



Chapter 5 – Land, Soils and Geology

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5. LAND, SOILS AND GEOLOGY

5.1 Introduction

This chapter of the EIAR evaluates the likely significant effects, if any, which the Proposed Development will have on Land, Soils and Geology. This chapter contains necessary information as defined in the Environmental Protection Agency (EPA) Guidelines on the Information to be contained in Environmental Impact Assessment Reports' (EPA, 2022). Reference is made to hydrogeology, but this aspect is covered in more detail in Chapter 6 (Hydrology and Hydrogeology).

The Proposed Development comprises the construction, commissioning, and operation of the c. 23.65-kilometre (km) GNI 143 Ballykilleen Pipeline and all ancillary and associated temporary works. The proposed GNI 143 Ballykilleen Pipeline is designed to connect the existing BGE77 pipeline (also known as Pipeline to the West (PTTW)) to the Edenderry Renewable Energy Complex.

The chapter initially provides a description of the receiving environment of the site and the potential impacts of the development. When assessing the potential impacts, this assessment considers the significance of the environmental attributes, and the predicted scale, and duration of the likely effects.

The chapter also outlines the proposed mitigation measures that will reduce or eliminate the identified potential impacts and define the residual effects of the proposed overall development (the effect after the implementation of mitigation measures).

This chapter is supported by figures contained in Volume 4 of this EIAR. While selected figures may be reproduced within the chapter for ease of reference, the full size and quality of those figures are provided in Volume 4. Annotated mark ups, diagrams and photographic records are excluded, as these are provided for illustrative or contextual purposes only and are not replicated at full presentation quality.

The relevant Volume 4 figures to this chapter include:

- ▶ Teagasc Soils.
- ▶ Compound Teagasc Soils
- ▶ Quaternary Geology.
- ▶ Compound Quaternary Geology
- ▶ Bedrock Geology.
- ▶ Compound Bedrock Geology
- ▶ Groundwater Vulnerability.
- ▶ Compound Groundwater vulnerability
- ▶ Landslide Susceptibility.
- ▶ Compound landslide Susceptibility

5.2 Methodology

5.2.1 Legislation and Guidance

The baseline study and impact assessment have will be out in accordance with the following key guidance and established best practice:

- ▶ Environmental Protection Agency (EPA) Advice notes on current practice in the preparation of Environmental Impact Statement (EPA, 2003) and Guidelines on the Information to be contained in Environmental Impact Statements (EPA, 2022a).
- ▶ TII/National Roads Authority Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (TII/formerly NRA, 2009).
- ▶ Transport Infrastructure Ireland - Road Drainage and Water Environment (TII, 2015).

- ▶ Institute of Geologists Ireland (IGI) -Geology in Environmental Impact Statements, a guide (IGI, 2002) and Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI, 2013).
- ▶ The Planning System and Flood Risk Management, Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW)).

Land soil and geology resource management in Ireland is dealt with in the following key pieces of legislation and guidelines:

- ▶ Institute of Geologists Ireland (IGI) -Geology in Environmental Impact Statements, a guide (IGI, 2002) and Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI, 2013).
- ▶ Waste Management Acts 1996 as amended.
- ▶ Environment Agency (EA), Land contamination: risk assessment (EA 2020).
- ▶ BS 10175:2011 + A2:2017 Investigation of potentially contaminated sites. Code of practice (British Standards Institute 2017).
- ▶ CIRIA C552 Contaminated Land Risk Assessment: A Guide to Good Practice (CIRIA 2001).
- ▶ TII/National Roads Authority Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (TII/formerly NRA, 2009).
- ▶ Transport Infrastructure Ireland, The Management of Waste from National Road Construction Projects (TII 2017).
- ▶ Environmental Protection Agency, Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (EPA 2013).
- ▶ Local Authority planning guidance as applicable.
- ▶ Consolidated EIA Directive 2011/92/EU and 2014/52/EU.

5.2.2 Assessment Methodology

This chapter presents the Environmental Impact Assessment (EIA) of the Proposed Development in relation to land soils and geology, undertaken in accordance with the Environmental Protection Agency (EPA) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (2022). The methodology applied is consistent with the overarching EIA framework described in Chapter 1 of this EIAR.

The assessment addresses the construction and operational phases of the Proposed Development and, where relevant, considers the potential for direct, indirect and residual effects on the receiving environment.

The impact assessment methodology applied within this chapter comprises the following stages:

5.2.2.1 Characterisation of Receiving Environment

The receiving environment is described in Section 5.3 of this chapter based on desk-based review, site investigations and monitoring and relevant published datasets as described in Section 5.2.5.

The receiving environment has been established for land, soils and geology to identify sensitive environmental receptors within the study area.

5.2.2.1.1 Sources of Information

In line with the above guidance, the assessment considers the existing land soil and geological regime in the vicinity of the Proposed Development. The data sources to aid in assessing the existing baseline environment are as follows:

- ▶ An Foras Talúntais (1980) General Soil Map of Ireland (An Foras Talúntais 1980);

- ▶ Teagasc Irish Soil Information System online map (Teagasc);
- ▶ Historic Mine Sites – Inventory and Risk Classification (EPA and Geological Survey Ireland (GSI));
- ▶ GSI online geology viewer (GSI);
- ▶ 1:500,000 scale – Quaternary Geological Map of Ireland (GSI);
- ▶ 1:1,000,000 scale – Bedrock Geology of Ireland (GSI);
- ▶ Topographic-map.com online viewer (topographic-map);
- ▶ GeoHive, Ordnance Survey Ireland online spatial data viewer (OSI);
- ▶ Current and historical mapping;
- ▶ EPA Interactive Map (EPA 2025); and
- ▶ NPWS Interactive Map (NPWS 2025).

Site specific data was also derived from the following sources:

- ▶ Gas to Bord na Mona, Edenderry Construction Methodology. Fingleton White (2025).
- ▶ Site Investigation- Gas to Bord na Mona, Edenderry Phase 1 GI – Geotechnical Interpretative Report (IGSL Ltd, 2025);
- ▶ Construction Environmental Management Plan. Gas to Bord na Mona, Edenderry. AWN Consulting (2025);
- ▶ Site development plans and drawings submitted with the planning application pack.
- ▶ Consultation with project engineers and design team.

This Chapter will assess the potential effects of the Proposed Development on the following topics:

- ▶ Soils and superficial geology;
- ▶ Bedrock geology;
- ▶ Karst Landforms;
- ▶ Landslide Susceptibility;
- ▶ Current and historic mining sites;
- ▶ Irish Geological Heritage Sites; and
- ▶ Contaminated land.

5.2.2.2 Study Area

The study area for this assessment is a buffer distance of 250m from the centre line of the Proposed Scheme (i.e. overall width of 500m) (hereafter referred to as 'study area') as per relevant guidelines (Estimation of Importance of Geological Attributes, TII, 2009). This method involves evaluating the quality, significance, or value of soils and geological attributes on a regional, national, or local scale. However, professional judgement has also been applied to this assessment during the evaluation of potential risks posed to the receiving land, soils and geological environment. Accordingly, where relevant, search criteria have been applied beyond the stated buffer distance.

5.2.2.3 Criteria for Rating of Effects

The assessment follows the procedures set out in the Institute of Geologists of Ireland (IGI) Guidelines for the preparation of Soils Geology and Hydrogeology Chapters of Environmental Impact Statements (2013) and other relevant guidelines set out below in Section 5.2.3 to assess and evaluates land, soils and geology within the context of the Proposed Development. This assessment includes a review of the existing environment, the potential impacts of the Proposed Development, mitigation measures, and the potential impacts.

In the EIA assessment, consideration is given to both the importance of an attribute and the magnitude of the potential environmental impacts of the proposed activities on that attribute.

The Transport Infrastructure Ireland (TII, 2009/ formerly National Roads Authority) guidance criteria referenced in Section 5.2.3 is used for estimating the importance of the soil, geology and hydrogeological attribute (Table 1 in Appendix 5.1).

The magnitude of the potential environmental impacts effects on the land, soil, geological and hydrogeological environment is based on the TII matrix presented in Table 2 in Appendix 5.1 and the quality, significance and duration of potential impacts are described in this chapter in accordance with the criteria provided in the Chapter 1 (Introduction).

In assessing likely potential and predicted impacts, account has been taken of both the importance of the attributes and the predicted scale and duration of the likely impacts. Where an impact is identified, planned mitigation measures are identified and assessed.

The principal attributes (and impacts) to be assessed include the following:

- ▶ Geological heritage sites in the vicinity of the perimeter of the subject site.
- ▶ Landfills, industrial sites in the vicinity of the site and the potential risk of encountering contaminated ground.
- ▶ The quality, drainage characteristics and range of agricultural uses of soil around the site.
- ▶ Quarries or mines in the vicinity, the potential implications (if any) for existing activities and extractable reserves.
- ▶ The extent of topsoil and subsoil cover and the potential use of this material on site as well as the requirement to remove it off-site as waste for appropriate reuse, recovery, recycling or disposal.

5.2.2.4 Identification of Potential Impacts and Significance

The potential impacts arising from interactions between the Proposed Development are identified in Section 5.5 having regard to:

- ▶ the location, nature, scale and duration of the proposed works;
- ▶ the characteristics and sensitivity of identified receptors; and
- ▶ relevant guidance, standards and industry best practice (set out in Section 6.2.1).

The significance of each identified impact is evaluated using professional judgement, informed by the EPA Guidance (2022) descriptors defined in Table 1-5 of Chapter 1 of this EIAR.

5.2.2.5 Mitigation, Monitoring or Reinstatement Measures

Where potentially significant adverse effects are identified, mitigation measures are provided in Section 5.6 of this chapter to avoid or reduce those effects.

Monitoring or reinstatement measures are identified where relevant in Section 5.7 of this chapter

5.2.2.6 Residual Effect

Residual effects (the effects after the implementation of the mitigation measures) on hydrology and hydrogeology, are defined in Section 5.8 of this chapter.

The significance of each identified impact is evaluated using professional judgement, informed by the EPA Guidance (2022) descriptors defined in Table 1-5 of Chapter 1 of this EIAR.

5.2.3 Forecasting Methods and Difficulties Encountered

No difficulties were encountered in the development of this document.

5.3 Receiving Environment

5.3.1 Area of the Project

The Proposed Development site and associated temporary working areas (the “Proposed Development Site”) covers an area of approximately 243.4 hectares (ha) (the “Proposed Development Site”) and encompasses all lands required for the construction and operation of the pipeline, including the Kilwarden Offtake Installation, the Ballykilleen AGI, temporary construction compounds, line-pipe storage areas, and all associated ancillary works.

The Proposed Development Site comprises the c.23.65km linear route of the underground GNI 143 Ballykilleen Pipeline and its temporary working areas.

For the purpose of this EIAR chapter, the pipeline length has been subdivided into 6 sections, (refer to Table 5-1 below for the chainage and corresponding distances along the pipeline length). Refer to Volume 4 (Site Location Sheet 1-6) for the site location mapping which includes the chainage and respective sections 1-6 which correspond to Sheets 1-6.

In addition to the linear pipeline, the Proposed Development includes temporary construction infrastructure within the red line boundary, comprising five Temporary Construction Compounds, temporary laydown areas (Type A and Type B), construction access points, and a temporary construction haul road or ‘running track’ along the pipeline route. Temporary Construction Compounds 03 (near Edenderry town) and 04 (located in the townland of Esker More, Co. Offaly) are located off the linear route but within the red line boundary. All other temporary works, including access, haul roads, laydown areas, and temporary watercourse crossings, are located along the pipeline route.

Table 5-1 Structured Sections to describe the Proposed Development

Pipeline Section	Start Point (m)	End Point (m)	Length (m)
Pipeline Section 1: Kilwarden Offtake Installation to the L40181 Road (RDX05)	0	3,931	3,931
Pipeline Section 2: L40181 Road (RDX05) to the L4091 (RDX09)	3,931	7,441	3,510
Pipeline Section 3: L4091 Road (RDX09) to the Yellow River (RVX02)	7,441	11,669	4,228
Pipeline Section 4: Yellow River (RVX02) to the R441 (RDX12)	11,669	15,348	3,679
Pipeline Section 5: R441 (RDX12) to the L5003 (RDX15)	15,348	19,494	4,146
Pipeline Section 6: L5003 (RDX15) to the Ballykilleen AGI	19,494	23,650	4,156
GNI 143 Ballykilleen Pipeline	0	23,650	23,650

5.3.2 Land Use, Topography, and Site History

The wider area is characterised as predominantly rural and primarily associated with greenfield land with a predominant agricultural function.

The landscape within the Proposed Development Site is predominantly rural, comprising irregular agricultural fields used for grazing and cropping and bounded by traditional hedgerows characteristic of Counties Meath and Offaly. The lands are largely undeveloped, with no residential dwellings or permanent buildings located within site. Existing infrastructure intersected along the pipeline route includes regional and local roads, agricultural access tracks, drainage ditches, the M4 Motorway, and the Grand Canal.

Residential dwellings occur in the wider area but primarily as dispersed one-off houses along local roads, with no urban centres directly adjoining the site.

At the southern end of the route, the receiving environment transitions from agricultural to industrial lands associated with the Edenderry Renewable Energy Complex, an established energy-generation facility. The proposed Ballykilleen AGI is located within this industrial area. The nearest external industrial operation is Kilsaran Clonard Quarry, approximately 2.8 km east.

Temporary Construction Compound 03 and 04 include areas of existing hardcore or stone surfacing. As a result, a reduced level of site preparation and groundworks will be required at these locations compared to compounds established on undisturbed agricultural land.

5.3.3 Soil and Geology Baseline Features and Properties

For the purpose of this EIAR chapter, the pipeline length has been subdivided into 6 sections. Refer to Table 5-2 below for the baseline features in relation to land, soil and geology which exist along the proposed GNI143 Ballykilleen pipeline and its respective pipeline sections 1 to 6.

Table 5-2 Baseline Land, Soil and Geological Features within GNI143 Pipeline Sections

Pipeline Section	Receiving Environment
<p>Pipeline Section 1: Kilwarden Offtake Installation to the L40181 Road (RDX05)</p>	<p>Teagasc Soils: BminDW- Deep well drained mineral (mainly basic), BminPD- Mineral poorly drained (mainly basic), BminPDPT- Peaty poorly drained mineral (mainly basic), BminSP- Shallow poorly drained mineral (mainly basic), BminSRPT- Shallow, rocky, peaty/non-peaty mineral complexes (mainly basic), BminSW- Shallow well drained mineral (mainly basic), Cut- Cutover/cutaway peat. Refer to Volume 4 (Teagasc Soils Sheet 1 of 6) for the Teagasc Soils mapping for this section.</p> <p>Quaternary Sediments (Subsoils): 'Alluvium' associated with stream/rivers which traverse the pipeline route, 'Cut over raised peat', 'Lacustrine Sediments', 'Gravels derived from Limestones' and 'Till derived from Limestone'. Refer to Volume 4 (Quaternary Sediments Sheet 1 of 6) for the Quaternary Sediments (Subsoils) mapping for this section.</p> <p>Bedrock Geology: The Majority of this section is underlain by the 'Waulsortian Limestones Formation'. The northernmost portion of this section is overlying the 'Edenderry Oolite Member Formation', while the southernmost portion of this section is overlying the 'Lucan Formation'. Refer to Volume 4 (Bedrock Geology Sheet 1 of 6) for the Bedrock Geology mapping for this section.</p> <p>Aquifer / Groundwater Vulnerability: The predominant aquifer vulnerability classification for this section is 'Moderate', while some areas of the central and northern portion of this section have been classified as 'High' and 'Extreme' vulnerability, respectively. Refer to Chapter 6 (Hydrology & Hydrogeology) Section 6.3.8.1 for the indicative subsoil thickness based on the aquifer/groundwater vulnerability rating. Refer to Volume 4 (Aquifer/Groundwater Vulnerability Sheet 1 of 6) for the Aquifer Vulnerability mapping for this section.</p> <p>Landslide Susceptibility: The Landslide Susceptibility for this section ranges from 'Low to 'Inferred low' throughout this section. Refer to Volume 4 (Landslide Susceptibility Sheet 1 of 6) for the Landslide Susceptibility mapping for this section.</p>
<p>Pipeline Section 2: L40181 Road (RDX05) to the L4091 (RDX09)</p>	<p>Teagasc Soils: AlluvMIN- Alluvial (mineral), BminDW- Deep well drained mineral (mainly basic), BminPDPT- Peaty poorly drained mineral (mainly basic), BminSP- Shallow poorly drained mineral (mainly basic), BminSRPT- Shallow, rocky, peaty/non-peaty mineral complexes (mainly basic), BminSW- Shallow well drained mineral (mainly basic), Cut- Cutover/cutaway peat, Lac- Lacustrine type soils. Refer to Volume 4 (Teagasc Soils Sheet 2 of 6) for the Teagasc Soils mapping for this section.</p>

Pipeline Section	Receiving Environment
	<p>Quaternary Sediments (Subsoils)- <i>Primary:</i> 'Till derived from Limestone', <i>Secondary:</i> 'Lacustrine Sediments', 'Gravels derived from Limestones', 'Alluvium'. Refer to Volume 4 (Quaternary Sediments Sheet 2 of 6) for the Quaternary Sediments (Subsoils) mapping for this section.</p> <p>Bedrock Geology- The Majority of this section is underlain by the 'Lucan Formation'. The southernmost portion of this section is overlying 'Volcanics (in carboniferous)'. Refer to Volume 4 (Bedrock Geology Sheet 2 of 6) for the Bedrock Geology mapping for this section.</p> <p>Aquifer / Groundwater Vulnerability- The predominant aquifer vulnerability classification for this section is 'Moderate', while some localised areas of the northern and southern portion of this section have been classified as 'High' vulnerability. Refer to Chapter 6 (Hydrology & Hydrogeology) Section 6.3.8.1 for the indicative subsoil thickness based on the aquifer/groundwater vulnerability rating. Refer to Volume 4 (Aquifer/Groundwater Vulnerability Sheet 2 of 6) for the Aquifer Vulnerability mapping for this section.</p> <p>Landslide Susceptibility- The Landslide Susceptibility for this section ranges from 'Low' to 'Inferred low' throughout this section. Refer to Volume 4 (Landslide Susceptibility Sheet 2 of 6) for the Landslide Susceptibility mapping for this section.</p>
<p>Pipeline Section 3: L4091 Road (RDX09) to the Yellow River (RVX02)</p>	<p>Teagasc Soils: AlluvMIN- Alluvial (mineral), BminDW- Deep well drained mineral (mainly basic), BminPDPT- Peaty poorly drained mineral (mainly basic), BminSP- Shallow poorly drained mineral (mainly basic), BminSRPT- Shallow, rocky, peaty/non-peatymineral complexes (mainly basic), BminSW- Shallow well drained mineral (mainly basic), Cut-Cutover/cutaway peat, Lac- Lacustrine type soils. Refer to Volume 4 (Teagasc Soils Sheet 3 of 6) for the Teagasc Soils mapping for this section.</p> <p>Quaternary Sediments (Subsoils)- <i>Primary:</i> 'Till derived from Limestone' & 'Gravels derived from Limestones'. <i>Secondary:</i> 'Lacustrine Sediments', 'Alluvium'. Refer to Volume 4 (Quaternary Sediments Sheet 3 of 6) for the Quaternary Sediments (Subsoils) mapping for this section.</p> <p>Bedrock Geology- The Majority of this section is underlain by the 'Edenderry Oolite Member Formation'. The northernmost portion of this section is overlying the 'Lucan Formation' (and a very minor zone overlying Volcanics in carboniferous). Refer to Volume 4 (Bedrock Geology Sheet 3 of 6) for the Bedrock Geology mapping for this section.</p> <p>Aquifer / Groundwater Vulnerability- The predominant aquifer vulnerability classification for this section is 'Moderate', while some localised (less extensive) zones of the northern, central and southern portion of this section have been classified as 'High' vulnerability. Refer to Chapter 6 (Hydrology & Hydrogeology) Section 6.3.8.1 for the indicative subsoil thickness based on the aquifer/groundwater vulnerability rating. Refer to Volume 4 (Aquifer/Groundwater Vulnerability Sheet 3 of 6) for the Aquifer Vulnerability mapping for this section.</p> <p>Landslide Susceptibility- The Landslide Susceptibility for this section ranges from 'Low' to 'Inferred Low' throughout this section. Refer to Volume 4 (Landslide Susceptibility Sheet 3 of 6) for the Landslide Susceptibility mapping for this section.</p>
<p>Pipeline Section 4: Yellow River (RVX02) to the R441 (RDX12)</p>	<p>Teagasc Soils: AlluvMIN- Alluvial (mineral), BminDW- Deep well drained mineral (mainly basic), BminPDPT- Peaty poorly drained mineral (mainly basic), BminSP- Shallow poorly drained mineral (mainly basic), BminSRPT- Shallow, rocky, peaty/non-peatymineral complexes (mainly basic), BminSW- Shallow well drained mineral (mainly basic), Cut-Cutover/cutaway peat, Lac- Lacustrine type soils. Refer to Volume 4 (Teagasc Soils Sheet 4 of 6) for the Teagasc Soils mapping for this section.</p> <p>Quaternary Sediments (Subsoils)- <i>Primary:</i> 'Till derived from Limestone'. <i>Secondary:</i> 'Lacustrine Sediments', 'Alluvium', 'Gravels derived from limestones' (northern part of this section) & 'Cut over raised peat' (southern part of this section). Refer to Volume 4 (Quaternary Sediments Sheet 4 of 6) for the Quaternary Sediments (Subsoils) mapping for this section.</p>

Pipeline Section	Receiving Environment
	<p>Bedrock Geology- This section is entirely underlain by the 'Edenderry Oolite Member formation'. Refer to Volume 4 (Bedrock Geology Sheet 4 of 6) for the Bedrock Geology mapping for this section.</p> <p>Aquifer / Groundwater Vulnerability- The predominant aquifer vulnerability classification for this section is 'Moderate', while some localised (less extensive) zones of the northern portion of this section has been classified as 'High' vulnerability. Refer to Chapter 6 (Hydrology & Hydrogeology) Section 6.3.8.1 for the indicative subsoil thickness based on the aquifer/groundwater vulnerability rating. Refer to Volume 4 (Aquifer/Groundwater Vulnerability Sheet 4 of 6) for the Bedrock Geology mapping for this section.</p> <p>Landslide Susceptibility- The Landslide Susceptibility for this section is primarily/predominantly classified as 'Low' to 'Inferred low' throughout this section, with the exception of a minor localised zone located at c. 11,400m along the pipeline which has been classified as 'Moderately Low'. Refer to Volume 4 (Landslide Susceptibility Sheet 4 of 6) for the Landslide Susceptibility mapping for this section.</p>
<p>Pipeline Section 5: R441 (RDX12) to the L5003 (RDX15)</p>	<p>Teagasc Soils: Made ground, BminDW- Deep well drained mineral (mainly basic), BminPDPT- Peaty poorly drained mineral (mainly basic), BminSP- Shallow poorly drained mineral (mainly basic), BminSRPT- Shallow, rocky, peaty/non-peaty mineral complexes (mainly basic), BminSW- Shallow well drained mineral (mainly basic), Cut- Cutover/cutaway peat, Lac- Lacustrine type soils. Refer to Volume 4 (Teagasc Soils Sheet 5 of 6) for the Teagasc Soils mapping for this section.</p> <p>Quaternary Sediments (Subsoils)- This section is overlying 2No. subsoil types. The Northern portion of this section is predominantly underlain by 'Cut over raised peat', while the southern portion is largely underlain by 'Till derived from Limestone'. Refer to Volume 4 (Quaternary Sediments Sheet 5 of 6) for the Quaternary Sediments (Subsoils) mapping for this section.</p> <p>Bedrock Geology- This section is entirely underlain by the 'Edenderry Oolite Member formation'. Refer to Volume 4 (Bedrock Geology Sheet 5 of 6) for the Bedrock Geology mapping for this section.</p> <p>Aquifer / Groundwater Vulnerability- The aquifer vulnerability classification for this entire section is 'Moderate'. Refer to Chapter 6 (Hydrology & Hydrogeology) Section 6.3.8.1 for the indicative subsoil thickness based on the aquifer/groundwater vulnerability rating. Refer to Volume 4 (Aquifer/Groundwater Vulnerability Sheet 5 of 6) for the Aquifer Vulnerability mapping for this section.</p> <p>Landslide Susceptibility- The Landslide Susceptibility for this section is primarily/predominantly classified as 'Low', with some less extensive localised areas indicated as 'Inferred Low' located in the northern portion of this section. Refer to Volume 4 (Landslide Susceptibility Sheet 5 of 6) for the Landslide Susceptibility mapping for this section.</p>
<p>Pipeline Section 6: L5003 (RDX15) to the Ballykilleen AGI</p>	<p>Teagasc Soils: AlluvMIN- Alluvial (mineral), BminDW- Deep well drained mineral (mainly basic), BminPDPT- Peaty poorly drained mineral (mainly basic), Cut- Cutover/cutaway peat, Lac- Lacustrine type soils. Refer to Volume 4 (Teagasc Soils Sheet 6 of 6) for the Teagasc Soils mapping for this section.</p> <p>Quaternary Sediments (Subsoils)- This section is overlying 2No. subsoil types alternating between deposits of 'Cut over raised peat' and 'Till derived from Limestone'. Refer to Volume 4 (Quaternary Sediments Sheet 6 of 6) for the Quaternary Sediments (Subsoils) mapping for this section.</p> <p>Bedrock Geology- The Majority of this section is underlain by the 'Lucan Formation', while the central and northernmost portions of this section are overlying the 'Edenderry Oolite Member Formation'. Refer to Volume 4 (Bedrock Geology Sheet 6 of 6) for the Bedrock Geology mapping for this section.</p>

Pipeline Section	Receiving Environment
	<p>Aquifer / Groundwater Vulnerability- The northern and southern parts of this section have been widely classified with 'Moderate' Vulnerability. The central portion of this section displays varied vulnerability, ranging / alternating between 'Low', 'Moderate', 'High' and 'Extreme' vulnerability. Refer to Chapter 6 (Hydrology & Hydrogeology) Section 6.3.8.1 for the indicative subsoil thickness based on the aquifer/groundwater vulnerability rating. Refer to Volume 4 (Aquifer/Groundwater Vulnerability Sheet 6 of 6) for the Aquifer Vulnerability mapping for this section.</p> <p>Landslide Susceptibility- The Landslide Susceptibility classification for this entire section is determined to be 'Low'. Refer to Volume 4 (Landslide Susceptibility Sheet 6 of 6) for the Landslide Susceptibility mapping for this section.</p>
Temporary Construction Compounds 03	<p>Teagasc Soils: The eastern and central portion of this area is underlain by Cut-Cutover/cutaway peat. The western portion of the area is predominantly underlain by BminPD- Mineral poorly drained (mainly basic), and partially underlain by BminDW- Deep well drained mineral (mainly basic) in the southwest corner. Refer to Volume 4 (Figure 5-2 Compound Teagasc Soils) for the Teagasc Soils mapping for this localised area of the site.</p> <p>Quaternary Sediments (Subsoils)- This area of the site is overlying 2No. subsoil types. The central and eastern portions of the site are overlying 'Cut over raised peat', while the western portion of this area is underlain by 'Till derived from Limestone'. Refer to Volume 4 (Figure 5-4 Compound Quaternary Geology) for the Quaternary Sediments (Subsoils) mapping for this area.</p> <p>Bedrock Geology- This area is entirely underlain by the 'Edenderry Oolite Member Formation'. Refer to Volume 4 (Figure 5-6 Compound Bedrock Geology) for the Bedrock Geology mapping for this section.</p> <p>Aquifer / Groundwater Vulnerability- This area is classified as having 'Moderate' vulnerability. Refer to Chapter 6 (Hydrology & Hydrogeology) Section 6.3.8.1 for the indicative subsoil thickness based on the aquifer/groundwater vulnerability rating. Refer to Volume 4 (Figure 5-8 Compound Groundwater vulnerability) for the Aquifer Vulnerability mapping for this section.</p> <p>Landslide Susceptibility- The Landslide Susceptibility classification for this entire section is determined to be 'Low'. Refer to Volume 4 (Figure 5-10 Compound landslide Susceptibility) for the Landslide Susceptibility mapping for this section.</p>
Temporary Construction Compounds 04	<p>Teagasc Soils: This entire area is entirely underlain by BminSW- Shallow well drained mineral (mainly basic). Refer to Volume 4 (Figure 5-2 Compound Teagasc Soils) for the Teagasc Soils mapping for this localised area of the site.</p> <p>Quaternary Sediments (Subsoils)- This section is entirely underlain by Eskers comprised of gravels of basic reaction. Refer to Volume 4 (Figure 5-4 Compound Quaternary Geology) for the Quaternary Sediments (Subsoils) mapping for this area.</p> <p>Bedrock Geology- This area is entirely underlain by the 'Edenderry Oolite Member Formation'. Refer to Volume 4 (Figure 5-6 Compound Bedrock Geology) for the Bedrock Geology mapping for this section.</p> <p>Aquifer / Groundwater Vulnerability- This area is classified as having 'High' vulnerability. Refer to Chapter 6 (Hydrology & Hydrogeology) Section 6.3.8.1 for the indicative subsoil thickness based on the aquifer/groundwater vulnerability rating. Refer to Volume 4 (Figure 5-8 Compound Groundwater vulnerability) for the Aquifer Vulnerability mapping for this section.</p> <p>Landslide Susceptibility- The Landslide Susceptibility classification for this entire section is determined to be 'Low'. Refer to Volume 4 (Figure 5-10 Compound landslide Susceptibility) for the Landslide Susceptibility mapping for this section.</p>

5.3.4 Geological Heritage Areas

No geological heritage areas are identified within or adjacent the site boundary or in immediate proximity of the site (GSI, 2025).

5.3.5 Economic Geology

The GSI (2025) mineral database was consulted to determine whether there were any mineral sites in close proximity of the study area. There are no recorded mineral localities within or directly adjacent to the site boundary or within the immediate vicinity of the development site.

Karst is a landscape with distinctive hydrology and landforms that arise when the underlying rock is soluble. Although karst can develop on evaporite rocks such as gypsum and siliceous rocks such as quartzite, the vast majority of karst landforms are found on carbonate rocks, such as limestones. Karst landscapes may have sinkholes, caves, enclosed depressions, disappearing streams, springs and sinkholes. No karst landforms have been identified within or adjacent to the site boundary. The nearest karst feature is the Toberhale Spring (Historic GSI Karst Feature ID: 2623SWK001) which is located approximately 500m east of Section 5 of the proposed pipeline route (linear distance at the point of closest proximity), situated east of Edenderry town centre.

5.3.6 Historical Land Use and Environment

The site is currently characterised as predominantly greenfield land which consists of grassland fields and internal and boundary hedgerow.

The EPA (2025) mapping database does not indicate any licensed waste facilities in the immediate vicinity of the Proposed Development site.

The surrounding area features a predominant agricultural land use / function, coupled with a mixed use of residential, and tertiary (transport routes) land uses.

Upon review of historical 6-inch first edition, 6-inch last edition and 25-inch Cassini maps for the subject lands and surrounding area, no geological features or constraining land uses were identified on site.

The review of Aerial maps from 1995 to 2013 revealed that the overall land use was agricultural (OSI, 2025).

5.3.7 Site Investigation and Soil Quality

5.3.7.1 Site Investigation at Kilwarden Offtake Installation

Site investigation was carried out by IGSL Ltd (2025). The site investigation comprised boreholes (BH01-BH04, BH40-BH45), Rotary Cores (RC01-RC04) and Trial Pits (TP1.1, TP1.2 & TP3.1-TP3.5) in the immediate vicinity of the Kilwarden offtake installation location which is situated at the most northern point of the proposed Ballykilleen Pipeline Route (GNI143), and boreholes (BH40-BH45) which are located on lands directly adjacent to and aligning along the first c. 500m stretch of the northern end of the pipeline route (directly south of offtake location). All these boreholes are located within the first 500m of the 'Section 1' of the pipeline route (refer to Insert 5-1 and Insert 5-2).

The full site investigation report, *Gas to Bord na Móna, Edenderry Phase 1 GI – Geotechnical Interpretative Report* (Project No. 25882) prepared by IGSL Ltd (2025), is included in Volume 3, Appendix 5.2 of this EIAR.

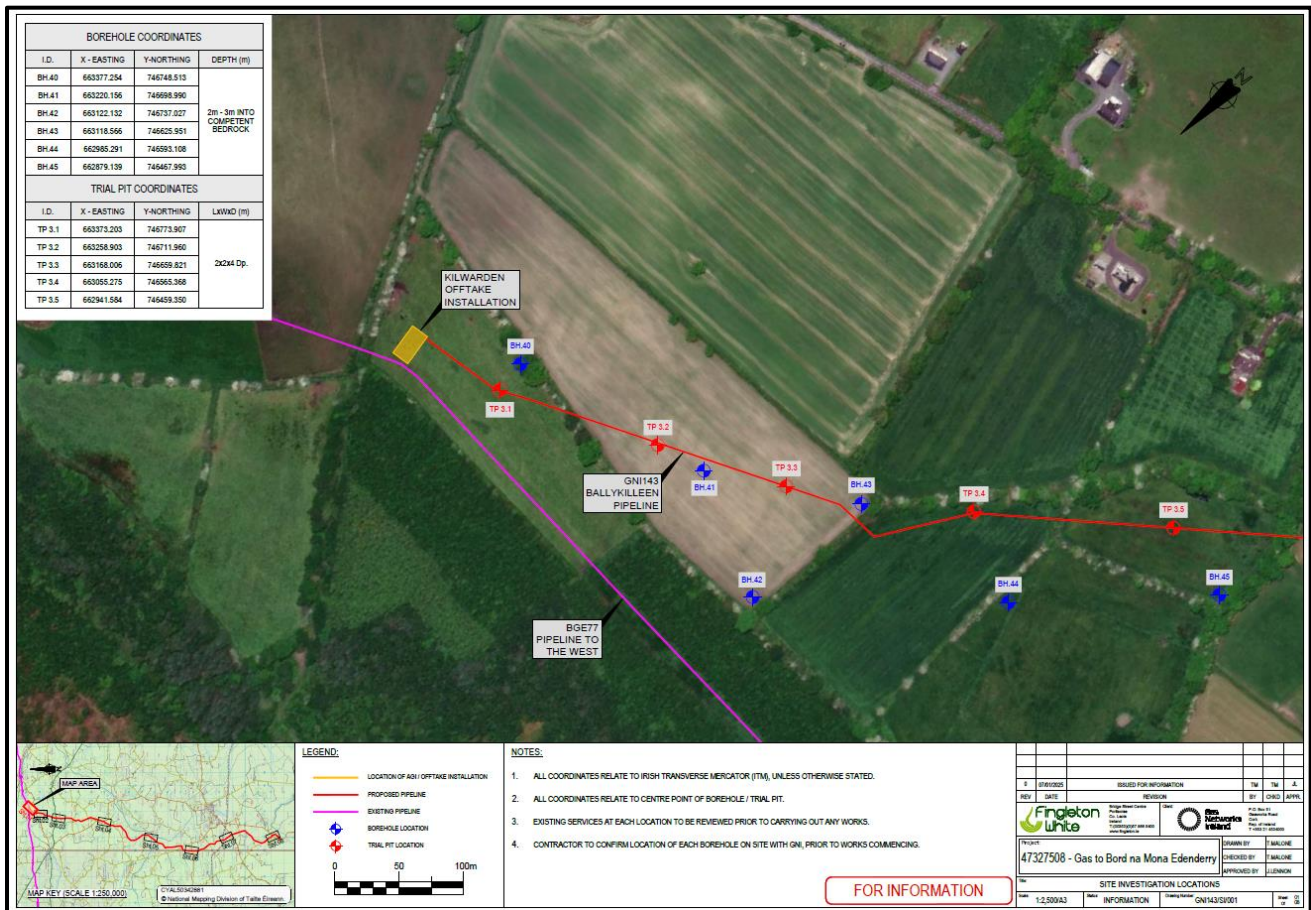
The sequence of subsoils deposits / strata recorded during the site investigation are summarised as follows:

- ▶ **Topsoil:** Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.10mbgl (meters below ground level).
- ▶ **Made Ground:** No made ground was encountered in any exploratory boreholes during the ground investigation.

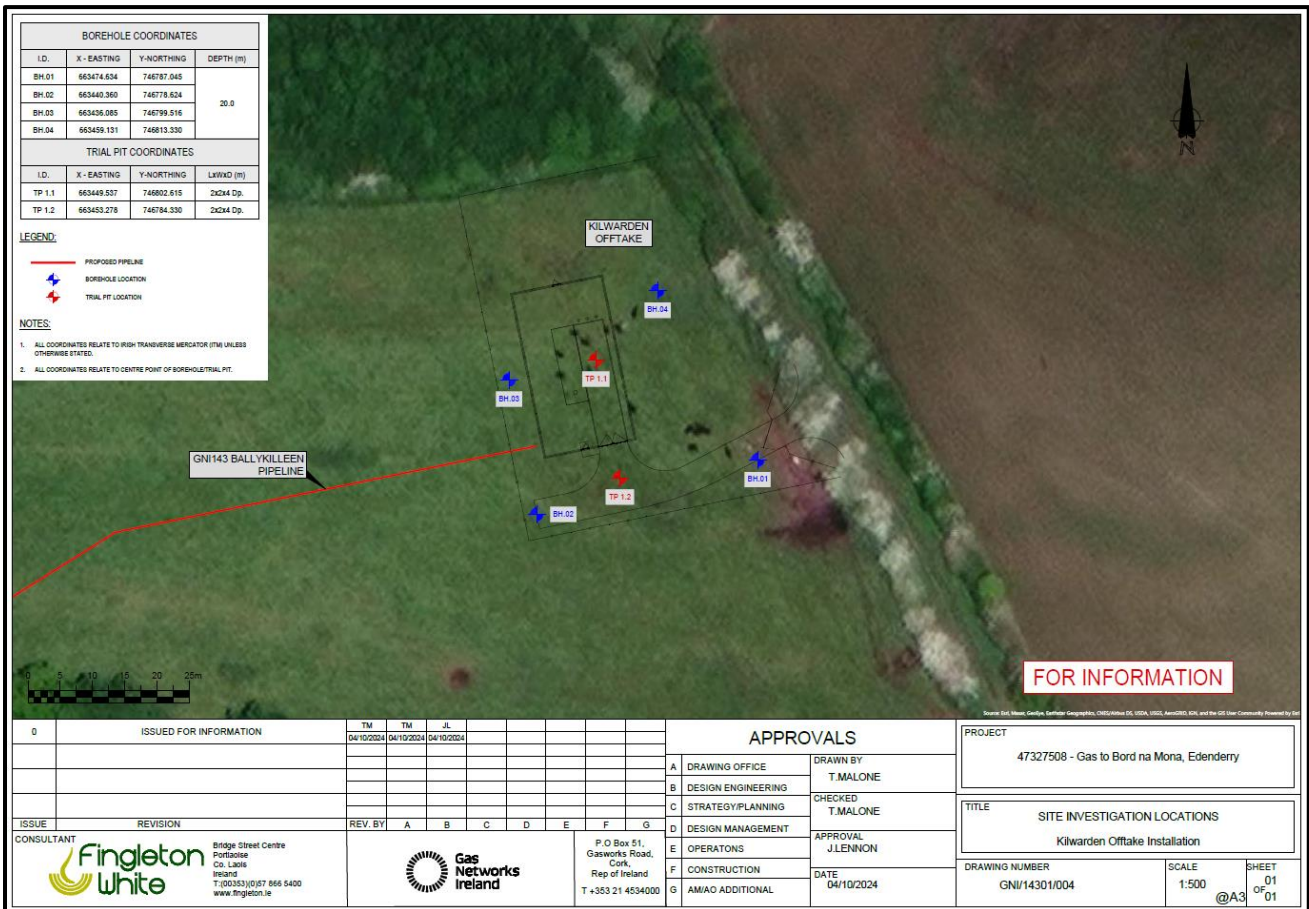
- ▶ **Cohesive Deposits:** Cohesive deposits were encountered beneath the topsoil and were described typically as *firm to stiff grey sandy gravelly CLAY with occasional cobbles & boulders* and *Stiff grey sandy gravelly SILT/CLAY with occasional cobbles & boulders*. These CLAY and SILT/CLAY strata were encountered at depths ranging from 3mbgl – 5.8mbgl with colour, stiffness and secondary sand and gravel constituents varied laterally across the site and with depth, and with granular lenses occasionally present in the cohesive till matrix.
- ▶ **Granular Deposits:** Granular deposits include a band of gravel which was typically described as *dense grey fine to coarse sandy GRAVEL with occasional cobbles & boulders* encountered at the base of CLAY deposits across the site extending in depth ranging from 3.0mbgl – 6.1mbgl and often interbedded with alternating strata of CLAY and GRAVEL.
- ▶ **Bedrock:** Bedrock was encountered at depths ranging from 8.3mBGL (RC01) to 11.6mbgl (RC02) during the ground investigation. The bedrock is described as Strong to very strong, thickly to thinly bedded, dark grey/black, fine-grained slightly dolomitised crystalline calcisiltite LIMESTONE.

The above sequence of subsoil deposits encountered onsite (Section 1 of the proposed pipeline route) is relatively consistent (in line) with the Quaternary sediments (subsoils) and Bedrock Geology indicated by the GSI database (2025).

Insert 5-1 Site Investigation Locations BH40-BH45



Insert 5-2 Site Investigation Locations BH01-BH04



5.3.7.1.1 Soil Quality / Contamination

During the site investigations at the Kilwarden offtake installation location, 4 no. boreholes (BH01 - BH04) were established. They were each analysed to determine the classification of the soil in accordance with the criteria set out in Council Decision 2003/33/EC made under Directive 1999/31/EC, which classifies soil for landfill disposal purposes. Based on the samples collected, the soil would be classified as inert if offsite disposal is required.

The results obtained from the testing of the four inert borehole samples were also compared with published limits set out in the EPA Guidance on waste acceptance criteria at authorized soil recovery facilities (EPA, 2020). With regard to each of the criteria set for Total Organic Carbon and for the organic compounds BTEX, Mineral Oil, PAH and PCB's, all four samples were found to satisfy the criteria stipulated by the EPA.

In relation to the four samples, all exhibit metal concentrations within those published for EPA Guidance Geochemical Domain 2 and would therefore, based on their metal and Total Organic Carbon (TOC)/ organic compound contents be accepted at an authorised soil recovery facility.

No asbestos was detected in screens ran on the five soil samples.

Historical OSI mapping indicate the land has been historically used for agriculture and associated/corresponding residential land, with no evidence of industrial activity.

While no minor past fuel spills or leaks have been recorded or documented, such events cannot be entirely ruled out.

For further information on soil quality in the subject study area refer to *Gas to Bord na Móna, Edenderry Phase 1 GI – Geotechnical Interpretative Report* (IGSL Ltd, 2025), included in Appendix 5.2 of this EIAR.

5.3.7.2 Site Investigation at M4 Motorway Crossing (Phase 1 GI- HCC1)

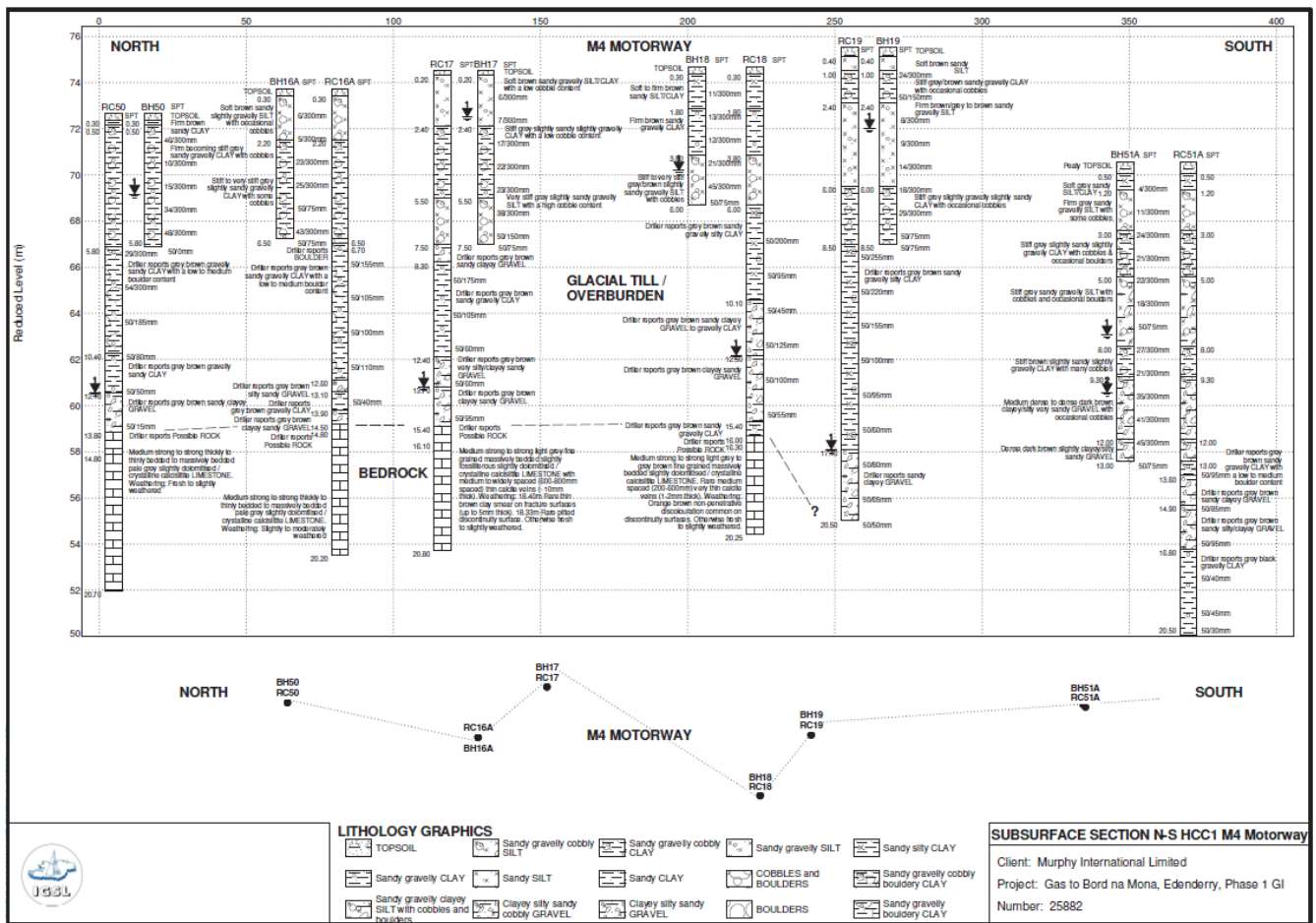
IGSL Ltd conducted a site / ground investigation which included Boreholes (BH) and Rotary Core (RC) sampling area in the *High Consequence Crossing* (HCC) 01. This refers to an area in the townland of Ardnamullen, Clonard, County Meath through which the M4 motorway traverses in an east-west trend. Boreholes were constructed in fields both immediately to the north and south of the M4 motorway. The holes extend approximately 150m from the mainline M4 motorway in both north and south directions, perpendicular to the motorway.

Refer to Insert 5-3 below for a cross section of the subsurface ground conditions found at the M4 Motorway Crossing. The exploratory hole locations are displayed in Insert 5-4 below. The sequence of subsoils deposits / strata recorded during the site investigation are summarised as follows:

- ▶ **Topsoil:** TOPSOIL was generally found to be between 0.20m and 0.30m thick in the boreholes. The southernmost borehole, location 51, was flagged as having a “peaty TOPSOIL” to a depth of 0.50m. This borehole was located approximately 5m topographically lower than the nearest other borehole location (BH19).
- ▶ **Made Ground:** No MADE GROUND was encountered in any exploratory boreholes during the ground investigation.
- ▶ **Superficial Deposits- Subsoil Cohesive Glacial Til Deposits (interbedded Granular Deposits):** Each exploratory hole encountered thick upper sequences of CLAY/SILT (stiffening with depth) with underlying deeper-seated, apparently water-bearing GRAVEL. Subsequent rotary coring at four of the six locations proved LIMESTONE bedrock from ca. 14.0 / 15.0m BGL. South of the motorway, bedrock fell away beyond 20m below ground level (RC end depth) and was subsequently not proven in either RC19 or RC51A. There is some variation in the uppermost cover of superficial deposits whereby a soft to firm and soft SILT was remarked initially in a number of holes to ca. 2.0 / 2.50m BGL.
- ▶ **Bedrock:** Rotary drilling was conducted at six locations at HCC1, both north and south of the M4 motorway. Drilling successfully proved rock at four of the six locations - the four northernmost holes. The recovered cores consist of fresh to slightly weathered, medium strong to strong, often massively bedded, pale grey, fine-grained slightly dolomitised crystalline calcisiltite LIMESTONE. Coring of the underlying bedrock commenced at depths ranging 14.80m (RC50 & RC16A) to 16.30m (RC18). These depths corresponded to elevations of 57.88 / 58.93m OD and 58.39m OD.

For further information on the sequence of subsurface deposits and ground conditions in the subject study area refer to *Gas to Bord na Móna, Edenderry Phase 1 GI – Geotechnical Interpretative Report* (IGSL Ltd, 2025), included in Appendix 5.2 of this EIAR.

Insert 5-3 Cross sections of subsurface ground conditions found at M4 Motorway Crossing



Insert 5-4 Site Location Points North and South of M4 Motorway Crossing



5.3.7.2.1 Soil Quality / Contamination

Five shallow soil samples were selected from the boreholes at the M4. They were each analysed to determine the classification of the soil in accordance with the criteria set out in Council Decision 2003/33/EC made under Directive 1999/31/EC, which classifies soil for landfill disposal purposes. Based on the samples collected, the soil would be classified as inert if offsite disposal is required.

The results obtained from the testing of the five inert borehole samples were also compared with published limits set out in the EPA Guidance on waste acceptance criteria at authorized soil recovery facilities (EPA, 2020). With regard to each of the criteria set for Total Organic Carbon and for the organic compounds BTEX, Mineral Oil, PAH and PCB's, all five samples were found to satisfy the criteria stipulated by the EPA.

In relation to the five samples, all exhibit metal concentrations within those published for EPA Guidance Geochemical Domain 2 and would therefore, based on their metal and Total Organic Carbon (TOC)/ organic compound contents be accepted at an authorized soil recovery facility.

No asbestos was detected in screens ran on the five soil samples.

Historical OSI mapping indicate the land has been historically used for agriculture and associated/corresponding residential land, with no evidence of industrial activity.

While no minor past fuel spills or leaks have been recorded or documented, such events cannot be entirely ruled out.

For further information on soil quality in the subject study area refer to *Gas to Bord na Móna, Edenderry Phase 1 GI – Geotechnical Interpretative Report* (IGSL Ltd, 2025), included in Appendix 5.2 of this EIAR.

5.3.7.3 *Site Investigation at the Yellow River Crossing (Phase 1 GI- HCC2)*

IGSL Ltd conducted a site / ground investigation which included Boreholes (BH) and Rotary Core (RC) sampling area in the *High Consequence Crossing* (HCC) 02. This refers to an area in the townland of Clongall, Castlejordan, County Meath and Clonmore, County Offaly, townlands separated by the E-W course of the Yellow River, a tributary of the River Boyne. Boreholes were constructed in fields both immediately to the north and south of the Yellow River.

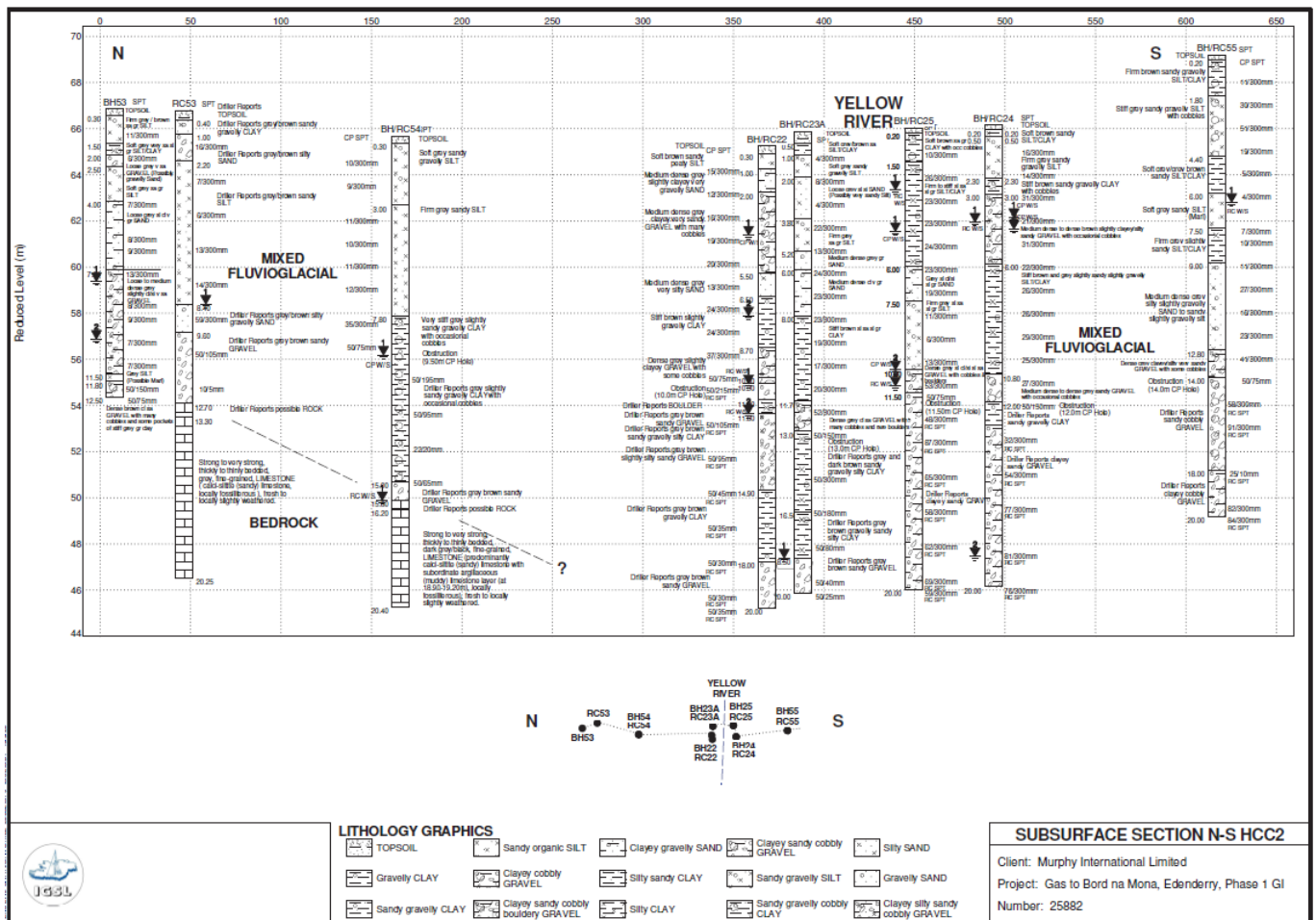
Refer to Insert 5-5 below for a cross section of the subsurface ground conditions found at the Yellow River Crossing. The exploratory hole locations are displayed in Insert 5-6 and Insert 5-7 below. The sequence of subsoils deposits / strata recorded during the site investigation are summarised as follows:

- ▶ **Topsoil:** TOPSOIL was generally found to be between 0.20m and 0.30m thick in the boreholes, with the exception of location 23A, where topsoil was logged to a greater depth of 0.50m.
- ▶ **Made Ground:** What was termed CONCRETE fill (MADE GROUND) was intercepted from 0.50m to 1.0m in BH23. No made ground was encountered in any other exploratory boreholes during the ground investigation.
- ▶ **Superficial Deposits:** All of the exploratory holes encountered upper sequences of CLAY/SILT (generally soft to firm and firm) with underlying deeper-seated, often water-bearing GRAVEL, SILT and silty SAND. Soft and soft to firm sandy SILT and SAND was identified at BH23A (2.0-3.80m), BH25 (8.0-9.0m), BH53 (2.50-7.0m), BH54 (0.30-7.80m) and BH55 (4.40-9.0m).
- ▶ **Bedrock:** Rotary coring was conducted at five of the seven borehole locations and proved the absence of bedrock to 20m bgl corresponding to depth levels between 45.24m OD and 49.20m. Rotary coring conducted at two locations (RC53 and RC54), both to the north of the site. Coring successfully proved bedrock at depths ranging 13.30m and 16.20m bgl. These depths corresponded to elevations of 53.49m OD and 49.48m OD. Cores were described as fresh to locally slightly weathered, strong to very strong, thickly to thinly bedded, dark grey/black, fine-grained, LIMESTONE (predominantly calci-

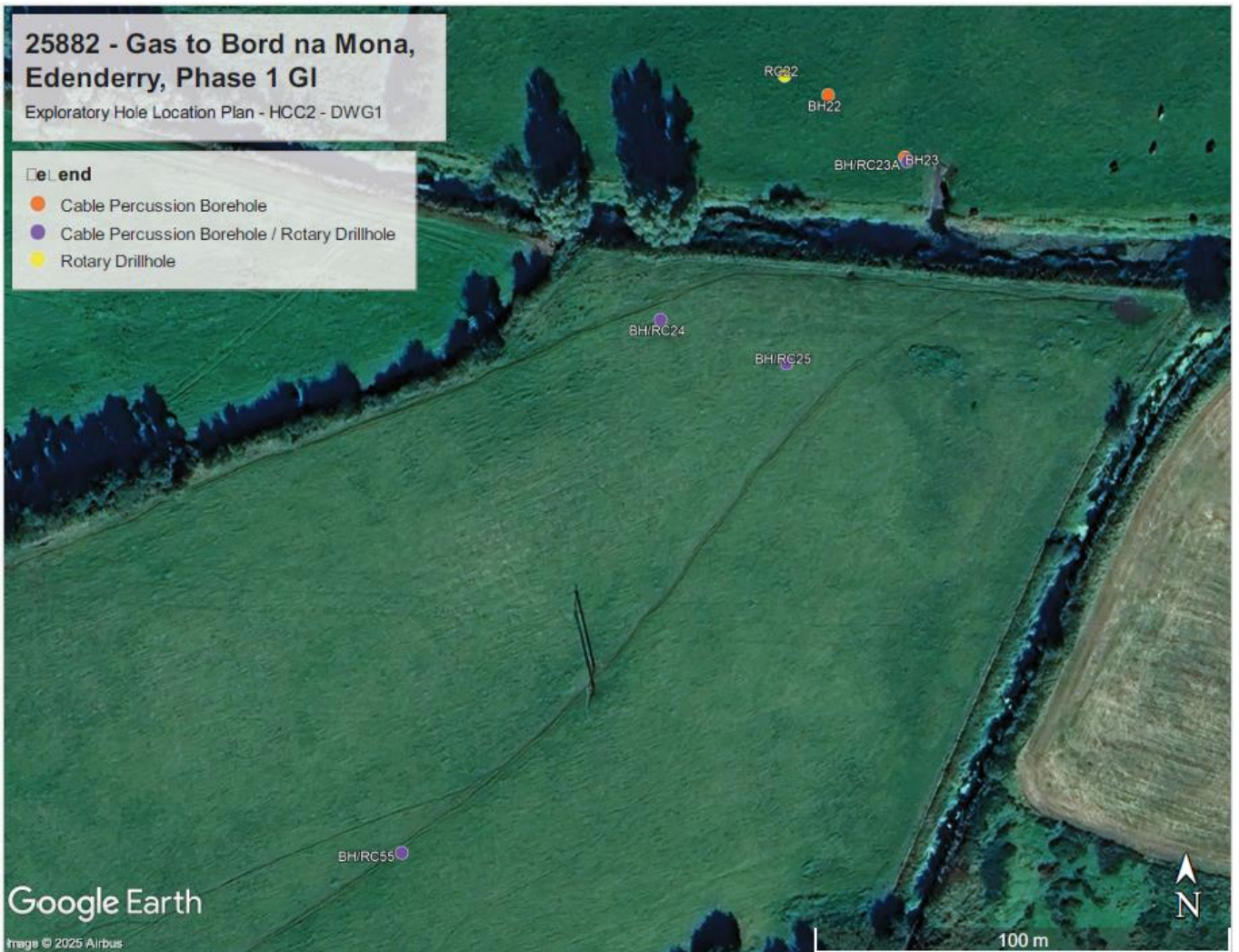
siltite (sandy) limestone with subordinate argillaceous (muddy) limestone layers. The limestone was locally fossiliferous.

For further information on the sequence of subsurface deposits and ground conditions in the subject study area refer to *Gas to Bord na Móna, Edenderry Phase 1 GI – Geotechnical Interpretative Report* (IGSL Ltd, 2025), included in Appendix 5.2 of this EIAR.

Insert 5-5 Cross sections of subsurface ground conditions found at the Yellow River Crossing



Insert 5-6 Site Location Points North and South of the Yellow River Crossing



Insert 5-7 Site Location Points North and South of the Yellow River Crossing



5.3.7.3.1 Soil Quality / Contamination

Eight shallow soil samples selected from boreholes were analysed to determine the classification of the soil in accordance with the criteria set out in Council Decision 2003/33/EC made under Directive 1999/31/EC, which classifies soil for landfill disposal purposes. Five of the eight samples tested, would be classified as inert if offsite disposal is required. The three exceptions were soil specimens from BH22 (0.50m) - tested twice – and BH23A (0.50m). Each of the three were noted to exceed inert waste limits for Total Organic Carbon [TOC] and exceeded hazardous limits for TOC. The samples would therefore not be accepted by an inert landfill due to their TOC content and would be required to be disposed of by a suitably licensed waste facility, if offsite disposal is required.

The results obtained from the testing of the five inert samples were compared with published limits set out in the EPA Guidance on waste acceptance criteria at authorised soil recovery facilities (EPA, 2020). With regard to each of the criteria set for Total Organic Carbon and for the organic compounds BTEX, Mineral Oil, PAH and PCBs, the EPA limits were met.

In relation to the remaining five samples, each exhibit metal concentrations within those published for EPA Guidance Geochemical Domain 2 (Carboniferous limestone and related rocks) maximum concentrations and / or trigger levels in soil and stone for soil recovery facilities for Geochemical Domain 2 and would therefore, based on non exceedances of metal and TOC / organic compound contents would be accepted at an authorized soil recovery facility.

No asbestos was detected in screens ran on the eight soil samples.

Historical OSI mapping indicate the land has been historically used for agriculture and associated/corresponding residential land, with no evidence of industrial activity.

While no minor past fuel spills or leaks have been recorded or documented, such events cannot be entirely ruled out.

For further information on soil quality in the subject study area refer to *Gas to Bord na Móna, Edenderry Phase 1 GI – Geotechnical Interpretative Report* (IGSL Ltd, 2025), included in Appendix 5.2 of this EIA.

5.3.7.4 Site Investigation at the Kilwarden River Crossing (Phase 1 GI- HCC3)

IGSL Ltd conducted a site / ground investigation which included Boreholes (BH) and Rotary Core (RC) sampling area in the bordering townlands of Kilwarden and Aghnagillagh, Kinnegad, Co. Meath through which the Kilwarden River meanders in an east-west trend. The holes extend approximately 200m from the river in both north and south directions, perpendicular to the course of the river.

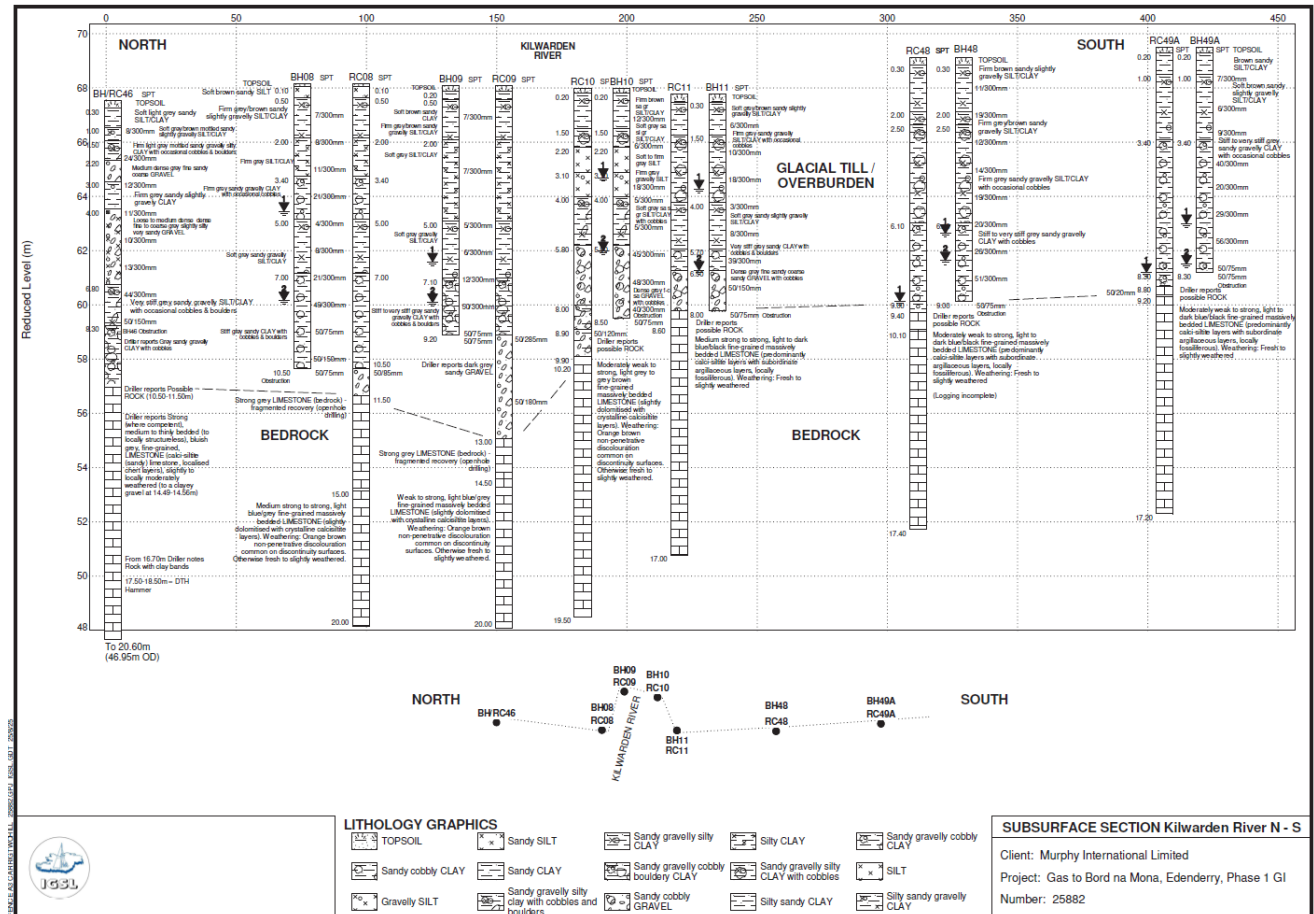
Refer to Insert 5-8 below for a cross section of the subsurface ground conditions found at and around the Kilwarden River Crossing. The exploratory hole locations are displayed in Insert 5-9 below. The sequence of subsoils deposits / strata recorded during the site investigation are summarised as follows:

The sequence of subsoils deposits / strata recorded during the site investigation are summarised as follows:

- ▶ **Topsoil:** Topsoil was generally found to be between 0.20m and 0.30m thick in the boreholes. At borehole location BH08, topsoil was measured to a depth of 0.10m. A soft brown sandy SILT was found immediately beneath the topsoil to a depth of 0.30m bgl.
- ▶ **Made Ground:** No made ground was encountered in any exploratory boreholes during the ground investigation.
- ▶ **Subsoil Cohesive Deposits, Granular Deposits:** Borehole BH46, located approx. 130m north of the northern riverbank revealed a mixed uppermost stratigraphy. Initially, a soft grey brown sandy SILT/CLAY was encountered. At 2.20m bgl, a thin layer of fine sandy coarse GRAVEL persisted to 3.0m. This was then underlain by sandy gravelly SILT deposits which re-entered the stratigraphy before a loose to medium dense slightly silty very sandy GRAVEL continued to 6.80m. The cable percussion borehole was terminated at 8.30m BGL in a very stiff grey SILT/CLAY with cobbles and boulders. Rotary drilling pushed on through the grey sandy gravelly CLAY from 8.30m to eventual rockhead at 10.50m. The remaining three boreholes north of the Kilwarden River were located between 30m and 12m from the riverbank. As with BH46, there were stiff to very stiff CLAY and dense GRAVEL deposits unearthed at depth. These were found from 3.30m BGL in BH07, from 7.0m BGL in BH08 and from 7.10m BGL OD in BH09. Blowing sands were again a feature in the openhole drill record, being noted at 9.0m in RC09. These were reported shy of a dense dark grey sandy GRAVEL from 9.20m. Rockhead was proven in RC09 at a depth of 12.0m / 56.08m OD.
- ▶ **Bedrock:** The recovered cores consist of fresh to slightly weathered, weak to strong, generally medium strong to strong, light to dark blue/black fine-grained massively bedded LIMESTONE. The bedrock is further classified as consisting of predominantly calci-siltite layers with subordinate argillaceous limestone, being locally fossiliferous.
 - Bedrock North of the River: LIMESTONE was encountered at a depth ranging from 12.0m BGL (RC09) to 11.5m BGL (BH07) to the north of the river crossing.
 - Bedrock South of the River: LIMESTONE was encountered at a depth ranging from 8.8m BGL (BH07) to 9.4m BGL (BH48) to the south of the river crossing.

For further information on the sequence of subsurface deposits and ground conditions in the subject study area refer to *Gas to Bord na Móna, Edenderry Phase 1 GI – Geotechnical Interpretative Report* (IGSL Ltd, 2025), included in Appendix 5.2 of this EIAR.

Insert 5-8 Cross sections of subsurface ground conditions found at Kilwarden River Crossing



Insert 5-9 Site Location Points North and South of Kilwarden River Crossing



5.3.7.4.1 Soil Quality / Contamination

During the site investigations at the Kilwarden River Crossing location, no contamination was identified. No known soil contamination exists within the Proposed Development area.

Nine shallow soil samples were selected from the boreholes at the Kilwarden River. They were each analysed to determine the classification of the soil in accordance with the criteria set out in Council Decision 2003/33/EC made under Directive 1999/31/EC, which classifies soil for landfill disposal purposes. Based on the samples collected, the soil would be classified as inert if offsite disposal is required.

The results obtained from the testing of the nine inert borehole samples were also compared with published limits set out in the EPA Guidance on waste acceptance criteria (WAC) at authorized soil recovery facilities (EPA, 2020). With regard to each of the criteria set for Total Organic Carbon and for the organic compounds BTEX, Mineral Oil, PAH and PCB's, eight of the nine samples were found to satisfy the criteria stipulated by the EPA. One of the nine samples was found to have a WAC exceedance in relation to Total Of 17 PAH content (BH07 – 1.0m). The soil from the named location would therefore not be accepted at an EPA Soil Recovery Facility based on the sample collected.

For the purposes of this report, the maximum concentrations and / or trigger levels in soil and stone for soil recovery facilities for Geochemical Domain 2 (Carboniferous limestone and related rocks) are applied. In relation to the remaining eight samples, six exhibit metal concentrations within those published for EPA Guidance Limit Geochemical Domain 2 and would therefore, based on their metal and TOC / organic compound concentrations, be accepted at an authorised soil recovery facility. However, BH11 1.0m and BH49A exhibit Arsenic (As) and Nickel (Ni) metal concentrations which exceed that which is published for Geochemical Domain 2. Such concentrations would preclude the soil from the areas where the two samples were collected from being accepted at a Geochemical Domain 2 facility where the more onerous trigger limits exist, if offsite removal is required.

No asbestos was detected in screens ran on the nine soil samples.

Historical OSI mapping indicate the land has been historically used for agriculture and associated/corresponding residential land, with no evidence of industrial activity.

While no minor past fuel spills or leaks have been recorded or documented, such events cannot be entirely ruled out.

For further information on soil quality in the subject study area refer to *Gas to Bord na Móna, Edenderry Phase 1 GI – Geotechnical Interpretative Report* (IGSL Ltd, 2025), included in Appendix 5.2 of this EIAR.

5.3.7.5 Site Investigation at the Grand Canal Crossing (Phase 1 GI- HCC4)

IGSL Ltd conducted a site / ground investigation which included Boreholes (BH) and Rotary Core (RC) sampling area in the High Consequence Crossing (HCC) 04. This refers to an area in the townland of Rathmore, Edenderry, County Offaly through which the Grand Canal traverses in an east-west trend. The holes extend approximately 25 to 65m from the canal banks in both north and south directions, perpendicular to the canal

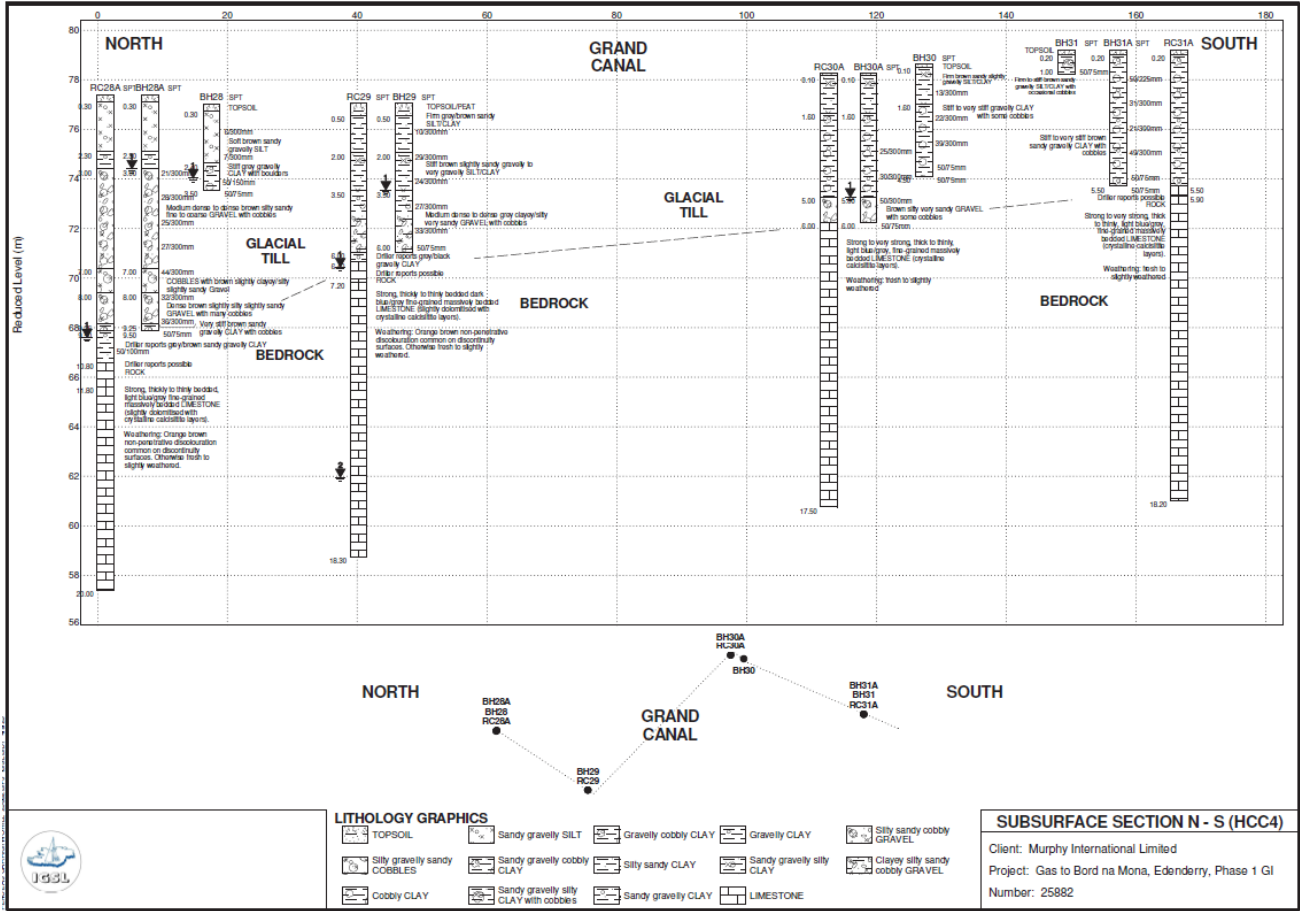
Refer to Insert 5-10 below for a cross section of the subsurface ground conditions found at the Yellow River Crossing. The exploratory hole locations are displayed in Insert 5-11 below. The sequence of subsoils deposits / strata recorded during the site investigation are summarised as follows:

- ▶ **Topsoil:** Topsoil was generally found to be between 0.10m and 0.30m thick in the boreholes. At location 29, a peaty TOPSOIL remarked as "TOPSOIL/PEAT" was logged to a depth of 0.50m.
- ▶ **Made Ground:** No made ground was encountered in any exploratory boreholes during the ground investigation.
- ▶ **Superficial Deposits:** All exploratory holes encountered upper sequences of CLAY/SILT (generally firm becoming stiff with depth) with underlying deeper-seated, water-bearing GRAVEL found in three of the four holes (BH28A, BH29 & BH30A).

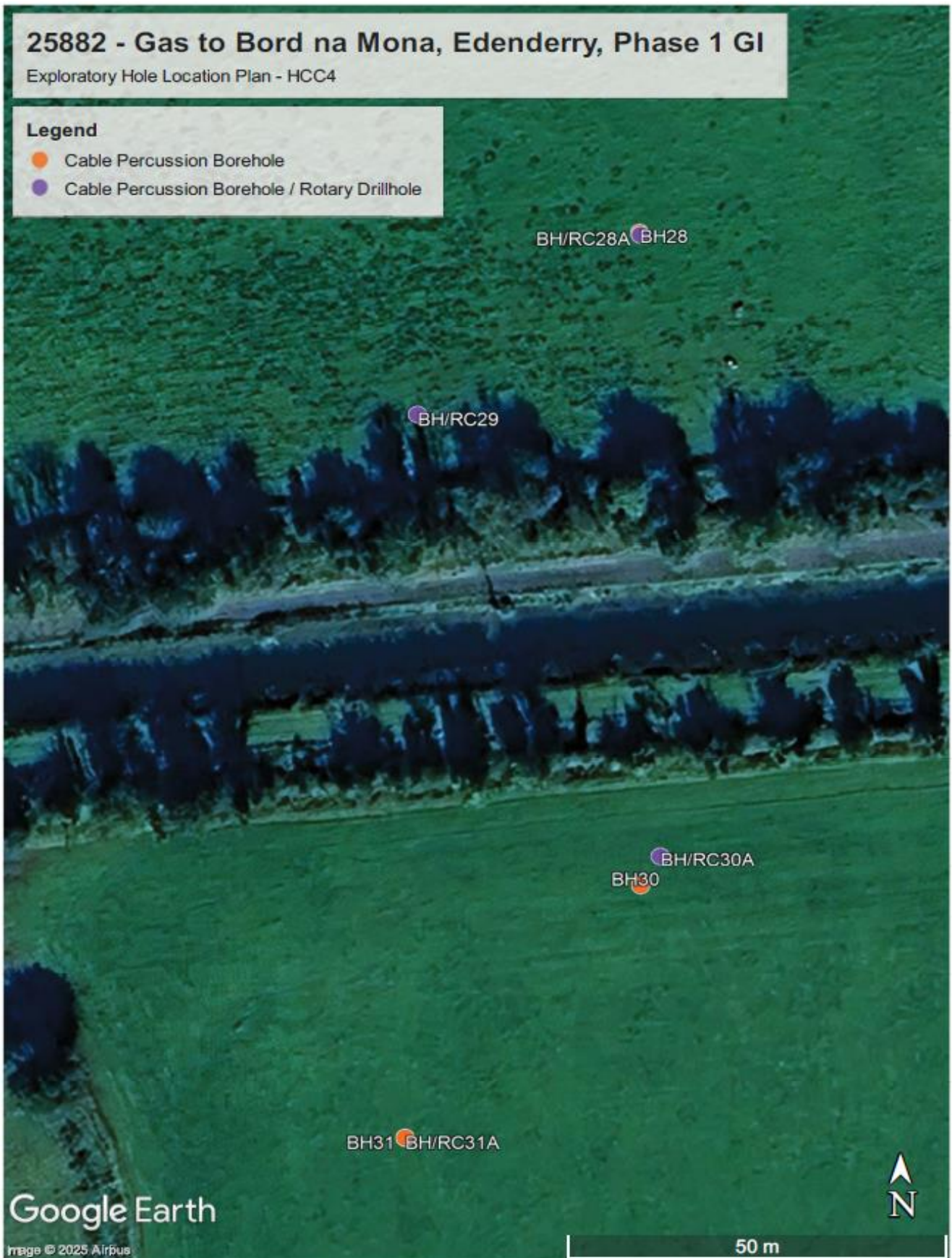
- **Bedrock:** Rotary drilling was conducted at four locations at HCC4, both immediately north and south of the Grand Canal. Coring successfully proved LIMESTONE bedrock at each of the four locations with rockhead depths ranging 5.90m to 11.80m bgl. These depths corresponded to elevations of 73.31m OD and 65.60m OD.

For further information on the sequence of subsurface deposits and ground conditions in the subject study area refer to *Gas to Bord na Móna, Edenderry Phase 1 GI – Geotechnical Interpretative Report* (IGSL Ltd, 2025), included in Appendix 5.2 of this EIAR.

Insert 5-10 Cross sections of subsurface ground conditions found at Grand Canal Crossing



Insert 5-11 Site Location Points North and South of Grand Canal Crossing



5.3.7.5.1 Soil Quality / Contamination

Two shallow soil samples were selected from the boreholes at the Grand Canal (BH28A & BH30). They were each analysed to determine the classification of the soil in accordance with the criteria set out in Council Decision 2003/33/EC made under Directive 1999/31/EC, which classifies soil for landfill disposal purposes. Based on the samples collected, the soil would be classified as inert if offsite disposal is required.

The results obtained from the testing of the two inert borehole samples were also compared with published limits set out in the EPA Guidance on waste acceptance criteria at authorized soil recovery facilities (EPA, 2020). With regard to each of the criteria set for Total Organic Carbon and for the organic compounds BTEX, Mineral Oil, PAH and PCB's, both samples were found to satisfy the criteria stipulated by the EPA.

In relation to the two samples, both exhibit metal concentrations within those published for EPA Guidelines Geochemical Domain 2 and would therefore, based on their metal and TOC / organic compound contents be accepted at an authorized soil recovery facility.

No asbestos was detected in screens ran on the two soil samples.

Historical OSI mapping indicate the land has been historically used for agriculture and associated/corresponding residential land, with no evidence of industrial activity.

While no minor past fuel spills or leaks have been recorded or documented, such events cannot be entirely ruled out.

For further information on soil quality in the subject study area refer to *Gas to Bord na Móna, Edenderry Phase 1 GI – Geotechnical Interpretative Report* (IGSL Ltd, 2025), included in Appendix 5.2 of this EIAR.

5.3.8 Rating of Site Importance of the Geological Features

Based on the NRA/TII methodology, the criteria for rating the importance of geological features, the importance of the bedrock and soil features at this site is rated as 'Low' Importance (refer to Appendix 5.1).

This is based on the assessment that the attribute has a low quality, significance or value on a local scale.

5.3.9 Conceptual Site Model

Based on available data, AWN has developed a conceptual site model (CSM) in order to identify any likely Source-Pathway-Receptor linkages relating to the site and the Proposed Development.

- ▶ The subsoil underlying the site predominantly comprises of primary subsoil constituents which include glacial tills, specifically 'Till derived from Limestone' & 'Gravels derived from Limestones'. The secondary subsoil constituents which are less extensive across the site include alternating localised zones of 'Lacustrine Sediments', 'Alluvium', and 'Cut over raised peat'.
- ▶ The predominant Aquifer / Groundwater vulnerability classification for the site is 'Moderate', while some localised (less extensive) zones of the site have been classified as 'Low', 'High' and 'Extreme' vulnerability rating.
- ▶ Bedrock underlying the pipeline route consists primarily of No.3 primary geological formations, namely the 'Waulsortian Limestone Formation', the 'Edenderry Oolite Member Formation', and the 'Lucan Formation'. A very minor localised zone within the central portion of the pipeline route (Section 3) is underlain by 'Volcanics in carboniferous'.
- ▶ During borehole sampling, TOPSOIL was found across the site to an approximate depth of 0.1 m bgl, underlain by a low-permeability CLAY layer extending to depths ranging from 3mbgl – 5.8mbgl. The CLAY layer overlies GRAVEL deposits extending in depth ranging from 3.0mbgl – 6.1mbgl and often interbedded with further strata of stiffer CLAY beneath.

- ▶ With regard to the proposed excavation works, the maximum excavation depths are as follows:
 - The maximum proposed open cut trench excavation for the pipeline is c. 1.8 mBGL.
 - The maximum proposed excavation at Kilwarden Offtake location is c. 3.4mBGL.
 - The maximum proposed trenchless drilling excavation is c. 21.73mBGL.

5.4 Characteristics of the Proposed Development

The purpose of this section is to provide an overview of the key relevant details of the construction phase and operational phase of the Proposed Development. The information presented in this section is informed by the project design, but it is not a complete description of the Proposed Development. Therefore, it should be read in conjunction with the full development package.

For a more comprehensive understanding of the Proposed Development, please refer to Chapter 2 'Description of the Proposed Development' of the EIA Report. Chapter 2 provides a detailed overview of the lifecycle of the project, including reference to the drawings, plans, reports, and other relevant documents in order to define the Proposed Development.

5.4.1 Construction Phase

The activities required for the construction phase of the Proposed Development represents the greatest risk of potential impact on the land, soils and geological environment. These activities primarily pertain to the site preparation, excavation and infilling activities required to facilitate construction of the Proposed Development.

5.4.1.1 *Ground Disturbance, Earthworks, and Excavations*

Excavations of topsoil, subsoil, stones, existing road materials (tarmac and hardcore) will be required to facilitate construction of the Proposed Development, primarily associated with installation of the underground gas transmission pipeline using open-cut trenching methods, together with construction of the Kilwarden Offtake Installation and the Ballykillen Above Ground Installation (AGI).

In agricultural and greenfield areas, a temporary working width of approximately 30m located within the Proposed Development Site will be established and fenced off along the pipeline alignment to accommodate trench excavation, pipe stringing, plant movements and reinstatement activities. At road crossings and certain watercourse crossings, larger temporary working areas (typically up to c. 40 m × 45 m) will be required on both sides of the crossing to facilitate excavation, temporary laydown, storage of materials and reinstatement works.

Topsoil will be stripped across the working width (c 30m) to a typical depth of approximately 300 mm and stored separately from subsoil to prevent mixing and preserve soil structure for reinstatement. Subsoil arising from trench excavation will be stored separately on the opposite side of the trench in accordance with best practice.

Pipeline trenches will generally be excavated to ensuring a minimum cover of 1200 mm above the pipe. Excavation depths will vary locally at crossings, service interfaces and abnormal construction areas.

At the Kilwarden Offtake Installation, deeper and localised excavation (c. 3.4 m deep c. 10m x 5m wide) will be required to facilitate construction of the hot tap connection, isolation valve pit and associated civil infrastructure.

Localised topsoil stripping and excavation will also be required within temporary construction compounds and associated working areas to facilitate site establishment. These works will be limited in extent, and all disturbed areas will be reinstated following completion of construction.

It has been estimated by the project engineers that a total of approximately 265,333.6 m³ of topsoil, subsoil, and stone will be excavated as part of the Proposed Development. It is anticipated that the majority (95%) of the excavated soil will be reinstated as backfill.

5.4.1.1.1 Trenchless Crossings

Trenchless construction techniques will be employed at key sensitive crossings along the route to minimise disturbance to soils, geology and surface features. Confirmed trenchless crossings include:

- ▶ Kilwarden River (RVX01)
 - The indicative planning design provides for an HDD crossing length of approximately 271.13 m (c. 272 m), gas transmission pipeline installed entirely underground. The HDD reaches a maximum depth of approximately 50 mOD below ground, corresponding to a depth of approximately 14.46 m beneath the bed of the Kilwarden River (RVX01) at its deepest point. See application drawing GNI143-GNI-PL-CRI-0001
- ▶ Yellow River (RVX02)
 - The indicative planning design provides for an HDD crossing length of approximately 508.7 m (c. 508 m), gas transmission pipeline installed entirely underground. The HDD reaches a maximum depth of approximately 40 m mOD below ground, corresponding to a depth of approximately 21.73 m beneath the Yellow River (RDX02) at its deepest point. See application drawing GNI143-GNI-PL-CRI-0002.
- ▶ M4 Motorway (RDX04)
 - The indicative planning design provides for an HDD crossing length of approximately 349.65 m (c. 350 m), gas transmission pipeline installed entirely underground. The HDD reaches a maximum depth of approximately 50 m mOD below ground, corresponding to a depth of approximately 20 m beneath the existing M4 Motorway (RVX01) at its deepest point, and 6.85m below the Aghinahillagh Stream (WCX02). See application drawing GNI143-GNI-PL-CRD-0003.
- ▶ Grand Canal (WCX23)
 - The indicative planning design provides for an HDD crossing length of approximately 191.59 m (c. 192 m), gas transmission pipeline installed entirely underground. The HDD reaches a maximum depth of approximately 66 m mOD below ground, corresponding to a depth of approximately 9.2m beneath the Grand Canal (WCX23) at its deepest point. See application drawing GNI143-GNI-PL-CWC-0001.

It is also anticipated that up to four additional regional road crossings may be constructed using trenchless techniques; however, the final construction methodology at these locations will be confirmed by the appointed contractor during the construction phase, who may elect to use open-cut methods subject to site specific conditions.

5.4.1.1.2 Dewatering and Bedrock Excavation

Localised dewatering of excavations may be required during trench construction, particularly in low lying areas, areas with a high groundwater table, or at watercourse crossings. Any dewatering will be temporary in nature and carefully controlled to prevent sediment mobilisation or pollution of surface waters, in accordance with the Outline Construction Environmental Management Plan (CEMP) as presented in Volume 3, Appendix 2.2.

For the majority of the pipeline route through agricultural lands, excavation works will be confined to topsoil and subsoil horizons, and bedrock is not expected to be encountered during open-cut trenching due to the relatively shallow depth (c 1.6 -1.8m BGL).

The Trenchless crossings require deeper excavation methods as a result, bedrock will be encountered locally at each location (see Section 5.4.1.1.1). As highlighted in Section 5.3.7.2 to 5.3.7.5, the depth to bedrock varies at each location. However, the depth of trenchless installation is located in bedrock.

In addition, at the Kilwarden Offtake Installation, deeper and localised excavation works (c. 3.4 m deep c. 10m x 5m wide) will be required to facilitate construction of the hot tap connection, isolation valve pit and associated civil infrastructure. However, as described in Section 5.3.7.1, bedrock was encountered at 8.3mBGL. Hence, the proposed excavation will not encounter bedrock.

Where bedrock is encountered, excavation depths may locally increase to accommodate pipeline alignment and bedding requirements. Rock excavation will be undertaken using appropriate mechanical methods, and excavated rock will be managed separately from soils. Bedding thickness will be increased where required to ensure pipeline protection and compliance with relevant design standards.

5.4.1.1.3 Bedding, Backfilling and Reinstatement

A bedding layer of preapproved inert material (Class 503) will be placed at a minimum depth of 150 mm (or 300 mm in rock) at the base of the trench, compacted prior to lowering in the pipeline. The pipeline will then be surrounded and covered with pre-approved material (Cl. 503) to a minimum of 150 mm above the pipe, followed by further backfilling in 300 mm layers, incorporating warning tape and facilitating appropriate compaction. Where required, water stops will be installed within the trench to prevent the pipeline corridor acting as a preferential pathway for groundwater movement.

Following completion of pipeline installation and backfilling, topsoil will be reinstated across the working width, regraded, contoured and reseeded, and agricultural land returned to its pre-construction condition in accordance with landowner agreements.

It is anticipated that the majority (95%) of the excavated soil will be reinstated as backfill. Any remaining excavated soil will be removed from site and disposed of as established in the Section 5.6.1.1.2 and in accordance with regulations by the contractor.

5.4.1.1.4 Reinstatement Works

Following completion of pipeline installation, all excavations will be backfilled and reinstated. The pipeline trench will be backfilled using an imported pre-approved granular bedding and surround material (Class 503) placed around and above the pipeline to the required depth, after which excavated subsoil will be replaced in layers and compacted to reinstate ground stability. Backfilling will be undertaken in controlled layers to accommodate warning tape and to ensure appropriate compaction, thereby avoiding long-term settlement. Once backfilling of the trench is complete, previously stripped topsoil will be reinstated across the working width, regraded to match pre-construction ground level.

In agricultural areas, reinstated land will be reseeded and returned to its original agricultural use, with field drains reinstated or repaired as necessary to avoid contamination pathways or increased flood risk. Hedgerows, fences and field boundaries temporarily removed to facilitate construction will be reinstated in accordance with landowner agreements and original boundary alignments. With the exception of permanent features associated with the Ballykilleen AGI and the Kilwarden Offtake Installation, reinstatement works are designed to ensure there is no permanent alteration to landform or soil permeability along the pipeline corridor.

5.4.1.2 Storage of Plant Equipment, Machinery, Oils and Fuels

All plant, equipment and machinery required during construction will be stored within the defined works areas or within designated temporary construction compounds established along the pipeline route. As described in Chapter 2, the Proposed Development includes a number of temporary construction compounds and linepipe storage compounds, including facilities at the Kilwarden Offtake Installation, along the pipeline corridor, and at the Ballykilleen AGI, which will accommodate site offices, plant, machinery, materials and welfare facilities for construction personnel.

During the construction phase there will be a requirement for the temporary storage of fuels. The storage of oils, fuels and other potentially contaminating substances will be strictly controlled to minimise the risk of pollution to soils or groundwater. Oils and fuels will not be stored within the general works area along the pipeline route. Instead, all fuels, oils and lubricants required for construction activities will be stored only within designated, secure storage areas inside the temporary construction compounds. These storage areas will be fully bunded in accordance with best practice, with bund capacity designed to contain at least 110% of the volume of the largest container stored (or 25% of total volume stored, whichever is greater).

The use of bunded storage provides effective secondary containment, ensuring that any accidental leaks or spillages are retained within the bunded area and do not enter surrounding soils, drainage features or watercourses. Spill kits and appropriate emergency response procedures will be available within compounds, enabling any spills to be promptly and safely managed in accordance with the Construction Environmental Management Plan (CEMP). These measures ensure that the storage and handling of plant, machinery, oils and fuels does not give rise to significant risk of contamination of land, soils or geological receptors.

5.4.1.3 Use of Land

The Proposed Development site, including the associated temporary working areas covers an area of approximately 243.4 hectares (ha) and encompasses all lands required for the construction and operation of the pipeline, including the Kilwarden Offtake Installation, the Ballykilleen AGI, temporary construction compounds, line-pipe storage areas, and all associated ancillary works.

The Proposed Development Site extends to a width of up to 100m in certain locations, within which the pipeline is located. The actual physical footprint required for construction is substantially smaller, comprising a temporary working width of approximately 30m along linear sections of the pipeline, increasing to approximately 40 m × 45 m at road and watercourse crossings. As a result, a substantial proportion of the lands within the Proposed Development Site will remain unaffected by construction works, as the temporary working width required for construction is narrower than the Proposed Development Site within which the final pipeline alignment will be confirmed.

Based on calculations undertaken by the project design engineers, Fingleton White, the total area of agricultural land falling within the temporary working width is estimated to be approximately 72.9 ha.

The Kilwarden Offtake Installation is located within agricultural land and will result in a 0.223 ha permanent land take at this location. The Ballykilleen AGI is situated within the Edenderry Renewable Energy Complex, an area already characterised by existing industrial and energy-related infrastructure.

5.4.2 Operational Phase

The Proposed Development characteristics which relate to the land soils and geology environment during operation are summarised below.

During operation, no further routine soil stripping, excavation will occur along the pipeline corridor. During operation, the proposed gas transmission pipeline will be located entirely below ground at a minimum

depth of cover in accordance with IS 328:2021. Once installed and reinstated, the pipeline will not be visible at the surface and will not require routine ground disturbance during normal operation.

5.4.2.1 Changes to Hardstanding

The underground gas transmission pipeline, once constructed, will not result in any permanent change to the extent of existing hardstanding areas. All trenches required to facilitate installation of the pipeline, including those across public roads, will be fully backfilled and reinstated following construction.

Temporary construction compounds established during the construction phase will be removed on completion of works and reinstated to their original ground condition.

Permanent hardstanding will be developed at limited locations associated with the Kilwarden Offtake Installation, the Ballykilleen AGI. These areas will result in the permanent sealing of underlying soils.

5.4.2.2 Storage of Hazardous Material

During the operational phase, there will be no bulk storage of fuels, chemicals or hazardous substances along the pipeline route. At above-ground installations, only limited quantities of oils, lubricants or operational materials may be present for maintenance purposes.

5.5 Potential Impacts of the Proposed Development

An analysis of the potential impacts of the Proposed Development on the land, soils and geology environment during the construction and operation is outlined below. Due to the inter-relationship between soils, geology and hydrogeology and surface water (hydrology) the following impacts discussed will be considered applicable to both Chapter 5 and 6 of the EIA Report. Remediation and mitigation measures included in the design of this project to address these potential impacts are presented in Section 5.6.

5.5.1 Construction Phase

5.5.1.1 Potential Impacts Due to Ground Disturbance, Excavations, and Reinstatement

Ground disturbance and excavation works associated with the Proposed Development will result in the local removal and reinstatement of the 'protective' topsoil and subsoil cover across parts of the site during construction. This temporary disturbance of soils may temporarily increase the vulnerability of underlying soils and aquifers, which is already predominantly "Moderate", for the duration of construction activities. However, these works are temporary (short-term) only, and fully reinstated.

At the Kilwarden Offtake Installation, the maximum proposed excavation depth is 3.4m to facilitate construction of the hot tap connection while at Ballykilleen AGI estimated excavation depths are 0.45m, excavation works will involve the removal of soils and subsoils and their replacement with permanent hardstanding and built infrastructure. This will result in a permanent change in ground cover at these limited locations. The introduction of hardstanding will, however, provide a protective capping layer, thereby reducing the potential for downward migration of contaminants to underlying soils and bedrock when compared with exposed ground conditions.

Following construction, the reinstatement of soils along the pipeline corridor and the permanent capping of limited areas at the Ballykilleen AGI and Kilwarden Offtake Installation will restore ground protection, thereby minimising the potential for contamination of underlying soils or bedrock.

Trenchless crossings are proposed at 4no. locations as described in Section 5.4.1.1.1. The proposed HDD method minimises any potential impact on the soil and geological environment. However, based on the proposed depths, bedrock will be encountered at all locations. Given the temporary nature of the

excavation works and the reinstatement measures embedded in design, no significant potential impacts on soils, subsoils, aquifers or bedrock are anticipated.

In the absence of mitigation, the potential impacts during the construction phase due to ground disturbance and excavation on land, soils and geology are **negative, moderate** and **short term**.

A potential risk exists in relation to the excavation and management of soils that may be previously contaminated, including the risk that contaminated soils could be encountered during excavation and reinstated.

Based on the historic land uses and findings of the site investigations, the overall likelihood of encountering contaminated soils along the GNI143 Ballykilleen Pipeline route is considered to be low except for in localised areas where the site investigation encountered elevated concentrations of certain parameters. These elevated concentrations are expected to be localised and are not representative of the entire route. However, if contaminated soils or unsuitable materials were to be reused or imported without appropriate controls, there is potential for adverse effects on soil quality and an increased risk of contaminant migration to underlying geology.

Historical OSI mapping indicates that lands within the Proposed Development area have been historically used predominantly for agriculture use, with no evidence of past industrial activity. While undocumented minor fuel spills or leaks cannot be entirely ruled out, no such incidents have been recorded. Road crossings and areas within or adjacent to the Edenderry Renewable Energy Complex present a slightly higher potential for localised soil contamination compared to agricultural sections of the route, due to historical infrastructure presence and vehicle activity.

Based on the site investigation works, a limited number of localised exceedances were identified within individual shallow soil samples at specific borehole locations as established on Section 5.3.7. These exceedances were not widespread and were restricted to specific sampling depths and locations. If encountered during construction, these materials would require segregation and management by a suitably licensed facility.

A potential risk exists in relation to the sourcing and handling of imported aggregate and fill materials, as well as or that imported materials could introduce contaminants to areas of underlying soils, aquifers or bedrock if not appropriately controlled.

In the absence of mitigation, the potential impacts during the construction phase due to isolated areas of contamination on land, soils and geology are **negative, moderate** and **short term**.

5.5.1.2 Potential Impacts Due to Pollution Risk to Land, Soils, Geology

There is potential for the underlying soil and geology to become contaminated with pollutants associated with construction activity. Short-term pollution risks may arise where contaminated water or construction-related materials come into direct contact with exposed soils during excavation, ground disturbance and material handling.

The potential of contamination during the construction phase is associated with the following sources:

- ▶ Suspended solids (fine soil and particulate matter) – arising from excavation and ground disturbance.
- ▶ Cement/concrete (increase turbidity and pH) – arising from construction materials.
- ▶ Contaminated soils– arising from excavation and ground disturbance.
- ▶ Hydrocarbons and other construction chemicals (ecotoxic) – accidental spillages from construction plant or stored fuels, oils, and materials (or onsite storage).
- ▶ Wastewater (nutrient and microbial rich) – arising from accidental discharge from on-site toilets and washrooms.

In the absence of mitigation, disturbed or exposed soils are susceptible to contamination where pollutants are released or mobilised. Such contamination could lead to localised degradation of land and soils quality or minor impacts on the physical and chemical characteristics of near-surface geological materials. If inadequately controlled, this could result in the limited migration of contaminants within soils.

Based on the site investigation works, a limited number of localised exceedances were identified within individual shallow soil samples at specific borehole locations as established on Section 5.3.7. These exceedances were not widespread and were restricted to specific sampling depths and locations. All soil excavations within these areas are subject to testing prior to reuse. If any contamination is encountered, the soils will be segregated from inert material and classified and removed for offsite disposal in accordance with Council Decision 2003/33/EC made under Directive 1999/31/EC. Hence, minimising any potential migration of contaminants.

There is the potential risk of unintentional discharge from construction traffic or stored materials like fuels and oils which could have negative impacts on land and soils and the underlying bedrock. Construction activities often involve the use of chemicals, such as paints, adhesives, solvents, and pesticides, which can also pose a risk of contamination if not handled and disposed of properly. If a spill occurs, contaminants may be retained within soils or superficial deposits, particularly in areas of low permeability or where ground disturbance has occurred.

Accidental discharges associated with site welfare facilities may also pose a pollution risk to land and soils if wastewater is not adequately contained. However, the provision and use of sealed welfare facilities and appropriate waste management arrangements ensures that the potential for such impacts is effectively controlled.

In the absence of mitigation measures the potential impacts due to pollution risk during the construction phase on land, soils and geology are **negative, moderate** and **short term**.

5.5.1.3 Potential Impacts on Human Health and Populations

Excavation on site may encounter localised areas of contamination which will need to be excavated and disposed of appropriately to a licenced facility. Material that is exported from site, if not correctly managed or handled, could impact negatively on human beings (onsite and offsite). A reduction in soil quality via historical or unmitigated pollutants entering the soil has the potential to lead to negative impacts on human health during construction. Hydrocarbons and petroleum products for example have a risk for humans by inhaling the fumes / dust from contaminated soil.

Given the historic use of the site as predominantly greenfield, characterised by an agricultural function, the risk of potentially contaminated soils along the entirety of the proposed route is considered low except for localised exceedances identified during site investigation.

In the absence of mitigation measures the potential impacts to human health during the construction phase on land, soils and geology are **negative, not significant** and **short term**.

5.5.1.4 Potential Impacts Resulting from Land and Land Use

While the overall Proposed Development Site extends to approximately 243.4 ha, the area of agricultural land based on design calculations undertaken by the project engineers, approximately 72.9 ha of agricultural land will fall within the temporary working width and be subject to short term disturbance during construction.

The Proposed Development will result in the temporary occupation of agricultural lands during the construction phase, principally along the pipeline route and within defined construction compounds and access areas which will result in temporary disruption to normal farming activities. However, considered

in the context of Ireland's total agricultural land resource (approximately 4.5 million hectares¹), this temporary disturbance represents a very small proportion (less than 0.002%) and is therefore not significant at a national scale.

These disruption impacts are short term and reversible. On completion of construction and commissioning, all temporarily affected agricultural lands will be reinstated in accordance with best practice and landowner requirements, allowing farming activities to resume. No above-ground infrastructure will remain along the pipeline route, and therefore no permanent agricultural land take will occur outside the Kilwarden Offtake Installation footprint (permanent land take of approximately 0.223 ha).

Agreements with affected landowners have been secured to manage both temporary and operational requirements. This includes Temporary Licence Agreements for construction and Permanent Easements for long-term access and maintenance. While these agreements facilitate orderly land management, any associated compensation arrangements are outside the scope of environmental impact assessment. These agreements do not prevent continued agricultural use of the reinstated lands.

In the absence of mitigation, the potential impact from the Proposed Development will result in **negative, imperceptible, short-term** and reversible land-use impacts during construction, with only a small permanent land take at the Kilwarden Offtake Installation, and no long-term reduction in agricultural land use along the pipeline route.

5.5.2 Operational Phase

5.5.1.1 Potential impacts on Land, Soils and Geology

During the operational phase, the Proposed Development will comprise a buried gas transmission pipeline, the Kilwarden Offtake Installation, and the Ballykilleen Above Ground Installation (AGI). Once construction is complete and reinstatement undertaken, the majority of the pipeline route will be returned to its original agricultural or greenfield condition, with no ongoing disturbance to soils or geological materials. The permanent presence of buried infrastructure does not give rise to contamination within the soil and superficial deposits.

The Kilwarden Offtake Installation and Ballykilleen AGI includes areas of hardstanding and sealed surfaces that will prevent interaction between operational activities and underlying soils. No routine storage of hazardous substances is undertaken at these sites.

There is limited potential for localised and minor accidental emissions to ground, such as leaks or spillages of petroleum hydrocarbons (e.g. fuels, oils or lubricants), associated with infrequent inspection, maintenance or repair activities undertaken during operation. Unmitigated leaks or spills may lead to contamination of soil, bedrock (or groundwater) which can affect soil health.

In the absence of mitigation measures, the potential impacts during the operational phase on land, soils and geology is **neutral, imperceptible, and long term**.

5.5.1.2 Potential Impacts on Human Health and Populations

There are no sensitive economic features, potential contamination or historical geological features at the site. The Proposed Development does not involve the extraction, or permanent loss of mineral or geological resources, nor does it interact with designated geological features.

There is limited potential for leaks or spills of petroleum hydrocarbons from during site maintenance activities during operation of the development; unmitigated leaks or spills may lead to contamination of soil or groundwater, soils that are contaminated by petroleum hydrocarbons can affect soil health.

¹ <https://www.cso.ie/en/statistics/agriculture/>

Therefore, on this basis in the absence of mitigation measures the potential impacts during the operational phase on human health and populations due to the potential for contamination of soil are **neutral, imperceptible** and **long term**.

5.6 Mitigation Measures

5.6.1 Construction Phase

The Outline Construction Environmental Management Plan (oCEMP) included as Appendix 2.2 of this EIAR has been prepared by AWN Consulting and includes all the mitigation measures set out within this EIAR. The construction contractor will update this CEMP to include any additional mitigation required to ensure compliance with any subsequent consent conditions relevant to the Proposed Development. It will also set out in detail the overarching vision of how the construction Contractor of the Proposed Development will manage the site in a safe and organised manner.

Construction works and the proposed mitigation measures are informed by best practice guidance on the prevention of pollution during development projects including but not limited to:

- ▶ Construction Industry Research and Information Association (CIRIA), Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors (C532);
- ▶ CIRIA Environmental Good Practice on Site (4th edition), (C741);
- ▶ CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors;
- ▶ CIRIA C648 Control of Water Pollution from Linear Construction Projects: Technical Guidance;
- ▶ Enterprise Ireland Best Practice Guide, Oil Storage Guidelines (BPGCS005).
- ▶ Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (Eastern Regional Fisheries Board);
- ▶ Central Fisheries Board Channels and Challenges – The enhancement of Salmonid Rivers;
- ▶ Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (NRA 2008); and
- ▶ Inland Fisheries Ireland (IFI) – A Guideline on Planning for Watercourses in the Urban Environment.
- ▶ Inland Fisheries Ireland (IFI) –Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (2016);

The CEMP documents all mitigation measures in this EIAR to ensure implementation of procedures to control pollution and nuisances arising from site clearance and construction activities. Pollution and nuisances will be prevented where possible and managed in accordance with best environmental protection practices.

The CEMP will be implemented and adhered to by the construction Contractor and will be overseen and updated as required if site conditions change by the Project Manager, Environmental Manager, Resource Manager and Ecological Clerk of Works where relevant. All personnel working on the Site will be trained in the implementation of the procedures.

During the project planning phase, a further detailed emergency response plan will be developed by the construction contractor as part of the CEMP. This plan will outline a well-defined procedure for effectively managing emergencies as they arise. Furthermore, it's imperative to disseminate this emergency protocol to all site personnel during the site induction process. This plan will include for events such as:

- ▶ Pollution incidents: These may involve spillages, the malfunction of temporary structures, embankment collapse, acts of vandalism, fires, and other related events.
- ▶ Extreme weather occurrences: Events such as heavy rainfall, flooding, are important factors to consider due to their potential impact on the construction process.

All mitigation measures outlined here, and within the oCEMP will be implemented during the construction phase, as well as any additional measures required pursuant to planning conditions which may be imposed.

5.6.1.1 Mitigation for Ground Disturbance, Excavations, and Reinstatement

5.6.1.1.1 Management of Ground Disturbance and Excavation

In order to minimise impacts on land, soils and underlying geological materials during construction, including excavation, material storage and reinstatement works, the following mitigation measures will be implemented:

- ▶ Prior to commencement of construction, the main contractor will prepare and adhere to a method statement identifying the minimum area of land disturbance required to carry out the works safely and effectively.
- ▶ Earthworks and excavations will be carefully managed to minimise unnecessary disturbance, degradation of soil structure and loss of soil quality. Movement and handling of soils will be controlled to limit compaction and physical damage.
- ▶ Topsoil and subsoil will be stripped, stored and managed separately to prevent mixing and preserve soil integrity. Subsoil excavated from trenches will be stored on the opposite side of the excavation to topsoil to maintain segregation and reduce unnecessary handling.
- ▶ Temporary soil stockpiles will be located within defined working areas and managed to maintain physical stability and prevent degradation of soil structure.
- ▶ Construction materials, including aggregates and imported fill, will be stored in clearly defined and designated areas within secure compounds to prevent contamination of underlying soils.
- ▶ Access routes, haul roads and entrance areas will be designed to minimise soil compaction and surface damage, with movements restricted to defined haul routes and essential site traffic only.
- ▶ Excavations will be kept open for the minimum practicable duration prior to backfilling and reinstatement to avoid prolonged exposure of soils and geological materials.
- ▶ Reinstatement will be undertaken as soon as practicable following pipeline installation or equipment removal, including appropriate replacement of subsoil and topsoil layers and reinstatement of ground levels to pre-construction conditions.
- ▶ Trench supports or sheet piling may be used where required to ensure excavation stability, protecting surrounding soils and preventing excessive disturbance of geological materials.

With implementation of these measures, the potential impacts on land, soils and geology during construction will be effectively minimised.

5.6.1.1.2 Measures for the Reuse and Disposal of Excavated Material

Where excavated soil is intended for reuse on site, topsoil will be stockpiled separately to the subsoil at designated locations. Stockpiled topsoil and subsoil will be kept free from disturbance for the duration of construction to reduce risk of physical damage and compaction pending reuse across the site for backfilling and landscaping.

All excavated material will be segregated and tested prior to establishing reusability for backfilling. This will be especially applicable in the areas of recorded soil quality exceedance identified during site investigation and discussed in Section 5.3.7. If any contamination is identified, it will be handled in a way that will not impact negatively on workers as well as on water and soil environments, both on and off-site. Where contaminated soil is removed off site it will be brought for appropriate recycling, recovery or disposal at a licensed facility as described in Appendix 14.1 of Chapter 14.

All excavated materials will be visually inspected by suitably qualified persons assessed for signs of possible contamination such as staining or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed to establish reusability for backfilling and for the presence of potential contaminants to ensure that historical pollution of the soil has not occurred. Should it be determined that

any of the soil excavated is contaminated, this will be segregated and appropriately managed by a suitably permitted/licensed waste contractor. It is expected that 95% of excavated material (c. 252,067 m³) will be retained and reused for backfilling purposes on site.

Any excess soil requiring removal from site will be tested to identify any potential contamination. If no contamination is identified, the soil from the greenfield area will be managed as a by product. However, should it be determined that any of the soil excavated is contaminated, this will be segregated, classified for disposal purposes and appropriately managed by a suitably permitted/licensed waste disposal contractor.

If any waste soil requires removal from site, it will be classified by an experienced and qualified environmental professional to ensure that the waste soil is correctly classified for transportation and recovery/disposal offsite.

The potential reuse of excavated material as a byproduct under Regulation 27 of the European Union (Waste Directive) Regulations 2011–2020 (as amended) will be considered where feasible and subject to meeting the relevant regulatory criteria and approval by the Environmental Protection Agency. Similarly, the applicability of Regulation 28 (End of Waste status) will be considered for relevant waste streams where recovery criteria can be satisfied. Further detail is provided in the site-specific Resource and Waste Management Plan (RWMP) in Appendix 14.1 of Chapter 14 of the EIAR.

5.6.1.1.3 Criteria for Sourcing of Aggregates

The Proposed Development will require deliveries of imported engineering fill, including sands and gravels, to support construction activities such as pipeline bedding and the formation of temporary construction compounds and laydown areas.

Imported CL.503 material will be required to provide a suitable bedding layer that will be placed in accordance with IS 328:2021, GNI/AO/SP/007, Guidelines for Managing Openings in Public Roads 2017 (The Purple Book) and compacted in the trench before laying the pipeline. All suppliers will be vetted for:

- ▶ Aggregate compliance certificates/declarations of conformity for the classes of material specified for the Proposed Development,
- ▶ Environmental Management status; and
- ▶ Regulatory and Legal Compliance status of the Company

All imported fill and aggregate that may be required for the Proposed Development will be sourced from reputable suppliers.

5.6.1.2 *Measures for the Control of Pollution from Fuels, Oils and Construction Chemicals*

The following mitigation measures will be implemented during the construction phase in order to prevent any spillages of fuels and other construction chemicals and prevent any resulting discharge of pollutants to soil, surface water or groundwater systems:

- ▶ All plant and machinery will be regularly maintained and serviced to minimise the risk of release of hydrocarbons. This will only be undertaken by qualified personnel;
- ▶ Designation of bunded maintenance and refuelling areas on the Site;
- ▶ Provision of spill kit facilities across the Site, strategically located in high risk areas;
- ▶ Where mobile fuel bowsers are used, the following measures will be undertaken:
 - Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use;
 - The pump or valve will be fitted with a lock and will be secured when not in use;
 - All bowsers to carry a spill kit and operatives must have spill response training;
 - Portable generators or similar fuel containing equipment will be placed on suitable drip trays.

In the case of drummed fuel or other potentially polluting substances which may be used during the construction phase, the following measures will be adopted:

- ▶ Secure storage of all containers that contain potential polluting substances in a dedicated internally bunded chemical storage cabinet unit or inside a concrete bunded area;
- ▶ Oil and fuel storage tanks shall be stored in designated areas, and these areas shall be stored within temporary bunded areas, doubled skinned tanks or bunded containers to a volume of 110% of the capacity of the largest tank/container. Drainage from the bunded area(s) shall be diverted for collection and safe disposal.
- ▶ Clear labelling of containers so that appropriate remedial measures can be taken in the event of a spillage;
- ▶ All drums to be quality approved and manufactured to a recognised standard;
- ▶ If drums are to be moved around the Site, they will be secured and on spill pallets; and
- ▶ Drums will be loaded and unloaded by competent and trained personnel using appropriate equipment.

Refuelling and maintenance of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated area or within the construction compound (or where possible off the site) which will be away from surface water drains – a minimum 50 m buffer zone will be adhered to. In the event of a machine requiring refuelling outside of this area, fuel will be transported in a mobile double skinned tank. An adequate supply of spill kits and hydrocarbon adsorbent packs will be stored in this area. All relevant personnel will be fully trained in the use of this equipment. Guidelines such as “Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors” (CIRIA 532, 2001) will be complied with.

5.6.1.3 Human Health and Populations

No additional mitigation measures are required beyond standard construction best practice and those set out elsewhere in this chapter and within the outline Construction Environmental Management Plan (oCEMP). The pipeline route is located predominantly within greenfield and roadside lands with no evidence of historical land contamination, and therefore significant risks to human health are not anticipated.

During construction, the principal potential risk to human health would arise from inadvertent exposure to contaminated soils, should any be encountered unexpectedly during excavation works. To address this risk, all excavated materials will be visually inspected by suitably qualified personnel for signs of potential contamination, such as unusual staining, discoloration or odours. Where such indicators are identified, appropriate sampling and analysis will be undertaken to confirm the presence or absence of contamination.

Any contaminated material identified will be segregated and managed in accordance with the relevant waste legislation and disposed of by a suitably permitted or licensed waste contractor. All handling of excavated materials and contaminated soils, where present, will be undertaken by trained personnel using appropriate personal protective equipment (PPE) to minimise potential exposure and protect worker health.

5.6.1.4 Land and Land Use

No additional mitigation measures are required in relation to land and land use. The Proposed Development will result in temporary land take during the construction phase, primarily within agricultural and roadside lands, with all disturbed areas fully reinstated following completion of works.

The underground pipeline will be operated under a permanent wayleave arrangement, which will not preclude continued agricultural use of the land above the pipeline once reinstatement has been completed.

5.6.2 Operational Phase

5.6.2.1 Land, Soils and Geology

During operation measures there is no requirement for bulk storage of petroleum products. Due to the nature of the Proposed Development in operation there is no risk of potential leaks and spillages of fuel and oil.

There will be no requirements for mitigations against increased run-off and sediment loading post construction phase of the Proposed Development as the underground gas transmission pipeline will not alter the existing hardstanding areas (all trenches established across roads to facilitate the proposed pipeline will be fully reinstated). There will be additional hardstanding at the above ground compound / pigging compound station location adjacent to the hot tap connection, which will result in increased surface water generation which will drain to the adjacent land and soakaway to ground. There will be no surface water management required for the Proposed Development once operational.

Refer to Chapter 6 (Hydrology and Hydrogeology) of the EIAR for further information on the proposed SUDs design measures at the AGI and pigging compound station hardstanding areas.

5.6.2.2 Human Health and Populations

As there is no source pathway linkage, thus no mitigation is required.

5.7 Monitoring

5.7.1 Construction Phase

During the construction phase, the following monitoring measures will be implemented as part of the Construction Environmental Management Plan (CEMP) to ensure protection of land, soils and underlying geological materials:

- ▶ Regular inspection of ground disturbance and soil management practices will be undertaken to confirm compliance with the mitigation measures set out in this chapter, including correct stripping, segregation, storage and reinstatement of topsoil and subsoil.
- ▶ Visual inspection of excavated materials will be carried out by suitably qualified personnel to identify any indications of potential contamination, such as unusual staining, discoloration or odours. Where such indicators are identified, soil sampling and laboratory analysis will be undertaken to confirm the presence or absence of contaminants and to inform appropriate handling, reuse or disposal options.
- ▶ Monitoring of soil stockpiles and material storage areas will be undertaken to ensure stability is maintained, segregation is preserved, and soils are not subject to excessive compaction, degradation or cross-contamination.
- ▶ Inspection of construction activities with potential pollution pathways to ground, refuelling and maintenance activities, will be carried out to verify that appropriate controls are in place to prevent contamination of soils or underlying geological materials.
- ▶ Findings from inspections and any required corrective actions will be recorded, and where necessary, additional control measures will be implemented in accordance with the CEMP.

5.7.2 Operational Phase

No monitoring measures will be requested during operational phase.

5.8 Residual Effects of the Proposed Development

5.8.1 Construction Phase

5.8.1.1 Land, Soils and Geology

The implementation of the mitigation and monitoring measures detailed in Section 5.6.1 and 5.7.1, will ensure that the potential impacts on land, soil and geology during the construction phase are adequately mitigated. Following the TII criteria (refer to Appendix 5.1) for rating the magnitude and significance of impacts on the soils and geology related attributes, the magnitude of impact is considered **negligible**.

The residual effect on land, soils and geology during the construction phase is considered to be **neutral, imperceptible** and **short-term**.

5.8.1.2 Human Health and Populations

The implementation of the mitigation and monitoring measures detailed in Section 5.6.1 and 5.7.1, will ensure that the potential impacts on human health and populations during the construction phase are adequately mitigated. The residual effect on human health and populations during the construction phase is considered to be **neutral, imperceptible** and **short-term**.

5.8.2 Operational Phase

5.8.2.1 Land, Soils and Geology

The implementation of the mitigation and monitoring measures detailed in Section 5.6.1 and 5.7.2, will ensure that the potential impacts on land, soils and geology once the Proposed Development is constructed and operations are adequately mitigated. Following the TII criteria (refer to Appendix 5.1) for rating the magnitude and significance of impacts on the soils and geology related attributes, the magnitude of impact is considered **negligible**.

The residual effect on soils and geology during the operational phase is considered to be **neutral, imperceptible** and **long-term**.

5.8.2.2 Human Health and Populations

As there is no source pathway linkage, hence no mitigation is required. The residual effect on human health and populations during the operational phase is considered to be **neutral, imperceptible** and **long-term**.

5.9 References

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