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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE DEMOLITION OF AGRICULTURAL STRUCTURES AND THE DEVELOPMENT OF A MATERIALS RECOVERY FACILITY AT DERRYARKIN, RHODE, CO. OFFALY

VOLUME 2 – MAIN BODY OF THE EIAR

CHAPTER 9 – SOILS, GEOLOGY AND HYDROGEOLOGY

Prepared for: Oxigen Environmental Unlimited Company

Oxigen
working for a cleaner environment

Date: September 2022

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9. CHAPTER 9 SOILS, GEOLOGY AND HYDROGEOLOGY

9.1 Introduction

The proposed development is defined in Chapter 1: Introduction and a detailed description of the proposed development is set out in Chapter 4: Description of the Existing and Proposed Development in the local environment, referred to in this chapter as the study area.

This chapter has been prepared to examine the potential significant effects of the proposed development on Soils, Geology and Hydrogeology present in the receiving environment at and surrounding the proposed development site.

The potential significant effects of the proposed development are assessed, having taken account of mitigation measures to reduce or eliminate any residual effects on receiving Soils, Geology and Hydrogeology.

Appendices 9.1, 9.2 and 9.3 have been prepared in support of this chapter. They are included in Volume 3 of this EIAR.

9.1.1 Statement of Competency

This chapter of the EIAR was prepared by Declan Morrissey B.Sc., M.Sc. Declan is a Senior Project Hydrogeologist with 10 years' consultancy experience in Ireland and Canada. Declan has completed numerous soils, geology and hydrogeology impact assessments for energy and infrastructure projects in Ireland and Canada, including solar farm projects, wind farm projects, quarries, power plants, landfills and waste management facilities.

9.2 Assessment Methodology

The methodology adopted for this assessment is as follows:

- Review of appropriate guidance and legislation;
- Characterisation of the receiving geological and hydrogeological environments;
- Review of the proposed development;
- Assessment of Potential Effects;
- Identification of Mitigation Measures; and
- Assessment of Residual Impacts.

9.2.1 Relevant Guidance and Legislation

Relevant Guidance and Reference Documents / Data

The EIA guidelines referred to when completing this assessment are listed in Chapter 1: Introduction of Volume 2 of this EIAR. All topic specific relevant guidelines and reference documents/data that have been considered in the preparation of this chapter are shown below:

- NRA (2009), Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- IGI (2013), Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- EPA (2003), Towards Setting Guideline Values for the Protection of Groundwater in Ireland.
- EPA (2003), Towards Setting Guideline Values for the Protection of Groundwater in Ireland;
- OSI (2021) Current and historic Ordnance Survey Ireland mapping, and ortho-photography;
- Geological Survey of Ireland (2021) Public Data Viewer (https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx);
- Environmental Protection Agency (2021) Review of online EPA Maps (https://gis.epa.ie/EPAMaps/);
- Geological Survey Ireland. 2003. Groundwater Working Group Publication: Guidance Document GW2;
- Geological Survey Ireland (n.d.a). Athboy GWB: Summary of Initial Characterisation; and
- Environment Agency (2018) Technical Guidance WM3 v1.1, Guidance on the Classification and Assessment of Waste.

Relevant Legislation

All topic legislation that has been considered in the preparation of this chapter are shown below:

- European Union (2000/60/EC), Water Framework Directive;
- European Union (2006/118/EC), Groundwater Directive;
- European Communities Environmental Objectives (Groundwater) Regulations (S.I. No. 9 of 2010), as amended;
- European Communities (Water Policy) Regulations (S.I. No. 722 of 2003) as amended.

This chapter has been prepared in compliance with the above relevant guidance and legislation.

9.2.1.1 Water Framework and Groundwater Directives, Status and Risk Assessment

The Water Framework Directive (WFD) provides for the protection, improvement and sustainable use of waters, including rivers, lakes, coastal waters, estuaries and groundwater within the EU Member States. It aims to prevent deterioration of these water bodies and enhance the status of aquatic ecosystems; promote sustainable water use; reduce pollution; and contribute to the mitigation of floods and droughts.
Under the Water Framework Directive large geographical areas of aquifer have been subdivided into smaller groundwater bodies (GWB) for them to be effectively managed.

The overriding purpose of the WFD is to achieve at least 'good status' in all European waters and to ensure that no further deterioration occurs in these waters. European waters are classified as ground waters, rivers, lakes, transitional and coastal waters. The WFD has been implemented in Ireland by dividing the island of Ireland into eight river basin districts under the 1st Cycle. These districts are natural geographical areas that occur in the landscape.

The River Basin Management Plan 2018-2021 has been prepared adopted by Department of Housing, Planning and Local Government. The plan sets out the actions that Ireland will take to prevent deterioration of the status of groundwater and ensuring a balance of abstraction and recharge in all groundwater bodies to achieve good groundwater status by 2027. This plan is still in effect at the present time; however it is set to be replaced by the Draft River Basin Management Plan 2022 – 2027, which is currently in the latter stages of being prepared.

The Groundwater Directive establishes a regime which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. The directive establishes quality criteria that takes account of local characteristics and allows for further improvements to be made based on monitoring data and new scientific knowledge.

The Directive thus represents a proportionate and scientifically sound response to the requirements of the WFD as it relates to assessments on chemical status of groundwater and the identification and reversal of significant and sustained upward trends in pollutant concentrations in groundwater.

9.2.2 Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Chapter: 6 Scoping and Consultation in Volume 2 of this EIAR. The following consultation responses have been considered in the preparation of this chapter:

- Response from Geological Survey Ireland dated 01/06/2021 (See Appendix 6.2 of Volume 3 of this EIAR for details of this response).

9.2.3 Study Area

For the purposes of this assessment, the study area in the context of the receiving soils, geological and hydrogeological environment is defined as the local environment at and surrounding the development site 1:50,000 Scale.

9.2.4 Impact Appraisal Methodology

The following elements were examined to determine the potential significant effects of the proposed development on the Soils, Geology and Hydrogeology within the study area:

- Characterisation of the soils, geological and hydrogeological regimes underlying the study area; and
- Description and assessment of the likely significant effects of the proposed development.

9.2.5 Evaluation Criteria

During each phase (construction, operation, and decommissioning) of the proposed development, several activities will take place on site, some of which will have the potential to cause significant effects on the soil, geological and hydrogeological regimes at the proposed development site.

9.2.5.1 Assessment of Magnitude and Significance of Impact on Soils, Geology and Hydrogeology

An impact rating has been developed for each of the phases of the proposed development based on the Institute for Geologists Ireland (IGI) Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements. In line with the IGI Guidance the receiving environment (Geological Features) was first identified. Using the NRA rating criteria in Appendix C of the IGI Guidance the importance of the geological (Table 9-1) and hydrogeological (Table 9-2) features are rated followed by an assessment of the magnitude of the geological and hydrogeological impacts (Table 9-3 and Table 9-4, respectively). This determines the significance of the impact prior to application of mitigation measures as set out in Table 9-5.

Table 9-1: Criteria Rating Site Importance of Geological Features (NRA, 2009)

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

Table 9-2: Criteria Rating Site Importance of Hydrogeological Features (NRA, 2009)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g., SAC or SPA status
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – e.g., NHA status. Regionally important potable water source supplying >2500 homes. Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer. Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer Potable water source supplying >50 homes. Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer. Potable water source supplying <50 homes.

The assessment of the magnitude of an impact incorporates the timing, scale, size and duration of the potential impact. The magnitude criteria for geological impacts are defined as set out in Table 9-3 and for hydrogeological impacts in Table 9-4.

Table 9-3: Estimation of Magnitude of Impact on Geological Features (NRA, 2009)

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

Table 9-4: Estimation of Magnitude of Impact on Hydrogeological Features (NRA, 2009)

Magnitude	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Removal of large proportion of aquifer. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Potential high risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >2% annually.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer. Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. Potential medium risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >1% annually.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >0.5% annually.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident <0.5% annually.

The matrix in Table 9-5 determines the significance of the impacts based on the importance and magnitude of the impacts as determined by Table 9-1 and Table 9-3 (geology) and Table 9-2 and Table 9-4 (hydrogeology).

Table 9-5: Ratings of Significance of Impacts for Geology and Hydrogeology (NRA, 2009)

Importance of Attribute	Magnitude of Impact			
	Negligible	Small Adverse	Moderate Adverse	Large Adverse
Very High	Imperceptible	Significant/Moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

The significance of all likely effects on soils, geology and hydrogeology associated with each phase of the proposed development is assessed in Section 9.4.

9.2.6 Desk Study

Prior to intrusive site investigations, a desk study was undertaken to determine the baseline conditions within the study area and planning boundary to provide relevant background information. The desk top study involved an examination of the sources of information listed in Section 9.2.1.

To determine the existing soil, geological and hydrogeological regimes within the study area the following EPA and GSI online datasets and mapping from the sources outlined in Section 9.2.1 were reviewed:

- Quaternary Geology;
- Bedrock Geology;
- Economic Geology;
- Landslide Susceptibility;
- Catchment & Management Units;
- Groundwater Bodies Status and Risk;
- Drinking Water Protection Areas;
- Groundwater Resources (Aquifers);
- Groundwater Wells and Springs;
- Karst Features;
- Groundwater Vulnerability.

9.2.7 Field Assessments

An intrusive site investigation was undertaken in January and February 2021 by IGSL Ltd. The scope of the geotechnical survey is summarised below with the information obtained referenced in this chapter:

- Advancement of 5 No. trial pits to a maximum depth of 3.5m below ground level (BGL);
- Advancement of 6 No. cable percussion boreholes to a maximum depth of 8.5m BGL;
- Advancement of 4 No. rotary open hole drillholes to a maximum depth of 12m BGL;
- Installation of 4 No. groundwater monitoring installations from 4 No. rotary open hole drillholes;
- Collection of groundwater samples for laboratory analysis;
- Surveying of exploratory borehole locations.

Detailed logs of all trial pits, boreholes and drill holes advanced during the intrusive site investigation works are present in Appendix 9.1: Factual Ground Investigation Report.

The Certificate of Analysis from ALS Life Sciences Ltd. for groundwater monitoring completed by a Fehily Timoney and Company (FT) Environmental Scientist is in Appendix 9.2: ALS Life Sciences Ltd. Groundwater Monitoring Certificate of Analysis.

9.3 Baseline Environment

The receiving soils, geological and hydrogeological environment of the proposed development site are described hereunder.

The geological descriptions as recommended by NRA (2009) and IGI (2013) include underlying quaternary and bedrock geology, areas of geological heritage, areas of economic interest with respect to geological resources and potential for soil contamination. The hydrogeological descriptions as recommended by NRA (2009) and IGI (2013) include groundwater bodies, groundwater supply sources, groundwater protection zones, group water schemes, and wells and springs.

This section also includes site-specific information obtained during the intrusive site investigation and groundwater monitoring.

9.3.1 Quaternary (Subsoils) Geology

The subsoils present at the proposed development site were taken from the GSI 1:50,000 Quaternary Geology of Ireland map (GSI, 2021) and comprise of 'cut over raised peat' (Cut). Other deposits in the study area include 'gravels derived from limestones' (GLs) west and southwest of the proposed development site and 'till derived from limestones' (TLs) northeast of the proposed development site.

The intrusive site investigations completed within the proposed development site generally encountered concrete, made ground/fill or topsoil ranging from 0.1 to 0.8m in thickness overlying clayey and/or fine to coarse sandy gravel with occasional to many cobbles to a maximum depth of 12.0m BGL. Layers of silt, clay, sand and clay were noted at some locations.

No peat was noted during the site investigation, but shallow soils in TP1, TP3 and TP4 were noted as 'organic' or containing 'organic matter' to 1.1m.

Soils during the site investigation were closer to the GSI description of 'gravels derived from limestones' located west and southwest of the site.

The quaternary geology of the study area is presented in Figure 9-1.

9.3.2 Bedrock Geology

The GSI 1:100,000 scale bedrock geology map (GSI, 2021) shows the proposed development site is underlain by the Lucan Formation, which is described as dark grey to black, fine-grained, occasionally cherty, micritic limestones.

Bedrock was not encountered during the intrusive site investigation.

The bedrock geology of the study area is presented in Figure 9-2.

9.3.3 Geological Heritage

The GSI - Irish Geological Heritage Section (IGH) and NPWS (National Parks and Wildlife Service) have undertaken a programme to identify and select important geological and geomorphological sites throughout the country for designation as NHAs (Natural Heritage Areas) – the Irish Geological Heritage Programme. This is being addressed under 16 different geological themes. For each theme, a larger number of sites (from which to make the NHA selection) are being examined, to identify the most scientifically significant. The criterion of designating the minimum number of sites to exemplify the theme means that many sites of national importance are not selected as the very best examples. However, a second tier of County Geological Sites (CGS) (as per the National Heritage Plan) means that many of these can be included in County Development Plans and receive a measure of recognition and protection through inclusion in the planning system.

The GSI Online Irish Geological Heritage database (GSI, 2021) indicates that the proposed development is not located in an area of specific geological heritage interest, including NHAs and CGS. The nearest site of significant geological heritage feature to the proposed development site is Croghan Hill (Site Name: OY014). The geological feature is described by the GSI as 'a prominent hill rising from an otherwise flat landscape of midland raised bogs and low-lying pasture'. The hill is the remains of an extinct volcano which erupted during the Carboniferous Period. The feature is located approximately 3.1km south of proposed development sites in Offaly townlands Croghanhill, Cannakill and Ballybeg.

The distribution of Geological Heritage sites is shown on Figure 9-3.

9.3.4 Economic Geology

The GSI Online Minerals Database accessed via the Public Data Viewer (GSI, 2021) shows a number of active quarries within the study area. These consist of a sand and gravel quarries, none of which are located within the site boundary, see Figure 9-4. The nearest quarry is located c.80m west of the site (at its closest point).

The Aggregate Potential Mapping database indicates that the proposed development site is located within an area of high potential for granular aggregate, described as Carboniferous limestone sands and gravels of glaciofluvial origin. The quarry west of the proposed development site is located within this area. Mapping indicates there is low potential for crushed rock aggregate.

9.3.5 Landslide Susceptibility

The GSI Online Landslides Susceptibility Database accessed via the Public Data Viewer (GSI, 2021) shows landslide susceptibility at the proposed development site is low, see Figure 9-5. The nearest landslide event to the proposed development occurred ca. 7km to the south-southeast, recorded as a rupture occurring in 1975.

9.3.6 Intrusive Site Investigation

The site investigation factual report is provided in Appendix 9.1: Factual Ground Investigation Report, Volume 3 of this EIAR.

As part of the baseline assessment of the study area an intrusive site investigation was undertaken between January and February 2021 to confirm the geological succession underlying the site.
The investigation comprised the excavation of 5 No. trial pits to a maximum depth of 3.0m BGL, 6 No. cable percussion boreholes to maximum depths 8.5m BGL and 4 No. rotary open hole drillholes to a maximum depth of 12.0m BGL. The 4 No. rotary open hole drillholes were completed as groundwater monitoring wells (RC01 to RC04).

The intrusive site investigations completed within the proposed development site generally encountered concrete, made ground/fill or topsoil ranging from 0.1 to 0.8m in thickness overlying clayey and/or fine to coarse sandy gravel with occasional to many cobbles to a maximum depth of 12.0m BGL. Some layers of silt, clay, sand and clay were noted at some locations.

Bedrock was not encountered during the intrusive site investigation.
Geotechnical, chemical and environmental laboratory testing was scheduled on a range of soil samples. The geotechnical testing on soils includes moisture contents, Atterberg Limits and Particle Size Distribution [PSD] classification tests. Chemical analysis comprised BRE SD1 testing undertaken by Chemtest Laboratories. This analysis was carried out for the purpose of characterizing soils on-site and assessing the existing soils for the presence of contaminants.

Environmental soil samples were collected from trial pits (TP2 from 0.5 – 0.9m, TP5 from 0.2 – 0.7m) and boreholes (BH3 at 1.0m, BH5 at 0.5m) for Waste Acceptance Criteria (WAC) analysis. This WAC analysis was carried out for the purpose of further characterizing the nature of the existing soils present on-site, assessing the existing soils for the presence of contaminants, and determining whether the existing soils on-site should be classed as hazardous, non-hazardous or inert.

9.3.6.1 Waste Classification Assessment

The analytical soil results presented in Appendix 9.1: Factual Ground Investigation Report (Appendix 6) were assessed using the HazWasteOnline™ tool to classify the sampled material.

HazWasteOnline™ is a web-based commercial waste classification software package which assists the user in the classification of potentially hazardous and non-hazardous materials. The software incorporates the European List of Waste and the Environment Agency Guidance: *Technical Guidance WM3 v1.1, Guidance on the Classification and Assessment of Waste, 2018.*

The results of the waste classification assessment for samples collected from TP2 from 0.5 – 0.9m, TP5 from 0.2 – 0.7m, BH3 at 1.0m, BH5 at 0.5m classified all samples as "*Non-Hazardous*".

The HazWasteOnline™ report for the waste classification assessment is presented in Appendix 9.3: Waste Classification Assessment in Volume 3 of this EIAR.

9.3.6.2 Waste Acceptance Criteria (WAC) Assessment

As samples were classified as "*Non-Hazardous*", analytical WAC results for TP2 from 0.5 – 0.9m, TP5 from 0.2 – 0.7m, BH3 at 1.0m, BH5 at 0.5m presented in Appendix 9.1: Factual Ground Investigation Report (Appendix 6) were assessed against the Inert WAC threshold values to determine a suitable disposal facility should it be required.

All results were below the more stringent Inert threshold values, indicating that existing soils on-site are in an uncontaminated state.

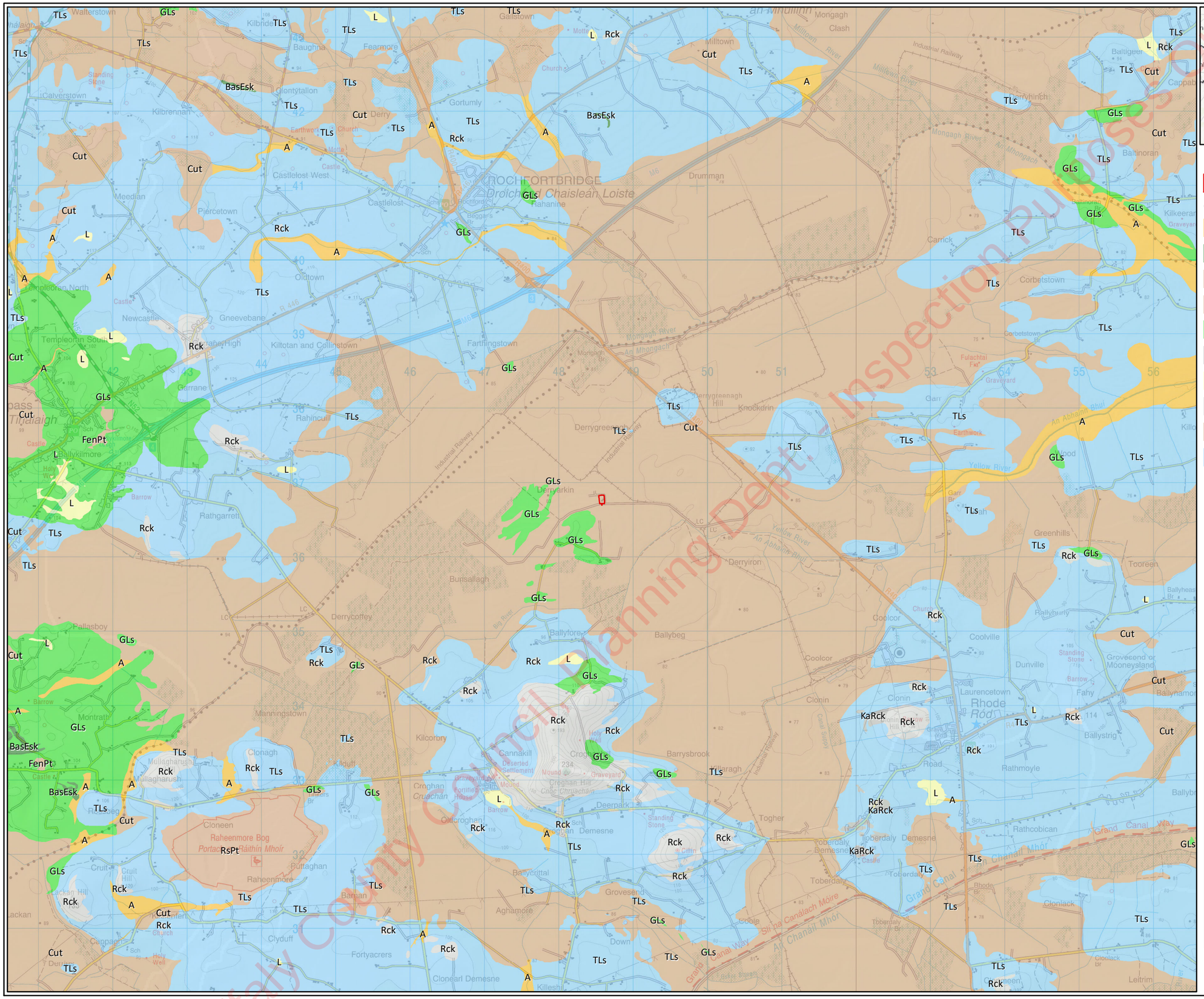
9.3.6.3 Soil Contamination

The proposed development site was previously used for agriculture. No evidence of soil contamination has been noted, having regard to the baseline soil testing carried out on-site.

9.3.6.4 Site Suitability Assessment

A Site Suitability Assessment involving on-site percolation testing has been undertaken to demonstrate that area of ground to be used for the proposed on-site wastewater treatment system percolation is suitable for safely filtering and moving treated effluent from the wastewater treatment system (which will consist of a secondary treatment / soil polishing system).

These results of this test and the Site Suitability Assessment Report can be found in Appendix 4.2, Site Suitability Assessment, in Volume 3 of this EIAR. This assessment concluded that the ground at the proposed percolation area on-site is suitable for the proposed wastewater treatment system.



Legend

- Site Boundary

Quaternary Sediments:

- A, Alluvium
- BasEsk, Eskers comprised of gravels of basic reaction
- Cut, Cut over raised peat
- FenPt, Fen Peat
- GLs, Gravels derived from Limestones
- KaRck, Kartsified bedrock outcrop or subcrop
- L, Lacustrine sediments
- Rck, Bedrock outcrop or subcrop
- RsPt, Raised Peat (intact)
- TLs, Till derived from limestones

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Offaly County Council
PLANNING
PL2 / 22 / 490
21 / 09 / 2022

TITLE:	Quaternary Geology		
PROJECT:	Oxigen Derryarkin Materials Recovery Facility		
FIGURE NO:	9.1		
CLIENT:	Oxigen Environmental Unlimited Company		
SCALE:	1:50000	**REVISION:**	0
DATE:	14/06/2022	**PAGE SIZE:**	A3

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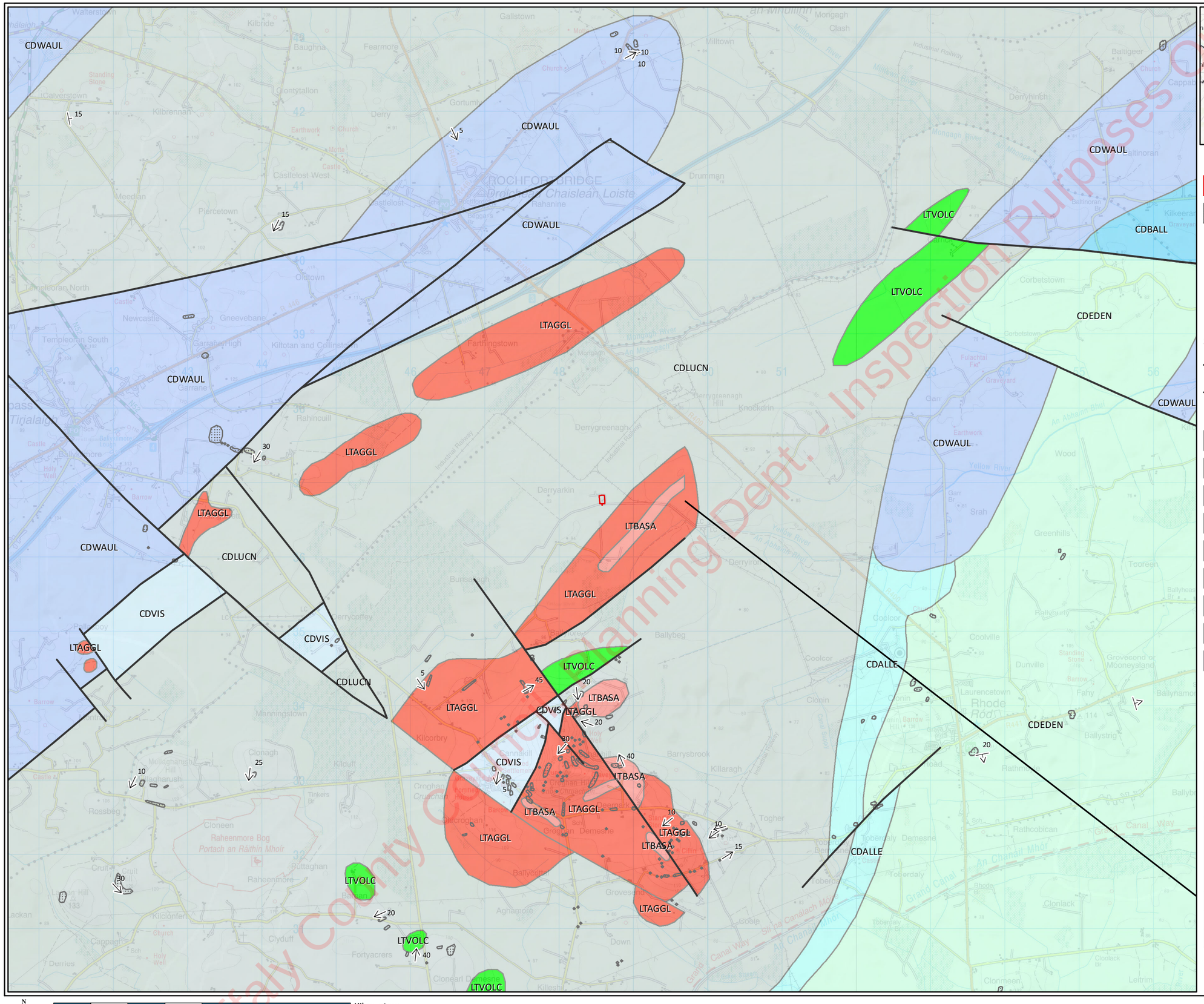

Legend

- Site Boundary
- Bedrock Outcrop

Bedrock Structural Symbols:

- Dip of bedding or main foliation, old GSI data
- Strike and dip of bedding, right way up
- Strike and dip of bedding, way up unknown

Stratigraphic and Structural Linework:

- Fault
- X-Section

Bedrock Geology:

- Allenwood Formation
- Ballysteen Formation
- Edenderry Oolite Member
- Lucan Formation
- Visean Limestones (undifferentiated
- Waulsortian Limestones
- Agglomerate
- Basalt
- Volcanics

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PL2 / 22 / 490
21 / 09 / 2022

TITLE: Bedrock Geology			
PROJECT: Oxigen Derryarkin Materials Recovery Facility			
FIGURE NO:	9.2		
CLIENT:	Oxigen Environmental Unlimited Company		
SCALE:	1:50000	**REVISION:**	0
DATE:	14/06/2022	**PAGE SIZE:**	A3

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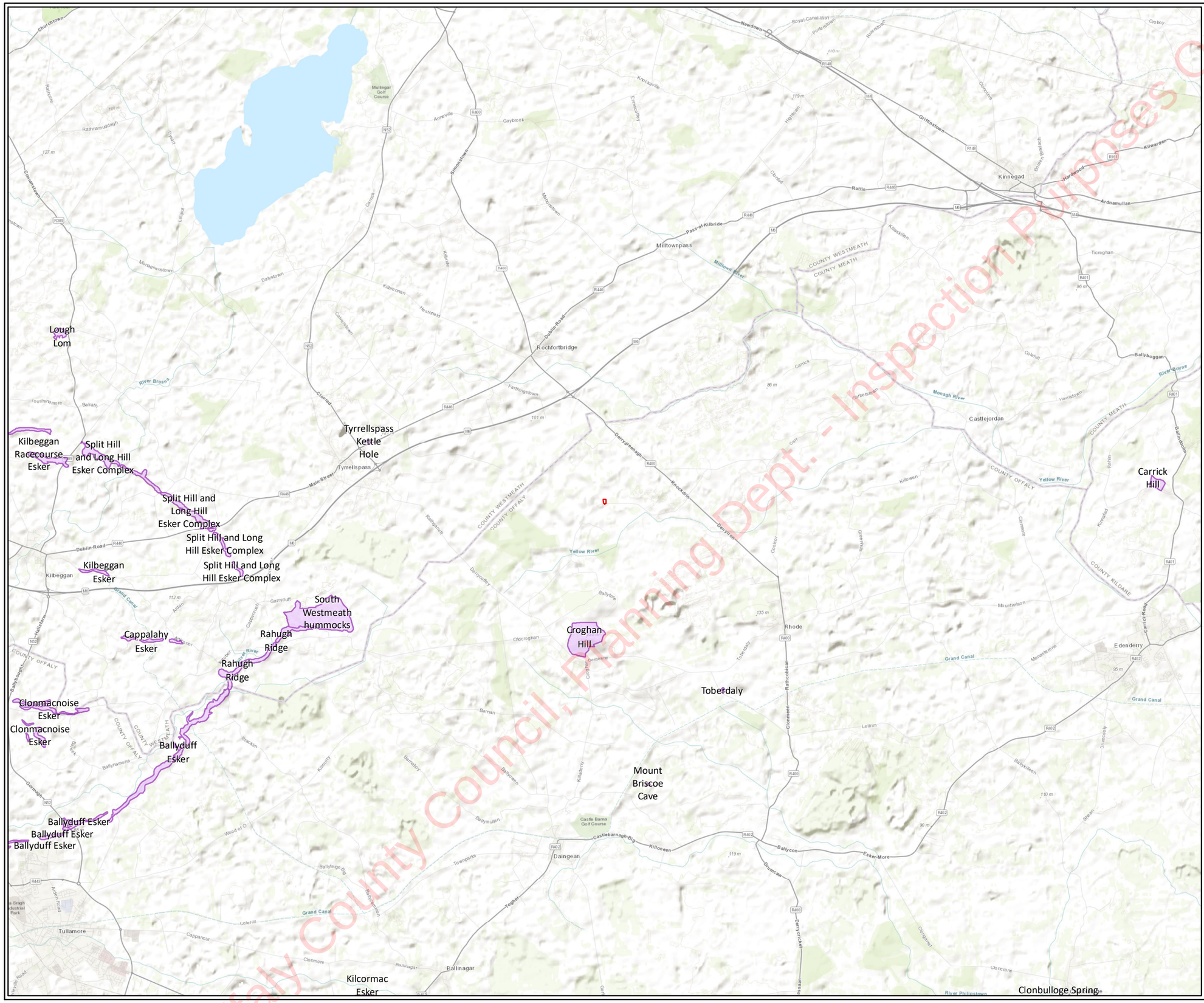

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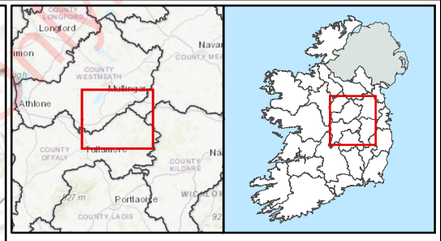

Legend

- Site Boundary
- Geological Heritage Sites (Audited Boundaries)

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PL2 / 22 / 490
21 / 09 / 2022

TITLE:	Geological Heritage		
PROJECT:	Oxigen Derryarkin Materials Recovery Facility		
FIGURE NO:	9.3		
CLIENT:	Oxigen Environmental Unlimited Company		
SCALE:	1:100000	**REVISION:**	0
DATE:	14/06/2022	**PAGE SIZE:**	A3

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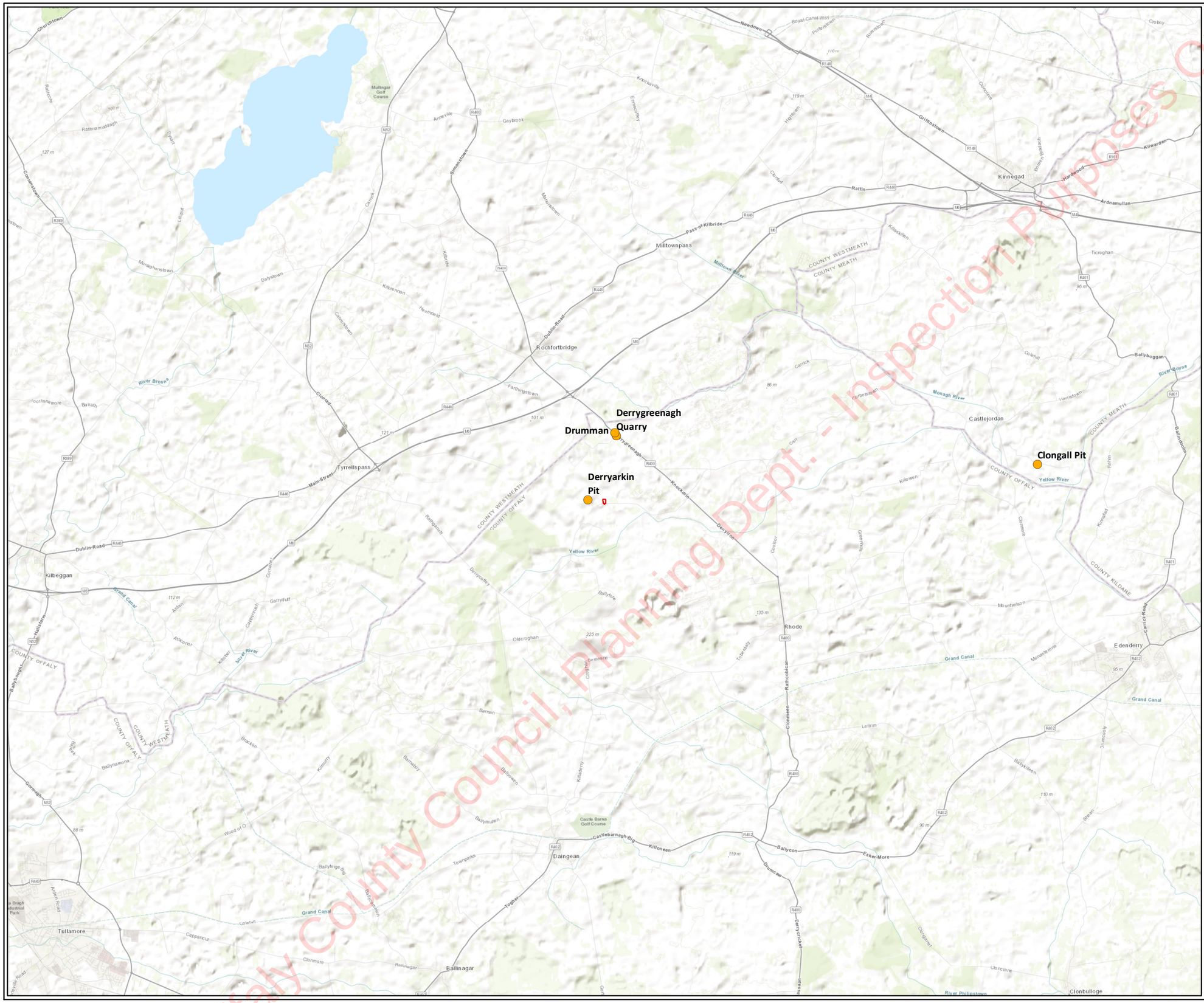

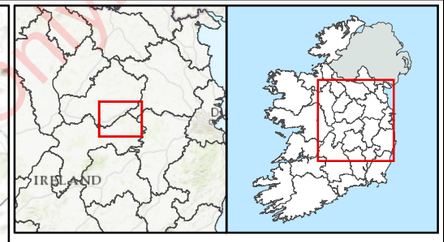

Legend

Site Boundary

Active Quarries:

Sand and Gravel

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TITLE: Economic Geology			
PROJECT: Oxigen Derryarkin Materials Recovery Facility			
FIGURE NO:	9.4		
CLIENT:	Oxigen Environmental Unlimited Company		
SCALE:	1:100000	**REVISION:**	0
DATE:	14/06/2022	**PAGE SIZE:**	A3

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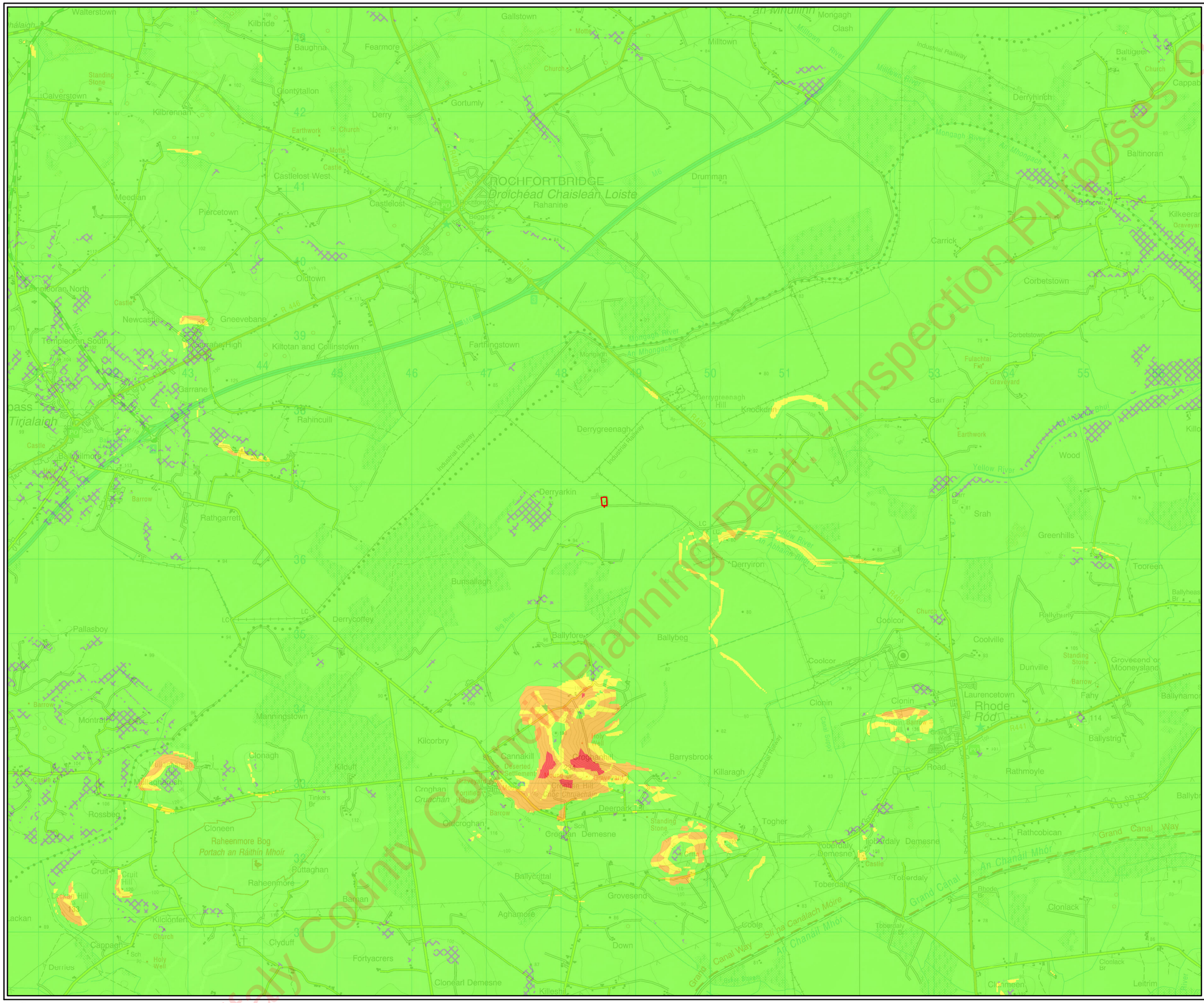

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TITLE: Landslide Susceptibility			
PROJECT: Oxigen Derryarkin Materials Recovery Facility			
FIGURE NO:	9.5		
CLIENT:	Oxigen Environmental Unlimited Company		
SCALE:	1:50000	**REVISION:**	0
DATE:	14/06/2022	**PAGE SIZE:**	A3

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9.3.7 Hydrogeology

9.3.7.1 Groundwater Vulnerability

The Groundwater Vulnerability is classified by the GSI as 'Moderate' at the proposed development site due to the presence of low permeability deposits (peat). GSI mapping indicates a total thickness of overburden of 5 to 10 metres (GSI, 2021).

The intrusive site investigation indicated peat was not present at the site, however a layer of gravel greater than 10m was present.

The groundwater vulnerability the proposed development site is presented in Table 9-6. This table outlines the standard ratings of vulnerability used by the GSI, with the existing site conditions is highlighted in grey based on the findings of the intrusive site investigation. The vulnerability of 'Moderate' based on the GSI is reclassified to 'High' based on the sandy gravel at the site.

Table 9-6: Groundwater Vulnerability

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (sand/gravel)	Moderate Permeability (sandy soil)	Low Permeability (clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	**> 3.0 m**	3.0 -10.0 m	3.0 - 5.0 m
Moderate (M)	N/A	>10.0 m	5.0 - 10.0 m
Low (L)	N/A	N/A	>10 m

Groundwater vulnerability as described by the GSI for the study area is shown on Figure 9-6.

9.3.7.2 Groundwater Bodies Description

The proposed development is located within the Athboy Groundwater Body (GWB) as shown in Figure 9-7.

The description of the GWB has been taken from the 'Summary of Initial Characterisation' draft reports for each defined GWB published by the GSI in accordance with the Groundwater Working Group Publication: Guidance Document GW2 (2003). The GWB Characterisation Reports are available from the GSI Public Data Viewer. Site specific data including subsoil type encountered during intrusive investigations has been used to supplement and validate the published information.

According to interim classification work carried out as part of the Water Framework Directive and published by the EPA, the Athboy GWB is classified as having *'Good'* status in terms of quality and quantity. The overall risk result of '*At Risk'* is applied to the GWB.

9.3.7.3 Athboy Groundwater Body

The Athboy GWB is a large GWB and extends from Navan in the northeast to Tyrrellspass and Rochfortbridge in Westmeath (GSI, n.d.a). The topography of the GWB is typical of the Midlands, with little relief and some isolated hills which rarely rise above 150m ordnance datum (OD). Generally, the elevation falls from northwest to southeast with an undulating land surface and large hummocks of glacial drift deposited under the ice as moraines.

The subsoil cover over the aquifer in the Athboy GWB is quite varied. The predominant subsoil type is till, mostly derived from limestone. Some till is derived from Lower Paleozoic rocks. There are several gravel or peat deposits throughout the GWB. Subsoil thickness has not yet been adequately mapped in the GWB.

The Athoy GWB comprises of Dinantian Upper Impure Limestones which form part of the Lucan Bedrock Formation, Dinantian Pure Unbedded Limestones, Dinantian Lower Impure Limestones and Dinantian Early Sandstones, Shales and Limestones.

The aquifer type within the Athoby GWB is mostly (ca. 97%) classified as LI - Locally important bedrock aquifer which is moderately productive only in local zones. There are small amounts of Pl - Poor aquifer, generally unproductive except for local zones (ca. 1.2%) and Lm - Locally important aquifer, generally moderately productive (ca. 2%) in the GWB.

According to the 'Summary of Initial Characterisation' report for the Cushina GWB (GSI, n.d.a), the majority of groundwater flow within this GWB is considered to occur in the upper 3 to 5m of weathered bedrock. Locally, deeper flow development through a network of fractures and fissures may be present. The fractures can become enlarged by solution to form karstic conduits, transporting large volumes of water at high speeds.

Information provided by the GSI indicates that the main recharge mechanism to the GWB is via diffuse recharge, with the slope and thickness and permeability of the soil and subsoil determining the amount of recharge reaching the aquifer. According to the GSI, due to the low permeability of the aquifer a high proportion of the recharge will discharge rapidly to surface water courses via the upper weathered layers of the aquifer, effectively reducing the available groundwater resources in the aquifer. Point source recharge can also occur in the GWB with rivers disappearing underground in swallow holes or caves and reappearing as springs.

The main discharge mechanism from the Athboy GWB is to overlying rivers and streams. There is also potential for discharge to the adjacent Trim GWB to the east.

9.3.7.4 Groundwater Body Classifications

The GSI classifications for the Athboy GWB, including the principal aquifer characteristics are summarised in Table 9-7, and shown on Figure 9-7:

Table 9-7: Summary of Aquifer Classifications and Characteristics

Groundwater Body	European Code	Aquifer Name	GSI Aquifer Classification	Status	Transmissivity (m^2/day)
Athboy	IE_EA_G_001	Unnamed	LI[1], PI[2], Lm[3]	Good	50

[1] LI: Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

[2] PI: Locally Important Aquifer - Bedrock which is Generally Productive except for Local Zones

[3] Lm: Locally Important Aquifer - Bedrock which is Generally Moderately Productive

9.3.8 Groundwater Supply Sources

A review of published information on groundwater supply sources within the study area was undertaken to identify potential groundwater dependant receptors at potential risk from the proposed development. These include group water schemes (GWS), source protection zones and private supply wells with information on these features obtained from the GSI Groundwater database.

9.3.9 Source Protection Zones

The GSI maintains a database of Public Supply Source Protection Areas. From a review of the database there are no Public Supply Source Protection Areas within the site boundary (GSI, 2021).

There is 1 no. Public Supply Source Protection Area in the study area (GSI, 2021), listed in Table 9-8 and presented in Figure 9-7.

Table 9-8: Source Protection Areas in Vicinity of the Proposed Development Site

Source Protection Area	Distance to Proposed Development Site
Toberydaly	4.4km southeast

9.3.10 Group Water Schemes

Based on a review of the current GSI groundwater database, there are no Group Water Schemes (GWS) within the site boundary or study area (GSI, 2021).

9.3.11 Groundwater Productivity at the Development Site.

The development site lies above a section of the Athboy GWB that comprises a Locally Important Aquifer that consists of Bedrock which is Moderately Productive only in Local Zones.

9.3.12 Groundwater Wells and Springs

A GW well was observed on-site during the site walkover.

Based on a review of the GSI Groundwater Wells and Springs database there is another 1 no. Groundwater Well recorded (to 1km accuracy) within 1km of the proposed development site (GSI, 2021). For the nature of the proposed development, the 1km search radius for groundwater wells and springs is based on a standard industry approach.

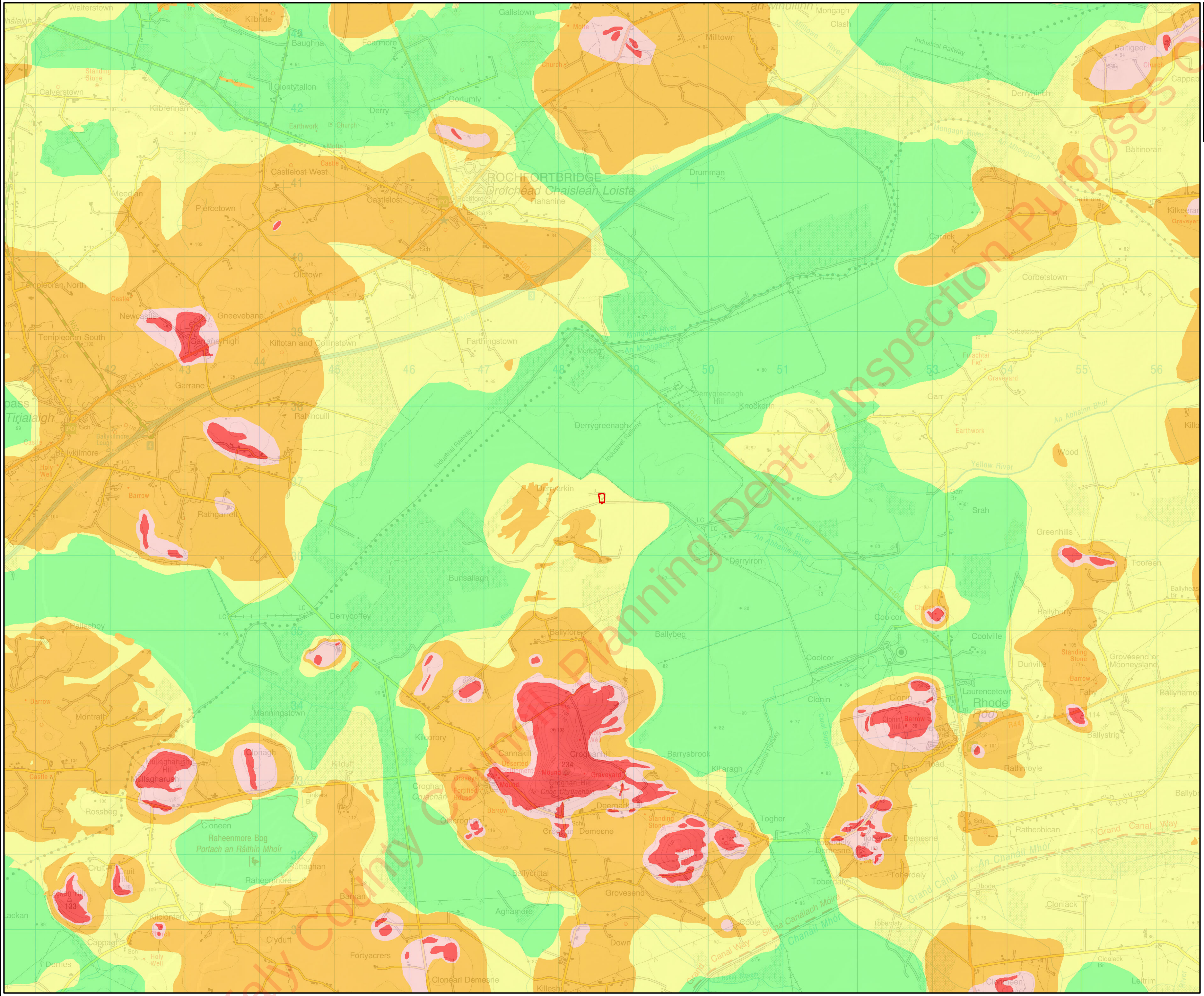
Figure 9-8 shows the location of groundwater wells included in the GSI dataset and the available details are included in Table 9-9:

Table 9-9: Groundwater Well Characteristics within 1km of Proposed Development

GSI Well ID	Groundwater Well Type	Total Depth	Depth to Bedrock	Yield (m^3/day)	Yield Class
2323SEW023	Borehole	19.8	Not available	33	Poor

9.3.13 Karst Features

According to the GSI datasets (GSI, 2021), there are no karst features recorded within the proposed development site boundary as shown in Figure 9-8. The nearest karst feature to the site is Toberdaly Spring (2323SEK001). The spring is located approximately 6.0km south-southeast of the proposed development site.



Legend

- Site Boundary

Groundwater Vulnerability:

- E - Extreme
- H - High
- M - Moderate
- L - Low
- X - Rock Near Surface or Karst

TITLE:	Groundwater Vulnerability
PROJECT:	Oxigen Derryarkin Materials Recovery Facility
FIGURE NO:	9.6
CLIENT:	Oxigen Environmental Unlimited Company
SCALE:	1:50000
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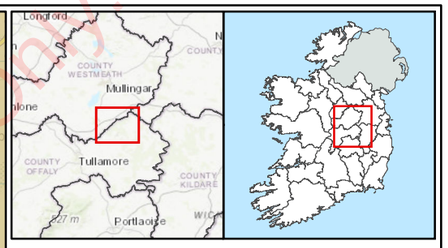

Legend

- Site Boundary
- Source Protection Area (Inner)
- Source Protection Area (Outer)
- WFD Ground Water Bodies

Sand and Gravel Aquifers:

- Locally important gravel aquifer

Bedrock Aquifers:

- Lk: Locally Important Aquifer - Karstified
- Ll: Locally Important Aquifer - Bedrock Mod Productive Locally
- Lm: Locally Important Aquifer - Bedrock Generally Mod Productive

Kilometers
0 1 2 4

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TITLE:	Groundwater Bodies and Groundwater Aquifers
PROJECT:	Oxigen Derryarkin Materials Recovery Facility
FIGURE NO:	9.7
CLIENT:	Oxigen Environmental Unlimited Company
SCALE:	1:50000
REVISION:	0
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Legend

- Site Boundary
- Wells and Springs (10-50m Accuracy)
- Wells and Springs (50-100m Accuracy)
- Wells and Springs (100-200m Accuracy)
- Wells and Springs (500m-1km Accuracy)

Karst Features:

- Spring

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TITLE:	Groundwater Wells and Springs		
PROJECT:	Oxigen Derryarkin Materials Recovery Facility		
FIGURE NO:	9.8		
CLIENT:	Oxigen Environmental Unlimited Company		
SCALE:	1:50000	**REVISION:**	0
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9.3.14 Groundwater Quality and Conductivity

Groundwater sampling was undertaken by FT on 22nd June 2021. Groundwater samples were taken from groundwater monitoring wells (RC01 to RC04) installed during the site investigation carried out on-site in January and February 2021. These samples were sent to a third-party laboratory ALS Life Sciences Ltd for testing. This monitoring was carried out to establish the baseline condition of groundwater at the development site.

The location of the groundwater monitoring wells, and groundwater levels are presented in Figure 9-9. Groundwater levels in April 2021 ranged from 2.72 to 3.09m BGL. Based on the hydraulic gradient, it is estimated that groundwater flows in a north to south/southeast direction, generally following topography in the area.

Samples were analysed for a broad suite of parameters including the following:

- pH
- Conductivity
- BOD
- COD
- TOC
- Suspended Solids
- Heavy metals (Toxic 9 metals)
- TPH CWG Suite (speciated)
- Ammoniacal nitrogen (low level)
- Nitrate as N
- Nitrite
- Phosphate
- Sulphate
- Chloride
- Total Alkalinity (as $CaCO_2$)

A summary of the groundwater testing results for key, relevant parameters is presented in Table 9-12. These monitoring parameters were chosen based on pre-existing contamination risks on-site (E.g. agricultural activities), and potential contamination risks associated with the proposed development (E.g. waste management related activities, fuel storage), noting the importance of quantifying baseline concentrations of the parameters of interest associated with proposed site activities.

The chemical analysis results were compared to overall threshold value (OTV) from the European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010), as amended, or where appropriate, the interim guideline values (IGVs) from the EPA publication, Towards Setting Guideline Values for the Protection of Groundwater in Ireland (EPA, 2003).

Low concentrations of filtered dissolved metals including copper, lead, and zinc were recorded in groundwater samples. Heavy metal concentrations below all applicable IGV/OTV values for heavy metal parameters.

Arsenic concentrations were above the IGV limit of 0.01µg/l at each of the 4 monitoring wells, however all arsenic results were below the OTV limit for arsenic of 7.5µg/l. It is noted that OTV limits have primacy over IGV limits. The source of this arsenic on-site is unconfirmed. Concentrations of arsenic in groundwater samples are very low nonetheless and may be indicative of natural background levels.

Recorded concentrations of Total Petroleum Hydrocarbon (TPH) Criteria Working Group (CWG) were found to be below laboratory detection limits at all monitoring locations with the exception of RC02 to the northeast of the site. Aliphatics >C12-C16, >C16-C21, >C21-C35, >C16-C35, Total Aliphatics >C12-C35 and Total Aliphatics & Aromatics >C5-35 were all above laboratory detection limits.

Concentrations of TPH in this groundwater sample are unlikely to be as a result of historical activity at the site however given that RC02 is situated along the northern boundary of the site and the flow of groundwater in the area is from north to south. These concentrations may be as a result of historical and/or current activity upgradient of the site.

pH values were between 7.12 and 7.52 (within normal range). Conductivity values were broadly consistent at each location with values between 0.63 mS/cm and 0.747 mS/cm recorded. It is noted that the 0.63 mS/cm conductivity value recorded at RC01 is below the acceptable range of 0.8 – 1.875 for conductivity defined in the groundwater regulations. Levels of conductivity in this groundwater sample are unlikely to be as a result of historical activity at the subject site however given that RC01 is situated along the northern boundary of the site and the flow of groundwater in the area is from north to south. In contrast, it is noted that published information from the GSI indicates that the Athboy GWB has a high calcium bicarbonate signature, is 'hard' and has a high electrical conductivity (600-700 µS/cm).

Table 9-10: Groundwater Monitoring Results, June 2021

Parameter	Units	RC01	RC02	RC03	RC04	OTV / IGV
Ammoniacal Nitrogen as N	mg/l	2.17	0.953	0.2	0.209	0.065 - 0.175
Conductivity @ 20 deg.C	mS/cm	0.63	0.748	0.68	0.747	0.8 – 1.875
Nitrite as NO2	mg/l	<0.05	<0.05	0.056	<0.05	N/A
pH	pH Units	7.47	7.12	7.52	7.39	>6.5 &<9.5
Sulphate	mg/l	109	129	89.6	97.4	200
Chloride	mg/l	13.2	17.6	13.1	16.7	24 - 187.5
COD, unfiltered	mg/l	238	684	690	976	N/A
Nitrate as N	mg/l	<0.0677	<0.0677	0.0864	<0.0677	N/A
Phosphate (Ortho as P)	mg/l	<0.02	<0.02	<0.02	<0.02	0.03 [2]
BOD, unfiltered	mg/l	2.72	<3	3.22	2.05	N/A
Arsenic	µg/l	7.22	0.672	1.9	3.63	7.5

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Legend

- Site Boundary
- Monitoring Well (Groundwater Elevation in mOD)

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TITLE:	Groundwater Monitoring Locations		
PROJECT:	Oxigen Derryarkin Materials Recovery Facility		
FIGURE NO:	9.9		
CLIENT:	Oxigen Environmental Unlimited Company		
SCALE:	1:1000	**REVISION:**	0
DATE:	14/06/2022	**PAGE SIZE:**	A3

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9.4 Potential Impacts

The potential effects the proposed development on soils, geology and hydrogeology are individually assessed in this section. Impacts associated with each phase of the proposed development (construction, operation and decommissioning, as described in Chapter 4 of this EIAR) are evaluated.

The potential impacts are assessed in accordance with the evaluation criteria outlined in Section 9.2. The geological potential effects are summarised in Table 9-12. The hydrogeological potential effects are summarised in Table 9-13. The proposed mitigation measures are then assessed to reduce or eliminate potential effects in Section 9.5 and residual effects are identified in Section 9.6.

9.4.1 'Do Nothing' Impacts

If the proposed development were not constructed, it is likely that the site would likely remain as a disused site containing agricultural structures and associated ancillary infrastructure. The do-nothing scenario will not result in likely significant effects.

9.4.2 Construction Phase Impacts

9.4.2.1 Potential Direct Effects

9.4.2.1.1 Demolition and Site Clearance

The proposed development will include the demolition and removal of all existing above ground structures and infrastructure as described in Chapter 4: Existing and Proposed Development. This includes excavation and stripping of all existing concrete yard surfaces where required, excavation of an existing earthen bund on-site, and removal of foundations and sub-surface structures. Site levelling and removal of vegetation will also occur during these works.

Residual soil and stone which may not be able to be reused on-site will be removed from the site and transported to the adjacent Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility, also situated in Derryarkin, Rhode, Co. Offaly (WFP Reference: WFP-OY-19-0204-01).

Potential geological effects associated with demolition and site clearance are as follows:

- The use of plant and machinery during demolition and site clearance activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils.
- Temporary rubble stockpiles created from the breaking out of the existing concrete hardstanding and portal frame foundations may result in the generation of alkaline discharges to ground.

An asbestos survey report, provided in Appendix 4.1, Asbestos Survey Report, in Volume 3 of this EIAR identified asbestos containing materials (ACM) on the following structures:

- Main shed roof and gables – Asbestos Cement sheeting
- Main shed roof - asbestos cement ridge capping
- Main shed surround - asbestos cement debris
- Shed 2 (4 bay shed) - Asbestos Cement sheeting

All ACM will be stripped and removed prior to demolition of existing structures by a suitability qualified Contractor. There is no potential for ACM to enter soils or groundwater during this phase of works.

The Magnitude of the impact from these works is considered to be Small Adverse in nature. The importance of the geology receptors (subsoils, bedrock) is considered to be ''Medium'. The significance of these potential effects, prior to mitigation, is therefore considered to be **Slight.**

Potential hydrogeological effects associated with demolition and site clearance are as follows:

- Soil erosion and disturbance due to earthworks and excavations.
- Overburden may be removed as part of the site clearance works. Although, bedrock was not encountered to 12.0m BGL during the site investigation, the works may increase the vulnerability of the aquifer whether or not the bedrock is exposed (i.e. the presence of a thinner layer of overburden increases the risk that groundwater could be contaminated, and therefore increases the vulnerability of the groundwater.
- Excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could result in the deposition and entrainment of silt in surface water. This surface water may in turn percolate to groundwater and have indirect adverse effect on groundwater quality (I.e. through increasing suspended solid concentration in groundwater).
- Potential for contamination to groundwater from spills/leakages during works. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.
- Temporary rubble stockpiles created from the breaking out of the existing concrete hardstanding and portal frame foundations may result in the generation of alkaline discharges to groundwater.

The Magnitude of the impact from these works is considered to be Small Adverse in nature. The importance of the groundwater receptors is considered to be 'Medium'. The significance of these potential effects, prior to mitigation is considered to be **Slight.**

9.4.2.1.2 Construction of the Materials Recovery Facility

The proposed development will comprise the construction of a Materials Recovery Facility (MRF) with the built elements of this development described in Chapter 4: Existing and Proposed Developments.

The proposed development will require construction phase earthworks to facilitate the development / installation of proposed foundations, tanks and the drainage network.

Excavated areas will be appropriately backfilled where required utilizing a suitable fill material. Where possible excavated material from the site will be reutilized as fill material.

Residual soil and stone which may not be able to be reused on-site will be removed from the site and transported to the adjacent Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility, also situated in Derryarkin, Rhode, Co. Offaly (WFP Reference: WFP-OY-19-0204-01).

As such there is the potential for impact to soils, geology and hydrogeology from the excavation and movement of soils during the construction phase of the proposed development.

Potential geological effects associated with construction of the proposed development are:

- Soil erosion and disturbance due to earthworks and excavations.
- The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils.
- Concrete/cement works required for the proposed structures/buildings on-site may result in the generation of alkaline discharges to ground.

The Magnitude of the impact from these works is considered to be Small Adverse in nature. The importance of the geology receptors (subsoils, bedrock) is considered to be ''Medium'. The significance of these potential effects, prior to mitigation, is considered to be **Slight.**

Potential hydrogeological effects associated with construction of the proposed development are:

- Overburden may be removed as part of the site clearance works. Although, bedrock was not encountered to 12.0m BGL during the site investigation, the works may increase the vulnerability of the aquifer whether or not the bedrock is exposed (i.e. the presence of a thinner layer of overburden increases the risk that groundwater could be contaminated, and therefore increases the vulnerability of the groundwater.
- Excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could result in the deposition and entrainment of silt in surface water. This surface water may in turn percolate to groundwater and have indirect adverse effect on groundwater quality (I.e. through increasing suspended solid concentration in groundwater).
- Potential for contamination to groundwater from spills/leakages during works. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.
- Concrete/cement works required for the proposed structures/buildings on-site may result in the generation of alkaline discharges to ground.
- During construction, imported engineering fill and excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could deposit silt in surface water with an indirect impact on groundwater quality.

The Magnitude of the impact from these works is considered to be Small Adverse in nature. The importance of the groundwater receptors is considered to be 'Medium'. The significance of these potential effects, prior to mitigation is considered to be **Slight.**

9.4.2.1.3 Rerouting of ESB Lines

An existing overhead powerline is required to be diverted as an underground cable. Connection works will involve the installation of ducting, joint bays, drainage and ancillary infrastructure and the subsequent running of cables.

Residual soil and stone which may not be able to be reused on-site will be removed from the site and transported to the adjacent Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility, also situated in Derryarkin, Rhode, Co. Offaly (WFP Reference: WFP-OY-19-0204-01).

Direct impacts to the existing environment associated with the proposed cabling works include:

- The excavations for the underground cabling trenches and joint bays can have a direct impact on the exposed soils in the form of increased erosion from surface water ingress. This may lead to an increase in the discharge of silt laden surface water run-off to receiving surface waters, which in turn may percolate to groundwaters. The proposed underground cabling, associated excavations and ducting may present a preferential pathway for the movement of groundwater and/or contamination in the subsurface.

Given that the open sections of the trench will be backfilled following the installation of each section of ducting the potential significance of effects on geological receptors, prior to mitigation, is **Slight**.

The significance of these potential effects on hydrogeological receptors, prior to mitigation, is considered to be **Slight.**

9.4.2.2 Potential Indirect Effects

Quantities of granular material will be required for the proposed development. This will place a demand on local aggregate extraction facilities.

Some material excavated from the site during the site clearance and demolition work and earthworks may be exported from the site for recovery at the Kilmurray Soil/C&D recovery facility. This will take up available void space at that facility.

The significance of these potential impacts, prior to mitigation, is considered to be **Imperceptible**, having regard to the overall scale of the Kilmurray facility.

9.4.3 Operational Phase Impacts

The potential effects on geology and hydrogeology from the operation of the proposed development are outlined hereunder.

9.4.3.1 Potential Direct Effects

Very few potential effects are envisaged during the operational phase of the development. Potential direct effects of the proposed development's operation on soils, geology and hydrogeology during this phase would mainly be related to potential contamination from spills/leakages. The sources for potential impacts will be:

- Normal operational traffic and other traffic necessary for the maintenance of the proposed development may result in minor accidental leaks or spills of fuel/oil;
- Storage of fuel on site and refuelling of mobile plant.
- Risk of accidents which could include the following:
    - Uncontrolled spillages of foul water / washwater or wastewater arising from the accidental release from the underground tanks or the wastewater treatment system;
    - Spills/leaks of oil from the transformers in the substation;
    - Release of contaminated firewater during fire event;
- Groundwater abstraction at the site impacting upon groundwater abstraction capacity. (Ca. 0.74 m^3 per day).

The Magnitude of the impact from these operational phase activities is considered to be Negligible in nature, having regard to the design of the proposed facility, given the relatively low level of water usage associated with facility operations (I.e. an estimated 230 m^3 of water per annum, or 0.74 m^3 per day[1]), given the development site is situated above an aquifer that is productive in local zones, and given the rural nature of the surrounding area / parcity of surrounding land uses abstracting groundwater in the area. The importance of the soils and geology receptors (subsoils, bedrock) is considered to be 'Medium'. The significance of these potential effects, prior to mitigation, is considered to be **Imperceptible**.

The Magnitude of the impact from operational phase activities is considered to be Negligible in nature, having regard to the design of the proposed facility. The importance of the groundwater receptors is considered to be 'Medium'. The significance of these potential effects, prior to mitigation is considered to be **Imperceptible.**

9.4.3.2 Potential Indirect Effects

Operations at the proposed facility have the potential to result in the accidental discharge of polluting material (e.g. fuels, oils) to the receiving surface water body to the south of the site (a drainage channel which runs to the Yellow River). Such a discharge may indirectly impact groundwater in the receiving environment via surface water infiltration to groundwater.

The Magnitude of this indirect effect is considered to be Negligible in nature, having regard to the design of the proposed facility. The importance of the groundwater receptors is considered to be 'Medium'. The significance of these potential effects, prior to mitigation is considered to be **Imperceptible.**

[1] Assuming 306 working days in 2024, 254 Monday – Friday working days combined with 52 Saturday working days at the operational facility.

9.4.4 Decommissioning Phase Impacts

Decommissioning activities are described in Chapter 4 Existing and Proposed Development of this EIAR. Decommissioning will be carried out in accordance with a Closure, Restoration and Aftercare Management Plan for the facility, and in accordance with the conditions of the prospective IE licence for the proposed facility. It is unlikely decommissioning activities will have a significant effect on the environment given this and given that the built infrastructure on-site will remain in-situ and there will be no demolition activities or earthworks during decommissioning.

9.4.5 Cumulative Impacts

There is potential for the construction, operation and decommissioning of the proposed development to coincide with the operation of:

- Piggery operated by Skeagh Farms located immediately north/north-west of the development site; and
- The active quarry / concrete batching facility / C&D / Soil Recovery facility operated by Kilmurray Precast Concrete Ltd located c.80m west of the site (at its closest point);
- The Yellow River Windfarm project.

During the construction of the proposed development there will be the requirement for the importation of engineered fill from source quarries and potential for disposal of materials unsuitable for reuse at licensed facilities. There will be an **Imperceptible** cumulative impact in terms of demands placed on local quarries for aggregate and available void space at licensed facilities during the construction phase of the development, having regard to the overall scale of the proposed Kilmurray facility situated in the local area which will be used for sourcing aggregate and manging excess soil and stone material associated with construction.

The proposed development will only have an imperceptible to slight impact on receiving soils, geology and hydrogeology during its operational and decommissioning phase. As such, the proposed development is not expected to contribute to any significant cumulative effect on soils, geology or hydrogeology contained in the receiving environment.

9.4.6 Summary of Potential Effects

A summary of unmitigated potential effects on geology attributes from the proposed development is provided in Table 9-11. The potential unmitigated effects on hydrogeological attributes from the proposed development is provided in Table 9-12.

Table 9-11: Summary of Potential Unmitigated Impact Significance on Geology Attributes

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Construction Phase					
Demolition and Site Clearance	Soil erosion and disturbance due to earthworks and excavations. The use of plant and machinery during demolition and site clearance activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Temporary rubble stockpiles created from the breaking out of the existing concrete hardstanding and portal frame foundations may result in the generation of alkaline discharges to ground. Dispatch of surplus material to the Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility for recovery.	Local overburden deposits Bedrock Receiving waste recovery facility	Medium	Small Adverse	Slight
Construction of the Materials Recovery Facility	Soil erosion and disturbance due to earthworks and excavations. The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Concrete/cement works required for the proposed structures/buildings on-site may result in the generation of alkaline discharges to ground.	Local overburden deposits Bedrock Local quarries Receiving waste recovery facility	Medium	Small Adverse	Slight

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
	Importation of engineering fill and concrete products. Dispatch of surplus material to the Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility for recovery.				
Rerouting of ESB Line	This may lead to an increase in the discharge of silt laden surface water run-off to receiving surface waters, which in turn may percolate to groundwaters. The proposed underground cabling, associated excavations and ducting may present a preferential pathway for the movement of groundwater and/or contamination in the subsurface. Dispatch of surplus material to the Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility for recovery.	Local overburden deposits Receiving waste recovery facility	Medium	Small Adverse	Slight
Operational Phase					
Facility Traffic and refuelling	Release of hydrocarbons or fuel spill, or contents of underground tanks with potential for contamination.	Local overburden deposits Bedrock	Medium	Negligible	Imperceptible
Accidents	Uncontrolled spillages arising from the accidental release from the underground tanks or wastewater treatment system, with potential for contamination. Spills/leaks of oil from the transformers in the substation, with potential for contamination. Release of contaminated firewater during fire event.	Local overburden deposits Bedrock	Medium	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Cumulative Impacts					
Construction of the Materials Recovery Facility	Cumulative impacts on local quarries from extraction of fill for proposed development. Dispatch of surplus material to the Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility for recovery.	Local quarries Receiving waste recovery facility	Medium	Negligible	Imperceptible

Table 9-12: Summary of Potential Unmitigated Impact Significance on Hydrogeology Attributes

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Construction Phase					
Demolition and Site Clearance	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (I.e. through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer. Temporary rubble stockpiles created from the breaking out of the existing concrete hardstanding and portal frame foundations may result in the generation of alkaline discharges to groundwater.	Athboy GWB Bedrock Aquifer	Medium	Small Adverse	Slight
Construction of the Materials Recovery Facility	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (I.e. through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.	Athboy GWB Bedrock Aquifer	Medium	Small Adverse	Slight

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
	Concrete/cement works required for the proposed structures/buildings on-site may result in the generation of alkaline discharges to ground. During construction, imported engineering fill and excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could deposit silt in surface water with an indirect impact on water quality.				
Rerouting of ESB Line	The excavations for the underground cabling trenches and joint bays can have a direct impact on the exposed soils in the form of increased erosion from surface water ingress. This may lead to an increase in the discharge of silt laden surface water run-off to receiving surface waters, which in turn may percolate to groundwaters. The proposed underground cabling, associated excavations and ducting may present a preferential pathway for the movement of groundwater and/or contamination in the subsurface. Dispatch of surplus material to the Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility for recovery.	Athboy GWB Bedrock Aquifer Receiving waste recovery facility	Medium	Small Adverse	Slight
Operation					
Facility Traffic and refuelling of vehicles	Some operational traffic will be necessary for maintenance plus normal operational traffic which could result in minor accidental leaks or spills of fuel/oil. Storage of fuel on site and refuelling of vehicles with potential for contamination from spills/leakages.	Athboy GWB Bedrock Aquifer	Medium	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Accidents	Uncontrolled spillages from the underground tanks, wastewater treatment system or substation with potential for contamination. Release of contaminated firewater during fire event.	Athboy GWB Bedrock Aquifer	Medium	Negligible	Imperceptible
Groundwater Abstraction	Groundwater abstraction for drinking water, sanitation and wash down.	Athboy GWB Bedrock Aquifer	Medium	Negligible	Imperceptible
Indirect Impacts					
Facility Traffic and refuelling of vehicles / Accidents	Uncontrolled release to Surface Water impacting connected Groundwater.	Local overburden deposits Bedrock	Medium	Negligible	Imperceptible

9.5 Mitigation Measures

The following section outlines appropriate mitigation measures to by design and best practice to avoid or reduce the potential impact of the proposed development.

9.5.1 Mitigation by Design and Best Practice

With regard to the proposed development, detailed design and best practice will be implemented as follows:

- To ensure the highest standards of environmental protection, the proposed development has been designed to operate in accordance with the following environmental protection standards:
    - European Commission (2018) BREF on Waste Treatment.
    - European Commission (2018) BATC on Waste Treatment.
    - EPA (2011) BAT Guidance Note on the Waste Sector.
- The site has been designed to ensure that sufficient contaminated firewater retention capacity has been provided on-site, if required.
- The construction works will be designed, overseen and checked by geotechnical and civil engineers, suitably qualified and experienced in excavation and earthworks design and construction methodologies.
- Any excavation and construction related works will be subject to a design risk assessment at detailed design stage to evaluate risk levels for the construction, operation and maintenance of the works. Identified impacts will be minimised by the application of principles of avoidance, prevention and protection. Information on residual impacts will be recorded and relayed to appropriate parties.
- A method statement for each element of the works will be prepared by the Contractor prior to any element of the work being carried out.
- Given that the works comprises a significant proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works.
- The Contract will require programming of the works such that earthworks are not scheduled during severe weather conditions. Where such weather is forecast, suitable measures will be taken to secure the works. The Project Manager is the person responsible for determining when works are to be stopped due to weather.

9.5.2 Construction Phase Mitigation

9.5.2.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) has been prepared for the proposed development and is included in Appendix 4.3 of Volume 3 of this EIAR. Measures for the protection of soils, geology and hydrogeology are defined in this CEMP. The CEMP defines the work practices, environmental management procedures and management responsibilities relating to the construction phase of the proposed development. The CEMP describes how the Contractor for the main construction works will implement a site Environmental Management System (EMS) to meet the specified contractual, regulatory and statutory requirements including the requirements identified as part of the environmental impact assessment process.

The CEMP will be updated prior to construction to take account of any amendments arising during the consenting process and relevant conditions attached to the planning permission and will be implemented for the duration of the construction phase of the project. The CEMP will be a live document and will be reviewed and updated as required.

9.5.2.2 Asbestos Containing Material

All Asbestos containing materials will be stripped and removed prior to demolition in accordance with the Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006, and the relevant HSA Guidance documents. A suitably qualified contractor will be procured to carry out these works. Site-specific risk assessments and method statements will be developed for the Asbestos removal works to be undertaken.

9.5.2.3 Earthworks and Construction Activities

The works will be designed and checked by suitably qualified geotechnical and civil engineers, suitably qualified and experienced in demolition, excavation and earthworks design and construction methodologies. The excavation and construction related works will be subject to a design risk assessment at detailed design stage to evaluate risks posed to the geological and hydrogeological regime from the construction, operation and maintenance of the works. Identified risks will be minimised by the application of principles of avoidance, prevention and protection. Information on residual risks will be recorded and relayed to appropriate parties, e.g. Contractor for the Works.

Details of the proposed methodology and mitigation measures are summarised below and are also defined in the CEMP in in Appendix 4.3 of Volume 3 of this EIAR.

A method statement for each element of the works will be prepared by the Contractor prior to any element of the work being carried out. The Contract will require programming of the works such that earthworks are not scheduled during severe weather conditions. Where such weather is forecast, suitable measures will be taken to secure the works.

To mitigate against erosion of exposed soils, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events. To mitigate against possible contamination of the exposed soils and bedrock, refuelling of machinery and plant will only occur at designated refuelling areas.

Where necessary, material which is required to be removed from site during demolition site clearance activities and earthworks will be taken to an authorized facility for recovery where required.

To mitigate against possible contamination of the exposed soils, refueling of machinery and plant will only occur at designated refueling areas with drip trays and spill kits available.

All excavations will be carried out such that they are stable or adequately supported. Unstable excavations will not be left unsupported. Where appropriate and necessary, excavations will be protected against the ingress of water or erosion.

9.5.2.4 Control of Sediment Laden Runoff

Control and mitigation measures for the protection of surface water from silt run-off are defined in the Chapter 10 Hydrology and Surface Water Quality of this EIAR. These measures will prevent the accidental discharge of polluting material to surface waters in turn impacting groundwater.

9.5.2.5 Measures for Spills

Details of oil spill protection measures and emergency spill response procedures are defined in the CEMP which is contained in Appendix 4.3 of Volume 3 of this EIAR.

Refuelling of construction vehicles will be carried out from delivery vehicles at designated refuelling areas. Specific mitigation measures relating to the management of hydrocarbons are as follows:

- Any oil containers stored at the temporary site compound will be stored above appropriate bunds (e.g. sump pallets). Bunds will be sized to ensure they can store 110% the volume of the fuel and oil stored within them.
- Appropriately sized drip trays will be utilized on-site to prevent the release of fuels or oils during refuelling operations or other work activities.
- Spill kits containing oil soakage pads and booms will be made available on-site to ensure prompt and adequate clean-up of any accidental fuel or oil spills.
- Waste oils will be collected in leak-proof containers and stored in bunds prior to removal from the site.
- An Emergency / Spill Response Procedure will be prepared, and all construction site operatives will be briefed on the response measures required during the site inductions and routine toolbox talks.
- All site plant will be inspected at the beginning of each day prior to use. Defective plant shall not be used until the defect is satisfactorily fixed. All major repair and maintenance operations will take place off-site. Vehicles entering the site will be in good working order, free from leakage of fuel or hydraulic fluid.

9.5.3 Operational Phase Mitigation

It is not envisaged that the operation of the proposed facility will result in significant impacts on the soils, geology and hydrogeology within the study area, as there will be no further disturbance of overburden post construction.

The main potential residual impact during the operation phase will be the risk to the soils, bedrock and aquifer from contamination from fuel or oil spills or loss of containment of polluting material such foul water, wash water or wastewater. The proposed development will be designed, constructed and operated in accordance with best practice to prevent such spills / loss of containment.

The following mitigation measures will in place to prevent spills/loss of containment/pollution of ground or groundwater:

- Most of the waste handling, storage and processing will take place indoors under cover. A relatively small quantity of wastes will be stored in external waste storage bays; however these will drain to an appropriate collection tank. This foul water will be dispatched off-site for proper and safe disposal at an appropriately authorized wastewater treatment facility.
- Fuel stored on-site during facility operations will be stored in a bunded double skinned diesel tank.
- Oils stored on-site will be stored in indoor locations on sump pallet bunds.
- Transformer oil will be stored in a specially designed, bunded container in the ESB sub-station on-site.
- Spill kits will be made available on-site. Staff will be trained in the use of spill kits.
- Good housekeeping will be adopted to prevent improper storage/generation of waste in outdoor locations (I.e. Regular inspection and clean up, yard sweeping etc.).
- The underground foul water / washwater retention tank and connected pipelines will be integrity tested prior to commencement of operations at the site and periodically in accordance with the conditions of the prospective WFP and subsequent IE licence. These tests will need to be part hydrostatic and part visual inspection by chartered engineer. Yard integrity testing (through visual inspection) will also be undertaken once every three years also, so as to ensure the yard area is impermeable, as designed. A programme for maintenance of infrastructure/retention systems will be developed.

9.5.3.1 Regulatory Control

Phase 1 of operations will be carried out in accordance with the conditions a Waste Facility Permit enforced by Offaly County Council. Phase 2 operations will be carried out in accordance with the conditions an IE licence enforced by the EPA. Both these authorizations will define strict environmental protection standards in relation to the proposed facility. These authorizations will necessitate the development and implementation of an Environmental Management System (EMS) for the proposed facility.

9.5.3.2 Accidents

The facility will be designed and constructed in accordance with best practices to control any potential risk from accidents during the operation phase and associated potential impacts to soils, geology and hydrogeology at the proposed development. A Fire Protection and Mitigation Plan and Emergency Response Procedures will be developed and implemented during the operation phase of the facility to address potential spills. The site has been designed to ensure the retention of contaminated firewater that may arise during a fire event on-site. Therefore, the risk of uncontrolled releases due to accidents impacting receiving soils, geology and hydrogeology is **Negligible.**

9.5.4 Decommissioning Phase Mitigation

Decommissioning of the proposed facility/site will take place in accordance with the terms of a Closure, Restoration and Aftercare Management Plan and the prospective IE licence for the facility. It is intended to wind the operation down gradually until such time the vast majority of residual wastes and materials are removed from the site.

Residual materials will be classified before being dispatched to an appropriately authorized waste management facility for treatment.

To prevent the release of fuels or oils during decommissioning, mitigation measures similar to the fuel/oil control measures proposed for the construction phase of the proposed development will be implemented during decommissioning (See Section 9.5.2).

9.5.5 Cumulative

During the construction of the proposed development there will be the requirement for the importation of engineered fill from source quarries and potential for disposal of materials unsuitable for reuse at licensed facilities.

There will be an **Imperceptible** cumulative geological impact in terms of demands placed on local quarries for aggregate and available void space at licensed facilities during the construction phase of the development.

No significant, direct negative cumulative geological effects are envisaged during the operation of decommissioning phase of the proposed development. As such no mitigation measures are required with respect to potential geological cumulative impacts of the proposed development.

The proposed development is not expected to contribute to any significant cumulative effects on the existing hydrogeological conditions at the site or the study area during the construction, operation or decommissioning phases; therefore, no specific measures to mitigate against cumulative effects are required.

9.6 Residual Impacts

A summary of residual impacts is presented in Table 9-14, using the impact assessment methodology outlined in Section 9.2 and taking account of mitigation measures in Section 9.5 of this document.

The residual significance of the effects of the proposed development on soils and geology is expected to be low taking account of the effective implementation of the mitigation measures as outlined in Section 9.5.

Following the implementation of mitigation measures, the residual impact significance to the receiving geological environment would be **Imperceptible** during the construction period and **Imperceptible** during the operation of the proposed development.

There will be an **Imperceptible** residual cumulative impact on the receiving geological environment with the adoption of the proposed mitigation measures. There will also be **Imperceptible** residual cumulative impact in terms of demands placed on local quarries for aggregate and available void space at licensed facilities during the construction phase of the development.

The residual significance of the impacts of the proposed development on the hydrogeological regime is expected to be **Imperceptible** taking account of the effective implementation of the mitigation measures as outlined in Section 9.5. The residual impact is summarised in Table 9-13, using the impact assessment methodology outlined above in Section 9.2 and taking account of mitigation measures in Section 9.5 of this document.

There will be an **Imperceptible** residual cumulative impact on the receiving hydrogeological environment with the adoption of the proposed mitigation measures.

Table 9-13: Summary of Residual Impact Significance on Geology Attributes

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Construction Phase							
Demolition and Site Clearance	Soil erosion and disturbance due to earthworks and excavations. The use of plant and machinery during demolition and site clearance activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Temporary rubble stockpiles created from the breaking out of the existing concrete hardstanding and portal frame foundations may result in the generation of alkaline discharges to ground. Dispatch of surplus material to the Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility for recovery.	Local overburden deposits Bedrock Receiving waste recovery facility	Medium	Small Adverse	Slight	Negligible	Imperceptible
Construction of the Materials Recovery Facility	Soil erosion and disturbance due to earthworks and excavations. The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Concrete/cement works required for the proposed structures/buildings on-site may result in the generation of alkaline discharges to ground. Importation of engineering fill and concrete products. Dispatch of surplus material to the Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility for recovery	Local overburden deposits Bedrock Local quarries Receiving waste recovery facility	Medium	Small Adverse	Slight	Negligible	Imperceptible
Rerouting of ESB Line	This may lead to an increase in the discharge of silt laden surface water run-off to receiving surface waters, which in turn may percolate to groundwaters. The proposed underground cabling, associated excavations and ducting may present a preferential pathway for the movement of groundwater and/or contamination in the subsurface. Dispatch of surplus material to the Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility for recovery.	Local overburden deposits Receiving waste recovery facility	Medium	Small Adverse	Slight	Negligible	Imperceptible
Cumulative Impacts							
Construction of the Materials Recovery Facility	Cumulative impacts on local quarries from extraction of fill for proposed development. Dispatch of surplus material to the Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility for recovery.	Local quarries Receiving waste recovery facility	Medium	Small Adverse	Slight	Negligible	Imperceptible

Table 9-14: Summary of Residual Impact Significance on Hydrogeology

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Construction Phase							
Demolition and Site Clearance	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (I.e. through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer. Temporary rubble stockpiles created from the breaking out of the existing concrete hardstanding and portal frame foundations may result in the generation of alkaline discharges to groundwater.	Athboy GWB Bedrock Aquifer	Medium	Small Adverse	Slight	Negligible	Imperceptible
Construction of the Materials Recovery Facility	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (I.e. through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer. Concrete/cement works required for the proposed structures/buildings on-site may result in the generation of alkaline discharges to ground. During construction, imported engineering fill and excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could deposit silt in surface water with an indirect impact on water quality.	Athboy GWB Bedrock Aquifer	Medium	Small Adverse	Slight	Negligible	Imperceptible
Rerouting of ESB Line	The excavations for the underground cabling trenches and joint bays can have a direct impact on the exposed soils in the form of increased erosion from surface water ingress. This may lead to an increase in the discharge of silt laden surface water run-off to receiving surface waters, which in turn may percolate to groundwaters. The proposed underground cabling, associated excavations and ducting may present a preferential pathway for the movement of groundwater and/or contamination in the subsurface. Dispatch of surplus material to the Kilmurray Construction and Demolition (C&D) / Soil Recovery Facility for recovery	Athboy GWB Bedrock Aquifer	Medium	Small Adverse	Slight	Negligible	Imperceptible

9.7 Interactions

9.7.1 Geology

Geology interacts with other environmental attributes as follows:

Population and Human Health (Chapter 7) – the development of land and soils and the mitigation of potential effects is closely linked to population and human health.

Biodiversity (Chapter 8) – the protection of biodiversity is integral to the development of land and soils. The prevention of potential effects to the biodiversity are directly linked to the maintenance of mitigation measures for geology.

Hydrology and Surface Water Quality (Chapter 10) – the development and disturbance of the underlying geology and potential effects are directly linked to the existing hydrological regime and surface water quality. The prevention of potential effects to the hydrological regime are directly linked to the maintenance of mitigation measures for geology.

Hydrogeology (Chapter 9) – the development of land and soils is integral to the underlying hydrogeological regime. The prevention of potential effects associated with land and soils are directly linked to the protection of the hydrogeological regime.

It has been concluded in this EIAR that the proposed development will not have any significant effect on population and human health, biodiversity, hydrology and surface water quality or hydrogeology, respectively. There will therefore be no potential for these environmental topics interacting with geological elements and having a signficant impact on geology.

Conversely, impacts on geology associated with the proposed development are deemed to be imperceptible to slight. These geological impacts will not result in the creation of an interacting significant effect on any of the above environmental topics.

9.7.2 Hydrogeology

Hydrogeology interacts with other environmental attributes as follows:

Population and Human Health (Chapter 7) – the protection of the hydrogeological regime and the mitigation of potential effects is directly linked to population and human health.

Biodiversity (Chapter 8) – the prevention of potential effects to the biodiversity are directly linked to the protection and maintenance of mitigation measures for hydrogeology.

Hydrology and Surface Water Quality (Chapter 10) – the existing hydrogeological regime and potential effects are directly linked to hydrological features and surface water quality. The prevention of potential effects to the hydrological regime are directly linked to the maintenance of mitigation measures for hydrogeology.

Geology (Chapter 9) – the development of land and soils is integral to the underlying hydrogeological regime. The prevention of potential effects associated with land and soils are directly linked to the protection of the hydrogeological regime.

It has been concluded in this EIAR that the proposed development will not have any significant effect on population and human health, biodiversity, hydrology and surface water quality or hydrogeology, respectively. There will therefore be no potential for these environmental topics interacting with hydrogeological elements and having a signficant impact on hydrogeology.

Conversely, impacts on hydrogeology geology associated with the proposed development are deemed to be imperceptible. These hydrogeological impacts will not result in the creation of an interacting, significant effect on any of the above environmental topics.

9.8 References

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