. The significance of the fact that the quarry under consideration in this assessment is mapped as a GHS is that its exposure of rock aids geological understanding and it is a positive rather than negative impact.

Examination of Bedrock Exposed at the Site

7.67 The site is already a quarry that has excavated its central portion of bedrock to a permitted elevation of 33m OD. Therefore, the bedrock is readily visible. Dr. Pamela Bartley visited the

site and observed its exposed rock walls on many occasions in differing seasons in the course of her assessment.

7.68 The walls of the quarry are solid masses of limestone with no conduits and no water entry evidence.

7.69 Site observations clearly demonstrate, and provide direct experiential evidence of the compact and competent dry nature of the rock and the fact that there is no evidence of a water table in the bedrock, which is as expected by karst specialists because the concept of a 'water table' is not valid in karst conduit limestone bedrock.

7.70 Of specific reference to the proposal to continue quarrying the site, is that there are large extents of exposed bedrock boundary walls of the void that facilitate examination for the potential for evidence of any discontinuities or evidence of water movement zones, which are wholly absent. All walls are solid massive limestone.

Aggregate Materials Testing

7.71 The site supplies a large range of aggregates to projects in Galway County and Galway City.

7.72 Materials Testing for the aggregates is completed by Mattest accredited Laboratories. Certificates of Analysis are available in the site office for review. Hydro-G has reviewed the results. They are relevant to the nature of the rock when converted to different grades of aggregate and pass all standards required but are not strictly necessary for an EIA.

7.73 An assessment for SR16-21 concluded that the aggregate being produced from the quarry is compliant and meets the relevant for use in Concrete and it meets with S.R.16:2016 guidelines and is suitable for use as unbound granular fill (hardcore) for use under concrete floors and footpaths and that it meets with S.R.21:2014 & A1:2016 guidelines.

Impact Assessment

7.74 The proposal assessed for potential impact relates to the proposed extraction of bedrock over the course of a 33 year permission for extraction plus 2 years to complete site restoration. Details were presented in the opening chapters of the EIAR.

7.75 The application of the framework and methodologies, as shown in Appendix 7-2, provide a general screening of the likely impact to the land, soils and geology environment.

7.76 The procedure for determination of more specific potential impacts to the receiving land, soils and geology environment is to use the information gathered, by desk study and field work, within the site boundary and surrounding landscapes and the assessment of potential impacts to these receptors are then described in terms of quality, significance, duration and type. This methodology adheres to the terminology provided by (EPA, 2022)'s Table 3.4 'Description of Effects', as provided in 'Guidelines on the information to be contained in Environmental Impact Assessment Reports'. Refer again to Appendix 7-2 of this Chapter.

Potential Impacts - Direct

7.77 Potential Impacts can arise from three project phases:

(i) Construction (enabling) phase.

(ii) Operational phase, and

(iii) Landscaping, restoration, decommissioning and aftercare phase.

7.78 Overburden was previously removed and utilised to create site berms as part of the original site preparation during initial quarry development. Therefore, there has been historical, permitted, development across the application area involving the stripping of soils and overburden, followed by the extraction and breaking of rock. Therefore, movement of soil and overburden has already taken place across most of the application area.

7.79 For the proposed new yard area, it will be necessary to strip some soils and bring the area to the same elevation as the current concrete yard. The site has experience and expertise in completing these types of tasks without incident.

7.80 For the rock void, the Construction Phase is already past and no enabling works are necessary there. Any overburden material remaining in parts of the site will be moved within the site and used later for final restoration purposes. As the berms are well-established and no further large-scale stripping of subsoil is required, the risk of subsoil mobilisation is minimal and the enabling phase deemed negligible.

7.81 With respect to the Operational Phase, further extraction of bedrock within the application site and associated activities, such as blasting and mechanical removal of rock, has the potential for direct impact on the geology of the limestone within the bedrock extraction area. This is therefore considered to be a direct and permanent impact to bedrock. This impact has occurred historically within the active quarry and it is considered appropriate in order to continue extraction of bedrock at this site. Operational Phase impacts require assessment.

7.82 There is concurrent infill under Waste Facility Permit (WFP-G-21-0007-02, granted 29/09/2022), which allows for the importation of permitted and controlled material for the purpose of progressive infilling and restoration of the bedrock void. This requires assessment. It is addressed from the perspective of impact on the Water Environment in the Water Chapter.

7.83 Given the mostly absent soils/subsoils over most of the application area of already worked bedrock and the small amount of subsoil movement required in the proposed new yard area, the impact to the quaternary geology (soils/subsoils) attribute is deemed to be 'Negligible'. The subsoil requiring movement for the preparation of the new yard is also considered to be 'Negligible' in the context of the regional resource.

7.84 Bedrock at the site is considered to be a geological attribute of High importance and the proposed works have a potential adverse impact of Moderate magnitude (Loss of a moderate proportion of future quarry or pit reserves). The impact to the geological (bedrock) attribute is deemed to be 'Significant/Moderate'.

7.85 The significance of the proposed extraction of bedrock from this geological unit is considered to be significant/moderate. A quarry of this size would be considered to be at Moderate scale for quarry development.

7.86 The proposal is to continue to extract rock from within the existing quarry footprint. There is no proposal to deepen the quarry deeper than its current permitted elevation of 33m OD. The proposed development will result in the exact same rainfall runoff amount at the quarry and the same volume of water will require management at the site.

7.87 Water Management Systems are already in place to manage the waters that will arise on the floor during the excavation and breaking of bedrock proposed. To maintain a dry and workable quarry floor, surface runoff will continue to be directed to collection sumps, which will evolve progressively in line with the advancing quarry benches. As is current practice, accumulated water will be reused on-site for essential operational needs such as aggregate washing, dust suppression, and general site maintenance. By its nature, quarrying of the underlying rock will involve removal of an identified geological resource and therefore impact

upon land, soils and geology must be expected. There will be impact arising from removal of rock. There need not be negative impacts, by virtue of correct design and mitigation measures.

7.88 Quarrying presents a risk of potential impact on the stability of the bedrock environment. Subsidence, slope stability, compaction and slope failure are fully considered in the design of all extraction phases at this site, which ensures that these impacts will be prevented.

7.89 The restoration stage of the project describes the aftercare phase that follows the cessation of extractive activities. The decommissioning phase will provide a safer environment than is currently the case, with the removal of all plant and infrastructure, and creation of stable slopes in the interest of health & safety and long-term sustainability. The restoration plan will involve restoration to agricultural uses and natural habitat. This confirms that the long-term land use will have changed from quarrying to agricultural/biodiversity/amenity.

7.90 The site will be reinstated in accordance with the approved quarry restoration scheme and thus integrated back into the surrounding landscape with the attendant improvement to the visual amenity of the area.

7.91 With respect to Land, Soils & Geology or geological features, there are no Designated Sites with Conservation Objectives (SACs or SPAs), within the application area or within radius of influence of the proposed development.

7.92 On the basis of the foregoing, the Summary Table for Potential Impacts on Land, Soils and Geology is presented as Table 7-4.

Table 7-4 Summary of Potential Impacts on Land, Soils & Geology Environment

Scenarios where impacts may arise	Activity	Attribute	Importance of attribute	Nature and Description of the Effect	Quality of effect	Significance / magnitude of effect	Extent & Context of Effect	Probability of Effects (pre-mitigation)	Duration and Frequency	Type of effect
Enabling Phase	Overburden was previously removed and utilised to create site berms as part of the original quarry development. Additionally, some remaining overburden material within the proposed new yard area will be removed and used internally for final site restoration purposes.	-	-	As the berms are well-established and no further large-scale stripping of subsoil is required, the risk of subsoil mobilisation is minimal.	Neutral	Imperceptible	Local, confined to the existing quarry footprint	Negligible	Continuous during operation	Indirect
Operational Phase	Extraction of bedrock	Bedrock	High	Loss of bedrock	Moderate / Adverse	Significant / Moderate	Removal of limestone	Likely	Permanent	Direct

Scenarios where impacts may arise	Activity	Attribute	Importance of attribute	Nature and Description of the Effect	Quality of effect	Significance / magnitude of effect	Extent & Context of Effect	Probability of Effects (pre-mitigation)	Duration and Frequency	Type of effect
							bedrock over 35 years.			
	Extraction of bedrock	Bedrock	High	Raw material for use in construction industry	Positive	Significant/ Moderate	Local & Regional resource generation	Likely	Long-term	Direct
	Use and storage of fuel & hydrocarbon	Bedrock	High	Potential for contamination of underlying bedrock during refuelling or due to leakage	Adverse	Significant/ High	Within application boundary	Unlikely	Medium	Direct
	Use & Operation of Concrete Batching & Block Plant and Asphalt Plant.	Exposed Bedrock	High	Potential for contamination of underlying bedrock during operations, refuelling or due to leakage	Adverse	Significant/ High	Within application boundary	Unlikely	Medium	Direct
	Infill importation under Waste facility Permit WFP-G-21-0007-02.	Exposed Bedrock	High	Potential for contamination of underlying bedrock during operations	Adverse	Significant/ High	Within application boundary	Unlikely	Medium	Direct
	Use of new Yard	Exposed Bedrock	High	Potential for contamination of underlying bedrock during operations, refuelling or due to leakage	Adverse	Significant/ High	Within application boundary	Unlikely	Medium	Direct

Scenarios where impacts may arise	Activity	Attribute	Importance of attribute	Nature and Description of the Effect	Quality of effect	Significance / magnitude of effect	Extent & Context of Effect	Probability of Effects (pre-mitigation)	Duration and Frequency	Type of effect
Restoration Phase	Landscaping, movement of soils and stockpiles necessary to facilitate site restoration	Soil & Bedrock	High	Restoration of land to greenfield lands with agricultural and biodiversity value.	Positive	Significant/ Moderate	Application Area	Likely	Permanent	Direct
Unplanned Events	Fuel tank failure or large scale spillage	Exposed Bedrock	High	Hydrocarbon contamination	Negative	Significant/ High	Within application site boundary	Unlikely	Medium	Direct
	Face Collapse / Wall Stability	Exposed Bedrock	High	Rock Fall / Slump	Negative	Small / Adverse	Within application site boundary	Unlikely	Medium	Direct

Potential Impacts - Indirect

7.93 Indirect impacts (or secondary impacts) are those which are not a direct result of the proposed activity, often produced away from the project site or because of a complex pathway. The extraction of bedrock across the floor has already removed the capacity of these lands to provide agricultural production. The indirect impact on the soils may be considered to be of a medium to long-term nature because the soils have been reused elsewhere.

7.94 Activity at the proposed development site has the potential for the generation of dust, which could have an indirect, brief, imperceptible impact beyond the application boundary, without mitigation and monitoring methods already associated with the site.

Impacts – Transboundary

7.95 EIA Directive 2014-52-EU invokes the Espoo Convention on Environmental Impact Assessment in a Transboundary Context (1991) and applies its definition of transboundary impacts.

7.96 Given the location of the site at c.109 km, approximately, at its closest position to the border with Northern Ireland, which is to the north east of the site, the nature, size and scale of the proposed development, and the fact that regional groundwater in the area likely flows in a south westerly direction towards Lough Corrib, it is expected that the development will not have any significant transboundary effects with respect to land, soils and geology.

Impacts – Cumulative

7.97 The aim of the cumulative impact assessment is to examine whether any other proposed developments have the potential to act in-combination with the proposed application, subsequently giving rise to effects that would not otherwise be significant.

7.98 The cumulative impact assessment considered relevant activities within a 10 km radius. The cumulative impact Section of the Water Chapter has considered all potential for cumulative impact on the hydrogeological environment and the same targets are relevant for the geological environment. Given that the Water Chapter could conclude no potential for cumulative impact with other developments with respect to hydro and geology, the same conclusion is possible here in the LSG conclusions: No Potential for Cumulative Impact.

'Worst Case' Impacts

7.99 The 'worst case' impacts would involve a substantial fuel or other hydrocarbon spill on-site, resulting in localised contamination of the working bedrock environment, given that there are no soils or subsoils on the quarry floor. However, the experience of the site, as shown in the Long Term on-site monitoring data is that both the floor water and the on-site well are free from hydrocarbons and are free from all markers for contamination. In addition, the control measures associated with the Waste Facility Licence (WFP-G-21-0007-02, Galway County Council) will ensure that there is no migration of contamination off site.

7.100 Changes in climate and extreme rainfall events could result in an increase in water volumes collected in the sump, which will require management. The quarry floor is large enough to accommodate any additional, unexpected, water.

Mitigation Measures

7.101 Mitigation measures are set out in Table 7-5 and these will be adopted for the proposed extraction activities to reduce the potential impacts to the receiving land, soils and geology environment as identified in Table 7-4.

7.102 As a result of the mitigation measures implemented at the site, it is considered that any impacts associated with the quarrying related activities undertaken at the site will not contribute to cumulative impacts in combination with any developments in the surrounding area.

Residual Impacts

7.103 Residual impacts refer to the degree of environmental change that will occur after the proposed mitigation measures have taken effect. Residual Impacts are also shown with Mitigation Measures in Table 7-5.

7.104 As a result of the proposed mitigation and enhancement measures incorporated in the design, no significant, long-term, adverse residual impacts are predicted in terms of Land, Soils and Geology during the operational phase, other than the inevitable loss of mineral resources (*i.e.*, limestone) due to quarrying.

7.105 It is considered that following full restoration and closure of the site that there will be no significant, long-term, adverse impacts in terms of Land, Soils and Geology, again other than the permanent, significant negative impact due to extraction of the mineral resources. The restored quarry will provide a more manageable environment, than is currently the case, but with a change in land-use from Mineral extraction to the future beneficial future land-use as agricultural, biodiversity and wildlife amenity.

7.106 The primary mitigating factor is that the overall regional and national scale of this type of bedrock is large. The impact of the extraction of the proposed footprint of limestone bedrock is small relative to the volume of this type of this rock in the region. Large areas of County Galway are underlain by this type of Limestone and large tracts of the Burren are protected for a similar type of limestone. Therefore, it will remain insitu in other parts of the region.

Table 7-5 Mitigation Measures and Residual Impacts

	POTENTIAL IMPACT			MITITGATION MEASURES	RESIDUAL EFFECT FOLLOWING MITIGATION	
Phase where impacts may arise	Activity	Attribute	Character of Potential Impact	Description of Mitigation	Significance or quality of Effect	Probability
Construction	Not applicable as explained in Potential Impact Table, above.					
Operational	Extraction of bedrock	Bedrock	Local & Regional Resource Generation	No mitigation required for the supply of materials because it is the planned, positive activity for the development.	Positive, Significant	Likely
	Extraction of bedrock	Bedrock	Long-term stability	A detailed working scheme/ restoration plan has been prepared. In preparing the design, standard criteria were adopted with regard to face slopes, standoffs to site boundaries, etc. The final quarry face angles will be assessed by a geotechnical engineer to ensure long-term stability after completion of extraction operations. The stability of restored faces observed in the existing quarry indicates that the long-term stability of the final quarry faces will be satisfactory in this geological environment.	Negative, Not significant	Likely
	Extraction of bedrock	Bedrock	Geological Heritage	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 site is worthy of recognition post extraction and through restoration planning.	Positive, Significant	Likely

	POTENTIAL IMPACT			MITITGATION MEASURES	RESIDUAL EFFECT FOLLOWING MITIGATION	
Phase where impacts may arise	Activity	Attribute	Character of Potential Impact	Description of Mitigation	Significance or quality of Effect	Probability
	Use and storage of fuel & hydrocarbon	Bedrock	Potential for contamination of exposed bedrock as a result of spillages/leakages.	Standard Operation procedures ensuring good practices.	Neutral	Unlikely
	Use & Operation of Concrete Batching & Block Plant and Asphalt Plant.	Exposed Bedrock		Standard Operation procedures ensuring good practices.	Neutral	Unlikely
	Use of new Yard	Exposed Bedrock		Standard Operation procedures ensuring good practices.	Neutral	Unlikely
	Infill importation under Waste facility Permit WFP-G-21-0007-02.	Exposed Bedrock	Potential for Contamination	The Licence controls the nature of the fill. Infill has been ongoing for years and the site's monitoring results suggest exceptionally high quality water for the waters accumulating on the floor, adjacent to the infill. Similarly, operational monitoring of the site's well also demonstrates that the ongoing mitigation by licence control is enough to ensure protection.	Neutral	Unlikely
	Landscaping. Restoration of Residual faces, movement of berms and stockpiles necessary to facilitate site restoration	Soils, subsoils & Bedrock	Restoration of void as greenfield landscape	No mitigation is required for restoration as it is a planned part of the development. It is anticipated that the completion of the restoration phase will be achieved within 2 years of completion of extraction operations. Final restoration will be to a beneficial after-use. A detailed Restoration and landscaping plan has been prepared as part of the application. The site will be infilled by importation of soil and stone (both waste and non-waste) for site restoration purposes, as extraction progresses.	Positive	Likely

	POTENTIAL IMPACT			MITITGATION MEASURES	RESIDUAL EFFECT FOLLOWING MITIGATION	
Phase where impacts may arise	Activity	Attribute	Character of Potential Impact	Description of Mitigation	Significance or quality of Effect	Probability
Restoration Phase	Fuel tank failure or large-scale spillage	Exposed Bedrock	Potential for contamination of exposed bedrock as a result of spillages/leakages.	Fuels are stored with bunds and the restoration enabling phase / demobilisation till remove all potential sources of contamination.	Neutral	Unlikely
Unplanned Events	As above.					

Interaction with other Impacts

7.107 The EIAR guidelines (EPA, 2022) highlight that the interaction of impacts to the land, soils and geological environment, arising from proposed activities, must be given due consideration alongside potential receptors identified in other EIAR sections. The likely interactions have been identified as follows:

(i) The movement of bedrock by blasting and mechanical means can give rise to increased dust emissions.

(ii) The operation of plant associated with extraction and haulage can give rise to increased traffic movements.

(iii) The operation of plant associated with extraction and haulage can give rise to increased noise emissions.

(iv) The extraction of bedrock can impact upon surface and groundwater quality and flow patterns.

(v) The extraction of bedrock can impact upon biodiversity and cause disturbance to habitats in the area.

7.108 Each of these issues and the mitigation measures proposed are addressed in detail in the relevant chapters of this EIAR & the 'Interactions of the Foregoing'. These impacts are considered to be negative but with suitable measures in place, their significance can be mitigated, with the exception of the extraction of bedrock, the removal of which is permanent. However, this is an inevitable consequence of quarrying and extractive activities that is deemed essential to development of society.

Do-Nothing Scenario

7.109 The 'Do Nothing Scenario' evaluation requires consideration of the effect on the environment as it would be in the future should the proposed works not be carried out.

7.110 If the development did not proceed, the aggregate resource would remain unused in situ, and the local supply of quality aggregates would be more restricted.

7.111 The lands represent a disturbed and degraded landscape with infrastructure and stockpiles on the quarry floor. Under the 'Do Nothing' scenario, all quarrying activities would cease. The site would be restored to beneficial after-use as per the requirements of the existing planning permission. However, the potential future resources of the quarry would remain in situ, unutilised, and would possibly result in the requirement to develop a more remote greenfield site in a different part of the landscape of County Galway or in another County.

7.112 As the proposed activities are a continuation and extension of activities at an established extraction site, it is envisaged that no new or different potential impacts shall be introduced when compared to the current operational phase.

7.113 It is considered more appropriate to continue activities at an existing active quarry as opposed to opening a new quarry on a greenfield site. The extractive industry is necessary in order to meet the needs of society for homes, transport networks, places of work and recreational areas. Quarrying is an established land use at this site and it has been integrated into the local environment. In addition to extraction, the site accommodates integrated manufacturing facilities including a concrete batching plant and asphalt production plant,

both of which are dependent on the continued availability of on-site aggregates. Without the continuation of quarrying activities, these facilities would be forced to cease operation or rely on imported aggregates, increasing transportation distances, costs, and associated emissions. As it is a continuation of existing activities, there will be effectively no construction or enabling phase with respect to access to the extraction area.

7.114 Extraction capacity is sought to provide the applicant with the ability to respond to demand for aggregates in the region. The proposed development is within an overall application area of c. 16.3 hectares and is for a total period of 35 years (the extraction operational period is for 33 years and the importation of materials for restoration is for a further 2 years).

7.115 Whilst machinery will be replaced as necessary, there will be no increase in site infrastructure associated with ongoing extraction, internal haulage and processing of raw material.

7.116 Sourcing of bedrock at a greenfield site at a further remove would significantly increase impacts linked to traffic such as increased combustion of fossil fuels.

Monitoring

7.117 As no significant impacts are expected other than the loss of the mineral resource, the only monitoring required, with respect to the land, soil or geological environment is the continuation the rock resource and suitability assessments.

7.118 The detailed procedures to be followed, in respect of monitoring for the purpose of demonstrating compliance with Permissions and Licences etc., are understood by site workers, operators and management. Operation of the quarry already includes monitoring activities (e.g., Water, Blasting, Noise and Dust) to demonstrate that the development is not having an adverse impact on the surrounding environment.

7.119 Future environmental monitoring reports for the site will continue to be submitted to Galway County Council for their approval.

7.120 New monitoring programs will be compiled to comply with any new Conditions attached to any decision to grant planning permission, and also to ensure that the development is not having an adverse impact on the surrounding environment.

Close

7.121 The Galway County Development Plan (2022 – 2028) acknowledges quarrying as an important source of employment and that the continual supply of aggregates is necessary for future growth. In addition, Galway County Council acknowledges the need for environmental protection and that extractive industry guidelines must be adhered to. The field works and application of EPA (2022), NRA (2009) and IGI (2013) Guidelines for Assessment enable a conclusion that the quarry can continue to supply rock, with the application of mitigation measures and that there will be no residual effects. It is respectively suggested that the site has been assessed in accordance with the EU EIA Directive 2011/92/EU, as amended by EIA Directive 2014/52/EU, and the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

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Figures

Figure 7-1 Site Location and Topography

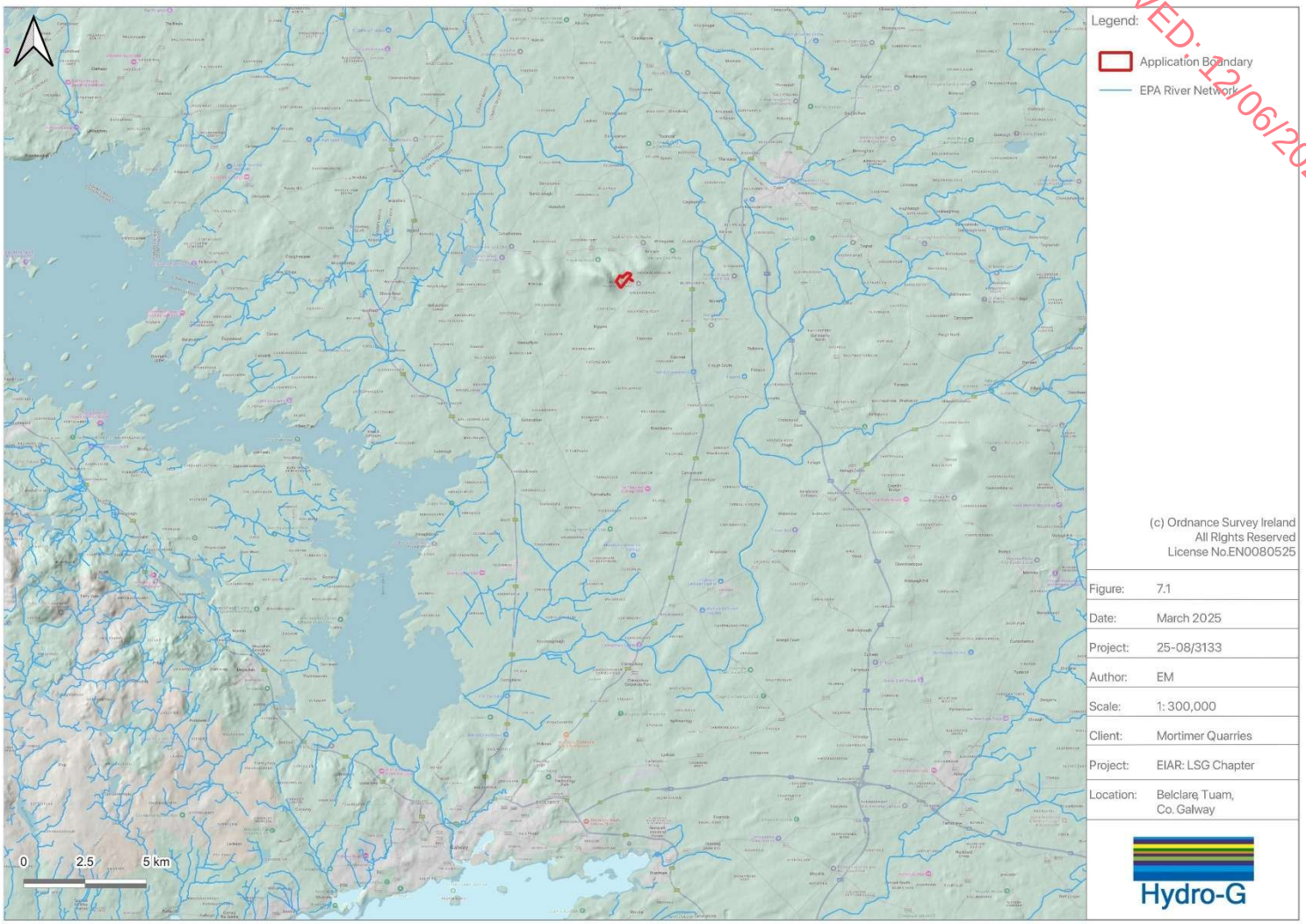

Figure 7-2 General Soils

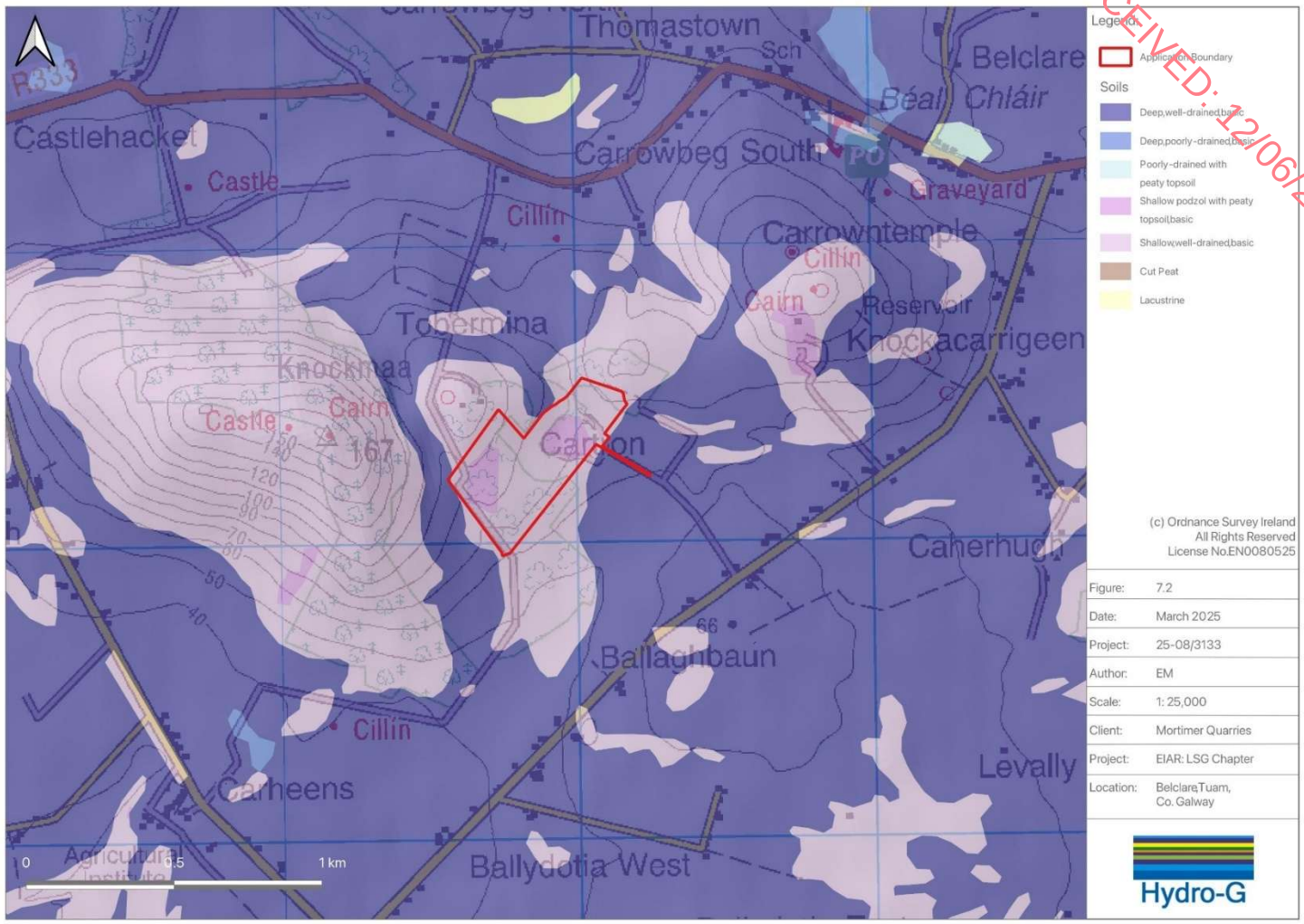

Figure 7-3 Quaternary Geology

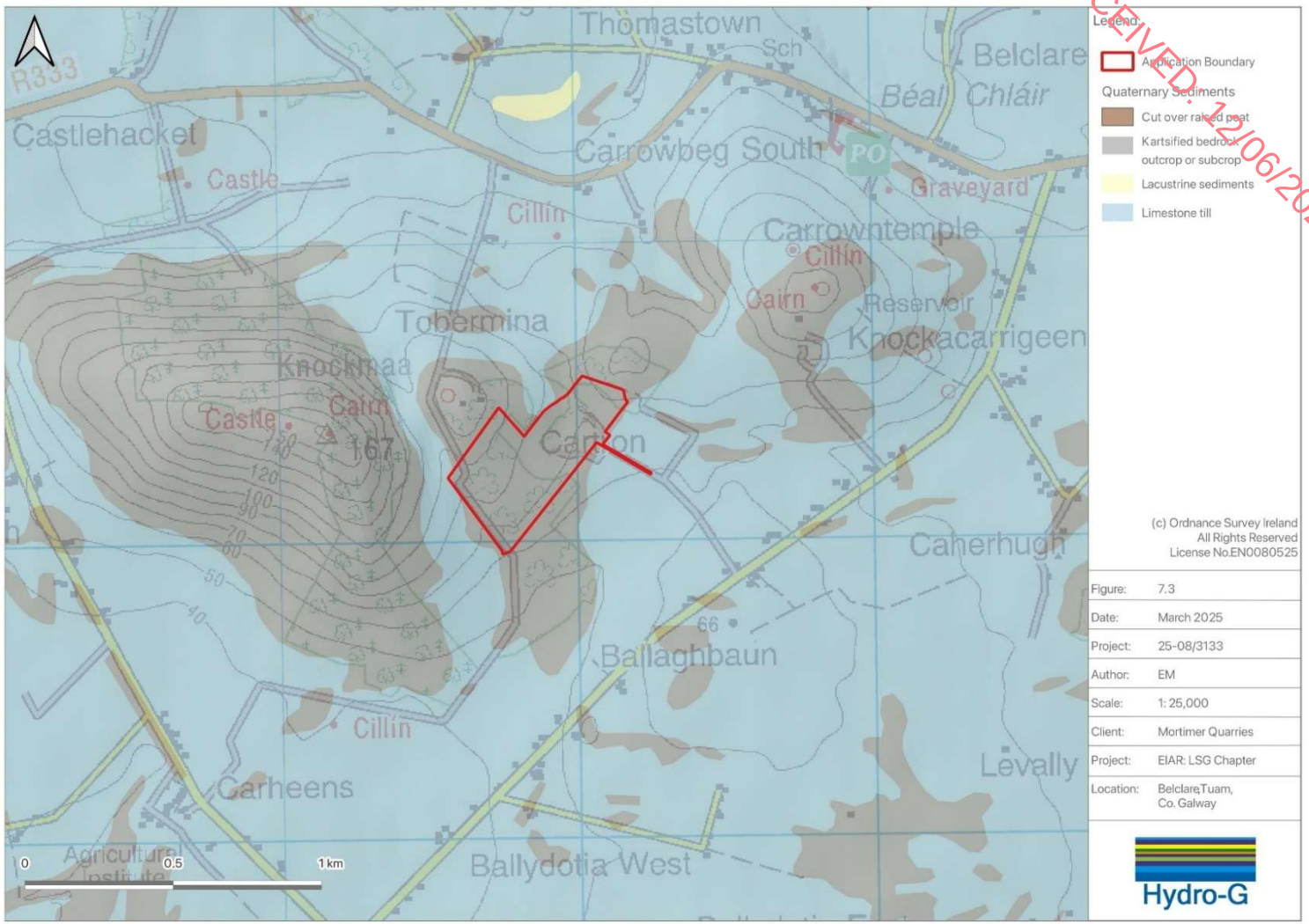

Figure 7-4 Bedrock and Structural Geology

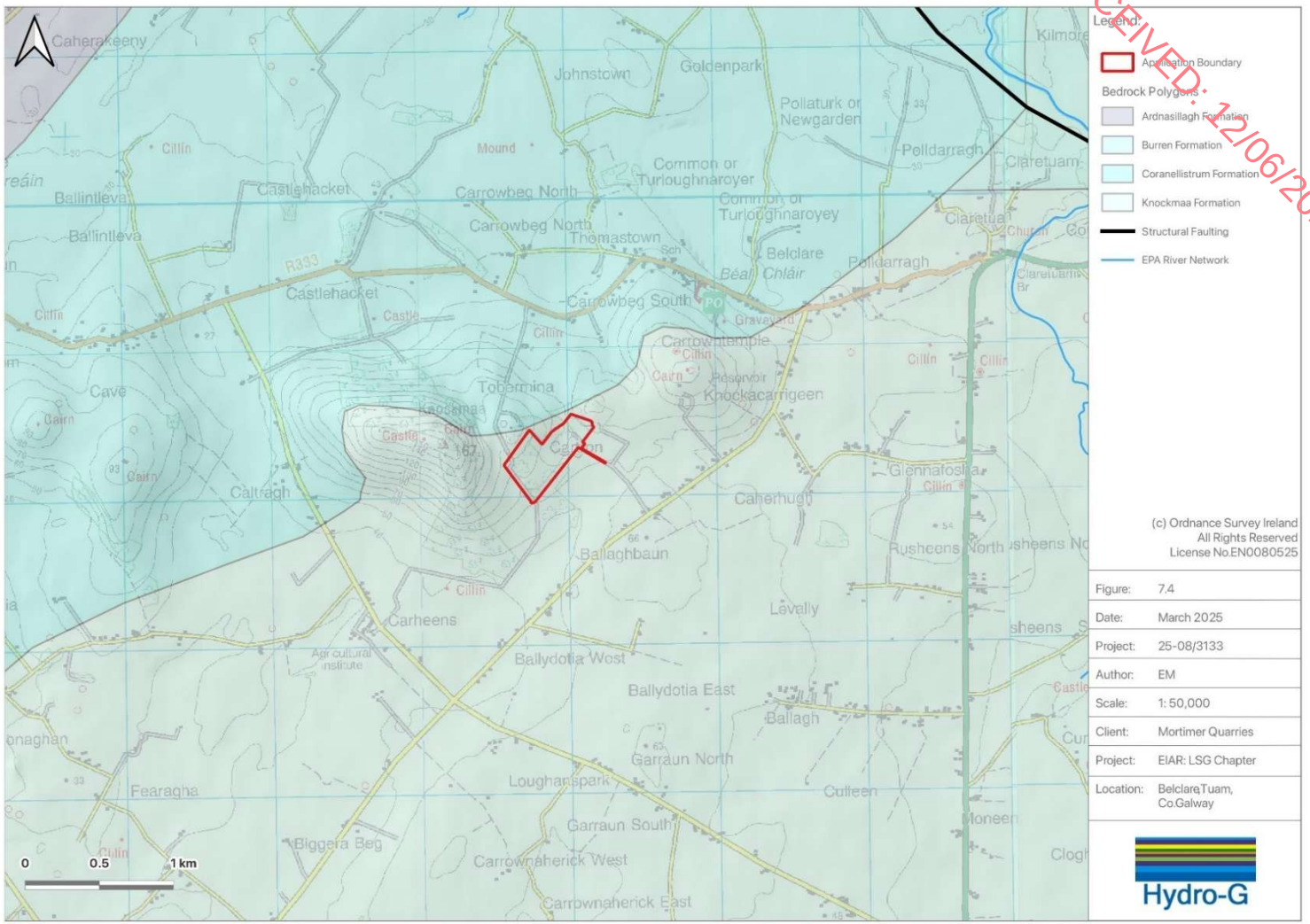

Figure 7-5 Geoheritage Areas

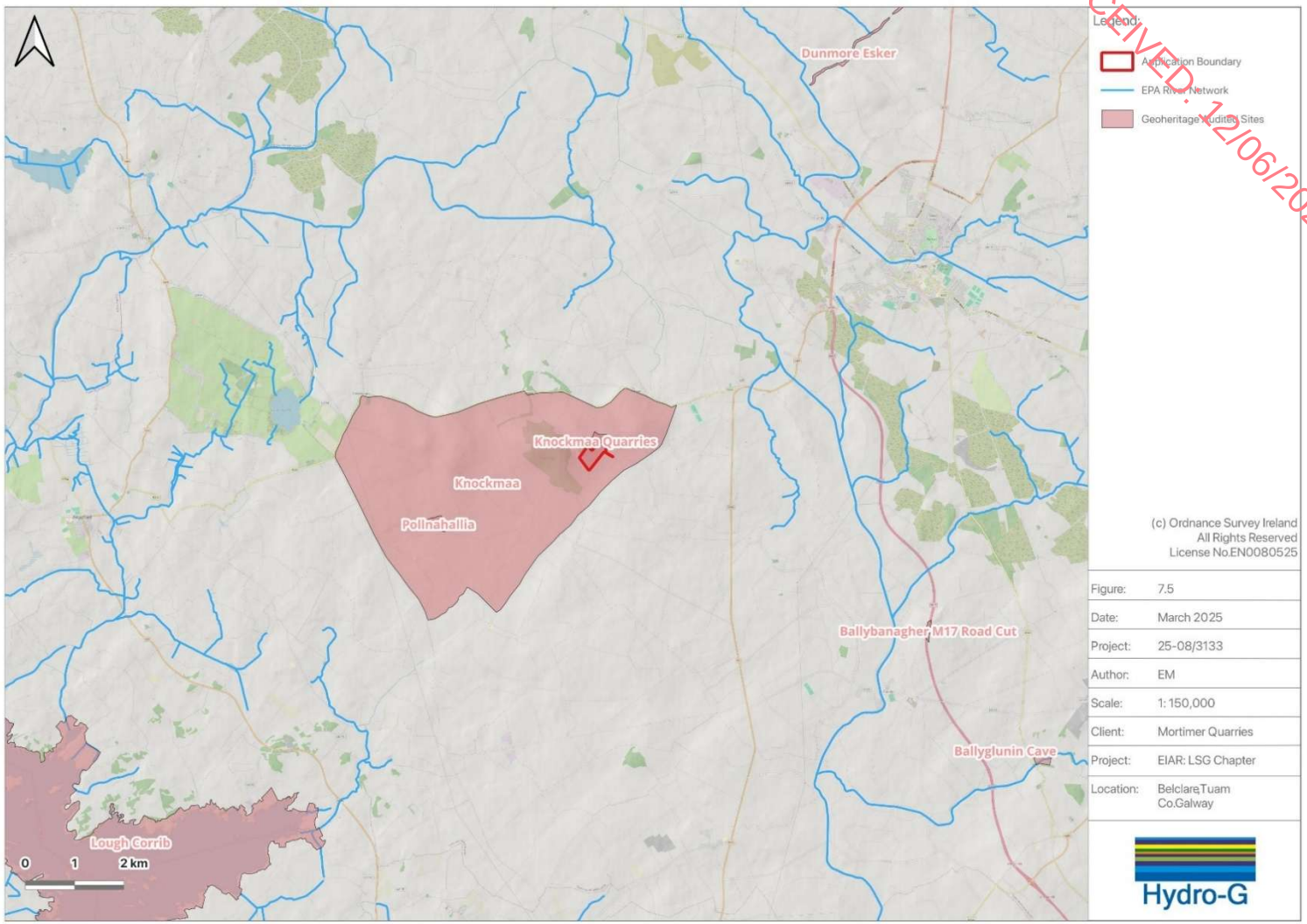

Figure 7-6 Site & Borehole

Appendix 7-1 GSI Scoping Response

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

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Peter Kinghan
Unit 3, Cedar Crescent
Cedar Park
Westport
Co. Mayo, F28 PN47

26 August 2024

Re: Preplanning Consultation Mortimers Quarry, Cartron, Belclare, Tuam, Co. Galway
Your Ref: n/a
Our Ref: 24/308

Dear Peter,
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 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'.

The publicly available data referenced/presented here, should in no way be construed as Geological Survey Ireland support for or objection to the proposed development or plan. The data is made freely available to all and can be used as independent scientific data in assessments, plans or policies. It should be noted that in many cases this data is a baseline or starting point for further site specific assessments.

With reference to your email received on the 20 August 2024, concerning the Preplanning Consultation Mortimers Quarry, Cartron, Belclare, Tuam, Co. Galway, 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
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. Galway was carried out in 2019. The full report details can be found here. **Our records show that there are CGSs within the proposed quarry development application area.**

> **Knockmaa**, Co. Galway (GR 134737, 247715), under IGH themes: IGH1 Karst, IGH3 Carboniferous to Pliocene Palaeontology, IGH7 Quaternary, IGH12 Mesozoic and Cenozoic. A large area of landscape between Headford and Tuam with thin glacial deposits which have only slightly modified a pre-Pleistocene karst landscape, developed on Carboniferous limestones, which contains late Pliocene sediments. The site is of international importance and is recommended to NPWS for Geological NHA status. Link to Site Report: GY082.
>
> **Knockmaa Quarries**, Co. Galway (GR 136933, 248357), under IGH themes: IGH1 Karst, IGH8 Lower Carboniferous, IGH12 Mesozoic and Cenozoic. This site includes two large working quarries, side-by-side, on the southeastern slopes of Knockmaa Hill, about 7 km southwest of Tuam. These quarries provide a good representative site displaying the Carboniferous limestone bedrock geology of mid-Galway, with additional features of pre-glacial and karstic interest. Link to Site Report: GY083.

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 would be desirable to consider retaining representative faces for geological purposes during aftercare and restoration plans instead of straight forward infill to original pre-quarrying topography.

The Geological Survey 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 scientifically significant new stratigraphies / relationships as they might become exposed and to establish if the quarry 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.

We also encourage discussion on end-of-life plans for the quarry and would be happy to recommend ways to promote the geology to the public or develop tourism or educational resources if appropriate. Geological Survey Ireland would like to offer help with interpretative signs where interesting geological features have been exposed, if appropriate.

In 4.2. 'Soils & Geology' of the preplanning consultation, we welcome the undertaking to "continue to monitor the site for "new features and sediments which can be sampled for dating and other environmental evidence"".

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 an aquifer classed as a 'Regionally Important Aquifer - Karstified (conduit)' underlies the proposed development.

The Groundwater Vulnerability map indicates the range of groundwater vulnerabilities within the area covered is variable. We would therefore recommend use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' in your assessments, as any groundwater-surface water interactions that might occur would be greatest in these areas.

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.

Geological Survey Ireland has completed Groundwater Protection Schemes (GWPSs) in partnership with Local Authorities, and there is now national coverage of GWPS mapping. A Groundwater Protection Scheme provides guidelines for the planning and licensing authorities in carrying out their functions, and a framework to assist in decision-making on the location, nature and control of developments and activities in order to protect groundwater. **The Groundwater Protection Response overview and link to the main reports is here: https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/projects/protecting-drinking-water/what-is-drinking-water-protection/county-groundwater-protection-schemes/Pages/default.aspx**

Geological Mapping

Geological Survey Ireland maintains online datasets of bedrock and subsoils geological mapping that are reliable and accessible. We would encourage you to use these data which can be found here, in your future assessments.

Please note we have recently launched QGIS compatible bedrock (100K) and Quaternary geology map data, with instructional manuals and videos. This makes our data more accessible to general public and external stakeholders. QGIS compatible data can be found in our downloadable bedrock 100k .zip file on the Data & Maps section of our website.

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.

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.
- EPA, 2022. Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)

- 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 be created, we would ask that they will be designed to remain visible as rock exposure 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 the Geological Survey Ireland Planning Team at GSIPlanning@gsi.ie.

Yours sincerely,

Geoheritage and Planning Programme

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

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

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann
An Roinn Comhshaoil, Aeráide agus Cumarsáide
Department of the Environment, Climate and Communications

Geological Survey Ireland's Publicly Available Datasets Relevant to Planning, EIA and SEA processes

following European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018
(S.I. No. 296 of 2018)

Geological Survey Ireland Programme	Dataset	Relevant EIA Topic	Coverage	Description / Notes	Link to Geological Survey Ireland map viewer
Geohazards	Landslide: National landslide database and landslide susceptibility map	Land & Soil/Climate/Landscape	National	Associated guidance documentation relating to the National Landslide Susceptibility Map is also available.	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=b68ef1e4a9044a5981f950e9b9c5625c
Geohazards	Groundwater Flooding (Historic)	Water	Regional	Provide information of historic flooding, both surface water and groundwater. [A lack of flooding presented in any specific location of the map only indicates that a flood has not been detected. It does not indicate that a flood cannot occur in that location at present or in the future]	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=848f83c85799436b808652f9c735b1cc
Geohazards	Groundwater Flooding (Predictive)	Water	Regional	Provides information on the probability of future karst groundwater flooding (where available). [The maps do not, and are not intended to, constitute advice. Professional or specialist advice should be sought before taking, or refraining from, any action on the basis of the flood maps]	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=848f83c85799436b808652f9c735b1cc
Geohazards	Radon Map	Land & Soils/Air	National		https://gis.epa.ie/EPAMaps/Radon?&lid=EPA:RadonRiskMapofIreland
Geoheritage	County Geological Sites as adopted by National Heritage Plan and listed in County Development Plans	Land & Soils/Landscape	Regional	All geological heritage sites identified by Geological Survey Ireland are categorised as CGS pending any further NHA designation by NPWS.	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=b245c2bd11a64162a1632ad6bccf8e34
Geological Mapping	Bedrock geology:	Land & Soils	National	1:100,000 scale and associated memoirs.	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=de7012a99d2748ea9106e7ee1b6ab8d5
Geological Mapping	Bedrock geology:	Land & Soils	Regional	1:50,000 scale	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=de7012a99d2748ea9106e7ee1b6ab8d5
Geological Mapping	Quaternary geology: Sediments	Land & Soils	National	1:50,000 scale	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=de7012a99d2748ea9106e7ee1b6ab8d5
Geological Mapping	Quaternary geology: Geomorphology	Land & Soils	National	1:50,000 scale	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=de7012a99d2748ea9106e7ee1b6ab8d5
Geological Mapping	Physiographic units:	Land & Soils	National	Broad-scale physical landscape units mapped at 1:100,000 scale in order to be represented as a cartographic digital map at 1:250,000 scale	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=afa76a420fc54877843aca1bc075c62b
Geological Mapping	GeoUrban: Spatial geological data for the greater Dublin and Cork areas	Land & Soils	Regional	includes 3D models	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=9768f4818b79416093b6b2212a850ce6
Geological Mapping	Geotechnical database	Land & Soils	National	Digitised geotechnical and Site Investigation Reports and boreholes which can be accessed through online downloads	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=a2718be1873d47a585a3f0415b4a724c
Goldmine	Historical data sets including geological memoirs and 6" to 1 mile geological mapping	land & Soils/Water	National	available online	https://secure.decc.gov.ie/goldmine/index.html
Groundwater & Geothermal	Groundwater resources (aquifers)	Water	National	Data limited to 1:100,000 scale; sites should be investigated at local	https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=d333a8a9b6ab44378411fc0d973db4ef
Groundwater & Geothermal	Groundwater recharge.	Water	National	Data limited to 1:40,000 scale; sites should be investigated at local scale; long term annual average recharge	https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=d333a8a9b6ab44378411fc0d973db4ef
Groundwater & Geothermal	Groundwater vulnerability.	Water	National	Data limited to 1:40,000 scale; sites should be investigated at local scale	https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=d333a8a9b6ab44378411fc0d973db4ef
Groundwater & Geothermal	Group scheme and public supply source protection areas.	Water	National	Not all PWS / GWS have SPZ / ZOC. Check with IW / coco / NFGWS for private supplies.	https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=d333a8a9b6ab44378411fc0d973db4ef
Groundwater & Geothermal	Groundwater Protection Schemes	Water	National	Data is limited to scale of 1:40,000. Data does not include all of the source protections areas	https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=d333a8a9b6ab44378411fc0d973db4ef
Groundwater & Geothermal	Catchment and WFD management units.	Water	National		https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=d333a8a9b6ab44378411fc0d973db4ef
Groundwater & Geothermal	karst specific data layers	water	National	For areas underlain by limestone, includes karst features, tracer test database; turlough water levels (gwlevel.ie).	https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=d333a8a9b6ab44378411fc0d973db4ef
Groundwater & Geothermal	Wells and Springs	Water	National	Not comprehensive, there may be unrecorded wells and springs	https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=d333a8a9b6ab44378411fc0d973db4ef
Groundwater & Geothermal	Groundwater body Descriptions	Water	National	Not exhaustive; only those in designated SACs; could be other GWDTEs; for more information contact NPWS / EPA / site investigations	https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-ireland-groundwater/Pages/Groundwater-bodies.aspx
Groundwater & Geothermal	Geothermal Suitability maps	land & Soils/Water	National	Also, Roadmap for a Policy and Regulatory Framework for Geothermal Energy, November 2020	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=9ee46bee08de41278b90a991d60c0b9e
Marine & Coastal Unit	INFOMAR - Ireland's national marine mapping programme; providing key baseline data for Ireland's marine sector.	Water	National		https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=85b8ecf8832e40cca6d923aa0688f08e
Marine & Coastal Unit	CHERISH - Coastal change project (Climate, Heritage and Environments of Reefs, Islands, and Headlands)	Water	Regional		http://www.cherishproject.eu/en/
Marine & Coastal Unit	Coastal Vulnerability Index (CVI).	water /Land & Soils	Regional	Currently the project is being carried out on the east coast and will be rolled out nationally	https://www.gsi.ie/en-ie/programmes-and-projects/marine-and-coastal-unit/projects/Pages/Coastal-Vulnerability-Index.aspx
Minerals	Aggregate potential	Land & Soils/Material Assets	National	Consideration of mineral resources and potential resources as a material asset which should be explicitly recognised within the environmental assessment process	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=ee8c4c285a49413aa6f1344416dc9956
Minerals	Active quarries	Land & Soils	National		https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=ee8c4c285a49413aa6f1344416dc9956
Minerals	Historic mines	Land & Soils/Cultural Heritage	National	Inventory and Risk Classification 2009. Environmental Protection Agency, Economic Minerals Division and Geological Survey Ireland (DECC).	https://gis.epa.ie/EPAMaps/default?easting=?&northing=?&lid=EPA:LEMA_Facilties_Extractive_Facilities https://www.epa.ie/enforcement/mines/
Tellus	Geochemical data: multi-element data for shallow soil, stream sediment and stream water	Land & Soils	Regional	A national mapping programme	https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=6304e122b733498b99642707ff72f754
Tellus	Airborne geophysical data including radiometrics, electromagnetics and magnetics	Land & Soils	Regional	A national mapping programme	https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=6304e122b733498b99642707ff72f754
Tellus	urban geochemistry mapping (Dublin SURGE project),	Land & Soils	Regional		https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=6304e122b733498b99642707ff72f754

Notes:

1. The maps and data listed above are available on the Geological Survey Ireland map viewer https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx

2. Please read all disclaimers carefully when using Geological Survey Ireland data

3. Geological Survey Ireland and Irish Concrete Federation published guidelines for the treatment of geological heritage in the extractive industry in 2008.

4. Please read the GSI Data Licence Agreement and the Groundwater Flooding Data Licence Agreement (https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx)

Appendix 7-2 NRA rating criteria Tables of Appendix C of IGI (2013) Guidance

Table 7-1 Criteria for Rating Site Importance of Geological Features (NRA, 2009)

Magnitude	Criterion	Description & Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying the site is significant on a national or regional scale	• Geological feature on a regional or national scale (NHA). • Large existing quarry or pit. • Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying the site is significant on a local scale	• Contaminated soil on site with previous heavy industrial usage • Large recent landfill site for mixed wastes • Geological feature of high value on a local scale (County Geological Site) • Well drained and/or high fertility soils • Moderately sized existing quarry or pit • Marginally economic extractable mineral resource
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying the site is moderate on a local scale	• Contaminated soil on site with previous light industrial usage • Small recent landfill site for mixed wastes • Moderately drained and/or moderate fertility soils • Small existing quarry or pit • Sub- economic extractable mineral resource
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying the site is small on a local scale	• Large historical and/or recent site for construction and demolition wastes • Small historical and/or recent landfill site for construction and demolition wastes • Poorly drained and/or low fertility soils • Uneconomic extractable mineral resource

The assessment of the magnitude of an impact incorporates the timing, scale, size and duration of the impact. The magnitude criteria for geological impacts are defined in Table 7-2.

Table 7-2 Criteria for Estimating Magnitude of Impact on Geology Attribute (NRA, 2009)

Magnitude	Criterion	Description & Example
Large Adverse	Results in loss of attribute	• Loss of high proportion of future quarry or pit reserves • Irreversible loss of high proportion of local high fertility soils • Removal of entirety of geological heritage feature • Requirement to excavate / remediate entire waste site • Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Loss of moderate proportion of future quarry or pit reserves • Removal of part of geological heritage feature • Irreversible loss of moderate proportion of local high fertility soils • Requirement to excavate / remediate significant proportion of waste site • Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Loss of small proportion of future quarry or pit reserves • Removal of small part of geological heritage feature • Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils • Requirement to excavate / remediate small proportion of waste site • Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

The matrix in Table 7-3 determines the significance of the impacts based on the site importance and magnitude of the impacts as determined by and Table 7-2.

Table 7-3 Criteria for Rating of Significant Environmental Impacts (NRA, 2009; IGI, 2013)

Importance of Attribute	Magnitude of Impact			
	Negligible	**Small**	**Moderate**	**Large**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/moderate	Profound/significant	Profound
High	Imperceptible	Moderate/slight	**Significant/moderate**	Severe/significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/moderate