PURSER

Volume 2:

09

Land, Soils and Geology

9.0 Land, Soils and Geology

9.1 Introduction

This chapter of the EIAR provides a description of the land, soils and geology within and immediately surrounding the site of the Proposed Development, an assessment of the potential effects of the Proposed Development on land, soils and geology and sets out any required mitigation measures where appropriate.

The principal objectives of this chapter are to identify:

- Land, soil and geological characteristics of the receiving environment at the Site.
- Potential effects that the Proposed Development may have on the receiving land, soil and geological environment including "worst case" scenario assessment.
- Potential constraints that the environmental attributes may place on the Proposed Development.
- Required mitigation measures which may be necessary to minimise any adverse effects related to the Proposed Development.
- Evaluate the significance of any residual effects.

This chapter of the EIAR should be read in conjunction with **Chapter 7** Population and Human Health, **Chapter 8** Biodiversity, **Chapter 10** Hydrology and Hydrogeology, **Chapter 11** Air Quality (including Odour), **Chapter 14** Traffic and Transport, **Chapter 15** Material Assets: Waste and **Chapter 18** Landscape and Visual Effect of this volume and other information provided by the Applicant pertaining to the design proposals for the Proposed Development.

9.2 Quality Assurance and Competency of Experts

This chapter of the EIAR has been prepared by Gareth Carroll BA, BEng, MIEnvSc, CEnv a Principal Consultant of Enviroguide with over 11 years' experience of environmental assessment of brownfield and greenfield sites. This chapter was reviewed by Patrick Higgins BSc, MSc, MIEnvSc, CEnv who is Technical Director of the Contaminated Land and Hydrogeology Division of Enviroguide and has over 18 years' experience in preparing environmental assessments for a range of project types and geological and hydrogeological site settings.

9.3 Study Methodology

9.3.1 Aspects Relevant to this Assessment

The methodology adopted for the assessment will take cognisance of relevant guidelines, in particular the following:

- S.I. No. 92 of 2011- European Parliament and of the Council on the assessment of the effects of certain public and private projects on the environment including amendments S.I. No. 52 of 2014.
- S.I. No. 98 of 2008- European Parliament and of the Council on waste and repealing certain Directives.
- Environmental Protection Agency, May 2022. Guidelines on the information to be contained in Environmental Effect Assessment Reports (EPA, 2022)
- Institute of Geologists of Ireland Guidelines, 2002. Geology in Environmental Effect Statements, A Guide (IGI, 2002).
- Institute of Geologists of Ireland Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Effect Statements (IGI, 2013).
- National Roads Authority, 2009. Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2009).
- Tipperary County Council, 2022. Tipperary County Development Plan 2022- 2028.

9.3.2 Phased Approach

A phased approach was adopted for this EIAR in accordance with the Environmental Protection Agency (EPA) and Institute of Geologists of Ireland (IGI) guidelines as set out above and is described in the following sections.

Element 1: An assessment and effect determination stage was carried out by Enviroguide to establish the project location, type and scale of the development, the baseline conditions, and the type of land, soils and geological environment, to establish the activities associated with the Proposed Development and to undertake an assessment and effect determination. This element of the assessment also included developing the Conceptual Site Model (CSM) for the Site and receiving environment.

The study area, for the purposes of assessing the baseline conditions for the Land, Soils and Geology Chapter of the EIAR, extends beyond the site boundaries and includes potential receptors with which there may be a pathway to/from the Proposed Development and receptors that may be indirectly effected by the Proposed Development. The extent of the wider study area was based on the IGI, 2013 Guidelines which recommend a minimum distance of 2.0km from the Site.

The study area for the Land, Soils, and Geology Chapter of the EIAR is defined to ensure a comprehensive assessment of baseline conditions. This area extends beyond the immediate boundaries of the site of the Proposed Development to include a broader region. The site refers specifically to the land where the Proposed Development will take place. In contrast, the study area encompasses a wider region, extending at least 2.0 km from the site, as recommended by the Institute of Geologists of Ireland (IGI) 2013 Guidelines. This broader area is necessary to identify and evaluate all potential receptors that could be affected by the Proposed Development, either directly or indirectly. The distinction between the application site and the study area is crucial. The site of the Proposed Development is the focal point of the proposed development, while the study area includes additional regions that might experience secondary effects. For instance, potential receptors within the study area include surrounding land that might undergo changes in land use or quality, soil quality and composition that could be altered by construction activities, and underlying geological features that might be effected.

The justification for this wider study area lies in the need to capture all potential effects comprehensively. While the primary focus is on the application site, the broader study area ensures that any indirect or secondary effects on land, soil, and geology are also considered. This approach provides a detailed and accurate picture of how the proposed development might affect these aspects of the environment, helping stakeholders make informed decisions and ensuring that all potential environmental effects are thoroughly assessed.

The desk study involved collecting all the relevant data for the Proposed Development site and surrounding area including published information and details pertaining to the Proposed Development provided by the applicant and design team.

A site walkover survey to establish the environmental site setting and baseline conditions at the site of the Proposed Development relevant to the hydrological and hydrogeological environment was undertaken by Enviroguide on 25 June 2024.

The Element 1 stage of the assessment was completed by Enviroguide and included the review of the following sources of information:

- Environmental Protection Agency (EPA) webmapping 2024 (EPA, 2024).
- Geological Survey of Ireland (GSI) Datasets Public Viewer and Groundwater webmapping, 2024 (GSI, 2024).
- Google Earth Mapping and Imagery, 2024 (Google Earth, 2024).
- Ordnance Survey Ireland (OSI) webmapping, 2024 (OSI, 2024).
- National Parks and Wildlife Services (NPWS) webmapping, 2024 (NPWS, 2024).
- Teagasc webmapping, 2024 (Teagasc, 2024).
- Information provided by the Applicant pertaining to the design proposals for the Proposed Development.

Element 2: Involves direct and indirect site investigation and studies stage where necessary to refine the CSM developed as part of Element 1 and evaluate the potential effects associated with the Proposed Development. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey (Minerex, 2024) between August 2024 and September 2024 consisting of an EM31 Ground Conductivity Survey, a 2D-Resistivity (ERT) Survey and a Seismic Refraction survey of the site. Intrusive ground investigations (including trial pitting, borehole drilling, and soil sampling) was undertaken by IGSL Ltd. (IGSL) in July 2024 and August 2024 (IGSL, 2024). Post completion of the intrusive ground investigation works IGSL requested O'Callaghan Moran & Associates (OCM) to undertake a waste characterisation assessment of eighteen (18 No.) samples of made and natural ground collected from eleven (11 No.) trial pits and six (6 No.) cable percussion boreholes (OCM, 2024). The results of the site investigations were used to identify and assess the existing ground conditions and geological environment at the site. The site investigation reports (Minerex, 2024, IGSL, 2024 and OCM, 2024) are included in **Volume 3: Appendix 9.1**.

Element 3: Evaluation of Mitigation Measures, Residual Effects and Final Effect Assessment were based on the outcome of the information gathered in Element 1 and Element 2 of the assessment. Mitigation measures to address all identified adverse effects that were identified in Element 1 and Element 2 of the assessment were

considered in relation to the construction phase and operational phase of the Proposed Development. These mitigation measures were then considered in the effect assessment to identify any residual effects.

Element 4: Completion of the Land, Soil and Geology sections of the EIAR in this chapter which includes all the associated figures and documents.

9.3.3 Description of Importance of the Receiving Environment

The Transport Infrastructure Ireland (TII) criteria for rating of the importance of geological features at the Site as documented in the National Roads Authority Guidelines (NRA, 2009), are summarised in **Table 9-1**.

Importance	Criteria	Typical 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 route is significant on a national or regional scale.	Geological feature rare 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 route 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 route 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.

Importance	Criteria	Typical Example
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 route 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. Uneconomically extractable mineral resource.

Table 9-1. Criteria for Rating Site Importance of Geological Features

9.3.4 Description and Assessment of Potential Effect

Effects will vary in quality from negative, to neutral or positive. The effects of effects will vary in significance on the receiving environment. Effects will also vary in duration. The terminology and methodology used for assessing the 'effect' significance and the corresponding 'effect' throughout this chapter is described in **Table 9-2** in accordance with EPA, 2022 guidelines on the information to be contained in EIARs.

Type of Effect Quality of Effects/ Effects	Definition Definition
Negative	A change which reduces the quality of the environment
Neutral	No effects or effects that are imperceptible, within the normal bounds of variation or within the margin of forecasting error.
Positive	A change that improves the quality of the environment
Significance of Effects / Effects	**Definition**
Imperceptible	An effect capable of measurement but without significant consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration, or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment.

Type of Effect	Definition
Profound	An effect which obliterates sensitive characteristics.
Duration of Effects / Effects	**Definition**
Momentary	Effects lasting from seconds to minutes
Brief	Effects lasting less than a day
Temporary	Effects lasting one year or less
Short-term	Effects lasting one to seven years
Medium-term	Effects lasting seven to fifteen years
Long-term	Effects lasting fifteen to sixty years
Permanent	Effects lasting over sixty years
Reversible	Effects that can be undone, for example through remediation or restoration
Brief	Effects lasting less than a day

Table 9-2. Assessment of Potential Terminology and Methodology

9.4 The Existing and Receiving Environment (Baseline Situation)

9.4.1 Site Location and Current Land Use

The site is located at the former Lisheen Mine Site, Killoran, Moyne, Thurles, Co. Tipperary. The site is accessed from the existing entrance off the L5612 local road. It covers approximately 5.5 hectares and consists of undeveloped brownfield lands. The site is currently vacant following the closure of the Lisheen Mine in 2015. The implementation of the "Closure, Restoration & Aftercare Management Plan – C.R.A.M.P" (The Lisheen Mine, 2016; refer to **Volume 3: Appendix 9.2**) involved detailed strategies to ensure the site's safe and sustainable closure. These reports provided comprehensive guidelines for decommissioning activities, restoration of the land, and long-term aftercare measures to mitigate environmental effects and promote ecological recovery.

The site is accessed from the existing entrance off the L5612 local road, which was used by the former Lisheen Mine Site. The egress joins with the R502 regional road and wider road network.

The site is currently undeveloped and consists of infill from aggregate materials (soil, stone, and rock) extracted from a permitted borrow area within the wider Lisheen Mine site (TCC Planning Reg. Ref. 14600480) for the purpose of restoring the Lisheen Mine (refer to **Figure 9-3**). Additionally, surplus suitable material generated during the decommissioning process has been used. The historic mine entrance, now backfilled with concrete, is located in the southern portion of the site.

The site of the proposed development is within a rural area and is surrounded by agricultural land. There are a small number of residential properties in proximity to the application site located in a linear fashion along the surrounding roads. The closest residential neighbour to the site being 750m away. To the north of the site is former industrial boglands which are owned by Bord na Mona. Industrial peat continues to be harvested within the locality, but a number of wind turbines have been installed, some in close proximity to the site on the former Lisheen mine site. The Lisheen Wind Farm became operational in August of 2009, with eighteen (18 no.) wind turbines erected across the former Lisheen Mine complex, with another 24 wind turbines neighbouring the site, all of which connect into the onsite sub-station. The lands are leased from Lisheen Mine on which the turbines and other infrastructure necessary for the operation of the Wind Farm are located. To the east of the site is the permitted national BioEconomy Foundation R&D Unit (Planning Ref. 211128) which is housed in a former maintenance shed associated with the Lisheen mine. To the west of the site is a former office/laboratory building which was used as part of former mining operations. This building is now vacant.

The Cooleney Stream is located approximately 0.02km south of the site.

In accordance with Tipperary County Council's Climate Action Plan Guidelines, a Decarbonising Zone has been identified in Tipperary, centred around the National Bioeconomy Campus at Lisheen, Thurles. Decarbonisation zones are areas where a range of potential climate change mitigation, adaptation, and biodiversity measures have been identified. These sites will act as demonstration areas for possible decarbonising and positive climate action at the local and community levels. The Mid-Tipperary Decarbonisation Zone is the only inland and rural decarbonising zone in the country. Therefore, opportunities and actions are focused on the bioeconomy, rural and

agricultural diversification, land use change, and biodiversity. Co-benefits include building retrofitting, renewable energy, rural transport, forestry, and tourism. The proposed development at the former Lisheen mine site within Tipperary's decarbonisation zone. The development of the biomethane facility complies with the climate actions identified by Tipperary County Council as part of the Climate Action Plan. The proposed use of the site supports the diversification of land use in the area while contributing to a circular economy through links with the agricultural industry. It also has the potential to provide heating and other outputs to local residents and businesses, along with outputs that can be used on the land. Additionally, the Tipperary County Development Plan 2022-2028 provides a comprehensive framework for sustainable development across the county. This plan aims to protect the environment, reduce energy demands, maintain the viability of towns, villages, and rural communities, and support job creation1. The Proposed Development aligns with these objectives by promoting renewable energy and sustainable land use practices.

The site location is presented in **Figure 9-1** and the existing site layout is presented in **Figure 9-2**. Further details regarding the site location and surrounding land use are detailed in **Chapter 3** of this volume.

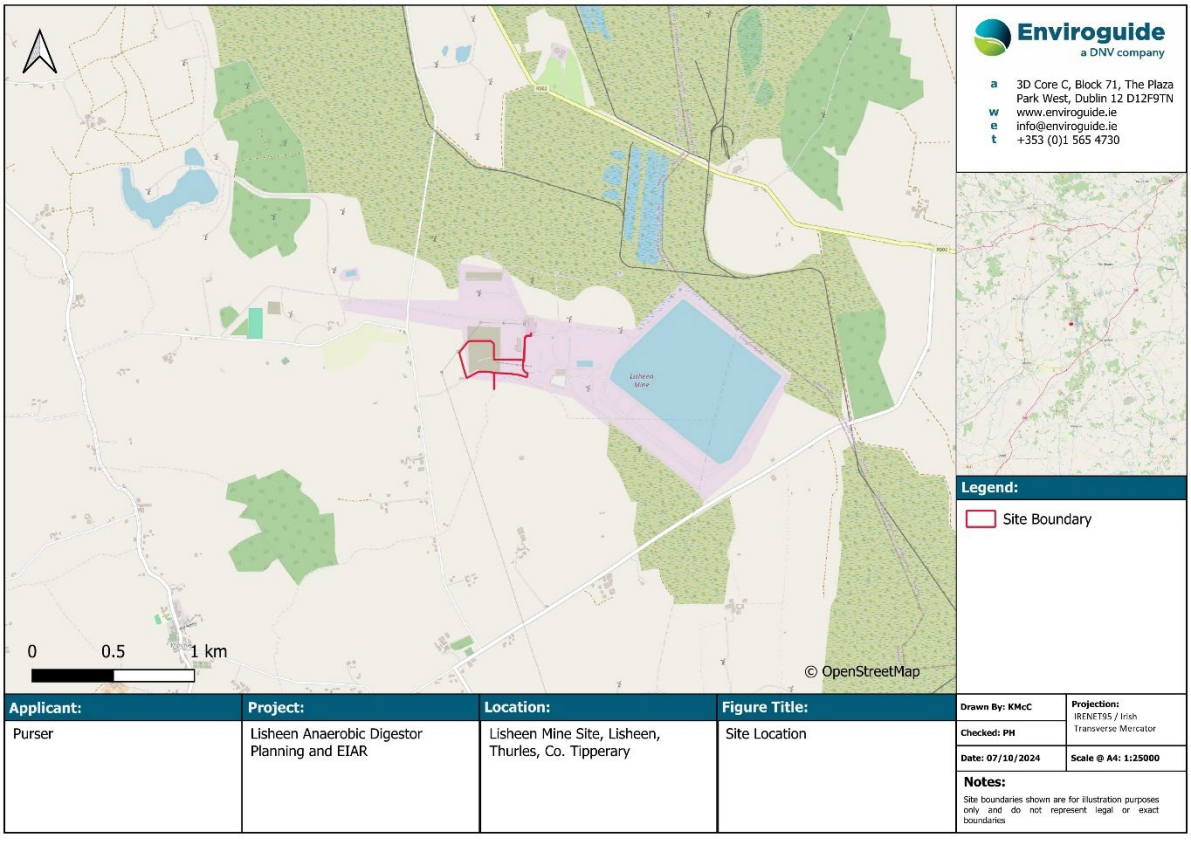

Figure 9-1. Site Location

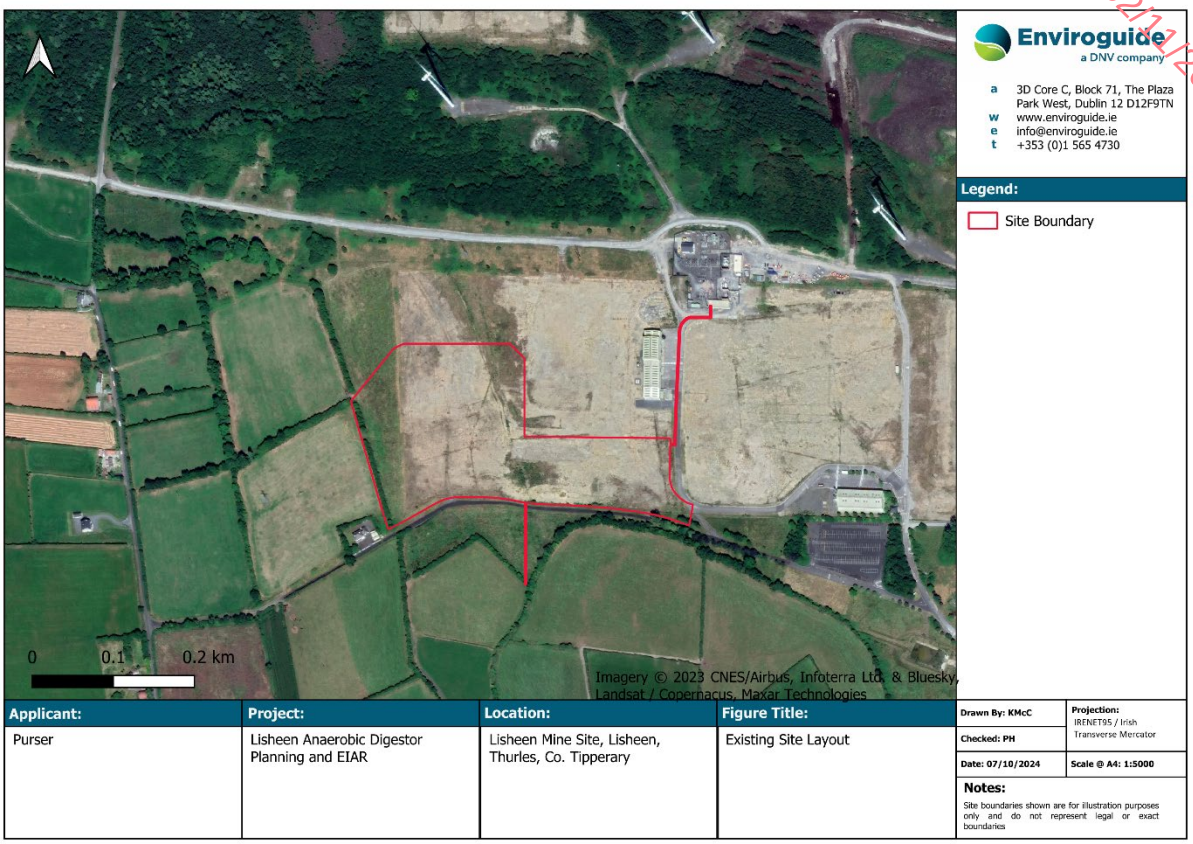

Figure 9-2. Existing Site Layout

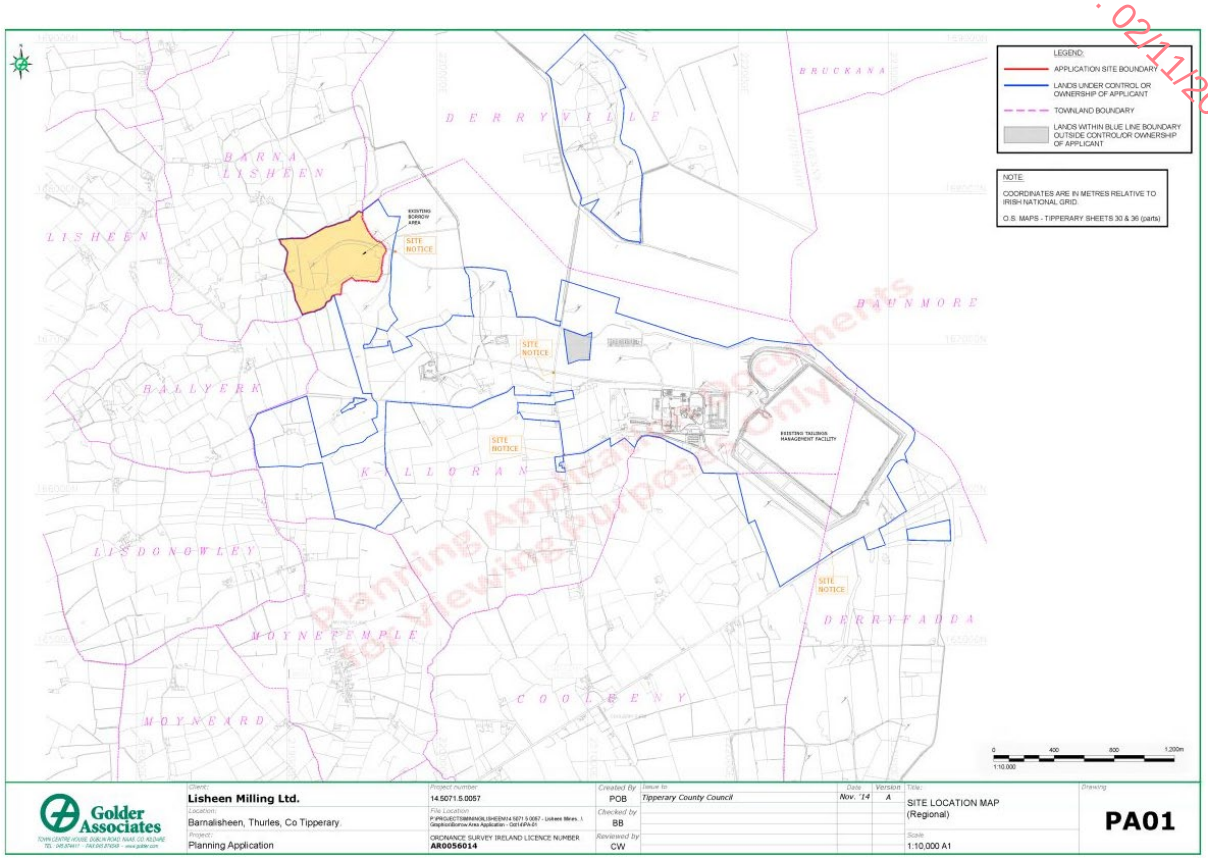

Figure 9-3. Borrow Site (Golder Associates, 2014)

9.4.2 Historical Land Use

The Lisheen Mine was a significant zinc and lead mine that operated from 1999 until its closure in 2015. It was one of the largest producers of zinc concentrate in Europe. The mine was accessed via a 1.5-kilometre-long decline and utilised underground drilling rigs and explosives to extract ore. Over its operational life, the mine produced approximately 22.4 million tonnes of ore, with an average grade of 11.63% zinc and 1.96% lead.

The infrastructure at Lisheen Mine was demolished in accordance with the "Closure, Restoration & Aftercare Management Plan – C.R.A.M.P" (The Lisheen Mine, 2016; refer to **Volume 3: Appendix 9.2**) as part of the site's decommissioning process, which began in 2016 following the cessation of mining operations in December 2015. The active closure phase continued until February 2018. The decommissioning included the removal of all surface and underground plant and equipment.

Historical mapping and aerial photography available from the Ordnance Survey of Ireland website (OSI, 2024) and Google Earth (Google Earth, 2024) were reviewed and key observations on-site and off-site are summarised in **Table 9-2**.

Date	Information Source	Site Description
1837-1842	OSI Map 6 inch	Onsite: The site is comprised of greenfield agricultural land to the south of a large area of bog. Offsite: The surrounding lands are predominantly open fields divided by field boundaries. There is a cluster of dwellings 0.3 km west of the site
1888-1913	OSI 25 Inch	Onsite: No significant changes. Offsite: No significant changes.
1995	OSI Aerial Photograph	Onsite: No significant changes. Offsite: Access tracks are developed throughout the area of bog to the north. A new dwelling is built 0.39 km southwest of the site.
2001-2005	OSI Aerial Photograph	Onsite: The Lisheen mines site is established comprising a car park, warehouses, silos and broken ground. Offsite: A large artificial pond is established 0.5km to the east of the site.
2013-2018	OSI Aerial Photograph	Onsite: No significant changes. Offsite: A second smaller pond is established 0.69 km northeast of the site, and the previously identified large pond is partially drained. Four wind turbines are erected 0.3 km north of the site.
2024	Google Earth	On site: All onsite buildings relating to the mine are demolished. Off site: Both previously identified ponds are drained and backfilled.

Table 9-2. Historical Land Use

The following table outlines the planning history of the Lisheen Mine site, detailing key milestones and decisions that have shaped its development and current status.

Planning Ref. / ABP Ref.	Status	Description of Development
51/17763	Granted	Zin/Lead mine with ore processing and related facilities
5124572	Granted	Extraction of Borrow material
04511667	Granted	Extension of existing mine and construction of three no. ventilation shafts, two of which have evases and the third a hoist house. An EIS has been submitted with this application.
8510773	Granted	Wind turbine farm consisting of 22 no. wind turbine generators, access roads, carnage ponds, and associated infrastructure. An EIS will be submitted to the Planning Authority with this application.
9510142	Granted	Erect one no. permanent meteorological mast of 95m height with internal access road to be utilised for the limited purpose of monitoring wind and climate conditions for the development in North Tipperary County Council Pl Ref. 06510773 and APB PL 22.222.142.
12510034	Granted	Develop the Derryville Island Ore Deposit underground workings as an extension to the existing Lisheen Mine and the construction of one no.

Planning Ref. / ABP Ref.	Status	Description of Development
		ventilation shaft. The Lisheen Mine is subject to the conditions of IPPCL No. P0099-03. The development will include underground mine workings, as an extension to the existing Lisheen Mine and the construction of one no. ventilation shaft and associated building. An EIS shall be submitted to the Planning Authority with the application The Major Accident Regulations apply to the proposed development
13510275	Granted	Consisting of modification of the permitted water impoundment facility (permitted under An Bord Pleanála Ref No. PL22. 100093 (North Tipperary County Council Reg Ref PLC17663) including use of the facility to provide for the storage and management of mine tailing within the same structure (for the purposes of extending life of the mine) and associated capping and reinstatement activities. The proposed development also includes: the installation of spigots and reclaim pumps; and all other ancillary site development works. An EIS and Natura Effect Statement (NIS) have been prepared and will be submitted to the Planning Authority with the planning application. The application relates to development which comprises or is for the purposes of an activity requiring an integrated Pollution Prevention and Control Licence (IPPC) under the EPA Acts. 1992 to 2013 (EPA Licence Reg. No. P0069-03).
14600396	Granted	An increase in height of the existing Tailings Management Fact (TWF) Previously permitted under Reg. No. 13/510275, granted in 2013 (small adjoining facility to the main TMP). The raise in height of this adjoining cell from c.131.5 mod up to a maximum of c.136.5 mod, will provide additional storage for the management of mine tailings for the purposes of extending the life of the mine, and will result in an increase in the footprint of the TMF of c. 2.25 hectares. The development also includes all related ancillary development works. This application is accompanied by an EIS and NIS and relates activity requiring an EPA Licence.

Table 9-3. Planning History associated with the historical use of the subject site as a mine.

9.4.3 Topography

The site is relatively level, with a gentle slope to the southeast toward the Cooleney Stream. Ground elevations at the site range from a high point of approximately 131.10 meters above Ordnance Datum (mOD) along the northwest boundary to approximately 125.8mOD along the Cooleney Stream at the southernmost extent of the site (refer to DOBA, 2024. Topographical Survey).

9.4.4 Soils

The soils beneath the majority of the site have been mapped by the GSI (GSI, 2024) as deep, well-drained mineral soils (mainly basic) classified as Grey Brown Podzolic and Brown Earths with medium to high base status, derived from mainly calcareous parent materials (IFS Soil Code: BminDW).

A narrow band of soils beneath the eastern boundary of the site, crossing the southern portion, has been mapped by the GSI as mineral alluvium (IFS Soil Code: AlluvMIN).

Additionally, another narrow band of soils along the southern boundary of the site has been mapped by the GSI as mineral, poorly drained soils (mainly basic) classified as Surface Water Gleys and Ground Water Gleys, derived from mainly calcareous parent materials (IFS Soil Code: BminPD).

The GSI (GSI, 2024) mapped soils at the site are presented in **Figure 9-4**.

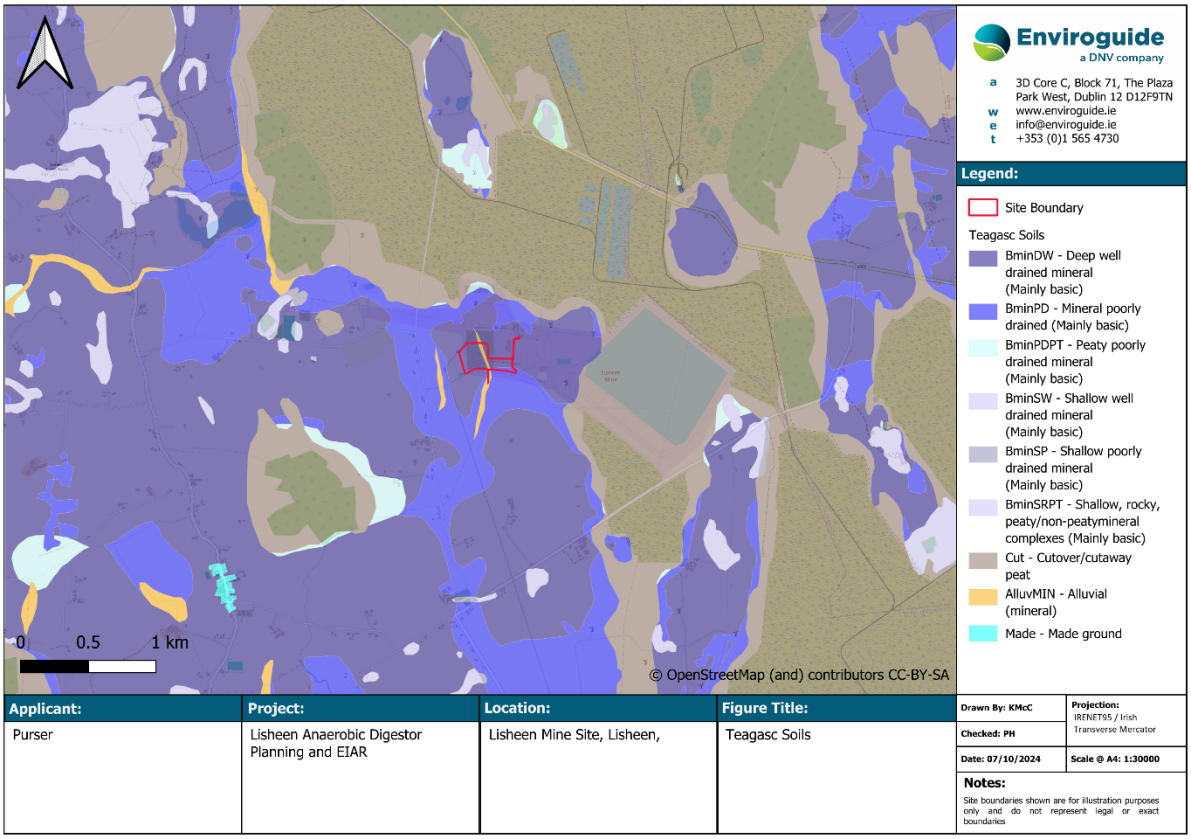

Figure 9-4. Teagasc soils.

9.4.5 Quaternary Geology

The subsoil or Quaternary sediments beneath the majority of the site of the Proposed Development are mapped by the GSI (GSI, 2024) as till derived from limestone. The narrow band of alluvium underlying the eastern boundary of the site and crossing the southern portion indicates historic drainage pathways (GSI, 2024).

The Lisheen Mine has extensive borehole log data available through public releases (Department of the Environment, Climate and Communications, 2019). The Lisheen Mine site features a complex subsurface profile characterized by varying depths of overburden and glacial deposits. The topsoil layer is generally thin, ranging from 0.2 to 0.5 meters, with peat deposits in certain areas extending from 0.5 to 2 meters. Beneath this, the glacial till layer, composed of clay, silt, sand, and gravel, typically ranges from 3 to 8 meters in thickness (Piteau Associates UK Ltd., 2019).

The quaternary geology at the Site is presented in **Figure 9-5**.

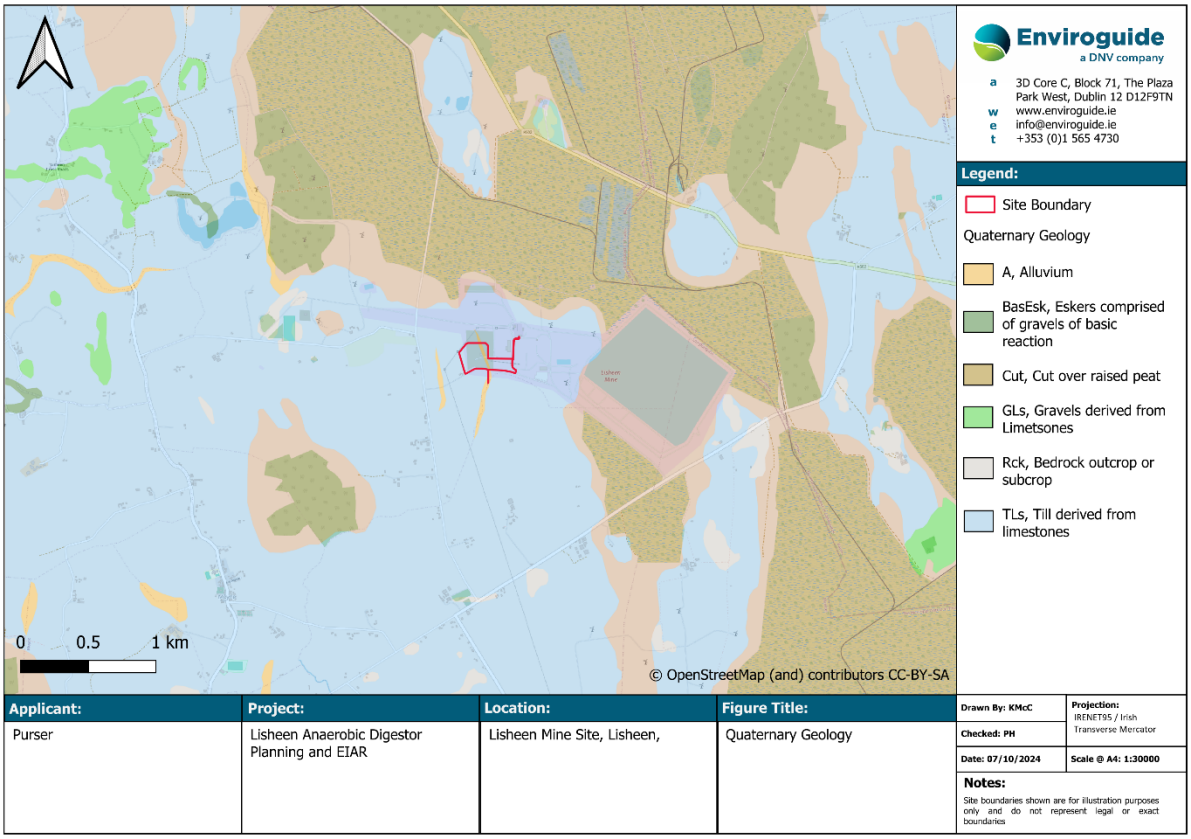

Figure 9-5. Quaternary Geology

9.4.6 Quaternary Geomorphology

There is a streamlined bedrock landform oriented in a north to south direction mapped by the GSI (GSI, 2024) approximately 1.33 km southeast of the site. Additionally, there are 7 No. drumlins, all oriented in a southeast direction, mapped by the GSI within a 2 km radius of the site the closest of which is located approximately 0.01km west of the site.

9.4.7 Bedrock Geology

The bedrock beneath the site is mapped by the GSI (GSI, 2024) as the Waulsortian Limestones (New Code: CDWAULdo), described as dolomitised massive fine-grained limestone. A fault is identified beneath the southwest portion of the site.

The historic Lisheen Mine site and surrounding area is situated within a complex geological setting characterised by significant faulting. The primary faults in the area are normal faults, which developed during the Lower Carboniferous period due to north-south rifting (Society of Economic Geologists, 2018a). These faults have played a crucial role in the formation and localization of the zinc and lead mineralization at the site (Society of Economic Geologists, 2018b). The faults in the Lisheen area typically exhibit displacements of up to 50m, although most have displacements of less than 10m. These faults act as major conduits for groundwater flow and have influenced the hydrogeology of the site (International Mine Water Association, 2021).

The depth to bedrock in the Waulsortian Formation, which is known for its zinc and lead mineralization and was the primary focus of mining operations at Lisheen Mine, varies between 3 to 8 meters below the surface (Society of Economic Geologists, 2018a).

While there is no bedrock outcrops mapped within the site boundary, there are a number of bedrock outcrops mapped by the GSI (GSI, 2024) within a 2km radius of the site. The closest are located approximately 1.71km north, 1.72km south and 1.75km southeast of the site.

There are no karst features mapped by the GSI (GSI, 2024) at the site or within a 2km radius of the site.

The GSI bedrock geology map is presented in **Figure 9-6**.

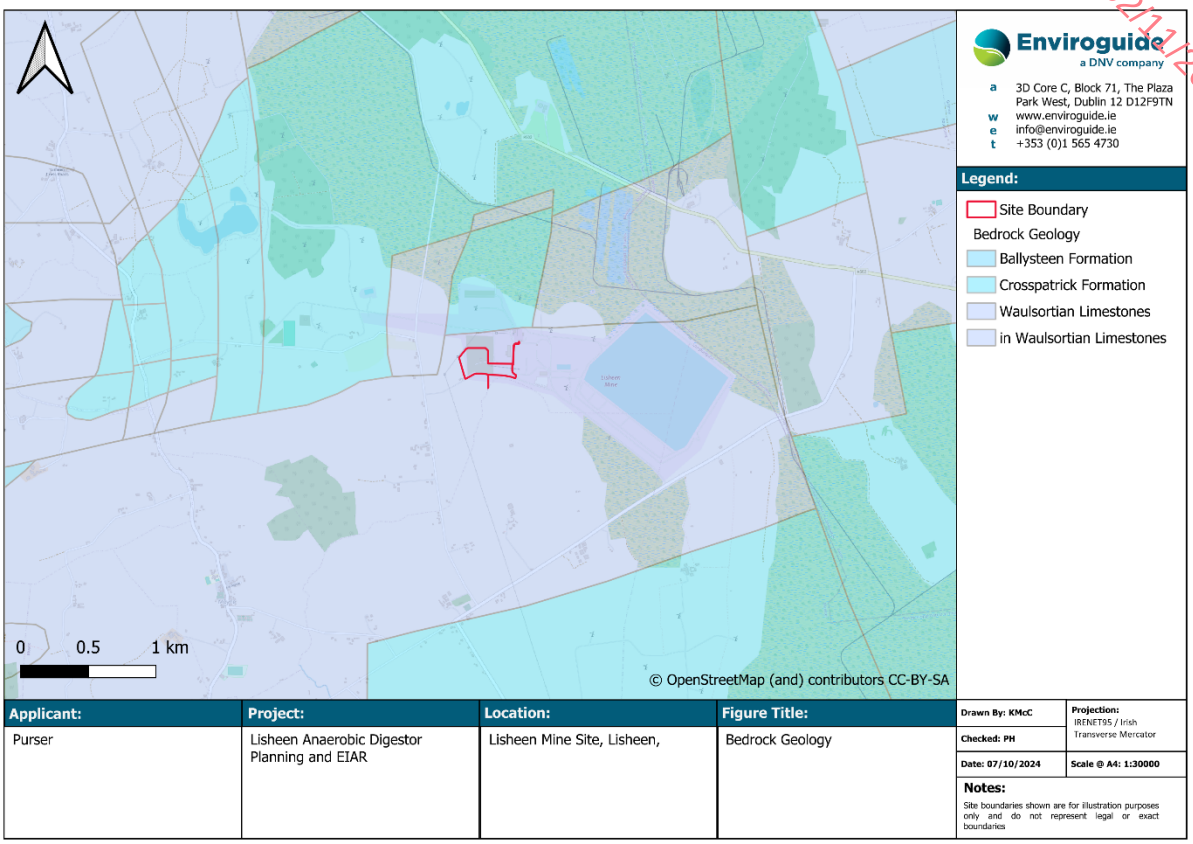

Figure 9-6. Bedrock Geology

9.4.8 Site Investigation Results

9.4.8.1 Intrusive Ground Investigation

The site investigation undertaken across the site by IGSL in July 2024 and August 2024 (included in **Volume 3: Appendix 9.1**) comprised of the following:

- Excavation of 11 No. trial pits with dynamic probes.
- Drilling of 8 No. boreholes (cable percussive and follow-on rotary core drilling methods)
- Completion of 5 No. soakaway tests.
- Groundwater Monitoring and Installation of Data Loggers in 5 No. boreholes.
- Laboratory analysis of eighteen (18 No.) samples of made and natural ground collected from eleven (11 No.) trial pits and six (6 No.) cable percussion boreholes for waste classification assessment (refer to Section 9.4.8.3).

The ground conditions encountered are summarised as follows:

- Made Ground comprising re-worked sandy gravelly / cobbly clay with organics or roots was encountered from ground level to depths of up to 1.1 meters below ground level (mbGL). The matrix is described as firm, and the material is thought to have originated from excavations associated with the mine development (IGSL, 2024).
- The Made Ground was underlain by grey brown and reddish brown sandy gravelly CLAY with low to high cobble content and clayey / silty gravelly SAND with cobbles and boulders (proportions vary greatly) to depths ranging from 2.4mbGL to 8.0mbGL.
- Lenses or horizons of sandy GRAVEL or gravelly SAND occur within the glacial deposits.
- Standard Penetration Tests (SPT's) were conducted in both the cable percussive boreholes and IGSL rotary drillholes to establish stiffness or shear strength. The SPT's show quite a data scatter with an increase in strength apparent from approximately 3m, thereafter the majority of the N-Values fall within the 25 to 50 envelope and suggest the soils are high strength with shear strengths of the order of 120 to 150 kPa (stiff and very stiff) (IGSL, 2024).
- Bedrock described as light grey/blue slightly dolomitized LIMESTONE with solution weathering and dark grey / black argillaceous / muddy LIMESTONE was encountered at depths ranging from 2.4mbGL to 8.0mbGL. Weathering grades vary within the sequence and the light grey / blue limestone (which belongs to the Waulsortian Formation) exhibits solution or karst weathering.
- The point load strength index (PLSI) tests suggest the intact core specimens vary from weak (5 to 12.5 MPa) to very strong (100 to 200 MPa) (IGSL, 2024)

Groundwater strikes or inflows were encountered in two of the eleven trial pits (i.e. TP 2 and TP9). Standpipes were installed in the 5 No. of the 8 No. rotary drillholes and groundwater levels during mid-October 2024 ranged from 1.37mbGL (RC08) to 6.22mbGL (RC02). Soakaway tests were conducted to evaluate the infiltration characteristics for potential dispersion of storm water through a soakaway system. The tests demonstrated significant variability with no movement or dissipation recorded in some instances (SA02 & SA04) while the other tests determined infiltration rates (f) of 1.4 to 6.4x 10-6 m/s. Further details and assessment groundwater beneath the site and Proposed Development is provided in **Chapter 10** of this volume.

9.4.8.2 Geophysical Survey

Minerex Geophysics Ltd. (Minerex) carried out a geophysical survey (Minerex, 2024 included in **Volume 3: Appendix 9.1**) consisting of 2D-Resistivity (ERT), seismic refraction (p-wave) and MASW (s-wave) surveying for the site. The findings of the geophysical survey are summarised as follows:

- The data was modelled with 3 layers based on seismic velocities and all of the layers were divided using the electrical resistivities. Layer 4 is the backfilled mine entrance:
  - **Layer 1:** Consists of soft or loose materials like alluvium and soil/fill, with thicknesses ranging from 0.8m to 3m.
  - **Layer 2:** Interpreted as weathered or karstified rock or overburden with very stiff to hard or very dense stiffness or compaction, and varying thicknesses from 2m to 17m.

  - **Layer 3:** Consists of good to very good limestone rock, showing seismic velocities of over 4000 m/s, with top depths varying from 3m to 19m.
  - **Layer 4:** Represents disturbed geophysical data corresponding to the backfilled mine entrance.
- A geological fault is interpreted between these two limestone types. The Waulsortian dolomitised limestone is to the north of the fault, the argillaceous/muddy limestone seems to be uplifted by the fault as it could be expected to come from the Ballysteen formation under the Waulsortian limestone.
- The surveys indicated the presence of karstified limestone within the dolomitised limestone of the Waulsortian Formation.
- An alluvium band of shallow deposits crosses the site, generally corresponding with the subsoil or Quaternary sediments mapped beneath the site by the GSI (GSI, 2024).
- The mine entrance has been appropriately backfilled and matches the location on previous reports for the entrance.

9.4.8.2 Soil Quality and Contaminated Land

Soil analytical data for the 18 No. samples collected across the site are provided in the waste classification report (OCM, 2024; refer to **Volume 3: Appendix 9.1**). Soil samples collected were analysed for a suite of parameters suitable to facilitate an assessment of the hazardous properties of the waste, and also allows a determination of appropriate off-site management options based on the Waste Acceptance Criteria (WAC) applied by landfill operators. The sample location plan is presented in **Figure 9-7**.

Based on the soil and soil leachate analysis results for all 18 No. samples were classified as non-hazardous using HazWasteOnline™ software and meet the meet the waste acceptance criteria (WAC) for non-hazardous landfills as stipulated in the European Landfill Directive. (Council Directive 1999/31/EC of 26 April 1999). It is noted that 13 No. of the 18 No. samples also meet the WAC for inert landfills. Furthermore, 11 No. of the 18 No. samples meet the WAC for soil recovery facilities.

Based on a review of the results, there is no evidence of anthropogenic contamination in the sampled soils.

- The reported concentration of mineral oil, polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPHs), polychlorinated biphenyl (PCBs), benzene, toluene, ethylbenzene, m/p-xylene and o-xylene (BTEX), were less than the laboratory limits of detection (LOD) or not detected and therefore considered to be absent from the sampled soil.
- Asbestos was not detected in any of the samples tested or not detected and therefore considered to be absent from the sampled soil.

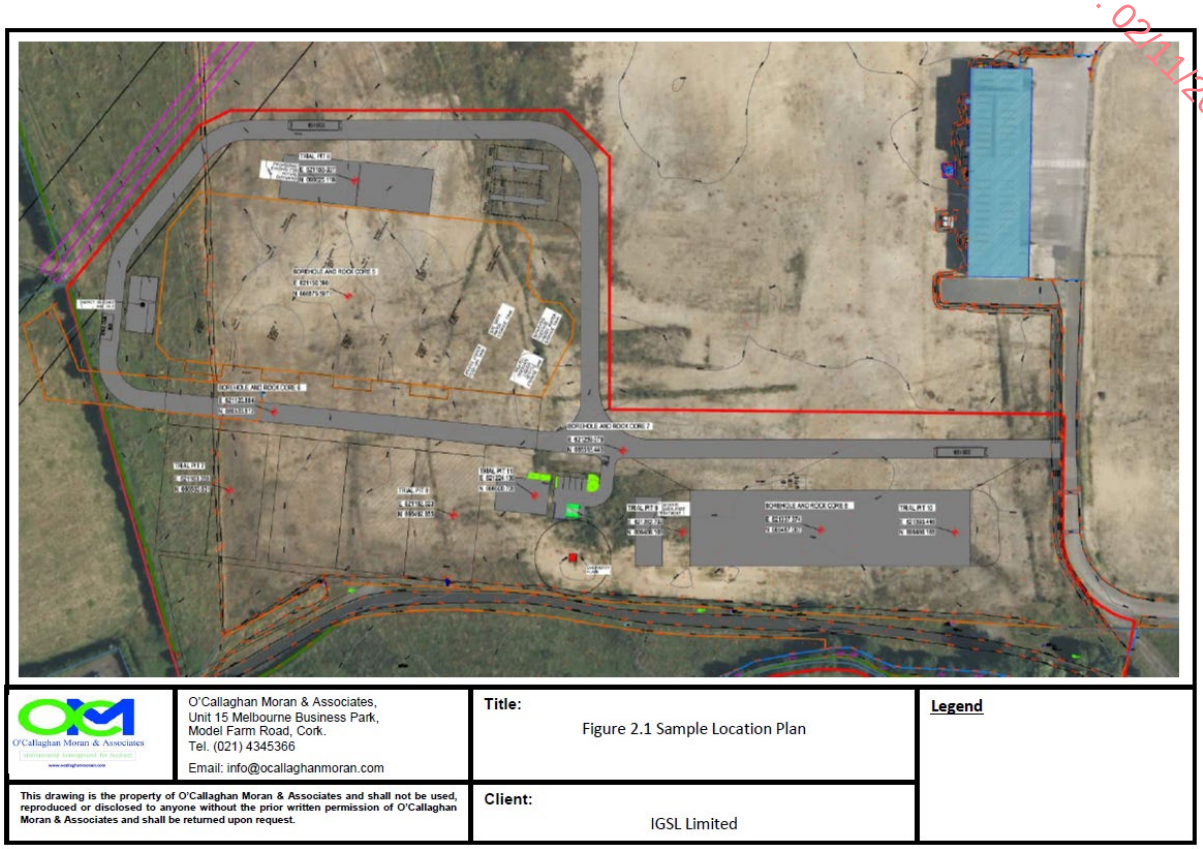

Figure 9-7. Sample Location Plan (OCM, 2024)

9.4.9 Geochemical Domain

The GSI along with the EPA have developed geochemically appropriate levels (GALs) for soil recovery facilities across Ireland specifically in relation to metals and metalloids in uncontaminated soil and stone (GSI, 2023). There are a total of seven defined domains across the country. The GSI (GSI, 2024) defined Geochemical Domains map indicates that the site of the Proposed Development is located within Domain 2 which is characterised as "carboniferous limestone, shale and related rocks". As discussed in Section 9.4.8.2, the soil analytical results for 11 No. of the 18 No. samples collected across the site meet the WAC for soil recovery facilities in Geochemical Domain 2.

A summary of the metals values for Domain 2 are presented below in **Table 9-4**.

Element	Units	Value
Arsenic	mg/kg	24.90
Cadmium	mg/kg	3.28
Chromium	mg/kg	50.30
Copper	mg/kg	63.50

Element	Units	Value
Mercury	mg/kg	0.36
Nickel	mg/kg	61.90
Lead	mg/kg	86.10
Zinc	mg/kg	197.00

Table 9-4. Geochemical Domain

9.4.10 Radon

The Radon Risk Map of Ireland (EPA, 2024) shows a prediction of the number of the houses in any one area that are likely to have high radon levels. The map is based on an analysis of indoor radon measurements plus geological information including, bedrock type, quaternary geology, soil permeability and aquifer type.

The site of the Proposed Development is mapped by the EPA (EPA, 2024) as being in an area where 'about 1 in 5 homes in this area is likely to have high radon levels.

The EPA cite the reference level for radon as 200 Bq/m3 and a High Radon Area where more than 10% of homes may have more than the reference level of radioactivity. As more than 10% of the houses in the area are mapped by the EPA as being over this reference level it indicates that the site is considered a High Radon Area (EPA,2024). It is noted that a high radon level can be found in any home, in any part of the country, but these homes are more likely to be located in High Radon Areas.

9.4.11 Geohazards

Earthquakes are not likely to occur in the vicinity of the site at a sufficient intensity to pose a risk for the Proposed Development.

The GSI database (GSI, 2024) indicated that the site is not located within an area with a 'low' susceptibility to landslides. There are no recorded landslides recorded on the GSI database (GSI, 2024) at the site or within a 2km radius of the site.

There are no karst features mapped by the GSI (GSI, 2024) at the site or within a 2km radius of the site. However, it is noted that the results of the intrusive site investigation (IGSL, 2024) and the geophysical survey (Minerex, 2024) confirmed the presence of karstified limestone within the dolomitised limestone of the Waulsortian Formation beneath the site.

9.4.12 Geological Heritage Sites

The site of the Proposed Development is mapped by the GSI (GSI, 2024) to be located within the Lisheen Mine geological heritage site (Site Code: TY044) described as a former mine site, now the location of the National Bioeconomy Campus, and a major Irish-type zinc-lead deposit of considerable importance scientifically and economically.

9.4.13 Economic Geology

The lands beneath the site are mapped by the GSI (GSI, 2024) to have no mapped granular aggregate potential.

The bedrock beneath the site has been identified by the GSI (GSI, 2024) as having a 'very low' potential for crushed rock aggregate.

There are no historical pits or quarries mapped by the Geological Survey Ireland (GSI, 2024) at the site or within a 2 km radius. However, as previously discussed in Section 9.4.1, the site is located at the former Lisheen Mine, which produced approximately 22.4 million tonnes of ore, with an average grade of 11.63% zinc and 1.96% lead over its operational lifetime. Aggregate materials (soil, stone, and rock) were extracted from a permitted borrow area within the wider Lisheen Mine site (TCC Planning Reg. Ref. 14600480) for the purpose of restoring the mine. The planning permission allowed for the re-opening of the borrow area (refer to **Figure 9-3**), which was previously permitted under Planning Ref No PLC/17663. Aggregate extraction activities were permitted over an extension area of approximately 13.5 m within an overall site area of approximately 27.5 hectares. The maximum permitted quantity of material to be extracted was 1,000,000 m^3. In accordance with the planning permission, extraction activities ceased once closure activities at Lisheen Mine were completed. It is understood that the borrow area was subsequently rehabilitated.

9.4.14 Importance of the Baseline Environment

In accordance with the TII Guidance as documented by the NRA (NRA, 2009) and as outlined in **Table 9-1**, the soil and geology underlying the site of the Proposed Development would be rated as an attribute of 'Very High' importance due to due to it being located within the Lisheen Mine geological heritage site (Site Code: TY044). The Lisheen Mine geological heritage site is notable for its Waulsortian limestone and Crosspatrick Formation, which offer valuable insights into the region's geological history. The site supports ongoing geological research and education. Historically, Lisheen Mine produced approximately 22.4 million tonnes of ore, with an average grade of 11.63% zinc and 1.96% lead, significantly contributing to the local and national economy and establishing Ireland as a key player in the global mining industry. The mine's economic legacy continues to influence the region, with potential for future resource exploration and development.

9.5 Characteristics of the Proposed Development

The Proposed Development will comprise the construction of a biomethane and bio-based fertiliser production facility, with an annual intake of up to 98,000 tonnes of feedstock per annum, at this site of c. 5.5 hectares at lands located at the former Lisheen Mine Site, Killoran, Moyne, Thurles, Co. Tipperary.

The Proposed Development will consist of the construction of an anaerobic digestion plant comprising: 4 No. primary digester tanks (each measuring c. 7.6 m in height); 3 No. secondary digester tanks (each measuring c. 14.5 m in height); 4 No. feed hoppers; 4 No. technical rooms (ranging in size from c. 35 sq m to c. 95 sq m GFA); 2 No. biogas conditioning units; process, storage and buffer tanks (comprising: 1 No. buffer digestate storage tank (c. 7.5 m in height), 1 No. suspension buffer tank (c. 8 m in height), 1 No. process area runoff storage tank (c. 4.5 m in height); 1 No. buffer digestate process tank (c. 4.5 m in height), 1 No. treated digestate liquids recycle storage tank (c. 4.5 m in height); 1 No. roofed liquids feed-mix tank (c. 3 m in height)); these components will be located within a containment bund constructed c. 3 m meters below ground level.

The Proposed Development will also consist of: feedstock storage (comprising 3 No. storage clamps (c. 1,050 sq m in area each) and 2 No. storage sheds (c. 500 sq m GFA each)); a biomethane upgrading plant (including natural gas compression unit); a biomethane loading facility (comprising a 4 No. loading bays with associated gates and safety features measuring c. 490 sq m in area); a biomass boiler with its associated pellet storage silo (c. 12.5 m in height);Combined Heat and Power (CHP) plant and associated heat exchanger; a single storey bio-based fertiliser processing and storage unit (c. 3,890 sq m GFA) (including digestate dewatering plant, fertiliser pasteurisation plant and bio-based fertiliser loading facilities); a single storey office building (c. 105 sq m GFA) (including offices, meeting room, control room, laboratory, welfare facilities, storeroom and a first-aid facility); bin storage; 9 No. car parking spaces (including 5 No. standard parking spaces, 2 No. electric vehicle (EV) spaces and 1 No. accessible car parking space); electric vehicle (EV) charging infrastructure; 10 No. bicycle parking spaces; vehicular, cyclist and pedestrian access / egress and associated circulation routes; 2 No. weighbridges; a vehicle steam wash area; fuel storage tank and associated bund; an emergency flare (c. 7.6 m in height); a process area runoff lagoon; an attenuation pond; an ESB sub-station; boundary treatments [including gates, piers and fencing]; site lighting; all hard and soft landscaping; provision of sustainable urban drainage systems (SUDS); and all other associated site excavation, infrastructural and site development works above and below ground, including changes in level and associated retaining features, and associated site servicing (water and electricity supply).

A full description of the Proposed Development is outlined in **Chapter 6** of this volume. The layout of the Proposed Development is presented in **Figure 9-8**.

The components of particular relevance with respect to land, soils and geology are discussed in Section 9.5.1 and 9.5.2 below.

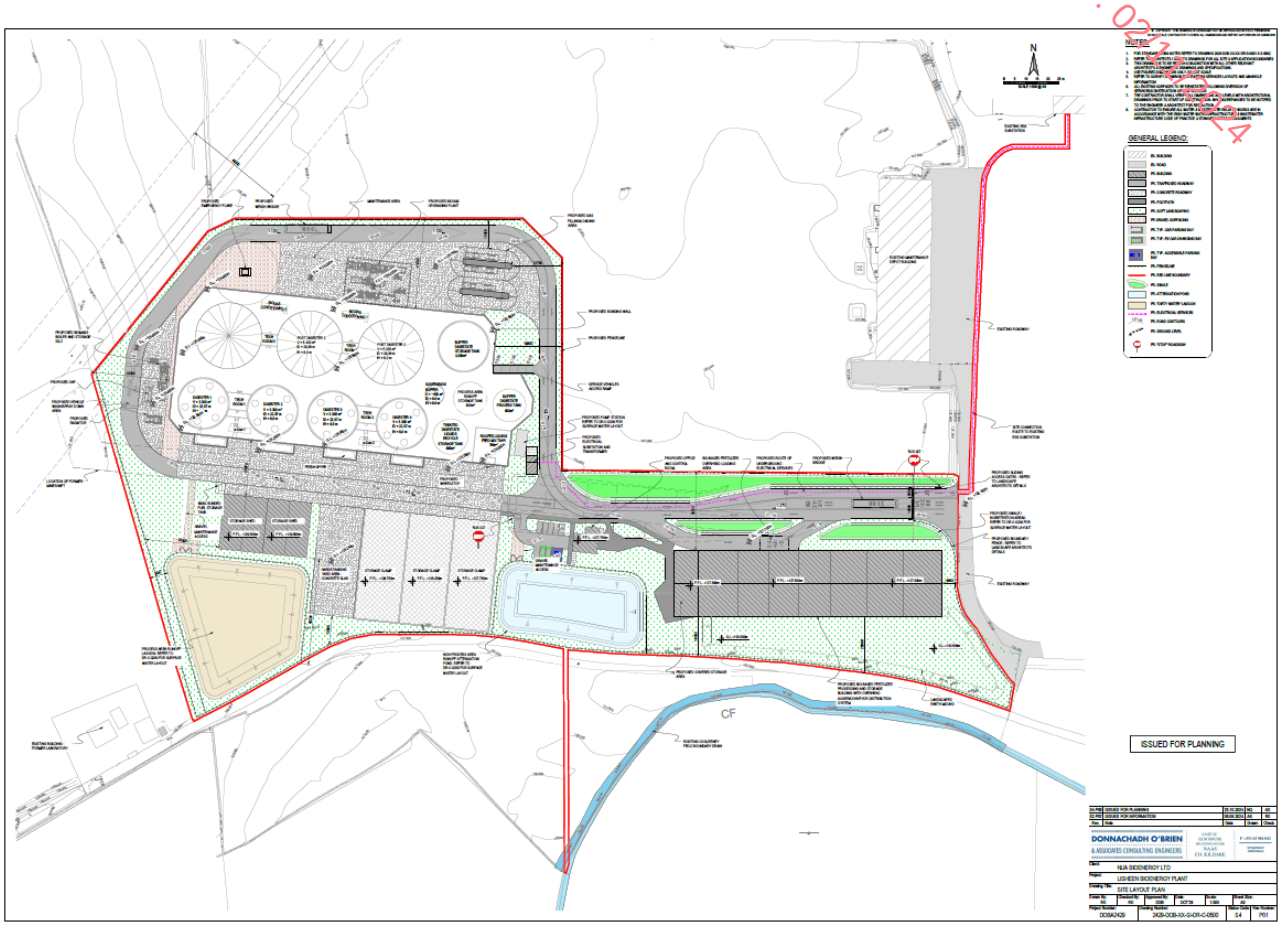

Figure 9-8. Proposed Development Site Layout (DOBA, 2024)

9.5.1 Construction Phase

The construction phase of the Proposed Development will include:

- The foundations for the main digestor yard area will be on traditional pad and strip foundations with no requirement for piling.
- The Proposed Development will involve the excavation of approximately 26,800 m^3 of soil and subsoil. Excavation depths will extend to 3.1 mbGL for the construction of the anaerobic digestion plant. Additionally, excavation depths will range between 1.2 mbGL and 4.0 mbGL for the construction of drainage systems, utilities, and roads.
- It is anticipated that there will be no requirement for the excavation of bedrock during the construction phase of the Proposed Development.
- It is intended to retain all excavated soil onsite and incorporate it into the landscape design for the Proposed Development. This will be subject to an assessment of its suitability for use, in accordance with engineering and environmental specifications that will be determined during the detailed design

phase. However, if required, surplus materials will require removal offsite in accordance with all statutory legislation.

- Temporary stockpiling of excavated material will be required pending re-use onsite or export offsite.
- The importation of 10,000 m^3 of selected structural stone / material will be required for placement under roads and building platforms.

9.5.2 Operational Phase

The Operational Phase of the Proposed Development will comprise an anaerobic digestion facility to produce renewable biomethane and bio-based fertiliser, with an annual intake of up to 98,000 tonnes of feedstock.

Feedstocks will be transported to the proposed development using HGVs, enclosed trailers, and sealed vacuum tankers. Only feedstocks that meet strict acceptance procedures and comply with EPA and DAFM licence conditions will be accepted. All suppliers must complete a Feedstock Acceptance Agreement (FAA) and notify the weighbridge operator 24 hours before delivery. Upon arrival, deliveries will be weighed and logged at the site entrance weighbridge. Haulier drivers will then proceed to the office to submit commercial documentation. Visual inspections will ensure conformity with the FAA. Once confirmed, delivery vehicles will be directed to the reception hall for further processing.

Anaerobic Digestion (AD) is a natural process where micro-organisms break down organic matter in an oxygen-free environment. This process produces biogas, which mainly consists of 55-70% methane (CH_4) and 30-45% carbon dioxide (CO_2), along with traces of other gases such as nitrogen (N_2), hydrogen (H_2), hydrogen sulphide (H_2S), ammonia (NH_3), and water vapour. Based on the feedstock composition and design capacity, the facility is projected to produce 1,140 Nm^3 of biomethane per hour.

The Proposed Development will have a total storage capacity of 36,360m^3, including 4 No. primary digesters with a capacity of 3,300m^3 each, 3 No. secondary digesters with a capacity of 5,420 each, 1 No. digestate storage tank with capacity of 3,700m^3 and 2 No. separated digestate liquid tanks with a capacity of 1,600m^3, 1 No. yard water tank with a capacity of 800m3 and 1 No. feed mix tank with a capacity of 768m^3. All separated liquid digestate produced on-site is recycled into the anaerobic digestion process. Separated digestate solids are pasteurised on-site in compliance with DAFM Animal By-products legislation and composted to produce bio-fertiliser.

Solid digestate fibre will be stored in a dedicated Digestate Storage Building, which is vented to an Odour Treatment System to manage and treat odours. Since land spreading is not allowed during the closed period, the storage building has sufficient capacity to store solid digestate for over 20 weeks. At full capacity, the Proposed Development will also produce digestate fibre for off-site transportation as bio-based fertiliser to local receivers.

The digestate produced will meet the quality and end-of-waste requirements of an agreed quality standard, such as Article 28 End of Waste, PAS110, or a standard agreed with the regulator. It will comply with DAFM transformation parameters and testing requirements as per CN 11: Approval and Operation of Biogas Plants Transforming Animal By-Products and Derived Products in Ireland (DAFM, 2014). Digestate liquid and fibre will be

classified as bio-based fertilisers for use on agricultural lands, serving as direct replacements for chemical/mineral fertilisers. These digestates will primarily be returned to lands associated with feedstock supplies of crops and/or slurry, thereby promoting a local circular bioeconomy. Digestate receivers will manage the storage and application of bio-based fertilisers on their lands, subject to controls set out in S.I. No. 113 of the 2022 European Union (Good Agricultural Practice for Protection of Waters) Regulations 2022.

Methane, the combustible component of biogas, is classified as a P2 flammable gas under Regulation (EC) No. 1272/2008 on the classification, labelling, and packaging of substances and mixtures. According to the Control of Major Accident Hazards (COMAH) regulations, P2 flammable gases are subject to a threshold quantity of 10 tonnes. This means that any biogas facility storing less than 10 tonnes of methane is not subject to COMAH regulations. At full operation, the proposed facility will store less than 4.1 tonnes of flammable gas and is therefore not classified as a COMAH regulated site.

The Proposed Development will be subject to an Industrial Emissions (IE) licence under the provisions of the Environmental Protection Agency Act 1992, as amended. An application for this licence will be made to the EPA. The operator will comply with the environmental control and mitigation requirements as per the conditions of the IE licence to ensure there will be no effect on the receiving land, soil, and geological environment.

An Environmental Management System (EMS) will be put in place for the facility, as will be required by the IE licence. The operator shall develop the EMS in accordance with ISO14001:2015, applying for accreditation when operational. This EMS will include but not be limited to the following:

- Measures to comply with the IE licence and other relevant environmental legislation.
- Waste Acceptance Procedures.
- Standard Operating Procedures.
- Measures to comply with the corporate sustainability goals (e.g., reducing water and energy consumption).
- Accident prevention and emergency response procedures.

The procedures set out in the EMS and conditions of the IE Licence will be strictly adhered to for the duration of the Operational Phase. Further details are provided in **Chapter 6** of this volume.

All feedstocks accepted at the anaerobic digestion facility during the Operational Phase of the Proposed Development will be in accordance with approved acceptance procedures developed in compliance with the conditions of the IE licence (once issued). Quality control procedures will be in place to check and verify that all feedstocks are acceptable.

The land spreading and management of digestate will be carried out by the receiver in compliance with the European Union (Good Agricultural Practice for Protection of Waters) Regulations 2017. These regulations cover various aspects such as the rate and timing of application, minimum distances from watercourses, and conditions under which organic fertiliser cannot be applied (e.g., on land prone to flooding or steeply sloping ground). Additionally, the regulations mandate thorough record keeping ensuring proper management practices

are followed. It is important to note that the responsibility for these activities lies with the receiver, not the producer.

There will be no excavation of soil or bedrock or infilling of waste during the Operational Phase of the Proposed Development.

There will be no direct discharges to ground during the Operational Phase of the Proposed Development.

Refuelling and the storage and handling of deleterious materials such as (fuel, lubricants, oils, etc.) will be undertaken in accordance with the procedures set out in the EMS and conditions of the IE licence (following grant of licence by the EPA). Further details are provided in **Chapter 6** of this volume.

9.6 Potential Effect of the Proposed Development

The procedure for determination of potential effects on the receiving land, soils and geology is to identify potential receptors within the Proposed Development site boundary and surrounding environment and use the information gathered during the desk study and site walkover to assess the degree to which these receptors will be effected upon in the absence of mitigation.

The potential effects associated with the construction phase and operational phase of the Proposed Development are summarised below. Effects are described in terms of quality, significance, duration and type as detailed in **Table 9-2**.

9.6.1 Construction Phase

9.6.1.1 Land Take and Land Use

The Proposed Development will require approximately 5.5 hectares of land, changing it from undeveloped brownfield to industrial use. In line with Tipperary County Council's Climate Action Plan, a Decarbonising Zone has been established around the National Bioeconomy Campus at Lisheen, Thurles. The proposed biomethane facility at the former Lisheen mine aligns with the climate actions of the Decarbonising Zone, supporting land use diversification and the circular economy. Additionally, the Proposed Development aligns with the goals and objectives of the Tipperary County Development Plan 2022-2028 by promoting renewable energy and sustainable land use practices. Consequently, there will be an unavoidable land take, resulting in a 'negative', 'moderate', and 'permanent' effect on land and soil, considering the surrounding land and zoning objectives.

9.6.1.2 Excavation of Soil and Subsoil

The soils underlying the site are considered to be of 'Very High' importance due to it being located within the Lisheen Mine geological heritage site (Site Code: TY044) (refer to Section 9.4.14). The construction of the Proposed Development will require the excavation of 26,800 of soil and subsoil to depths of up to 4.0 mbGL. These soils will be retained onsite and incorporated into the landscape design for the Proposed Development. Accordingly, there will be a 'neutral', 'imperceptible' and 'permanent' effect on soil and geology at the site.

The construction of the Proposed Development will comprise excavations depths of up to 4.0 mbGL for the construction of the anaerobic digestion plant. and other infrastructure, with no requirement for piling. Furthermore, all construction activities will be confined to the former facility area, where previous structures have been demolished and the ground comprises open undeveloped brownfield lands. Given these conditions, the potential effect on the geological heritage site is expected to be minimal. The shallow nature of the excavations and the absence of piling reduce the risk of disturbing significant geological features. Additionally, since the construction will occur in an already disturbed area, further effects on undisturbed geological features are unlikely. Overall, the effect on the Lisheen Mine geological heritage site is considered to be 'neutral', 'imperceptible', and 'permanent'.

9.6.1.3 Soil Structure

The excavation and infilling of soils at the Site will result in the exposure of the materials to various elements including weather and construction traffic. The temporary stockpiling of soils on site will be avoided and soils will be infilled in a controlled manner taking account of the geological conditions at the Site with a potential 'negative', 'slight' and long-term' effect on the natural strength of the materials.

9.6.1.4 Soil Quality and Contamination

The Site currently comprises some areas of localised made ground associated with the historical land use of the site (i.e., the Lisheen Mine). The reuse of soils onsite will be subject to an assessment of their suitability for use, in accordance with engineering and environmental specifications that will be determined during the detailed design phase. Given that there is no requirement to remove excavated soils from the site, except for potentially unsuitable material, it is considered that there would be a 'positive', 'slight', and 'permanent' effect on the quality of soils underlying the site. Where required, the removal of unsuitable materials offsite will be undertaken in accordance with applicable statutory requirements and waste management legislation. The potential effect with removal offsite of soil and other material as waste is assessed in **Chapter 15** of this volume.

There is a potential risk associated with the use of cementitious materials during construction of subsurface structures (such as foundations) on the underlying soil and geology at the Proposed Development. It is considered that this may result in a 'negative', 'moderate' and 'long-term' effect on the existing quality of soil within a localised area underlying the site.

The potential accidental release of deleterious materials including fuels and other materials being used onsite, through the failure of secondary containment or a materials' handling accident on the Proposed Development could potentially result in a 'negative', 'moderate to significant', 'long-term' effect on the receiving soil and geology depending on the nature of the incident.

9.6.1.5 Dust Generation

There is a potential for creation of windblown dust generation from the temporary stockpiling of materials onsite. There will be some exhaust emissions generated from use of excavators, HGVs (heavy goods vehicles) and vibrating rollers during the construction phase of the Proposed Development. An assessment of the potential effect of the Proposed Development with regard to the generation of dust is addressed in **Chapter 11** of this volume.

9.6.1.6 Importation of Fill Materials

The importation of 11,000 m3 of aggregate fill materials will be required for the construction of the Proposed Development (e.g., granular material beneath road pavement, construction of building and tank foundations and for drainage and utility bedding / surrounds etc). The potential effects may include loss of attribute and changes in the geological regime at the source site. It is anticipated that the required aggregates identified for importation onsite will be 'indirect' and have a 'neutral,' 'imperceptible' and 'permanent' effect on the source site taking account of the fact that the statutory consent process would have required the necessary environmental effects to be assessed and mitigated as appropriate at the source site.

9.6.1.7 Geological Hazards

Earthquakes are not likely to occur in the vicinity of the site at a sufficient intensity to pose a risk for the Proposed Development. The GSI database (GSI, 2024) indicates that the site of the Proposed Development is located within an area of 'low' susceptibly to landslides.

The intrusive site investigation (IGSL, 2024) and the geophysical survey (Minerex, 2024) undertaken at the site confirmed the presence of karstified rock. During the construction phase of the Proposed Development, there will be a temporary reduction in impermeable surfaces across the site. In karst-prone areas, alterations in groundwater flow, exacerbated by additional water such as rainfall infiltration, can lead to increased rock erosion and the formation of voids. The depth to rock across the site ranges from 3mbGL to 19mbGL (Minerex, 2024). It is considered that karst features located 10m or more below ground level are unlikely to effect building foundations and roads at the Proposed Development. However, karst features can lead to unpredictable subsurface conditions, including voids and sinkholes, which may require additional engineering solutions to ensure stability. The design and specification for all buildings will be in accordance with current Building Regulations, thereby avoiding any potential risks associated with karst features. Therefore, the potential risks associated with karstified rock at the site are considered 'neutral', 'imperceptible', and 'permanent'.

All aggregates imported to the site for use in the Proposed Development will be subject to strict quality control procedures in accordance with the design specification and relevant Building Regulations therefore avoiding any potential issues with pyrite in aggregates.

The site is identified as being located within a High Radon Area. The design and specification for all hangers will be in accordance with current Building Regulations and therefore any potential issues associated with radon will be addressed and avoided. Therefore, the potential risks associated with radon at the site is considered 'neutral' 'imperceptible' and 'permanent'.

9.6.2 Operational Phase

During the Operational Phase of the Proposed Development there is limited to no potential for any direct effect on the receiving land, soil and geology environment at the Proposed Development Site taking account of the operational design for the Proposed Development.

With the exception of rainfall on undeveloped grassland areas of the site, there will be no discharges to ground during the Operational Phase of the Proposed Development.

The potential accidental release of hazardous materials, including fuels, oils, or chemicals used on-site, could effect the receiving land, soil, and geological environment. Such an event would likely occur only through the failure of secondary containment or a major incident. In such a case, the effect could be 'negative', 'moderate to significant', and 'long-term'. However, considering the operational design and the Environmental Management System (EMS) that will be implemented for the proposed anaerobic digester facility, which includes measures to effectively manage and mitigate such incidents, this scenario is deemed unlikely. The EMS will ensure that all necessary precautions and response strategies are in place to prevent environmental harm, thereby significantly reducing the likelihood of such an occurrence.

At full capacity, the Proposed Development will also produce digestate (liquid and fibre) for off-site transportation as bio-based fertiliser to local receivers. The land spreading and management of digestate will be carried out by the receiver in compliance with the European Union (Good Agricultural Practice for Protection of Waters) Regulations 2017. The use of digestate will have a positive effect on the receiving lands given the improved recycling of nutrients and reduction of organic pollution / microbial contamination associated with untreated organic waste sources. Therefore, it is considered that there will be an overall 'positive', 'slight to moderate' and 'long term' indirect effect on the receiving soil quality.

No public health issues associated with the land, soil, geology conditions at the site have been identified for the Operational Phase of the Proposed Development. Human health is assessed in **Chapter 4** of this volume.

9.6.3 Potential Cumulative Effects Assessment

The consideration of potential cumulative effects is an important stage in the EIA process. Although the Proposed Development may not result in significant residual effects in isolation, when the Proposed Development is considered cumulatively with other projects, significant residual effects may occur. The potential cumulative effects to land, soil and geology have been assessed as per the methodology detailed in **Chapter 21** of this volume.

Stage 1: Cumulative Effects Assessment (CEA) Long List

A long list of "other existing and/or approved projects" deemed potentially relevant to the Proposed Development is presented in **Chapter 3** and **Chapter 21** of this volume. This has taken into account any existing environmental issues relating to areas of particular importance likely to be affected or the use of natural resources.

Stage 2: Screening of the Long List of 'Other Projects'

A screening exercise of the long list of "other existing and/or approved projects" was carried out in order to determine whether any projects have the potential to give rise to likely direct or indirect significant cumulative effects with the Proposed Development from a land, soil and geology perspective.

Stage 3: CEA

Following Stage 2, those projects which were "screened in" have been carried forward for assessment. The results of the Stage 3 CEA are presented below.

9.6.3.1 Screening

During the operational phase of the Proposed Development, no significant cumulative effects on land, soils, and geology are anticipated. However, during the construction phase of the Proposed Development, while there is no requirement to remove excavated soils from the site, where potentially unsuitable material is identified through engineering and environmental assessment, it could potentially be directed to the same receiving waste facilities for recovery or disposal as excavated materials from other developments. Furthermore, the importation of aggregates to the Proposed Development may be sourced from the same borrow site as other permitted developments. Therefore, there may be potential cumulative effects on land, soils, and geology due to the combined effect of waste management activities and material importation from this and other nearby developments.

All projects included in the long list of "other existing and/or approved projects", including the permitted but not yet constructed Biorefinery proposed by Glanbia (now Tírlán) at the former Lisheen Mine site, have been screened in for further assessment to evaluate their cumulative effects comprehensively.

9.6.3.2 Cumulative Effects Assessment

Table 9-5 below presents the results of the CEA in respect of land, soil and geology. The project numbers mentioned in the table below correspond to the projects listed in **Chapter 21** of this volume, which is the long list of "other existing and/or approved projects".

Environmental Factor	"Screened-in" Projects	Significance of Effects
Excavation and Removal of Soil and Subsoil	All Projects 1 through 24	All surplus soils and subsoils from the site will be removed offsite in accordance with all statutory legislation. Accordingly, it is considered that any cumulative effect on lands, soils and geology associated with the Proposed Development will be 'neutral', 'imperceptible' and 'permanent'.
Import of Aggregates and Materials	All Projects 1 through 24	Contract and procurement procedures will ensure that all aggregates and fill material originating from quarry sources that will be required for construction are sourced from reputable authorised suppliers operating in a sustainable manner and in accordance with the necessary statutory consents. Therefore, regardless of the number of other projects and developments using aggregates from the same source sites, there will be an 'indirect', 'neutral', 'imperceptible' and 'permanent' effect on the geological environmental at the source site.

Table 9-5. Cumulative Effects Assessment

There are no other cumulative effects associated with land, soil and geology associated with the construction phase and operational phase of the Proposed Development.

9.6.3.3 Mitigation Measures

During the construction phase and operational phase of the Proposed Development there is no identified potential for any cumulative effect on the receiving land, soil and geology environment and therefore there is no mitigation required in regard to the Proposed Development.

9.6.3.4 Overall Cumulative Residual Effects

Residual effects were not identified as a result of the waste management activities and material importation from the Proposed Development and other nearby developments.

9.6.4 "Do Nothing" Effect

The 'Do Nothing' scenario assesses the potential effect on the receiving land, soils, and geological environment if the Proposed Development did not proceed.

It is considered that there would be no change or resulting effect on the nature of the site with respect to land, soil and geology at the site which would remain as undeveloped brownfield land. The site of the Proposed Development is supported in principle by the land use zoning objective for industrial land use of the Tipperary County Development Plan 2022 – 2028. As such, it is reasonable to assume another similar development proposed for the lands could be brought forward for the site. This would require a separate assessment or EIAR applicable to the relevant scheme design.

9.7 Avoidance, Remedial and Mitigation Measures

The mitigation measures as outlined below, will ensure that there will be no significant effect on the receiving land, soil and geology.

9.7.1 Construction Phase

During the Construction Phase, all works will be undertaken in accordance with the Construction Management Plan (CMP) (DOBA, 2024). Following appointment, the contractor will be required to further develop the CMP to provide detailed construction phasing and methods to manage and prevent any potential emissions to ground and surface water with regard to the relevant industry standards (e.g., C532 Control of Water Pollution from Construction Sites, C692 Environmental Good Practice on Site, ICE Earthworks and TII Specification for Road Works Series 600 - Earthworks).

The CMP identifies the minimum requirements with regard to the appropriate mitigation, monitoring, inspection and reporting mechanisms that need to be implemented throughout construction. Compliance with the CMP does not absolve the appointed contractor or its sub-contractors from compliance with all legislation and bylaws relating to their construction activities. The CMP will be implemented for the duration of the construction phase, covering construction and waste management activities that will take place during the construction phase of the Proposed Development.

9.7.1.1 Import of Aggregates and Materials

Contract and procurement procedures will ensure that all imported aggregates and materials required for the construction phase of the Proposed Development will be sourced from reputable suppliers operating in a sustainable manner and in accordance with industry conformity/compliance standards and statutory obligations. The importation of aggregates and materials will be subject to management and control procedures which will

include testing for contaminants, invasive species and other anthropogenic inclusions and assessment of the suitability for use in accordance with engineering and environmental specifications for the Proposed Development. Therefore, any unsuitable material will be identified prior to unloading / placement onsite.

9.7.1.2 Airborne Dust

Excavated soils will be carefully managed and maintained in order to minimise potential effect on soil quality and soil structure. Handling of soils will be undertaken in accordance with the documented procedures outlined in the CMP (DOBA, 2024) in order to protect ground and minimise airborne dust. The measures required to prevent airborne dust emissions and associated nuisance arising from site work will be in place including measures to prevent uncovered soil drying out leading to wind pick up of dust and mud being spread onto the local road network and adjoining properties. This may require additional wetting at the point of dust release, dampening down during dry weather and wheel cleaning for any vehicles leaving the site. Potential effects and avoidance and mitigation measures associated with generation of dust are addressed in **Chapter 8** of this volume.

9.7.1.3 Reuse of Soil

Soil and subsoil materials to be reused within the Proposed Development (i.e., for landscaping on site) will be subject assessment of the suitability of for use in accordance with engineering and environmental specification for the Proposed Development.

9.7.1.4 Soil Structure

The extent of the required work area and the bulk excavation at the site will be minimised where appropriate to prevent unnecessary excavation of soil and tracking over soil and subsoil outside of the excavation work areas as a result of compaction and rutting from construction traffic.

Dedicated internal haul routes will be established and maintained by the contractor to prevent tracking over unprotected soils. The following criteria for the siting of haul routes must be adhered to:

- The length of haul routes on the site shall be minimised.
- The contour of the natural ground shall be followed as much as possible.
- The slope of haul routes shall not exceed 15%.
- Haul routes shall be constructed using permeable material, laid on geotextile.
- Trenchless gravel banks shall be used to filter runoff, and where possible existing vegetation along the perimeter of the haul routes shall be retained to provide an effective buffer against sediment leaving the area.
- Haul routes shall be at least 10m from a watercourse and shall be isolated from any watercourses with silt fencing.

- Exclusion zones will be established where soft landscaping is proposed in particular along site boundaries which are outside of the excavation areas to ensure soil structure is maintained

9.7.1.4 Export of Resource (Soil ad Subsoil) and Waste

As mentioned above, it is intended to retain all excavated soil onsite and incorporate it into the landscape design for the Proposed Development. However, where required, surplus materials or materials not suitable for reuse will require removal offsite in accordance with the procedures outlined in the CMP (DOBA, 2024) and all statutory legislation. It will be the contractor's responsibility to either; obtain a waste collection permit or, to engage specialist waste service contractors who will possess the requisite authorisations, for the collection and movement of waste off-site.

The re-use of soil and subsoil offsite will be undertaken in accordance with all statutory requirements and obligations including where appropriate re-use as by-product in accordance with Article 27 of the European Communities (Waste Directive) Regulations 2011 (SI No. 126 of 2011) as amended.

Any surplus material not suitable for re-use as a by-product and other waste materials arising from the construction phase will be removed offsite by an authorised contractor and sent to the appropriately authorised (licensed/permitted) receiving waste facilities. As only authorised facilities will be used, the potential effects at any authorised receiving facility sites will have been adequately assessed and mitigated as part of the statutory consent procedures.

Any waste soils will be transported under a valid waste collection permit issued under the Waste Management (Collection Permit) Regulations 2007, as amended and will be delivered to an appropriately authorised waste management facility.

Materials and waste will be documented prior to leaving the site. All information will be entered into a waste management register kept on the site.

Vehicles transporting material with potential for dust emissions to an off-site location shall be enclosed or covered with a tarpaulin at all times to restrict the escape of dust.

Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary. The main contractor will carry out road sweeping operations, employing a suction sweeper or similar appropriate method, to remove any project related dirt and/or material deposited on the road by construction/ delivery vehicles. Vehicles exiting the site shall make use of a wheel wash facility where appropriate, prior to entering onto public roads.

9.7.1.5 Management and Control of Stockpiles

Segregation and storage of soils for re-use on-site or removal off-site and waste for disposal off-site will be segregated and temporarily stored on-site pending removal or for reuse on-site.

Where possible, stockpiling of soils and subsoils onsite will be avoided. However, in the event that stockpiling is required, as documented in the CMP (DOBA, 2024), materials to be stored onsite (pending reuse onsite) will be stored in a safe manner and will minimise the risk of any negative environmental effects and will be managed on a 'just-in-time' basis. Stockpiled materials, pending reuse or removal offsite will be managed as follows:

- A suitable temporary storage area shall be identified and designated.
- All stockpiles shall be assigned a stockpile number.
- Material identified for reuse on site, off site and waste materials will be individually segregated and all segregation, storage and stockpiling locations will be clearly delineated on the site drawings.
- Soil stockpiles will be covered to prevent run-off from the stockpiled material generation and/or the generation of dust.
- Where required, silt fencing / bunding will be installed around the stockpile to ensure no soils and sediments are washed out overland to the existing surface water networks, or directly into the Cooleney Stream located approximately 0.02km south of the site. The silt fencing / bunding will be monitored daily by the appointed contractor and silt will be removed as required.
- Material identified for reuse on site, off site and waste materials will be individually segregated.
- Any waste that will be temporarily stored / stockpiled will be stored on impermeable surface high-grade polythene sheeting, hardstand areas or skips to prevent cross-contamination of the soil below or cross contamination with soil.
- Regular watering will take place to ensure the moisture content is high enough to increase the stability of the soil and thus suppress dust.
- In accordance with Inland Fisheries Ireland guidelines, stockpiles will not be allowed within 30m of the open watercourses or drainage.

Any waste generated from construction activities, including concrete, asphalt and soil stockpiles, will be managed in accordance with the procedures outlined in the CMP (DOBA, 2024) and will be stored onsite in such a manner as to:

- Prevent environmental pollution (bunded and/or covered storage, minimise noise generation and implement dust/odour control measures, as may be required).
- Maximise waste segregation to minimise potential cross contamination of waste streams and facilitate subsequent re-use, recycling and recovery.
- Prevent hazards to Site workers and the general public during Construction Phase (largely noise, vibration and dust.

9.7.1.6 Concrete Works

The cementitious grout and other concrete works during the Construction Phase, will avoid any contamination of ground through the use of appropriate design and methods implemented by the Contractor and in accordance with the CMP (Enviroguide Consulting, 2024a) and relevant industry standards.

Pre-cast concrete will be used where technically feasible to meet the design requirements for the Proposed Development. Where cast-in-place concrete is required (i.e., building foundations), all work must be carried out in dry conditions and be effectively isolated from any groundwater.

All ready-mixed concrete will be delivered to the Site by truck. Concrete batching will take place offsite, wash down and wash out of concrete trucks will take place into a container located within a controlled bunded area which will then be emptied into a skip for appropriate compliant removal offsite in accordance with all relevant waste management legislation. Any excess concrete is not to be disposed of onsite.

A suitable risk assessment for wet concreting shall be completed prior to works being carried out. Pumped concrete will be monitored to ensure there is no accidental.

9.7.1.7 Handling of Fuels, Chemicals and Materials

The Contractor's construction compound will be located on site for the duration of the project and shall primarily consist of site offices & associated welfare facilities, car parking facilities, materials drop-off and storage areas and set down areas for HGVs.

Fuel will be transported to the site in dedicated mobile units based on supply requirements. Fuelling and lubrication of equipment will be conducted in accordance with the procedures outlined in the CMP (DOBA, 2024), within a designated area of the compound, clearly marked and situated away from any watercourses and drains. A dedicated fuel filling point will be established onsite within the compound, where all equipment will be brought for refuelling.

Fuel storage areas and refuelling points will be bunded and located away from surface water drainage and features. The bunds will comply with the Environmental Protection Agency guidelines 'Amendment to IPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities' (EPA, 2013). All tank and drum storage areas will be bunded to a volume not less than the greater of the following:

- 110% of the capacity of the largest tank or drum within the bunded area; or
- 25% of the total volume of substance that could be stored within the bunded area.

As documented in the CMP, the appointed contractor will maintain an emergency response action plan and emergency procedures will be developed by the appointed contractor in advance of any works commencing. Construction staff will be familiar with the emergency response plan.

Strict supervision of contractors will be adhered to in order to ensure that all plant and equipment utilised on-site is in good working condition. Any equipment not meeting the required standard will not be permitted for use within the Proposed Development Site. Only emergency breakdown maintenance will be carried out on-site. Drip trays and spill kits will be available on-site to ensure that any spills from vehicles are contained and removed off-site.

Spill kits will be made available onsite and identified with signage for use in the event of an environmental spill or leak. A spill kit will be kept in close proximity to the fuel storage area for use in the event of any incident during refuelling or maintenance works. Heavy machinery used on the Site will also be equipped with its own spill kit.

There may also be the requirement for use of portable generators or similar fuel containing equipment during the construction phase of the Proposed Development, which will be placed on suitable drip trays. Regular monitoring of drip tray content will be undertaken to ensure sufficient capacity is maintained at all times

As documented in the CMP (DOBA, 2024), good housekeeping (e.g., site clean-ups, use of disposal bins, etc.) will be implemented on the site.

9.7.1.8 Emergency Procedures

As documented in the CMP, in advance of works commencing the emergency response action plan will be developed by the appointed contractor in accordance with the site emergency plan which will cover all foreseeable risks (i.e., fire, spill, flood, etc.). Appropriate site personnel will be trained as first aiders and fire marshals and be trained in environmental issues and spill response procedures. Spillage kits will be available on-site including in vehicles operating onsite. Construction staff will be familiar with emergency procedures in the event of accidental fuel spillages. Remedial action will be immediately implemented to address any potential effects in accordance with industry standards and legislative requirements.

- Any required emergency vehicle or equipment maintenance work will take place in a designated impermeable area within the site.
- Emergency response procedures will be put in place, in the unlikely event of spillages of fuels or lubricants. Such procedures will include:
  - Containment measures.
  - Emergency discharge routes.
  - List of appropriate equipment and clean-up materials.
  - Maintenance schedule for equipment.
  - Details of trained staff, location, and provision for 24-hour cover.
  - Details of staff responsibilities.
  - Notification procedures to inform the EPA or Environmental Department of Tipperary County Council.
  - Audit and review schedule.
  - Telephone numbers of statutory water consultees.
  - List of specialist pollution clean-up companies and their telephone numbers.

- Spill kits including oil absorbent material will be provided so that any spillage of fuels, lubricants or hydraulic oils will be immediately contained.
- In the event of a leak or spill from equipment in the instance of a mechanical breakdown during operation, any contaminated soil will be removed from the site and compliantly disposed of off-site. Residual soil will be tested to validate that all potentially contaminated material has been removed. This procedure will be undertaken in accordance with industry best practice procedures and standards.
- All construction works staff will be familiar with emergency procedures in the event of accidental fuel spillages.
- All construction works staff on-site will be fully trained on the use of equipment.

These procedures will be undertaken in accordance with industry best practice procedures and standards. These measures will ensure that there is minimal risk to the receiving land, soil and geological environment associated with the construction phase of the Proposed Development.

9.7.1.9 Welfare Facilities

Welfare facilities have the potential, if not managed appropriately, to release organic and other contaminants to ground or surface water courses. Foul drainage from temporary welfare facilities during the construction phase of the Proposed Development will be discharged to temporary holding tank(s) the contents of which will periodically be tankered off site to a licensed facility. All waste from welfare facilities will be managed in accordance with the relevant statutory obligations by tankering of waste offsite by an appropriately authorised contractor.

Any connection to the public foul drainage network during the construction phase of the Proposed Development will be undertaken in accordance with the necessary temporary discharge licences issued by UE.

9.7.2 Operational Phase

During the operational phase of the Proposed Development there is limited to no potential for any effect on the receiving land, soil and geology environment and therefore there is no mitigation required in regard to the Proposed Development.

The procedures set out in the EMS and conditions of the IE Licence will be strictly adhered to for the duration of the operational phase of the Proposed Development.

Accident prevention and emergency response procedures developed in accordance with the conditions of the IE Licence and outlined in the EMS, will be strictly implemented during the operational phase of the Proposed Development and spillage kits will be available on-site including in vehicles operating on-site. All staff will be familiar with emergency procedures for in the event of accidental fuel spillages.

9.8 “Worst Case” Scenario

The potential accidental release of hazardous materials, including fuels and waste materials used on-site, could effect the receiving land, soil, and geology environment. Such an event would only occur through the failure of secondary containment or a major incident on the Site. However, this worst-case scenario is considered unlikely due to the emergency procedures developed for the existing facility in accordance with the conditions of the IE Licence and outlined in the EMS, as well as the embedded design avoidance measures and mitigation measures for the Proposed Development. Additionally, during the construction phase, strict adherence to CMP will be enforced to prevent any accidental releases, further minimising potential risks.

9.9 Residual Effects

Residual Effects are defined as ‘effects that are predicted to remain after all assessment and mitigation measures. They are the remaining ‘environmental costs’ of a project and are the final or intended effects of a development after mitigation measures have been applied to avoid or reduce adverse effects.

The predicted effects of the construction phase and operational phase of the Proposed Development are described in **Table 9-6** in terms of quality, significance, extent, likelihood, and duration. The relevant mitigation measures are detailed, and the residual effects are determined which take account of the avoidance, remedial and mitigation measures.

Overall, there is no significant residual effects on land, soils and geology anticipated regarding this Proposed Development.

Activity	Attribute	Predicted Effect	Quality	Significance	Duration	Type	Mitigation	Residual Effect
Construction Phase								
Construction of the Proposed Development	Land Take and Land Use	The Proposed Development will require land take of approximately 5.5 hectares and will change from undeveloped brownfield lands to industrial land use.	Negative	Moderate	Permanent	Direct	Unavoidable and no mitigation. The Proposed Development aligns with the climate actions of the Decarbonising Zone as outlined in Tipperary County Council's Climate Action Plan and the goals and objectives of the Tipperary County Development Plan 2022-2028.	Moderate
Use of Cementitious Materials	Soils and Subsoils	Potential release of cementitious material during construction works for foundations, pavements and infrastructure to the land, soil, and geological environment.	Negative	Moderate	Long Term	Direct	Where cast-in-place concrete is required, all work will be carried out to avoid any contamination of the receiving land, soil and geological environment through the use of appropriate design and methods implemented by the appointed Contractor and in accordance with the CMP and relevant industry standards.	Imperceptible
Accidental Release of Deleterious Materials (e.g., Fuels or Other Hazardous Materials Being Used Onsite).	Soils, Subsoils and Bedrock	Potential (albeit low) for uncontrolled release of deleterious materials including fuels and other materials being used onsite, through the failure of secondary and tertiary	Negative	Moderate to Significant	Long Term	Direct / Worst Case	Refuelling of plant and storage of any deleterious materials including fuels will be undertaken in accordance with the requirements and procedures outlined in the CMP.	Imperceptible

Activity	Attribute	Predicted Effect	Quality	Significance	Duration	Type	Mitigation	Residual Effect
		containment or a materials handling accident, to the land, soil, and geological environment.						
Operational Phase								
Accidental Release of Deleterious Materials (e.g., Fuels or Other Hazardous Materials Being Used Onsite).	Soils, Subsoils and Bedrock	Potential (albeit low) for uncontrolled release of deleterious materials including fuels and other materials being used onsite, through the failure of secondary and tertiary containment or a materials handling accident, to the land, soil, and geological environment.	Negative	Moderate to Significant	Long Term	Direct / Worst Case	The EMS will ensure that all necessary precautions and response strategies are in place to prevent environmental harm, thereby significantly reducing the likelihood of such an occurrence	Imperceptible
Land Spreading of Digestate (Liquid and Fibre) on Offsite Lands	Soil Quality	The use of digestate will have a positive effect on the receiving lands given the improved recycling of nutrients and reduction of organic pollution / microbial contamination associated with untreated organic waste sources.	Positive	Slight to Moderate	Long Term	Indirect	None Required. The land spreading and management of digestate will be carried out by the receiver in compliance with the European Union (Good Agricultural Practice for Protection of Waters) Regulations 2017.	Positive

Table 9-6. Residual Effects

9.10 Monitoring

9.10.1 Construction Phase

During the construction phase the following monitoring measures will be considered:

- Routine monitoring and inspections during refuelling, concrete works to ensure no effects and compliance with avoidance, remedial and mitigation measures.
- Inspections and monitoring will be undertaken during excavations and other groundworks to ensure that measure that are protective of water quality are fully implemented and effective.
- Materials management and waste audits will be carried out at regular intervals to monitor the following:
  - Management of soils on-site and for removal offsite.
  - Record keeping.
  - Traceability of all materials, surplus soil and other waste removed from the site.
  - Ensure records are maintained of material acceptance at the end destination.

9.10.2 Operational Phase

The Proposed Development will be subject to an IE Licence from the EPA. The operator will comply with any monitoring requirements as per the conditions of the IE Licence.

There are no additional monitoring requirements specifically in relation to land, soil and geology during the operational phase of the Proposed Development.

9.11 Interactions

9.11.1 Population and Human Health

An assessment of the potential effect of the Proposed Development on human health is included in **Chapter 7** of this volume.

There is a potential risk of dust generated from excavation and stockpiling of soil during the construction phase of the Proposed Development posing a human health risk in the absence of standard avoidance and mitigation measures which will be implemented to be protective of human health. Appropriate industry standard and health and safety legislative requirements will be implemented during the construction phase of the Proposed Development that will be protective of site workers.

The geophysical survey undertaken for the site (Minerex, 2024) indicated the potential presence of karstified rock. In karst-prone areas, alterations in groundwater flow, exacerbated by additional water such as rainfall infiltration, can lead to increased rock erosion and the formation of voids. The design and specification for all buildings will

be in accordance with current Building Regulations and therefore avoiding any potential risks associated with karst features.

9.11.2 Biodiversity

An assessment of the potential effects of the Proposed Development on the Biodiversity of the site, with emphasis on habitats, flora and fauna which may be effected a result of the excavation and importation of materials to the site are included in **Chapter 8** of this volume. It also provides an assessment of the effects of the Proposed Development on habitats and species, particularly those protected by national and international legislation or considered to be of particular conservation importance and proposes measures for the mitigation of these effects.

9.11.3 Hydrology and Hydrogeology

An assessment of the potential effect of the Proposed Development on the hydrological and hydrogeological environment is included in **Chapter 10** of this volume. In the absence of avoidance, remedial, and mitigation measures, construction activities may potentially create pathways for potential sources of contamination to enter underlying groundwater. The intrusive site investigation (IGSL, 2024) and the geophysical survey (Minerex, 2024) undertaken for the site confirmed the presence of karstified. During the construction phase of the Proposed Development, groundwater vulnerability is expected to temporarily increase. In karstified limestone areas there is a high degree of interconnection between groundwater and surface water. This close interaction is reflected in their linked water quality, meaning any contamination of surface water can rapidly affect groundwater, and vice versa. Construction activities will involve the use of potentially hazardous materials such as cementitious materials, fuels, oils, and other substances. An uncontrolled release of these materials, whether through containment failure or handling accidents, could effect the surrounding environment. Furthermore, it is noted that groundwater storage in karstified bedrock is low, limiting the potential for contaminant attenuation in such aquifers. Procedures for the protection of the receiving water environment are set out in **Chapter 10** of this volume.

9.11.4 Air Quality (including Odour)

The excavation of soils across the Site and the temporary stockpiling of soils pending reuse or removal offsite has the potential to generate nuisance effects (i.e., dust) during the Construction Phase of the Proposed Development.

The use of digestate will have a positive effect of on the receiving lands given the improved recycling of nutrients and reduction of organic pollution / microbial contamination associated with untreated organic waste sources. Compared to other organic waste management practices, such as composting or direct land application of raw manure, digestate significantly reduces odour emissions. Composting can generate odours from volatile organic

compounds (VOCs) and ammonia if not properly managed. Direct land application of raw manure can also lead to strong odours and potential environmental pollution. By stabilising organic waste and reducing pathogens, digestate not only minimises odour but it also enhances the nutrient profile of the digestate.

An assessment of the potential effect of the Proposed Development on air quality (including odours) is included in **Chapter 11** of this volume.

9.11.5 Landscape and Visual

During the construction phase and into the operational phase of the Proposed Development, the site landscape will undergo a change from undeveloped brownfield lands to industrial with associated landscaping. An assessment of the potential effect of the Proposed Development on the receiving landscape is included in in **Chapter 18** of this volume.

9.11.6 Traffic, Transport and Waste

It is intended to retain and re-use the excavated soil and subsoil on the site for engineering fill and landscaping. However, where required, unsuitable material will require removal offsite. There is also a requirement to import aggregates during the construction phase of the Proposed Development. An assessment of the potential effect of the Proposed Development on Traffic and Transport and Material Assets (Waste) are included in **Chapter 14** and **Chapter 15** of this volume respectively.

9.12 Difficulties Encountered When Compiling

No difficulties were encountered in the preparation of this Chapter of the EIAR.

9.13 References

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